Integrated Device Technology

# PCI Express Solutions

## Comprehensive Portfolio from the Leader in PCI Express Solutions

### PCI Express Timing Solutions

*Industry's broadest offering of PCIe Gen1, Gen2, Gen3 and Gen4 clock generation and buffering solutions*

- Clock generators
- Zero delay buffers
- Fanout buffers and multiplexers

### PCI Express Signal Retimers and Repeaters

*Active signal conditioning for applications up to 8 Gbps PCIe Gen 3*

- Four, eight and sixteen channels
- Compensates for cable and PCB trace attenuation and ISI jitter
- Configurable receiver equalization
- Configurable transmitter de-emphasis
- On-chip diagnostics support
- Leading edge power minimization in active and shutdown modes

### PCI Express Switches

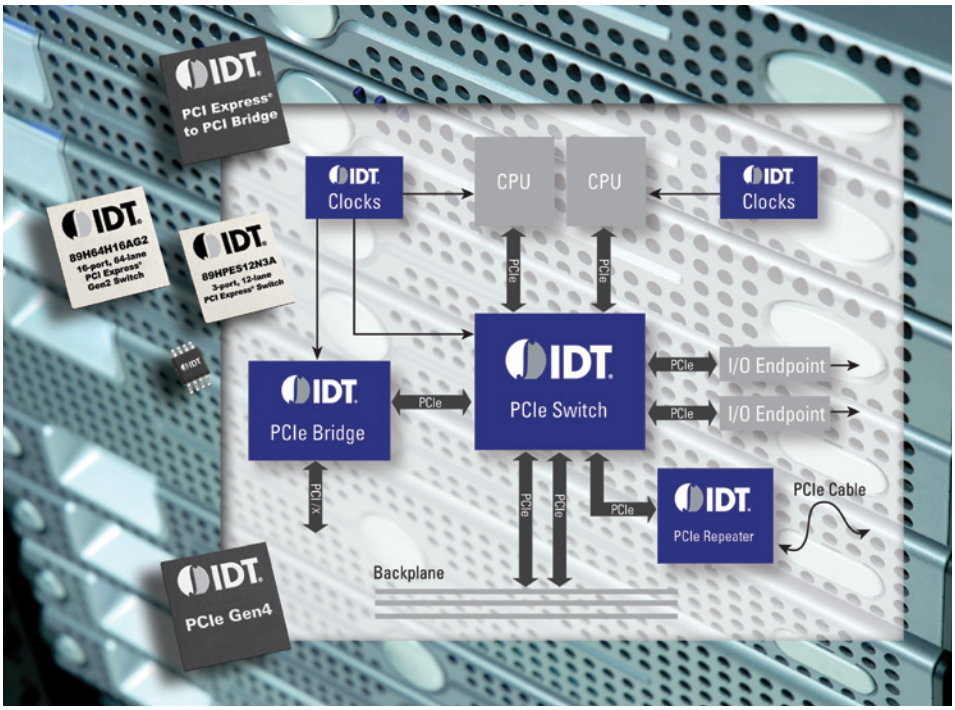
*Industry's most comprehensive family of high-performance, scalable PCIe switching solutions*

- Extensive portfolio
- Up to 64 lane and 24 port devices
- Highly flexible port configurations
- Unprecedented 8 non-transparent bridging (NTB) functions to enable multi-root applications

### PCI Express Bridges

*High performance PCIe bridging to legacy PCI and PCI-X protocols*

- Ultra-low power version for consumer applications
- Forward mode buffer optimization
- The only PCI Express bridges with Short Term Caching for significant improvement in PCI Read performance
- Pin-compatible with competitive offerings for dual source solution




PCI Express® (PCIe®) is globally recognized as the general purpose I/O that unifies the component interconnect across many applications including desktop computing, servers, workstations, storage, networking, enterprise router, industrial test and control equipment, defense, aerospace and many more.

IDT provides an extensive product portfolio that tackles design requirements needed to build an entire PCI Express network, including timing solutions, switches, signal integrity and bridges.

**Timing**

- Clock synthesizers and spread spectrum clock generators
- PLL zero-delay buffers (ZDB)
- Non-PLL fanout buffers and multiplexers

**Signal Integrity Products**

- Retimers
- Repeaters

**Switches**

- I/O expansion switches
- System interconnect switches

**Bridges**

- PCIe to PCI / PCI-X Bridges
- PCI-X to PCI-X Bridges
- PCI to PCI Bridges

**PCI Express timing** provides the reference-clock while maintaining tight jitter specifications for all components.

**PCI Express signal integrity** is signal conditioning to remove signal noise and correct for trace/cable attenuation.

**PCI Express switches** provide the switching capacity for the entire PCI Express network.

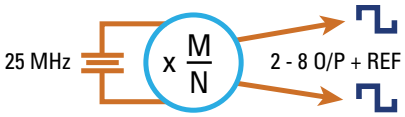
**PCI Express bridges** provide connectivity between PCI Express and a different interconnect protocol.

**Learn more:**
**idt.com/go/PCIe**

# Comprehensive Portfolio from the Leader in PCI Express Solutions

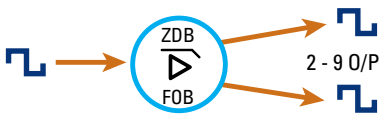
## PCI Express® Timing Solutions

### 9FG Clock (Frequency) Generators



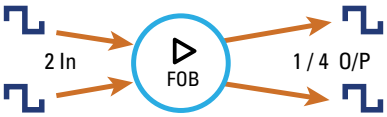

- Eliminate up to 32 resistors
- Save up to 55 mm² of area†
- As small as 6.25 mm²
- 85 Ω and 100 Ω system support
- SSC generation

### 9DB Zero-delay Fanout Buffers




- Eliminate up to 76 resistors
- Save up to 130 mm² of area†
- As small as 16 mm²
- 85 Ω and 100 Ω system support
- SSC compatible

### 9DM Fanout Multiplexers




- Eliminate up to 48 resistors
- Save up to 82 mm² of area†
- As small as 9 mm²
- 85 Ω and 100 Ω system support
- SSC compatible

## Full-Featured Low Power PCIe® Timing Solutions

**PCIe Clock Generators**

| Part Number | | | | Ref Output | PCIe Gen Compliance | PCIe Architecture Support* | Spread Spectrum Generation | Package Type | Package Dimensions (mm) |
|---|---|---|---|---|---|---|---|---|---|
| Prefix | Operating Voltage (V) | PCIe Outputs | Zout (W) | | | | | | |
| 9FG | V = 1.8<br>U = 1.5 | 02<br>04<br>06<br>08 | 31 = 33<br>41 = 100 | Yes | 1, 2, 3 | CC | 0%<br>-0.25%<br>-0.5% | QFN-24<br>QFN-32<br>QFN-40<br>QFN-48 | 4 x 4<br>5 x 5<br>5 x 5<br>6 x 6 |
| | L = 3.3** | | 41 = 100<br>51 = 85<br>P1 = Prog. | | 1, 2, 3, 4 | CC<br>SRNS<br>SRIS | | | |
| | V = 1.8 | 02 | 42 = 100 | No | 1, 2, 3 | CC | | QFN-16 | 3 x 3 |

**PCIe Clock Zero-Delay/Fan-out Buffers*****

| Part Number | | | | Pin Control of PLL Mode | PCIe Gen Compliance | PCIe Architecture Support* | Spread Spectrum Compatible | Package Type | Package Dimensions (mm) |
|---|---|---|---|---|---|---|---|---|---|
| Prefix | Operating Voltage (V) | PCIe Outputs | Zout (W) | | | | | | |
| 9DB | V = 1.8<br>U = 1.5 | 02<br>04<br>06<br>08 | 31 = 33<br>41 = 100 | Yes | 1, 2, 3 | CC | Yes | QFN-24<br>QFN-32<br>QFN-40<br>QFN-48 | 4 x 4<br>5 x 5<br>5 x 5<br>6 x 6 |
| | L = 3.3** | | 41/42 = 100<br>51/52 = 85 | | 1, 2, 3, 4 | CC<br>SRNS<br>SRIS | | | |

**PCIe Clock Fan-out Buffers*****

| Part Number | | | | Pin Control of PLL Mode | PCIe Gen Compliance | PCIe Architecture Support* | Spread Spectrum Compatible | Package Type | Package Dimensions (mm) |
|---|---|---|---|---|---|---|---|---|---|
| Prefix | Operating Voltage (V) | PCIe Outputs | Zout (W) | | | | | | |
| 9DB | V = 1.8<br>U = 1.5 | 05<br>07<br>09 | 31 = 33<br>41 = 100 | N/A | 1, 2, 3, 4 | CC | Yes | QFN-32<br>QFN-40<br>QFN-48 | 5 x 5<br>5 x 5<br>6 x 6 |
| | L = 3.3** | 07<br>09 | 41 = 100<br>51 = 85 | | | CC<br>SRNS<br>SRIS | | QFN-40<br>QFN-48 | 5 x 5<br>6 x 6 |

**PCIe Clock Mulitplexers**

| Part Number | | | | Sync/Async Switch Mode | PCIe Gen Compliance | PCIe Architecture Support* | Spread Spectrum Compatible | Package Type | Package Dimensions (mm) |
|---|---|---|---|---|---|---|---|---|---|
| Prefix | Operating Voltage (V) | PCIe Outputs | Zout (W) | | | | | | |
| 9DM | V = 1.8<br>U = 1.5 | 01<br>04 | 31 = 33<br>41 = 100 | Yes | 1, 2, 3 | CC | Yes | QFN-16<br>QFN-24 | 3 x 3<br>4 x 4 |
| | L = 3.3** | 04 | 41 = 100<br>51 = 85 | | 1, 2, 3, 4 | CC<br>SRNS<br>SRIS | | QFN-24 | 4 x 4 |

† Compared to traditional HCSL outputs
* CC = Common Clock, SRNS = Separate Reference No Spread, SRIS = Separate Reference Independent Spread
** L devices are factory customizable
*** For applications requiring more than 9 outputs, see IDT's 9ZXL line of PCIe Buffers

# Comprehensive Portfolio from the Leader in PCI Express Solutions

## PCI Express Signal Integrity Products

*PCIe® Gen3 and Gen2 Standards*

With the increase of signal speeds in the computing, storage and communications applications, system designers increasingly face signal integrity challenges. Signal Integrity Product (SIP) components provide signal conditioning for applications up to 8 Gbps, PCI Express® 3.0, delivering signal quality over extended distances while offering simplified design by alleviating board layout constraints.

These devices incorporate advanced receive equalization and transmit de-emphasis capabilities, as well as diagnostic features that help IDT customers achieve a simplified design with faster time-to-market. Specifically, the devices drive long on-board traces, backplane traces and cables to external devices to ensure optimum system performance. The devices all offer power savings modes for the lowest-possible power consumption.

### FEATURES

- Extends trace over 60 inches, and cable over 10 meters
- Eliminates Deterministic Jitter (Dj), Random Jitter (Rj) and Inter-Symbol Interference (ISI)
- Optimizes system performance by reducing lost packets
- Better system reliability with increased signal voltage and timing margins
- Simplifies system design and time-to-market

| Part Number | Channels | Pin Config | I²C Config | Package (mm) | Contact Pitch (mm) |
|---|---|---|---|---|---|
| **PCIe 3.0 Retimers** | | | | | |
| 89HT0808P | 8 | N | Y | 9 x 9 BGA | 0.8 |
| 89HT0816P | 16 | N | Y | 15 x 15 BGA | 1.0 |
| 89HT0816AP | 16 | N | Y | 15 x 15 BGA | 1.0 |
| 89HT0832P | 32 | N | Y | 13 x 20 BGA | 0.8 |
| 89HT0832P | 32 | N | Y | 16 x 24 BGA | 1.0 |
| **PCIe 2.1 Repeaters** | | | | | |
| 89HP0504P | 4 | N | Y | 4 x 7.5 QFN | 0.5 |
| 89HP0504P | 4 | Y | Y | 9 x 9 BGA | 1.0 |
| 89HP0504PB | 4 | Y | N | 4 x 7.5 QFN | 0.5 |
| 89HP0508P | 8 | N | Y | 9 x 9 BGA | 1.0 |

**Additional products and information available — idt.com/go/PCIeSIP**

## PCI Express Switches

*Featuring Dual DMA, Multiple NTB, Multicast; Configurations 3 to 64 Lanes and 3 to 24 Ports*

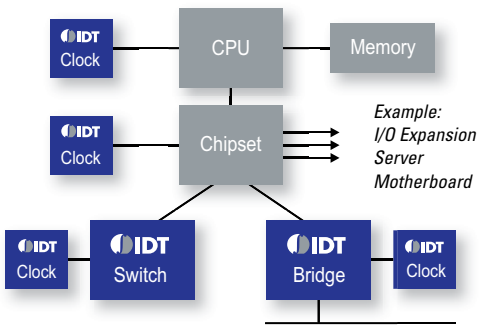
IDT provides the industry's most comprehensive family of high performance, scalable PCI Express switching solutions. PCIe switching solutions are optimized by application to maximize performance per watt for the most demanding applications.

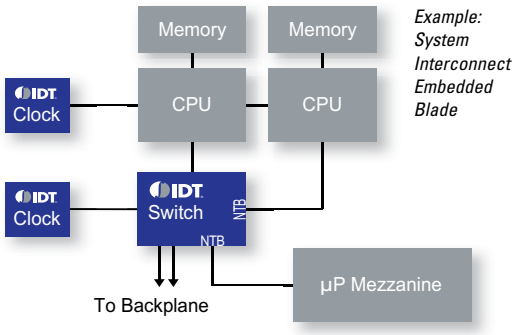
IDT "I/O Expansion PCIe Switches" are commonly used to connect a single Root Complex to I/O devices and add-in cards. In this usage model, the majority of traffic flows between the Root Complex and the I/O devices.

The other primary usage model is using a PCIe switch as an embedded system fabric referred to as "System Interconnect Switch," which utilizes a high degree of peer-to-peer traffic. The System Interconnect Switch is capable of PCIe domain isolation, which may involve connecting multiple processing endpoints or simply providing a redundant backplane architecture.

### FEATURES

- Most advanced switching architecture available
  - Switch partitioning
  - Adaptive cut-through latency
  - Request metering
  - Large flow control credits and buffers
- Enables multi-domain communication in multi-root applications
  - Multiple non-transparent bridge functions
  - Multi-port timing domain and spread spectrum clock support
  - Multicast
  - Dual DMA controllers



# Comprehensive Portfolio from the Leader in PCI Express Solutions

## PCI Express® Switches

| Part Number | PCIe Specification | Lanes | Ports | Switch Partitions (Multi-root) | NTB Ports | DMA Controllers | Multicast | Multi-Domain Clocking | Package Size (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 89H32NT24AG2 | 2 | 32 | 24 | 8 | 8 | 2 | Yes | 8 | 23 x 23 |
| 89H32NT8AG2 | 2 | 32 | 8 | 8 | 8 | 2 | | 8 | 23 x 23 |
| 89H24NT6AG2 | 2 | 24 | 6 | 6 | 6 | 2 | | 6 | 23 x 23 |
| 89H24NT24G2 | 2 | 24 | 24 | 8 | 8 | 2 | | 2 | 23 x 23 |
| 89H16NT16G2 | 2 | 16 | 16 | 4 | 4 | 2 | | 2 | 19 x 19 |
| 89H12NT12G2 | 2 | 12 | 12 | 3 | 3 | 2 | | 2 | 19 x 19 |
| 89HPES64H16G2 | 2 | 64 | 16 | 16 | N/A | N/A | N/A | N/A | 35 x 35 |
| 89HPES48H12G2 | 2 | 48 | 12 | 12 | | | | | 27 x 27 |
| 89HPES32T8G2 | 2 | 32 | 8 | N/A | | | | | 23 x 23 |
| 89HPES24T6G2 | 2 | 24 | 6 | | | | | | 19 x 19 |
| 89HPES24T3G2 | 2 | 24 | 3 | | | | | | 19 x 19 |
| 89HPES16T4G2 | 2 | 16 | 4 | | | | | | 23 x 23 |
| 89HPES12T3G2 | 2 | 12 | 3 | | | | | | 19 x 19 |
| 89HPES6T6G2 | 2 | 6 | 6 | | | | | | 19 x 19 |
| 89HPES8T5A | 1 | 8 | 5 | | | | | | 15 x 15 |
| 89HPES5T5 | 1 | 5 | 5 | | | | | | 15 x 15 |
| 89HPES4T4 | 1 | 4 | 4 | | | | | | 15 x 15 |
| 89HPES3T3 | 1 | 3 | 3 | | | | | | 10 x 10 |

**Additional products and information available — idt.com/go/PCIeSwitches**

## PCI Express Bridges

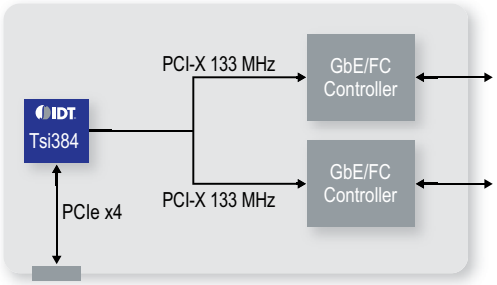
*PCIe® to PCI and PCI-X Bus Standards*

To complement the switch products, IDT offers bridges to connect PCIe® to the PCI and PCI-X bus standards. A PCIe bridge is used for bridging devices that use the PCI/X interface to provide a PCIe connection to a host processor or root complex. Applications include PCIe adapter cards, embedded computing, and motherboards to provide connection to PCI/X devices or additional PCI/X expansion slots.

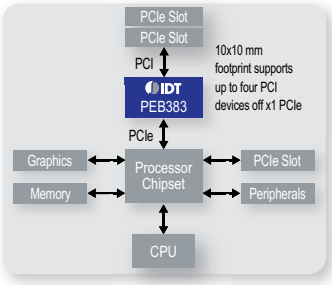
### FEATURES

- Compliant to PCIe 1.1 specification
- Low latency & high throughput features
- Proven interoperability
- Small footprint packages
- Simple power supply requirements
- Comprehensive design tools

*Contact an IDT representative for details on pin-compatibility with comparable solutions.*




*Example: Storage HBA*




*Example: Motherboard Application*

| Bridge | Part Number | PCIe I/F | PCI Speed (MHz) | External Master Support | Power | Package (mm) |
|---|---|---|---|---|---|---|
| PCIe to PCI | 89HPEB383 | x1 Gen1 | 32/66 | 4 | 450 mW | 14 x 14 QFP<br>10 x 10 QFN |
| PCIe to PCI | Tsi381 | x1 Gen1 | 32/66 | 4 | 700 mW | 13 x 13 PBGA |
| PCIe to PCI | Tsi382 | x1 Gen1 | 32/66 | 4 | 700 mW | 20 x 20 QFP<br>10 x 10 PBGA |
| PCIe to PCI-X | Tsi384 | x4 Gen1 | 64/133 | 4 | 1.3 W | 17 x 17 PBGA |
| PCI to PCI | Tsi340 | N/A | 32/66 | 4 | 500 mW | 23 x 17 QFP |
| PCI to PCI | Tsi350 | | 32/66 | 9 | 1.0 W | 31 x 31 QFP<br>17 x 17 BGA |
| PCI to PCI | Tsi352 | | 32/66 | 4 | 500 mW | 32 x 32 QFP |

**Additional products and information available — idt.com/go/PCIeBridges**

# Mouser Electronics

Authorized Distributor

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IDT (Integrated Device Technology):

89KTPES5T5 89KTPES24NT6AG2 89KTPES64H16G3 TSI381-RDK1 V2.0 89KTPES3T3QFN 89KTPES48H12G2 89KTPES48H12BG2 89KTPES48H12G3 89KTPES32NT8AG2 89KTPES6T5 89H32H8G3YAHL 89H32H8G3YAHLG 89KTPES48T12G2 89H32H8G3YAHLGI8 TSI381-RDK1 V2.1 89H32H8G3YAHLI 89KTPES32H8G2 TSI381-RDK2 V1.0 89H32H8G3YAHLI8 TSI310A-RDK1 V1.0 89H32H8G3YAHLGI 89H32H8G3YAHL8 89KTPES4T4QFN 89KTPES32NT8BG2 89KTPES48H12AG2 89KTPES32T8G2 89H32H8G3YAHLG8 89KTPES34H16G2 TSI340-RDK1 89KTPES4T4 89KTPES32NT24AG2