

# PEX 8613

## PCIe Gen 2, 5.0GT/s 12-lane, 3-port Switch

### Features

- **PEX 8613 General Features**
  - 12-lane, 3-port PCIe Gen 2 switch
    - Integrated 5.0 GT/s SerDes
  - 19 x 19mm<sup>2</sup>, 324-pin PBGA package
  - Typical Power: 1.74 Watts
  
- **PEX 8613 Key Features**
  - **Standards Compliant**
    - PCI Express Base Specification, r2.0 (backwards compatible w/ PCIe r1.0a/1.1)
    - PCI Power Management Spec, r1.2
    - Microsoft Vista Compliant
    - Supports Access Control Services
    - Dynamic link-width control
    - Dynamic SerDes speed control
  - **High Performance**
    - Non-blocking switch fabric
    - Full line rate on all ports
    - Packet Cut-Thru with 140ns max packet latency (x4 to x4)
    - 2KB Max Payload Size
    - Read Pacing (bandwidth throttling)
    - Dual cast
  - **Flexible Configuration**
    - Registers configurable with strapping pins, EEPROM, I<sup>2</sup>C, or host software
    - Lane and polarity reversal
    - Compatible with PCIe 1.0a PM
  - **Dual-Host & Fail-Over Support**
    - Configurable Non-Transparent port
    - Moveable upstream port
    - Crosslink port capability
  - **Dual-Clock Domain**
    - SSC clock isolation
  - **Quality of Service (QoS)**
    - Two Virtual Channels
    - Eight traffic classes per port
    - Weighted round-robin source port arbitration
  - **Reliability, Availability, Serviceability**
    - All ports Hot-Plug capable thru I<sup>2</sup>C (Hot-Plug Controller on every port)
    - ECRC and Poison bit support
    - Data Path parity
    - Memory (RAM) Error Correction
    - INTA# and FATAL\_ERR# signals
    - Advanced Error Reporting
    - Port Status bits and GPIO available
    - Per port error diagnostics
    - Performance Monitoring
      - Per port payload & header counters
    - JTAG AC/DC boundary scan

The *ExpressLane*<sup>TM</sup> PEX 8613 device offers PCI Express switching capability enabling users to add scalable high bandwidth, non-blocking interconnection to a wide variety of applications including **workstations, storage systems, communications platforms, embedded systems, and intelligent I/O modules**. The PEX 8613 is well suited for **fan-out, aggregation, and peer-to-peer** applications.

### High Performance & Low Packet Latency

The PEX 8613 architecture supports packet **cut-thru with a maximum latency of 140ns (x4 to x4)**. This, combined with large packet memory and non-blocking internal switch architecture, provides full line rate on all ports for performance-hungry applications such as **servers and switch fabrics**. The low latency enables applications to achieve high throughput and performance. In addition to low latency, the device supports a **max payload size of 2048 bytes**, enabling the user to achieve even higher throughput.

### Data Integrity

The PEX 8613 provides **end-to-end CRC (ECRC)** protection and **Poison bit** support to enable designs that require **end-to-end data integrity**. PLX also supports data path parity and memory (RAM) error correction as packets pass through the switch.

### Flexible Register & Port Configuration

The PEX 8613's 3 ports can achieve link up to lane widths of x1, x2, or x4. Flexible buffer allocation, along with the device's **flexible packet flow control**, maximizes throughput for applications where more traffic flows in the downstream, rather than upstream, direction. Any port can be designated as the upstream port, which can be changed dynamically. The PEX 8613 also provides several ways to configure its registers. The device can be configured through strapping pins, I<sup>2</sup>C **interface**, host software, or an optional serial EEPROM. This allows for easy debug during the development phase, performance monitoring during the operation phase, and driver or software upgrade. Figure 1 shows some of the PEX 8613's common port configurations.

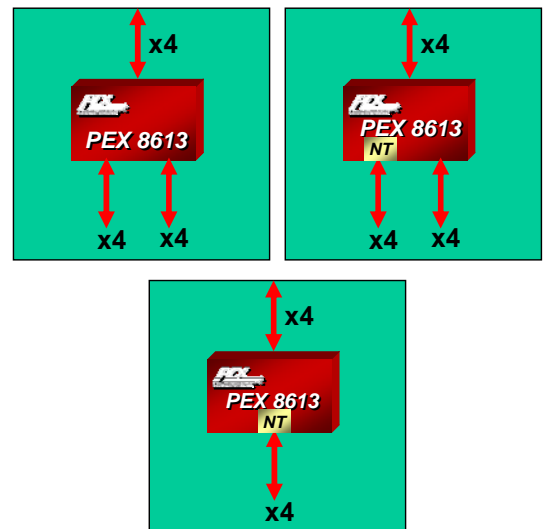


Figure 1. Common Port Configurations

## Dual-Host & Failover Support

The PEX 8613 product supports a **Non-Transparent (NT) Port**, which enables the implementation of **multi-host systems** and **intelligent I/O modules** in storage, communications, and blade server applications. The NT port allows systems to isolate host memory domains by presenting the processor subsystem as an endpoint rather than another memory system. Base address registers are used to translate addresses; doorbell registers are used to send interrupts between the address domains; and scratchpad registers (accessible by both CPUs) allow inter-processor communication (see Figure 2). In a two-port configuration (as in Figure 1), the PEX 8613 can serve as an NT buffer, isolating two host domains via two x4 links.

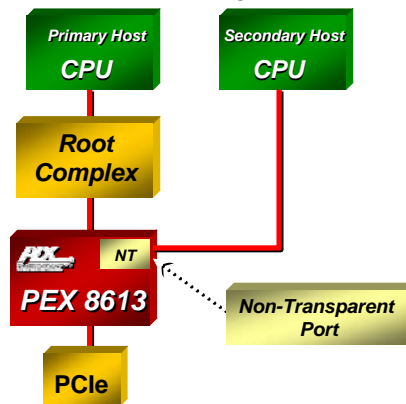


Figure 2. Non-Transparent Port

## Dual Cast™

The PEX 8613 supports Dual Cast, a feature which allows for the copying of data (e.g. packets) from one ingress port to two egress ports allowing for higher performance in dual-graphics, storage, security, and redundant applications.

## Read Pacing™

The Read Pacing feature allows users to throttle the amount of read requests being made by downstream devices. When a downstream device requests several long reads back-to-back, the Root Complex gets tied up in serving this downstream port. If this port has a narrow link and is therefore slow in receiving these read packets from the Root Complex, then other downstream ports may become starved – thus, impacting performance. The Read Pacing feature enhances performances by allowing for the adequate servicing of all downstream devices.

## Hot-Plug for High Availability

Hot-Plug capability allows users to replace hardware modules and perform maintenance without powering down the system. The PEX 8613 Hot-Plug capability feature makes it suitable for **High Availability (HA) applications**. Every port on the PEX 8613 is equipped with a Hot-Plug control/status register to support Hot-

Plug capability through external logic via the I<sup>2</sup>C interface.

## SerDes Power and Signal Management

The PEX 8613 supports software control of the SerDes outputs to allow optimization of power and signal strength in a system. The PLX SerDes implementation supports four levels of power – off, low, typical, and high. The SerDes block also supports **loop-back modes** and **advanced reporting of error conditions**, which enables efficient management of the entire system.

## Interoperability

The PEX 8613 is designed to be fully compliant with the PCI Express Base Specification r2.0, and is backwards compatible to PCI Express Base Specification r1.1 and r1.0a. Additionally, it supports **auto-negotiation**, **lane reversal**, and **polarity reversal**. Furthermore, the PEX 8613 is designed for Microsoft Vista compliance. All PLX switches undergo thorough interoperability testing in PLX's **Interoperability Lab** and **compliance testing at the PCI-SIG plug-fest**.

## Applications & Usage Models

Suitable for **host-centric** as well as **peer-to-peer traffic patterns**, the PEX 8613 can be configured for a broad range of form factors and applications.

## Host Centric Fan-out

The PEX 8613, with its symmetric or asymmetric lane configuration capability, allows user-specific tuning to a variety of host-centric applications. Figure 3 shows a typical **workstation** design where the root complex provides a PCI Express link that needs to be expanded to a larger number of smaller ports for a variety of I/O functions. In this example, the PEX 8613 has a 4-lane upstream port and two downstream ports using x4 links.

The PEX 8613 can also be used to create PCIe Gen 1 (2.5 Gbps) ports. The PEX 8613 is backwards compatible with PCIe Gen 1 devices. Therefore, the PEX 8613 enables a Gen 2 native Chip Set to fan-out to Gen 1 endpoints. In Figure 3, the PCIe slots connected to the PEX 8613's downstream ports can be populated with either PCIe Gen 1 or PCIe Gen 2 devices. Conversely, the PEX 8613 can also be used to create Gen 2 ports on a Gen 1 native Chip Set in the same fashion.

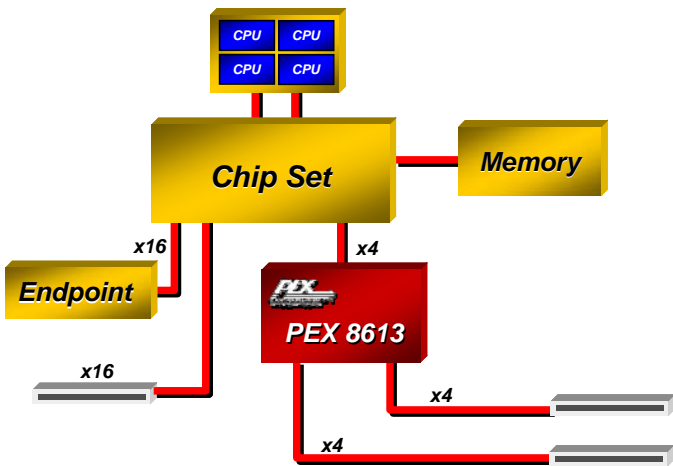


Figure 3. Fan-in/out Usage

**Network Interface Cards**

The PEX 8613 can also be utilized in communications applications such as Network Interface Cards (NICs). NICs, like the one shown in Figure 4, can utilize the PEX 8613 for its fan-out capabilities. In the example below, the PEX 8613 is being used on a Dual-port 10-Gigabit Ethernet (GE) NIC card. The PEX 8613 utilizes a x4 link to connect to the host and two x4 downstream links to fan-out to the 10GE ports. The peer-to-peer communication feature of the PEX 8613 allows the endpoints to communicate with each other without any intervention or management by the host.

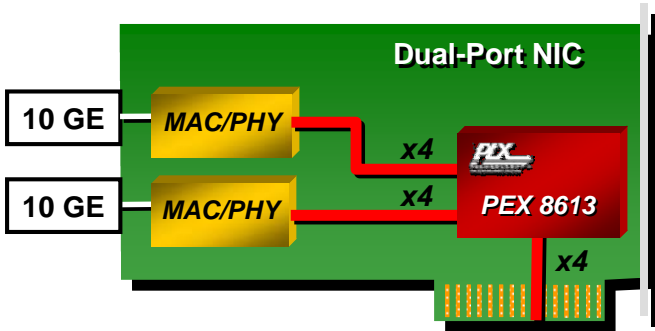


Figure 4. 10GE NIC Fan-Out

**Embedded Systems**

The PEX 8613 is well suited for embedded applications as well. Embedded applications, like the example shown in Figure 5, commonly use a number of independent modules for functions such as control plane processing, data acquisition, or image processing to name a few possibilities. Figure 5 represents an embedded system utilizing a PEX 8613 to fan-out to two ASICs/FPGAs.

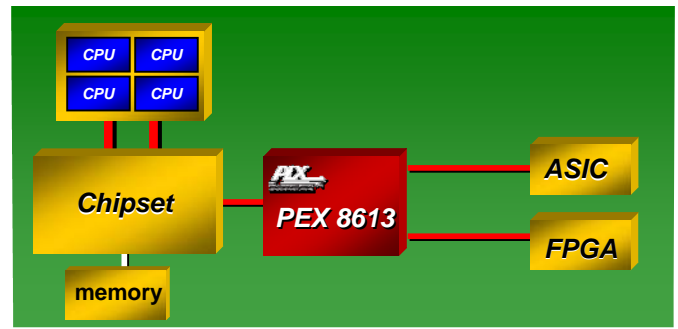


Figure 5. Embedded Systems

**Failover Storage Systems**

The PEX 8613's Dual Cast feature proves to be very useful in storage systems. In the example shown in Figure 6, the Dual Cast feature enables the PEX 8613 to copy data coming from the host to two downstream ports (see yellow traffic patterns) in one transaction as opposed to having to execute two separate transactions to send data to the backup chassis. By offloading the task of backing up data onto the secondary system, processor and system performance is enhanced.

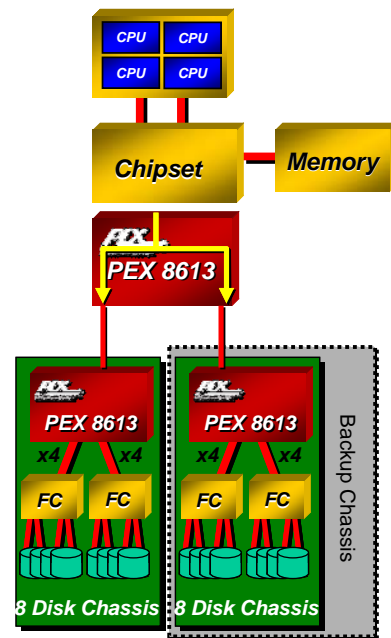


Figure 6. Dual Cast in Storage Systems

## Software Usage Model

From a system model viewpoint, each PCI Express port is a virtual PCI to PCI bridge device and has its own set of PCI Express configuration registers. It is through the upstream port that the BIOS or host can configure the other ports using standard PCI enumeration. The virtual PCI to PCI bridges within the PEX 8613 are compliant to the PCI and PCI Express system models. The Configuration Space Registers (CSRs) in a virtual primary/secondary PCI to PCI bridge are accessible by type 0 configuration cycles through the virtual primary bus interface (matching bus number, device number, and function number).

### Interrupt Sources/Events

The PEX 8613 switch supports the INTx interrupt message type (compatible with PCI 2.3 Interrupt signals) or Message Signaled Interrupts (MSI) when enabled. Interrupts/messages are generated by PEX 8613 for Hot-Plug events, doorbell interrupts, baseline error reporting, and advanced error reporting.

## Development Tools

PLX offers hardware and software tools to enable rapid customer design activity. These tools consist of a hardware module (PEX 8613BA-AIC 4U4D RDK), hardware documentation, and a Software Development Kit (available at [www.plxtech.com](http://www.plxtech.com)).

### ExpressLane PEX 8613BA-AIC4U4D RDK

The PEX 8613RDK is a hardware module containing the PEX 8613 which plugs right into your system. The PEX 8613RDK can be used to test and validate customer software, or used as an evaluation vehicle for PEX 8613 features and benefits. The PEX 8613RDK provides everything that a user needs to get their hardware and software development started. For more information, please refer to the PEX 8613RDK Product Brief.

### Software Development Kit (SDK)

PLX's Software Development Kit is available for download at [www.plxtech.com/sdk](http://www.plxtech.com/sdk). The software development kit includes drivers, source code, and GUI interfaces to aid in configuring and debugging the PEX 8613. For more information, please refer to the PEX 8613RDK Product Brief.



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## Product Ordering Information

Part Number	Description
PEX8613-BA50BC	12-Lane, 3-Port PCI Express Switch (19x19mm <sup>2</sup> )
PEX8613-BA50BC G	12-Lane, 3-Port PCI Express Switch, Pb-Free (19x19mm <sup>2</sup> )
PEX8613BA-AIC4U4D RDK	PEX 8613 Rapid Development Kit

Please visit the PLX Web site at <http://www.plxtech.com> for sampling.