

Important Notice

As of May 17, 1998, Digital Equipment Corporation's StrongARM, PCI Bridge, and Networking component businesses, along with the chip fabrication facility in Hudson, Massachusetts, were acquired by Intel Corporation and transferred to Intel Massachusetts, Inc. As a result of this transaction, certain references to web sites, telephone numbers, and fax numbers have changed in the documentation. This information will be updated in the next version of this manual. Copies of documents that have an ordering number and are referenced in this document, or other Intel literature may be obtained by calling **1-800-332-2717** or by visiting Intel's website for developers at:

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The Intel Massachusetts Customer Technology Center continues to service your StrongARM Product, Bridge Product, and Network Product technical inquiries. Please use the following information lines for support:

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Electronic mail address:	techdoc@intel.com

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Fax:	1-978-568-6698
Electronic mail address:	techsup@intel.com



Upgrading to the Digital Semiconductor 21140–AE and 21140–AF

Overview

The purpose of this document is to provide customers of Digital Semiconductor's 21140 family with information to upgrade to its newest and most powerful members, the 21140–AE and the 21140–AF. The 21140–AE has already achieved product qualification, and the 21140–AF is scheduled to achieve product qualification in May 1997, providing customers with timely upgrades to more robust products.

This document describes how to upgrade your designs from current Digital Semiconductor 21140 and 21140A devices (order numbers 21140–AB and 21140–AC, respectively) to the latest Digital Semiconductor 21140A devices (order numbers 21140–AE and 21140–AF). It also describes register-level differences, and serves as a convenient reference for upgrading customer-developed 21140 drivers. For detailed programming information and for register descriptions, consult the *Digital Semiconductor 21140A PCI Fast Ethernet LAN Controller Hardware Reference Manual* (order number EC–QN7NF–TE).

Advantages of Upgrading to the 21140–AE and the 21140–AF

The 21140–AE and the 21140–AF are pin compatible and are the functional equivalent of the 21140–AB and 21140–AC, yet offer the following additional features and performance enhancements:

- Supports early receive and transmit interrupt for improved data throughput¹
- Provides an upgradable boot ROM interface of up to 256KB that can support remote boot applications¹
- Implements low-power management with two power-saving modes (sleep or snooze) to minimize power consumption¹
- Supports automatic loading of subsystem vendor ID and subsystem ID from the serial ROM to the configuration register that can uniquely identify a customer's 21140 product¹
- Supports PCI read line, read multiple, and write and invalidate commands to maximize PCI bus performance and to minimize CPU utilization
- Supports both PCI 5.0-V and 3.3-V signaling environments for a variety of hardware applications¹
- Contains a variety of flexible address filtering modes, including pass all incoming packets with a status report for monitoring purposes¹

Physical Features of the 21140–AE and the 21140–AF

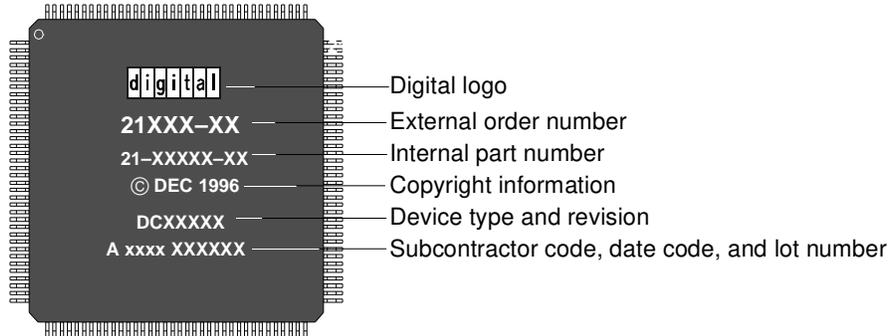
The 21140–AE and the 21140–AF are packaged in the same 144-pin PQFP package as other 21140 devices, with the same pinouts as the 21140–AB and 21140–AC, making them drop-in replacements. Compared to the 21140–AB, each 21140–AE and 21140–AF has an internal 2-K Ω pull-down resistor added to pin **sr_cs**, and internal 5-K Ω pull-up resistors² added to pins **sr_do**, **tdi**, and **tms**.

¹This feature is also available on the 21140–AC device.

²The value of this resistor was 12 K Ω for the 21140–AC.

Package Marking Conventions

All Digital Semiconductor 21140 devices use the following conventions for package markings.



Cross-Referencing Package Markings

Use the following table to cross-reference the 21140 and 21140A package markings with related documentation.

External Order Number	Device	Internal Part Number	Device Type and Revision	Hardware Reference Manual Number	Data Sheet Number
21140-AB	21140	21-40673-02	DC1010 CA	EC-QC0CA-TE	EC-QC0BB-TE
21140-AC	21140A	21-43864-01	DC1036 DA	EC-QN7NC-TE	EC-QN7PC-TE
21140-AE	21140A	21-43864-03	DC1064 B	EC-QN7NE-TE	EC-QN7PE-TE
21140-AF	21140A	21-43864-04	DC1064 C	EC-QN7NF-TE	EC-QN7PF-TE

Migrating Drivers

Software compatibility is retained for those customers utilizing Digital Semiconductor's drivers, allowing the same drivers and SROM format to be used with the 21140-AE and the 21140-AF that were used for the 21140-AB and the 21140-AC. For those customers who have developed their own drivers and require register information, see the section titled Comparing Registers in the 21140 Family.

The following table lists the network and communications software available from Digital Semiconductor for the 21140 and 21140A devices. For the latest driver and software information, see the Networks and Communications page available on the Digital Semiconductor World Wide Web at: <http://www.digital.com:80/i/info/semiconductor>

Drivers	Supports
NDIS3 Unified DC21x4 driver	NDIS3 MAC drivers for Windows NT 3.5, Windows NT 3.51, Windows NT 4.0, Windows for Workgroups 3.11, Windows 95, and Windows 95 OSR 2
NDIS4 Unified DC21x4 driver	NDIS4 MAC drivers for Windows NT 4.0 and Windows 95 OSR 2
Novell Server Unified DC21x4 driver	32-bit ODI drivers for Versions 3.1x and 4.x Novell Servers, Client32 drivers for DOS and Windows 95
Novell Client Unified DC21x4 driver	16-bit ODI drivers for DOS
NDIS2 Unified DC21x4 driver	NDIS2 MAC drivers for DOS, OS/2, Windows 3.1, Windows for Workgroups 3.11, and Windows 95
SCO UNIX Unified DC21x4 driver	SCO UNIX LLI and MDI drivers
Support Files	Description
SROM Specification for DC21x4 devices	SROM data and format requirements for interoperability with DC21x4 drivers
SROM programming tool kit	SROM programming utilities
BSDL	Boundary Scan Description Language files for Digital Semiconductor network chips

Comparing Registers in the 21140 Family

Many enhancements have been added to the 21140–AE and the 21140–AF, resulting in a device that consumes less power with a higher throughput, and is compliant with revisions 2.0 and 2.1 of the *PCI Local Bus Specification*. Some changes have also been made to the register fields of the 21140–AE and the 21140–AF; these items are identified with asterisks in the following table and may require some support for customer-developed drivers.

New or Different Items	21140–AB	21140–AC	21140–AE and 21140–AF
Configuration Registers			
CBER	Reserved	Boot ROM	Boot ROM
CFRV<7:0>	12H	20H	22H
CFCS<4>	Reserved	Reserved	Memory write and invalidate enable
CFDD<31>	Reserved	Sleep mode	Sleep mode
CFDD<30>	Reserved	Snooze mode	Snooze mode
CFLT<7:0>	Reserved	Reserved	Cache-line size in longwords
Control and Status Registers			
CSR0<24>	Reserved	Reserved	Write and invalidate enable
CSR0<23>	Reserved	Reserved	Read line enable
CSR0<21>	Reserved	Read multiple enable (for bursts greater than two longwords)	Read multiple enable (for bursts greater than two longwords)
CSR0<20>	Reserved	Big endian descriptor	Big endian descriptor
CSR0<19>	Reserved	Automatic polling interval	Automatic polling interval
CSR0 value after reset	FFF80000H	FF800000H	FE000000H
CSR5<16> [*]	Normal interrupt summary	Normal interrupt summary Added (compared to 21140–AB): • CSR5<11> – General-purpose timer expired • CSR5<14> – Early receive interrupt	Normal interrupt summary Added (compared to 21140–AB): • CSR5<11> – General-purpose timer expired • CSR5<11> – Early receive interrupt
CSR5<15> [*]	Abnormal interrupt summary	Abnormal interrupt summary Added (compared to 21140–AB): • CSR5<10> – Early transmit interrupt Removed (compared to 21140–AB): • CSR5<11> – General-purpose timer expired	Abnormal interrupt summary Added (compared to 21140–AB): • CSR5<10> – Early transmit interrupt Removed (compared to 21140–AB): • CSR5<14> – General-purpose timer expired
CSR5<14>	Reserved	Early receive interrupt	Early receive interrupt
CSR5<10>	Reserved	Early transmit interrupt	Early transmit interrupt
CSR6<31>	Reserved	Special capture effect enable	Special capture effect enable
CSR6<30>	Reserved	Receive all enable	Receive all enable
CSR6<25>	Must be one [†]	Must be one	Must be one
CSR6 value after reset	E2000040H [‡]	32000040H	32000040H

^{*}Customer-developed 21140 drivers that use these registers may require modification. For detailed programming information and for register descriptions, consult the *Digital Semiconductor 21140A PCI Fast Ethernet LAN Controller Hardware Reference Manual* (order number EC–QN7NF–TE).

[†]CSR6<25> is documented in the original *Digital Semiconductor 21140 PCI Fast Ethernet LAN Controller Hardware Reference Manual* (order number EC–QC0CA–TE) as Must Be Zero. For all versions of the 21140, this bit should be documented as Must Be One. When operating the 21140 in Symbol mode, CSR6<25>=0 causes the 21140 to clear an internal link failure flag after the establishment of a new link earlier than defined by the IEEE 802.3 standard. When CSR6<25>=1, the link failure is cleared according to the standard. Digital Semiconductor suggests that this software update be made for all versions of the 21140.

[‡]The values after reset were incorrectly documented for CSR6 as E0000040H and for CSR9 as FFF097F0H in the *Digital Semiconductor 21140 PCI Fast Ethernet LAN Controller Hardware Reference Manual* (order number EC–QC0CA–TE).

New or Different Items	21140–AB	21140–AC	21140–AE and 21140–AF
CSR7<14>	Reserved	Early receive interrupt enable	Early receive interrupt enable
CSR7<10>	Reserved	Early transmit interrupt enable	Early transmit interrupt enable
CSR8<28>	Reserved	Overflow counter overflow	Overflow counter overflow
CSR8<27:17>	Reserved	Overflow counter	Overflow counter
CSR8 value after reset	FFFE0000H	E0000000H	E0000000H
CSR9<14>	Serial ROM read enable	Serial and boot ROM read enable	Serial and boot ROM read enable
CSR9<13>	Serial ROM write enable	Serial and boot ROM write enable	Serial and boot ROM write enable
CSR9<7:4>	Reserved	Boot ROM data	Boot ROM data
CSR9<3:0>	Serial ROM control	Boot ROM data or serial ROM control	Boot ROM data or serial ROM control
CSR9 value after reset	FFF497FFH [‡]	FFF483FFH	FFF483FFH
CSR10	Reserved	Boot ROM programming address	Boot ROM programming address
SSID	Reserved	Subsystem vendor ID	Subsystem vendor ID
Receive and Transmit Descriptors			
RDES0<30> [*]	Most-significant bit of frame length indicator, RDES0<30:16>	Filtering fail is always 0 unless receive all addressing mode is enabled, (CSR6<30>=1)	Filtering fail is always 0 unless receive all addressing mode is enabled, (CSR6<30>=1)
RDES0<15> [*]	Error Summary	Error summary Removed (compared to 21140–AB): • RDES0<0> – Overflow	Error summary Removed (compared to 21140–AB): • RDES0<0> – Overflow
RDES0<3>	Always a one	Receive error reported from physical layer	Receive error reported from physical layer
RDES0<0> [*]	Reports FIFO overflow	Reports that FIFO overflow occurred during a reception only if FIFO had been partially unloaded to the host. Otherwise, the overflowed frame is discarded and counted in CSR8<27:17>, the overflow counter	Reports that FIFO overflow occurred during a reception only if FIFO had been partially unloaded to the host. Otherwise, the overflowed frame is discarded and counted in CSR8<27:17>, the overflow counter
TDES0<2>	Reserved	Link fail report	Link fail report
Bus Commands			
Memory read line	Unsupported	Unsupported	Supported as initiator and target
Memory write and invalidate	Unsupported	Unsupported	Supported as initiator and target
Expanded Features			
Support for big endian descriptors	Unsupported	Supported	Supported
Automatic polling intervals	4	8	8
JTAG boundary-scan includes boot ROM pins	Unsupported	Supported	Supported

^{*}Customer-developed 21140 drivers that use these registers may require modification. For detailed programming information and for register descriptions, consult the *Digital Semiconductor 21140A PCI Fast Ethernet LAN Controller Hardware Reference Manual* (order number EC–QN7NF–TE).

Comparing Characteristics of the 21140 Family

The following table compares the programming characteristics of the 21140–AB and the 21140–AC to the 21140–AE and the 21140–AF.

Characteristic	21140–AB	21140–AC	21140–AE and 21140–AF
Receive overflow errata	Did not exist	Exists	Resolved
Minimum PCI clock frequency	25 MHz	24.9 MHz ¹	20 MHz
Boot ROM	Unsupported	CBER – Base address and size CSR9 – Management CSR10 – Address	CBER – Base address and size CSR9 – Management CSR10 – Address
Subsystem Vendor ID and Subsystem ID	Unsupported	SSID	SSID
Sleep and snooze low-power modes	Unsupported	CFDD<31:30>	CFDD<31:30>
Receive all address filtering mode	Unsupported	CSR6<30> – Receive all ² RDES0<30> – Filtering fail	CSR6<30> – Receive all RDES0<30> – Filtering fail
Early receive interrupt to indicate that the first data buffer of the packet is filled	Unsupported	CSR5<14> – Early receive interrupt CSR7<14> – Early receive enable	CSR5<14> – Early receive interrupt CSR7<14> – Early receive enable
Early transmit interrupt to indicate that the packet to be transmitted was fully transferred into the chip’s internal transmit FIFOs	Unsupported	CSR5<10> – Early transmit interrupt CSR7<10> – Early transmit enable	CSR5<10> – Early transmit interrupt CSR7<10> – Early transmit enable
Enhanced resolution of capture effect on network	Unsupported	CSR6<31>	CSR6<31>
Indicator that link test failed before the frame was transmitted through the symbol port	Unsupported	TDES0<2>	TDES0<2>
Indicator that a receive error in the physical layer was reported during the frame reception	Unsupported	RDES0<3>	RDES0<3>
Promiscuous mode setting after reset	CSR6<6>=1 (Enabled)	CSR6<6>=x ¹ (Undefined)	CSR6<6>=1 (Enabled)
Memory-read-multiple command on the PCI bus	Unsupported	CSR0<21>	CSR0<21>
Specifies, in units of 32-bit words, the system cache line size	Unsupported	Unsupported	CFLT<7:0>
Supports the memory-write-and-invalidate (MWI) command on the PCI bus	Unsupported	Unsupported	CFCS<4> CSR0<24>
Supports the memory-read-line (MRL) command on the PCI bus	Unsupported	Unsupported	CSR0<23>
Cache alignment limit value (CSR0<15:14>)	Cannot be zero	No limitations	No limitations unless PCI commands MWI or MRL are enabled
Programmable burst length value (CSR0<13:8>)	No limitations	No limitations	No limitations unless PCI commands MWI or MRL are enabled
Bits for transmit automatic polling	CSR0<18> CSR0<17>	CSR0<19> CSR0<18> CSR0<17>	CSR0<19> CSR0<18> CSR0<17>
Receive overflow counter	Unsupported	CSR8<27:17> – Overflow counter overflow indicator RDES0<0> – Zero RDES0<15> – Error summary	CSR8<27:17> – Overflow counter overflow indicator RDES0<0> – Zero RDES0<15> – Error summary

¹This behavior is described in an errata.

²An errata affects this characteristic.



Hardware Characteristics

The following table describes the temperature and power characteristics of the 21140 family of devices.

Characteristic	21140 Family
Operating temperature range	0°C to 70°C (32°F to 158°F)
Package	144-pin PQFP
Power dissipation @ Vdd = 3.3 V Frequency = 33 MHz PCI clock	413 mW maximum
Sleep mode	198 mW maximum
Snooze mode	248 mW maximum
Power supply	Vdd = 3.3 V, Vdd_clamp = 5 V or 3.3 V
Storage temperature range	-55°C to +125°C (~67°F to 257°F)

Ordering Digital Semiconductor Products

To order the Digital Semiconductor 21140A PCI Fast Ethernet LAN Controller and Evaluation Boards, contact your local distributor. To obtain a *Digital Semiconductor Product Catalog*, contact the Digital Semiconductor Information Line.

The following table lists some of the products available from Digital Semiconductor:

Product	Order Number
Digital Semiconductor 21140A PCI Fast Ethernet LAN Controller	21140-AE
Digital Semiconductor 21140A PCI Fast Ethernet LAN Controller	21140-AF ¹
Digital Semiconductor 21140A 10/100BASE-TX Evaluation Board Kit	21A40-TX

¹Available only as a prototype until the product qualifies.

Ordering Digital Semiconductor Documentation

For a complete list of available documentation, contact the Digital Semiconductor Information Line or visit Digital Semiconductor's World Wide Web Internet site.

To determine which documents apply to a particular device part number, visit the Digital Semiconductor Documentation Library on Digital Semiconductor's World Wide Web Internet site at:

<http://ftp.digital.com/pub/Digital/info/semiconductor/literature/dsc-library.html>

For More Information

To learn more about the 21140A, visit the Digital Semiconductor World Wide Web Internet site:

<http://www.digital.com/semiconductor>

or contact the Digital Semiconductor Information Line:

United States and Canada

1-800-332-2717

Outside North America

1-510-490-4753

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