



**THE DATASHEET OF  
89H64H16AG2ZCBLGI**





## Device Overview

The 89HPES64H16AG2 is a member of the IDT PRECISE™ family of PCI Express® switching solutions. The PES64H16AG2 is a 64-lane, 16-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 PES64H16AG2 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

- 64-lane 16-port PCIe switch
  - Eight x8 switch ports each of which can bifurcate to two x4 ports (total of sixteen x4 ports)
- Integrated SerDes supports 5.0 GT/s Gen2 and 2.5 GT/s Gen1 operation
- Delivers up to 64 GBps (512 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 16 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
- SECCDED 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**

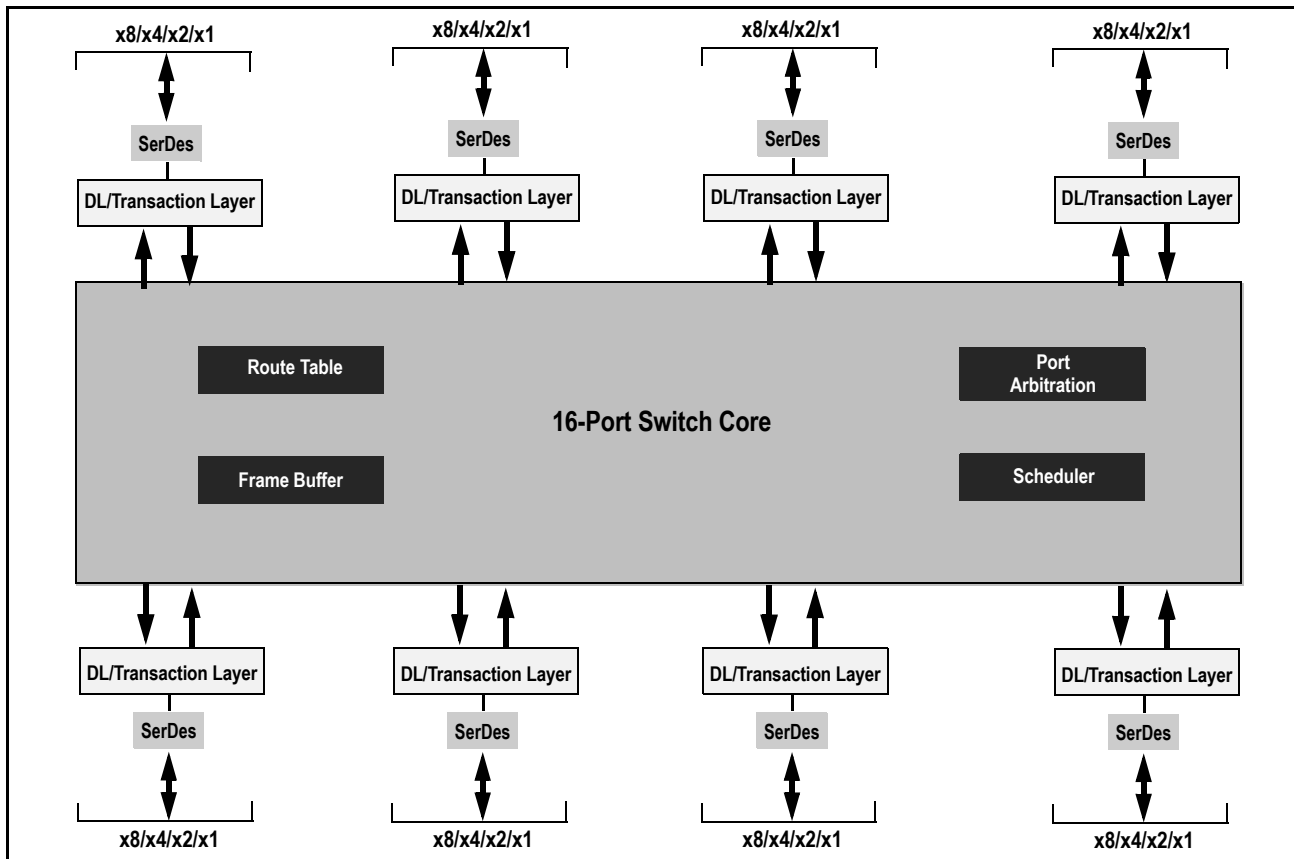
- On-chip link activity and status outputs available for several ports including the upstream ports
- Per port link activity and status outputs available using external I<sup>2</sup>C I/O expander for all remaining ports
- SerDes test modes
- Supports IEEE 1149.6 AC JTAG and IEEE 1149.1 JTAG

**◆ 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



**64 PCI Express Lanes**  
**Up to 8 x8 ports or 16 x4 Ports**

Figure 1 PES64H16AG2 Block Diagram

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