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Intel® 82541ER Gigabit Ethernet Controller

Overview

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Features and Benefits | Key Applications

Order Code: **GD82541ER**

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.

Features and 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 1000Mbps 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 1000Mbps down to 10 or 100Mbps 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

Key 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

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