



## Device Overview

The 89HPES48H12AG2 is a member of the IDT PRECISE™ family of PCI Express® switching solutions. The PES48H12AG2 is a 48-lane, 12-port system interconnect switch optimized for PCI Express Gen2 packet switching in high-performance applications, supporting multiple simultaneous peer-to-peer traffic flows. Target applications include servers, storage, communications, embedded systems, and multi-host or intelligent I/O based systems with inter-domain communication.

Utilizing standard PCI Express Gen2 interconnect, the PES48H12AG2 provides the most efficient system interconnect switching solution for applications requiring high throughput, low latency, and simple board layout with a minimum number of board layers. Each lane is capable of 5 GT/s of bandwidth in both directions and is fully compliant with PCI Express Base specification 2.0.

## Features

### ◆ High Performance Non-Blocking Switch Architecture

- 48-lane 12-port PCIe switch
  - Six x8 ports switch ports each of which can bifurcate to two x4 ports (total of twelve x4 ports)
- Integrated SerDes supports 5.0 GT/s Gen2 and 2.5 GT/s Gen1 operation
- Delivers up to 48 GBps (384 Gbps) of switching capacity
- Supports 128 Bytes to 2 KB maximum payload size
- Low latency cut-through architecture
- Supports one virtual channel and eight traffic classes

### ◆ Standards and Compatibility

- PCI Express Base Specification 2.0 compliant
- Implements the following optional PCI Express features
  - Advanced Error Reporting (AER) on all ports
  - End-to-End CRC (ECRC)
  - Access Control Services (ACS)
  - Power Budgeting Enhanced Capability
  - Device Serial Number Enhanced Capability
  - Sub-System ID and Sub-System Vendor ID Capability
  - Internal Error Reporting ECN
  - Multicast ECN
  - VGA and ISA enable
  - L0s and L1 ASPM
  - ARI ECN

### ◆ Port Configurability

- x4 and x8 ports
  - Ability to merge adjacent x4 ports to create a x8 port
- Automatic per port link width negotiation (x8 --> x4 --> x2 --> x1)

- Crosslink support
- Automatic lane reversal
- Autonomous and software managed link width and speed control
- Per lane SerDes configuration
  - De-emphasis
  - Receive equalization
  - Drive strength

### ◆ Switch Partitioning

- IDT proprietary feature that creates logically independent switches in the device
- Supports up to 12 fully independent switch partitions
- Configurable downstream port device numbering
- Supports dynamic reconfiguration of switch partitions
  - Dynamic port reconfiguration — downstream, upstream
  - Dynamic migration of ports between partitions
  - Movable upstream port within and between switch partitions

### ◆ Initialization / Configuration

- Supports Root (BIOS, OS, or driver), Serial EEPROM, or SMBus switch initialization
- Common switch configurations are supported with pin strapping (no external components)
- Supports in-system Serial EEPROM initialization/programming

### ◆ Quality of Service (QoS)

- Port arbitration
  - Round robin
  - Weighted Round Robin (WRR)
- Request metering
  - IDT proprietary feature that balances bandwidth among switch ports for maximum system throughput
- High performance switch core architecture
  - Combined Input Output Queued (CIOQ) switch architecture with large buffers

### ◆ Multicast

- Compliant to the PCI-SIG multicast ECN
- Supports arbitrary multicasting of Posted transactions
- Supports 64 multicast groups
- Multicast overlay mechanism support
- ECRC regeneration support

### ◆ Clocking

- Supports 100 MHz and 125 MHz reference clock frequencies
- Flexible port clocking modes
  - Common clock
  - Non-common clock

- *Local port clock with SSC and port reference clock input*
- ◆ **Hot-Plug and Hot Swap**
  - Hot-plug controller on all ports
    - *Hot-plug supported on all downstream switch ports*
  - All ports support hot-plug using low-cost external I<sup>2</sup>C I/O expanders
  - Direct package pin support for hot-plug on 5 ports
  - Configurable presence detect supports card and cable applications
  - GPE output pin for hot-plug event notification
    - *Enables SCI/SMI generation for legacy operating system support*
  - Hot-swap capable I/O
- ◆ **Power Management**
  - Supports D0, D3hot and D3 power management states
  - Active State Power Management (ASPM)
    - *Supports L0, L0s, L1, L2/L3 Ready and L3 link states*
    - *Configurable L0s and L1 entry timers allow performance/power-savings tuning*
  - Supports PCI Express Power Budgeting Capability
  - SerDes power savings
    - *Supports low swing / half-swing SerDes operation*
    - *SerDes optionally turned-off in D3hot*
    - *SerDes associated with unused ports are turned-off*
    - *SerDes associated with unused lanes are placed in a low power state*
- ◆ **54 General Purpose I/O**
- ◆ **Reliability, Availability and Serviceability (RAS)**
  - ECRC support
  - AER on all ports
  - SECDED ECC protection on all internal RAMs
  - End-to-end data path parity protection
  - Checksum Serial EEPROM content protected
  - Autonomous link reliability (preserves system operation in the presence of faulty links)
  - Ability to generate an interrupt (INTx or MSI) on link up/down transitions
- ◆ **Test and Debug**
  - On-chip link activity and status outputs available for several ports including the upstream ports
  - Per port link activity and status outputs available using external I<sup>2</sup>C I/O expander for all remaining ports
  - SerDes test modes
  - Supports IEEE 1149.6 AC JTAG and IEEE 1149.1 JTAG
- ◆ **Power Supplies**
  - Requires only two power supply voltages (1.0 V and 2.5 V)
  - No power sequencing requirements
- ◆ **Packaged in a 35mm x 35mm 1156-ball Flip Chip BGA with 1mm ball spacing**

## Block Diagram

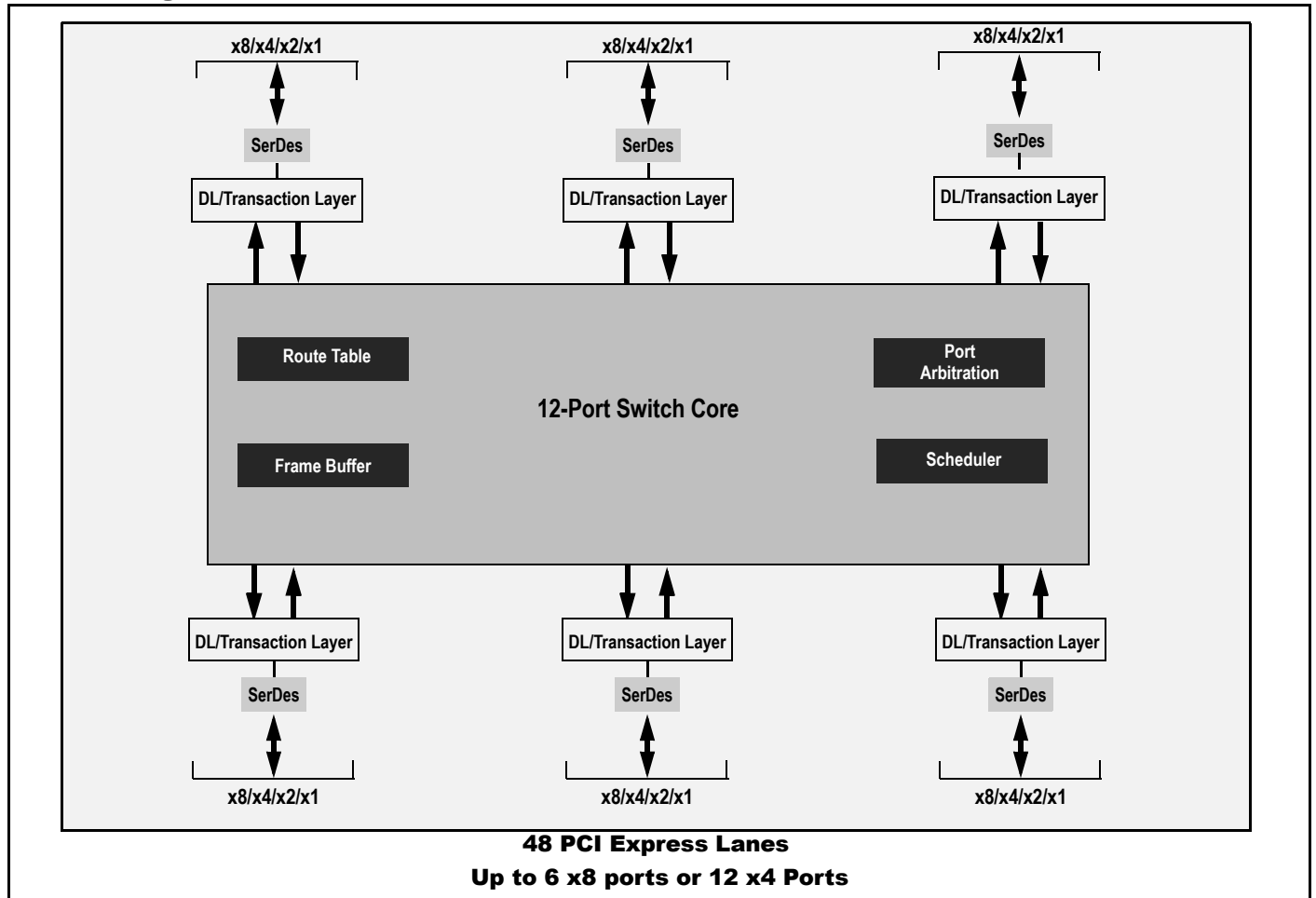


Figure 1 PES48H12AG2 Block Diagram

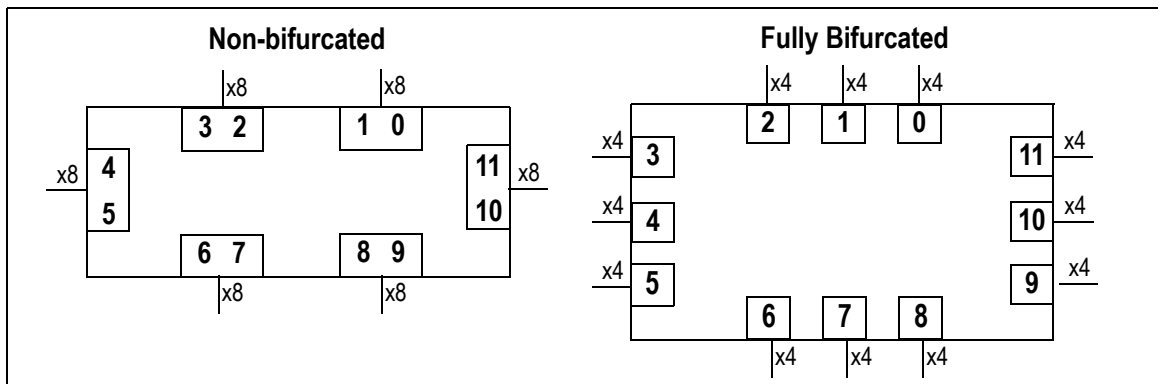


Figure 2 Port Configuration Examples

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