Intel® 82541ER Gigabit Ethernet Controller

Entry-level Gigabit connection designed for embedded applications

Intel in Communications

Product Overview

The Intelligent Way to Connect

- Enhanced power management for reduced power applications
- High-performance PHY technology meets IEEE 802.3ab specifications
- Footprint compatibility with other Intel® PRO Connections for flexible designs

The Intel® 82541ER Gigabit Ethernet Controller provides optimized Gigabit networking for PCI designs. This highly efficient controller, with enhanced power management, consumes less than 1.0W of power at Gigabit speeds. When no signal is detected on the wire, the controller reduces power consumption by switching to 100 or 10Mbps and powering down the physical-layer circuitry (PHY). When a signal is detected, the controller automatically negotiates the connection to Gigabit, if available.

The Intel 82541ER combines Intel's fifth-generation Gigabit MAC design with fully integrated state-of-the-art PHY technology, which meets or exceeds IEEE 802.3ab specifications for Bit Error Rate performance. In addition, the controller provides a direct Peripheral Component Interconnect (PCI) designed to be compliant with the PCI 2.3 bus up to 66MHz. Packaged in a 15x15mm PBGA, the Intel 82541ER Gigabit Ethernet Controller is footprint-compatible with the Intel® 82551ER and 82551QM Fast Ethernet Controllers, and Intel® 82562EX and 82562EZ devices. Footprint-compatibility allows for a flexible Gigabit Ethernet or Fast Ethernet implementation on the same motherboard layout.

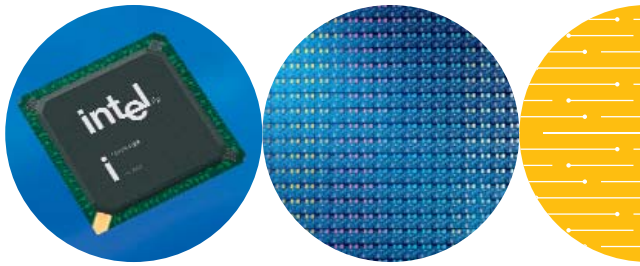
The Intel 82541ER Gigabit Ethernet Controller architecture is optimized to deliver both high-performance networking and PCI bus efficiency with the lowest power and smallest size. Using state logic design with a pipelined DMA Unit and 128-bit-wide buses for the fastest performance, the 82541ER controller handles Gigabit Ethernet traffic with low network latency and minimal internal processing overhead. The controller's architecture includes independent transmit and receive queues to limit PCI bus traffic, and a PCI interface that maximizes the use of bursts for efficient bus usage. A 64KB, on-chip packet buffer maintains superior performance as available PCI bandwidth changes.

Advanced interrupt moderation hardware manages interrupts generated by the 82541ER controller to further improve system efficiency. In addition, using hardware acceleration, the controller also offloads tasks from the host processor, such as TCP/UDP/IP checksum calculations and TCP segmentation.

Applications

The Intel 82541ER Gigabit Ethernet Controller is designed for use in the following applications:

- Printer LAN Connections
- Security Appliances for Enterprise Networking (VPN, firewall, intrusion detection systems)
- Industrial PCs, Interactive Clients (POS, kiosk, ATM, gaming)
- Communications and networking devices requiring improved performance over 10/100 Ethernet



Features	Benefits
PCI Bus Features	
PCI revision 2.3, 32-bit, 33/66MHz	■ Application flexibility for embedded board designs
CLKRUN# Signal	■ PCI clock suspension for low-power designs
Gigabit MAC Features	
64KB configurable RX and TX packet FIFO	■ No external FIFO memory requirements; ■ FIFO size tunable to the application
IEEE 802.3x compliant flow control support	■ Reduced frame loss due to receive FIFO overrun
Programmable host memory receive buffers (256B to 16KB)	■ Efficient usage of system resources
Low-latency transmit and receive queues	■ Network packets handled without waiting or buffer overflow
Gigabit PHY Features	
IEEE 802.3ab Auto-Negotiation	■ Automatic link configuration including speed, duplex, and flow control
State-of-the-art DSP/analog architecture	■ Implements digital adaptive equalization, echo, cross-talk and baseline wander cancellation ■ Robust 1000Mb/s performance in noisy environments
PHY detects polarity	■ Easier network installation and maintenance
PHY supports 2 pair and 3 pair cable downshift	■ Controller adapts to sub-standard cable plant
Host Offloading Features	
Transmit TCP segmentation, and IP, TCP, and UDP checksum off-loading	■ Increased throughput and lower CPU utilization; ■ Compatible with large send offload on RX and TX
Interrupt moderation controls	■ Reduces number of interrupts generated by RX and TX operations, resulting in lower CPU utilization
Jumbo frame support up to 16KB	■ High throughput for large data transfers on networks supporting jumbo frames
Power Management Features	
Compliance with PCI Power Management v1.1/ACPI v2.0	■ PCI power management capabilities for embedded applications
Automatic link speed switching from 1000Mb/s down to 10 or 100Mb/s in standby	■ Supports power-down states without software assistance ■ Low power in standby states
Smart Power Down mode when no signal is detected on the wire	■ Enables very low power consumption
Additional Features	
Four programmable LED outputs	■ Customizable indications for link speed, activity, duplex, collisions, and port ID on each port
On-chip power regulator control circuitry	■ Simplified low-cost power supply design
Internal PLL for clock generation using a 25MHz crystal or a 25MHz oscillator	■ Lower component count and cost
BIOS LAN Disable Pin	■ Enables low-power LAN disable via BIOS

Intel supported drivers

Linux*, FreeBSD*, Windows NT* 4.0, Windows* XP Embedded, Windows CE.NET, DOS*

Characteristics

Electrical	
Typical targeted power dissipation	■ Less than 1.0W at D0 1000Mbps ■ 100 mW at D3 100Mbps ■ 50 mW at D3 wake up disabled
Environmental	
Operating temperature	0°C to 70°C (without need for heat sink)
Storage temperature	-65°C to 140°C
Physical	
Package	196-pin PBGA, 1mm ball pitch, 15x15mm (simplifies PCB designs)
Footprint compatible with Intel® 82540EM Gigabit Ethernet Controller	Enables easy migration

Order Code

■ GD 82541ER

For more information, contact your Intel® sales representative.

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