Product Brief

Intel® Ethernet Controller I225 & I226

PCI Express multi-gigabit Ethernet controllers supporting mobile, desktop, workstation, value-server, Thunderbolt™ docking, and embedded space-constrained designs.

Key Features

- PCI Express 3.1 (5GT/s) x1 host interface
- MDI (Copper) standard IEEE 802.3 Ethernet interface up to 2.5Gb/s[1]
- Time Sensitive Networking (TSN) [2, 3] capability support
- Innovative power management features
- Support for Intel® Active Management Technology on systems enabled with Intel vPro® technology[2]
- Support for Intel® Stable IT Platform Program[2]

Overview of the Intel Ethernet Controller I225 and I226

This PCI Express controller with Base-T copper networking interface, provides compact, single-port integrated multi-gigabit (up to 2.5G) - MDI (Copper) standard IEEE 802.3 Ethernet interface for 2500BASE-T, 1000BASE-T, 100BASE-TX, 10BASE-TE connections (IEEE 802.3, 802.3u, 802.3ab).

The Intel® Ethernet Controller I225/I226 is designed for use mobile, desktop, workstation, value-server, or industrial designs that have critical space constraints. The I225/I226 can also support Intel vPro® technology on specific Intel platforms and chipsets.

The Intel Ethernet Controller I225/I226 also supports the latest time sensitive networking (TSN) features[2, 3], along with best in class power management and Operating System Support.

Filled with Performance Optimization Capabilities

The Intel® Ethernet Connection I225/I226 includes advanced interrupt-handling features to reduce CPU overhead. Other performance-enhancing features include offloading TCP/UDP (for both IPv4 and IPv6) checksum calculations and performing TCP segmentation.

Advanced features such as Jumbo Frame support for extra-large packets and Receive Side Scaling (RSS) (I226 only) are also supported. Additionally, I225/I226 builds on prior controller solutions to add Time Sensitive Networking[2, 3] (TSN) features including IEEE 802.1Qbu, 802.3br, 802.1Qbv, 802.1AS-REV, 802.1p/Q, and 802.1Qav on select operating systems. These features support advanced time critical, and synchronized applications prevalent in audio/video, embedded, and industrial applications.

Advanced interrupt-handling features manage multiple interrupts simultaneously. Combining interrupt-handling features with intelligent filtering, ordering, and directing packets to specific queues and cores, enables load-balancing network traffic flows to improve throughput in multi-core platforms.

Other performance-enhancing features include IPv4 and IPv6 checksum offload, TCP/UDP checksum offload, extended Tx descriptors for more offload capabilities, up to 256 KB TCP segmentation (TSO v2), 40 KB packet buffer size, and 9.5 KB Jumbo Frame support.

Other Advanced Features

Flexible Filters

Supports a total of 32 individually configurable flexible filters. Filters can be used for wake-up or proxying when in D3 state or for queueing when in D0 state.

Secure Flexible Firmware Architecture

Flexible Firmware Architecture with Secure NVM Update protects the flash from external unauthorized software programming. The Intel® Ethernet Controller I225/I226 also supports Dynamic Firmware Updating that enables Firmware Updates without the need for a system reboot.

Software Definable Pins

Four Software Definable Pins (SDPs) enable additional design customization for embedded platforms[2]. SDPs can be used for IEEE 1588 auxiliary device connections, to enable/disable the device, and for other miscellaneous hardware or software-control purposes. These pins can be individually configured to act as either standard inputs, General-Purpose Interrupt (GPI) input or output pins, as well as the default value of all pins configured as outputs. One SDP is dedicated, and three are shared with the JTAG interface.

Energy Efficient Ethernet (EEE)

The I226 Supports the IEEE 802.3az EEE standard. During periods of low network activity, EEE reduces the power consumption of an Ethernet connection by negotiating with the switch port to transition to a low power idle (LPI) state.

This capability reduces power dramatically, saving power on both the network and the switch ports. When increased traffic is detected, the controller and the switch quickly come back to full power to handle the increased traffic. EEE is supported for 2500BASE-T, 1000BASE-T and 100BASE-TX.

Flexible Design Configurations

The I225/I226 can be used for server system configurations such as rack-mounted or pedestal servers, in an add-on NIC, and in LAN on Motherboard (LOM) designs.

- Intel Ethernet Controller I225/I226-V/LM supports commercial temperature ranges of 0 °C to 70 °C up to 2500BASE-T.
- Intel Ethernet Controller I225-IT supports extended temperatures for embedded applications with commercial temperature ranges of -40 °C to 70 °C up to 2500BASE-T and -40 °C to 85 °C up to 1000BASE-T.
- Intel Ethernet Controller I226-IT supports industrial temperatures for embedded applications with commercial temperature ranges of -40 °C to 85 °C up to 2500BASE-T

Manageability Support[2]

The Intel® Ethernet Controller I225/I226 provides Intel® Active Management Technology support when connected to a system with Intel vPro technology, directly as LAN on motherboard, or via a certified vPro® Thunderbolt accessory.

Intel Ethernet Controller I226 Enhancements

The I226 retains the same board design compatibility of the I225, as well as utilizing the same driver code base. But the I226 adds some enhancements, most notably:

Improved Bit Error Rate (BER)

Better packet performance; especially at the longest cable lengths.

Reduced Active Power

Better packet performance; especially at the longest cable lengths.

FEATURES	DESCRIPTION
EXTERNAL INTERFACES	
PCI Express 3.1	• 5GT/s Support for x1 width (Lane).
Network Interfaces	• Integrated MAC + BASE-T PHY. • MDI (Copper) standard IEEE 802.3 Ethernet interface for 2500BASE-T, 1000BASE-T, 100BASE-TX, and 10BASE-TE applications (802.3, 802.3u, 802.3bz, and 802.3ab).
MDI Lane Swap	• A simple hardware strapping option that allows the ability to swap the MDI pairs order between ABCD<->DCBA. This reduces routing complexity and risk.
BOM COST OPTIMIZATION	
On-chip integrated Switched Voltage Regulator (iSVR)	• Removes need for a higher cost on-board voltage regulator.
ETHERNET FEATURES	
IEEE 802.3 auto-negotiator	• Automatic link configuration for speed duplex and flow control
IEEE 802.3x and IEEE 802.3z compliant flow control support with software-controllable Rx thresholds and Tx pause frames	• Local control of network congestion levels.
Automatic cross-over detection function (MDI/ MDI-X)	• Frame loss reduced from receive overruns.
IEEE 1588 protocol and 802.1AS implementation	• Time-stamping and synchronization of time sensitive applications. • Distribute common time to media devices.
Supporting Time Sensitive Networking (TSN) Capabilities[2, 3]	• IEEE 802.1Qbu, 802.3br, 802.1Qbv, 802.1AS-REV, 802.1p,Q, and 802.1Qav. • Supports Time-based transmission. • Any Tx and Rx queues can be used for scheduled traffic or best effort traffic. • Supports Forwarding and Queuing Enhancements for Time-Sensitive Streams.
POWER MANAGEMENT FEATURES	
I225 Controller is designed for low power	• 2.2W S0-Max 2500BASE-T Active 70 °C (Intel® Ethernet Controller I225-V/LM). • 1.3W S0-Typical 2500BASE-T Active 25 °C (Intel® Ethernet Controller I225-V/LM). • 950W S0-Typical 1000BASE-T Active 25 °C (Intel® Ethernet Controller I225-V/LM).
I226 Controller is designed for lowest power	• 1.48W S0-Typical 2500BASE-T Active 25 °C (Intel® Ethernet Controller I226-IT). • 1.3W S0-Typical 2500BASE-T Active 25 °C (Intel® Ethernet Controller I226-V/LM). • 0.7W S0-Typical 1000BASE-T Active 25 °C (Intel® Ethernet Controller I226-V/LM).
IEEE 802.3az – Energy Efficient Ethernet (EEE)	• Power consumption by the PHY is reduced; link transitions to low power idle (LPI) state as defined in the IEEE 802.3az (EEE) standard • Support only on I226

FEATURES	DESCRIPTION
POWER MANAGEMENT FEATURES	
Smart Power Down (SPD) at S0/ Sx no link	• PHY powers down circuits and clocks that are not required for detection of link activity.
Active State Power Management (ASPM)	• Optionality Compliance bit enables ASPM or runs ASPM compliance tests to support entry to L0s.
Full wake up support	• Advanced Power Management (APM) Support. Designed to receive a broadcast or unicast packet with an explicit data pattern (Magic Packet) and assert a signal to wake up the system. • Advanced Configuration and Power Interface (ACPI) specification v2.0c. PCIe power management-based wake-up that can generate system wake-up events from a number of sources
ACPI register set and power down functionality supporting D0 and D3 states	• Power-managed speed control lowers link speed/power when highest link performance is not required.
MAC Power Management controls	• Power management controls in the MAC /PHY enable the device to enter a low-power state.
Power Management Protocol Offload (Proxying)	• Enables the system to remain at low system power state while the NIC handles predefined ping or keep • alive messages.
Latency Tolerance Reporting (LTR)	• Reports service latency requirements for memory reads and writes to the Root Complex.
STATELESS OFFLOADS AND PERFORMANCE FEATURES	
TCP/UDP, IPv4 checksum offloads (Rx/ Tx)	• Offloading capabilities and improved CPU usage. • Extended Tx descriptors. • Checksum and segmentation capability extended to new standard packet type.
Transmit Segmentation Offloading (TSO) (IPv4, IPv6)	• Increased throughput and lower processor usage.
Interrupt throttling control	• Limits maximum interrupt rate and improves CPU usage.
Low-Latency Interrupts	• Based on the sensitivity of the incoming data, the controller can bypass the automatic moderation of time intervals between the interrupts.
Legacy and Message Signal Interrupt (MSI)	• Interrupt mapping.
Message Signal Interrupt Extension (MSI-X)	• Dynamic allocation of up to 5 vectors per port.
Scalable I/O for Linux environments (IPv4, IPv6, TCP/UDP)	• Improves the system performance related to handling of network data on multiprocessor systems.
Support for packets up to 9.5 KB (Jumbo Frames)	• Enables faster and more accurate throughput of data.
PCIe v3.1 support	• Includes additions to PCIe to support low power link states.
Descriptor ring management hardware for Transmit and Receive	• Optimized descriptor fetch and write-back for efficient system memory and PCIe bandwidth usage.

FEATURES	DESCRIPTION
REMOTE BOOT OPTIONS	
Preboot Execution Environment (PXE) flash interface support	• Enables system boot up via the EFI (64 bit). • Flash interface for PXE 2.1 option ROM.
MANAGEABILITY FEATURES	
Intel® Active Management Technology[2]	• Supported on systems enabled with Intel vPro® technology (I225/6-LM/IT only)

PRODUCT ORDER CODE

MM#	BRAND NAME	DESCRIPTION	MEDIA	FORECAST NAME
99AFMW	Intel® Ethernet Controller I226LM	Commercial and server version with long life supply, standard temperature	Tape and reel	KTI226LM
99AFMX	Intel® Ethernet Controller I226LM	Commercial and server version with long life supply, standard temperature	Tray	KTI226LM
99AFN0	Intel® Ethernet Controller I226V	Non-commercial version, standard temperature	Tape and reel	KTI226V
99AFN3	Intel® Ethernet Controller I226V	Non-commercial version, standard temperature	Tray	KTI226V
99AFN4	Intel® Ethernet Controller I226IT	Commercial and server version with long life supply, **industrial temperature**	Tape and reel	KTI226IT
99AFN5	Intel® Ethernet Controller I226IT	Commercial and server version with long life supply, **industrial temperature**	Tray	KTI226IT
99A57P	Intel® Ethernet Controller I225LM	Commercial and server version with long life supply, standard temperature **(v3)**	Tape and reel	KTI225LM
99A57N	Intel® Ethernet Controller I225LM	Commercial and server version with long life supply, standard temperature **(v3)**	Tray	KTI225LM
99A3W6	Intel® Ethernet Controller I225V	Non-commercial version, standard temperature **(v3)**	Tape and reel	KTI225V
99A3W5	Intel® Ethernet Controller I225V	Non-commercial version, standard temperature **(v3)**	Tray	KTI225V
99A57T	Intel® Ethernet Controller I225IT	Commercial and server version with long life supply, extended temperature **(v3)**	Tape and reel	KTI225IT
99A57R	Intel® Ethernet Controller I225IT	Commercial and server version with long life supply, extended temperature **(v3)**	Tray	KTI225IT

Warranty

Standard Intel limited warranty, one year. See Intel terms and conditions of sale for more details.

Customer Support

For customer support options in North America visit:
intel.com/content/www/us/en/support/contact-support.html

Product Information

For information about Intel® Ethernet Products, visit:
intel.com/ethernetproducts

[1] *For the Intel Ethernet Controller I225 – v1, 2.5GbE is available on select routers/switches. Please see https://cdrdv2.intel.com/v1/dl/getContent/621661 for the list of known compatible link partners and devices.*

[2] *Commercial and server version (LM/ IT) only.*

[3] *Commercial and server versions (LM/ IT) support the TSN standards and features and have been designed and validated accordingly, and maintained as part of its product lifecycle, including AVNU certification. Non-commercial version (V) does not support TSN; although some low-level features may be partially exposed temporarily, its usage is strongly discouraged.*

Printed in USA Please Recycle 341510-004US