



Integrated Device Technology

# PCI Express® Solutions

Comprehensive Portfolio from the Leader in PCI Express Solutions

ANALOG AND RF | INTERFACE AND CONNECTIVITY | MEMORY AND LOGIC | POWER MANAGEMENT | TIMING AND SYNCHRONIZATION

## 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 Signal Repeaters and Retimers

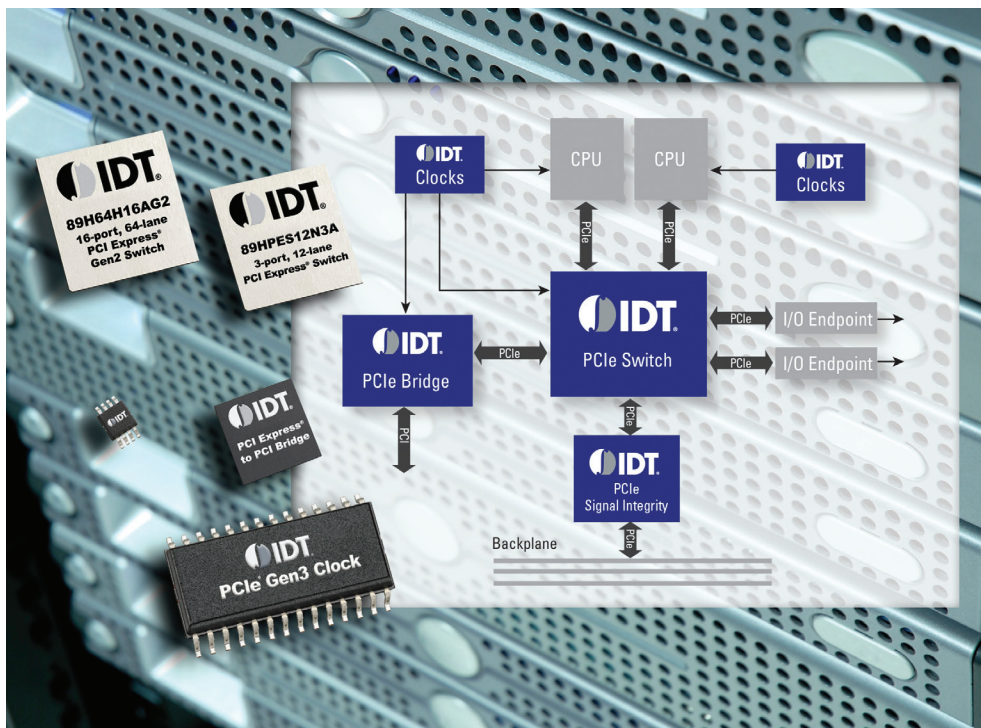
Active signal conditioning for applications up to 8Gbps PCIe Gen 3

- 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
- Mux / Demux modes provided

## PCI Express Timing Solutions

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

- World's first PCI Express Gen3 family of timing devices
- Industry's most accurate all-silicon CMOS oscillator
- Clock Generators and Synthesizers
- Spread Spectrum Clock Generators
- Fanout Buffers and Muxes
- Jitter Attenuators
- Frequency Translators
- Zero Delay Buffers



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 switches, bridges, signal integrity and timing solutions.

### 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

### Signal Integrity Products

- Repeaters
- Retimers

### Timing

- Clock synthesizers & Spread spectrum clock generators
- PLL Zero-Delay Buffers (ZDB)
- Non-PLL fanout Buffers and Muxes
- Jitter Attenuators
- All-silicon CMOS Oscillators

**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.

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

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



Learn more:

[www.idt.com/go/PCIe](http://www.idt.com/go/PCIe)

## 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 Gen1, Gen2 and Gen3 switching solutions are optimized by application to maximize performance per watt for the most demanding applications.

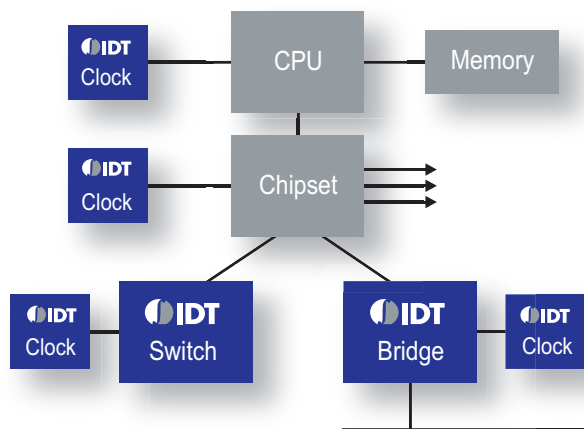
IDT "I/O Expansion PCIe Switches" are commonly used to connect a single Root Complex to I/O devices and add-in cards. In this usage

model, the majority of traffic flows between the Root Complex and the I/O devices.

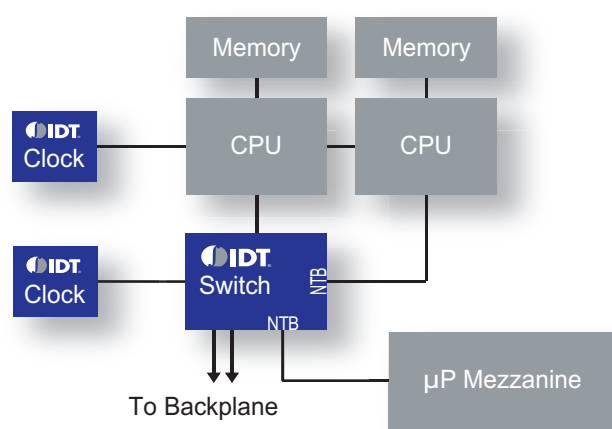
The other primary usage model is using a PCIe switch as an embedded system fabric referred to as "System Interconnect Switch," which utilizes a high degree of peer-to-peer traffic. The System Interconnect Switch is capable of PCIe domain isolation, which may involve connecting multiple processing endpoints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



Example: I/O Expansion Server Motherboard



Example: System Interconnect Embedded Blade

| Part Number * | PCIe Specification | Lanes | Ports | Switch Partitions (Multi-Root) | NTB ports (Multi-Root IO) | DMA Controllers | Multicast | ARID/ACS | Atomics/TPH | LTR/OBFF | Adaptive Cut-through | Multi-Domain Clocking | Request Metering | Temperature Sensor | Package Size (mm) |
|---------------|--------------------|-------|-------|--------------------------------|---------------------------|-----------------|-----------|----------|-------------|----------|----------------------|-----------------------|------------------|--------------------|-------------------|
| 89H64H16G3    | 3                  | 64    | 16    | 16                             |                           |                 | ✓         | ✓        | ✓           | ✓        | ✓                    | 16                    | ✓                |                    | 35x35             |
| 89H48H12G3    | 3                  | 48    | 12    | 12                             |                           |                 | ✓         | ✓        | ✓           | ✓        | ✓                    | 12                    | ✓                |                    | 27x27             |
| 89H32H8G3     | 3                  | 32    | 8     | 8                              |                           |                 | ✓         | ✓        | ✓           | ✓        | ✓                    | 8                     | ✓                |                    | 23x23             |
| 89H32NT24AG2  | 2                  | 32    | 24    | 8                              | 8                         | 2               | ✓         | ✓        |             |          | ✓                    | 8                     | ✓                | ✓                  | 23x23             |
| 89H32NT8AG2   | 2                  | 32    | 8     | 8                              | 8                         | 2               | ✓         | ✓        |             |          | ✓                    | 8                     | ✓                | ✓                  | 23x23             |
| 89H24NT6AG2   | 2                  | 24    | 6     | 6                              | 6                         | 2               | ✓         | ✓        |             |          | ✓                    | 6                     | ✓                | ✓                  | 23x23             |
| 89H24NT24G2   | 2                  | 24    | 24    | 8                              | 8                         | 2               | ✓         | ✓        |             |          | ✓                    | 2                     | ✓                | ✓                  | 23x23             |
| 89H16NT16G2   | 2                  | 16    | 16    | 4                              | 4                         | 2               | ✓         | ✓        |             |          | ✓                    | 2                     | ✓                | ✓                  | 19x19             |
| 89H12NT12G2   | 2                  | 12    | 12    | 3                              | 3                         | 2               | ✓         | ✓        |             |          | ✓                    | 2                     | ✓                | ✓                  | 19x19             |
| 89HPES8T5A    | 1                  | 8     | 5     |                                |                           |                 |           |          |             |          |                      |                       |                  |                    | 15x15             |
| 89HPES5T5     | 1                  | 5     | 5     |                                |                           |                 |           |          |             |          |                      |                       |                  |                    | 15x15             |
| 89HPES4T4     | 1                  | 4     | 4     |                                |                           |                 |           |          |             |          |                      |                       |                  |                    | 15x15             |
| 89HPES3T3     | 1                  | 3     | 3     |                                |                           |                 |           |          |             |          |                      |                       |                  |                    | 10x10             |

\* Additional products and information available — [www.idt.com/go/PCIESwitches](http://www.idt.com/go/PCIESwitches)

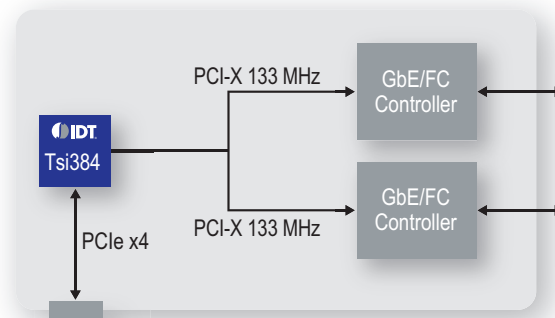
## PCI Express Bridges

### PCIe to PCI and PCI-X Bus Standards

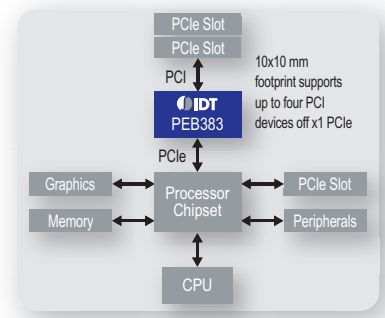
To complement the switch products, IDT offers bridges to connect PCIe to the PCI and PCI-X bus standards. A PCIe bridge is used for bridging devices that use the PCI/X interface to provide a PCIe connection to a host processor or root complex. Applications include PCIe adapter cards, embedded computing,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



Example: Storage HBA



Example: Motherboard Application

| Bridge         | Part Number* | PCIe    | PCI    | Short Term Caching | External Master Support | Non-Transparent Bridging | Power                    | Package Size (mm)       |
|----------------|--------------|---------|--------|--------------------|-------------------------|--------------------------|--------------------------|-------------------------|
| PCIe to PCI    | PEB383       | x1 Gen1 | 32/66  | ✓                  | 4                       | ✓                        | 450 mW<br>130 mW standby | 14x14 QFP<br>10x10 QFN  |
| PCIe to PCI    | Tsi382       | x1 Gen1 | 32/66  | ✓                  | 4                       | ✓                        | 700 mW                   | 20x20 QFP<br>10x10 PBGA |
| PCIe to PCI    | Tsi381       | x1 Gen1 | 32/66  | ✓                  | 4                       | ✓                        | 700 mW                   | 13x13 PBGA              |
| PCIe to PCI-X  | Tsi384       | x4 Gen1 | 64/133 | ✓                  | 4                       | ✓                        | 1.3 W                    | 17x17 PBGA              |
| PCI-X to PCI-X | Tsi310       |         | 64/133 | ✓                  | 6                       |                          | 3.0 W                    | 31x31 BGA               |
| PCI to PCI     | Tsi352       |         | 32/66  |                    | 4                       |                          | 0.5 W                    | 32x32 QFP               |
| PCI to PCI     | Tsi350A      |         | 32/66  |                    | 9                       |                          | 1.0 W                    | 25x25 QFP<br>15x15 BGA  |
| PCI to PCI     | Tsi340       |         | 32/66  |                    | 4                       |                          | 0.5 W                    | 23x17 mm QFP            |

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

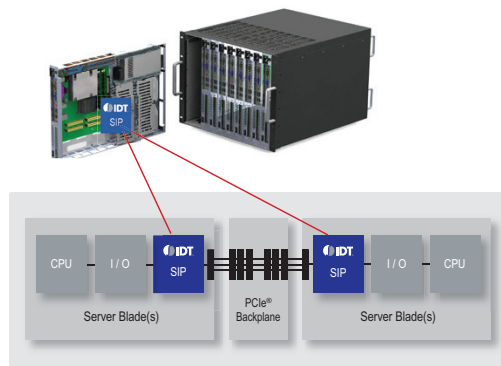
\* Additional products and information available — [www.idt.com/go/PCIEBridges](http://www.idt.com/go/PCIEBridges)

## PCI Express Signal Integrity Products

### PCIe Gen 3 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 8Gbps, 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.



Example: Signal Conditioner Use

### FEATURES

- Extends trace over 60 inches, and cable over 10 meters
- Eliminates Deterministic Jitter (Dj), Random Jitter (Rj) and ISI (Inter-Symbol Interference)
- 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. | PC config. | Package | Pins |
|--------------------|----------|-------------|------------|---------|------|
| PCIe 3.0 Retimers  |          |             |            |         |      |
| 89HT0808PZAAB      | 8        | N           | Y          | BGA     | 100  |
| 89HT0816PZABC      | 16       | N           | Y          | BGA     | 196  |
| PCIe 2.1 Repeaters |          |             |            |         |      |
| 89HP0504PZBNR      | 4        | N           | Y          | QFN     | 36   |
| 89HP0504PZBAB      | 4        | Y           | Y          | BGA     | 100  |
| 89HP0504PBZBNR     | 4        | Y           | N          | QFN     | 36   |
| 89HP0508PZBAB      | 8        | N           | Y          | BGA     | 100  |

\* Additional products and information available — [www.idt.com/go/PCIESIP](http://www.idt.com/go/PCIESIP)



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## PCI Express Timing Solutions

### Highly Integrated Clocks for PCIe-based Systems

The IDT PCI Express timing products meet or exceed the stringent PCIe SIG specification and include all the devices needed to design and manufacture top-of-the-line PCIe-based products requiring ultra-high-speed serial data transfer.

### SOLUTIONS

#### Clock Synthesizers and Spread Spectrum Clock Generators

- Single-ended clock input to differential output
- Meets PCIe jitter specs at 100MHz
- Spread Spectrum feature reduces EMI

#### PLL Zero-Delay Buffers (ZDB)

- Up to 19 outputs per device

#### Non-PLL Fanout Buffers and Muxes

- PCIe specification compliant outputs
- 2 to 21 outputs per device
- Frequencies > 500MHz

#### Jitter Attenuators

- Special purpose PLL reduces PCIe clock jitter
- 2 to 6 outputs per device

### All Silicon CMOS Oscillators

Eliminate Quartz with the World's Most Accurate CMOS Oscillators. For more information visit <http://www.idt.com/go/cmos-oscillators>

### High Performance PCIe Clock Synthesizers

Additional products and information available — [www.idt.com/go/PCleClocks](http://www.idt.com/go/PCleClocks)

| Part Number  | Description                                 | Inputs | Outputs   | Input Frequency    | Output Frequency | Pins & Package          |
|--------------|---|--------|-----------|--------------------|------------------|-------------------------|
| 5V41064/5/6  | PCIe Gen2 Clock Synthesizer. Spread Capable | 1      | 1 / 2 / 4 | 25 MHz             | 100 MHz          | 16-MLF, 16/20 TSSOP     |
| 9FG104D/108D | PCIe Gen2 Clock Synthesizer. Spread Capable | 1      | 4 / 8     | 14.318/ 25 MHz     | 100-400 MHz      | 28/48 SSOP, 28/48 TSSOP |
| 9DS400/800   | PCIe Gen2 Spread Generator                  | 1      | 4 / 8     | 100 MHz            | 100 MHz          | 28/48 SSOP, 28/48 TSSOP |
| 9FG430/830   | PCIe Gen3 Clock Synthesizer. Spread Capable | 1      | 4 / 8     | 14.318 MHz, 25 MHz | 100-400 MHz      | 28/48 SSOP, 28/48 TSSOP |

### Very High Performance PCIe Clock Synthesizers

Additional products and information available — [www.idt.com/go/PCleClocks](http://www.idt.com/go/PCleClocks)

| Part Number         | Description  | Inputs           | Outputs                 | Input Frequency        | Output Frequency      | Pins & Package              |
|---------------------|--|------------------|-------------------------|------------------------|-----------------------|-----------------------------|
| 841S101 / 102 / 104 | PCIe Clock Synthesizer. Gen3 jitter performance  | 1                | 1, 2 or 4               | 25MHz (xtal)           | 100MHz                | 16, 20, 24 TSSOP            |
| 841602 / 604 / 608  | PCIe Clock Synthesizer. Gen2 jitter performance  | 2                | 2, 4, or 8              | 25MHz (xtal)           | 100, 125MHz           | 32 VFQFN (841608), 28 TSSOP |
| 841N4830            | PCIe Gen2 Clock Synthesizer. Low phase noise outputs.  | 2                | 6 (HCSL, CMOS, Ref_Out) | 25MHz                  | 25, 50, 100MHz        | 32 VFQFN                    |
| 871S1022            | PCIe Gen2 jitter attenuator and selectable frequency synthesizer. Low phase noise outputs, SSC capable | 2 (XTAL or Diff) | 4                       | 25MHz (xtal) or 100MHz | 100, 125, 250, 500MHz | 32 VFQFN                    |

### PLL Zero Delay Buffers w/Fanout Mode

Additional products and information available — [www.idt.com/go/PCleClocks](http://www.idt.com/go/PCleClocks)

| Part Number | Description                              | Inputs | Outputs                  | Max Prop. delay | Max Output Skew | Pins & Package                                      |
|-------------|--|--------|--------------------------|-----------------|-----------------|---|
| 9DB102/106  | 2/6 output PCIe Gen2 buffer              | 1      | 2/6                      | 4.2 ns          | 25 ps           | 20 QSOP, 20/28 SSOP, 28 TSSOP                       |
| 9DB403/803  | 4/8 output PCIe Gen2 buffer              | 1      | 4/8                      | 4.5 ns          | 50 ps           | 28/48 SSOP, 28/48 TSSOP                             |
| 9DB423/823  | 4/8 output PCIe Gen2, QPI 6.4GB/s buffer | 1      | 4/8                      | 4.5 ns          | 50 ps           | 48 SSOP, 48 TSSOP                                   |
| 9DBx33      | 2-19 output PCIe Gen3 Buffers            | 1      | 2 / 4 / 6<br>8 / 12 / 19 | 4.5 ns          | 100 ps          | 20 / 28 / 48 / 64 / 72<br>QSOP / TSSOP / SSOP / MLF |
| 9ZX21x01    | PCIe Gen3, QPI 9.6GB/s buffer, low drift | 1      | 12/15/19                 | 4.5 ns          | 100 ps          | 56/64/72 MLF  |

### Non-PLL Fanout Buffers and Muxes

Additional products and information available — [www.idt.com/go/PCleClocks](http://www.idt.com/go/PCleClocks)

| Part Number | Description  | Inputs | Outputs | Max Prop Delay | Max Output Skew | Pins & Package   |
|-------------|--|--------|---------|----------------|-----------------|------------------|
| 557-08      | 2 to 1 HCSL output PCIe Gen1 clock multiplexing buffer | 2      | 1       | 4 ns           | 50 ps           | 16 TSSOP         |
| 557-06      | 2 to 4 HCSL output PCIe Gen1 clock multiplexing buffer | 2      | 4       | 3 ns           | 50 ps           | 20 TSSOP         |
| 9DBL411     | 4 output PCIe Gen2 low power fanout buffer             | 1      | 4       | 3.5 ns         | 50 ps           | 20 TSSOP, 20 MLF |

### PCIe Jitter Attenuators

Additional products and information available — [www.idt.com/go/PCleClocks](http://www.idt.com/go/PCleClocks)

| Part Number | Description   | Inputs           | Outputs | Input Frequency        | Output Frequency                       | Pins & Package |
|-------------|---|------------------|---------|------------------------|--|----------------|
| 874003-02   | PCIe. Part of Virtex5 ref. design   | 1                | 3       | 100MHz                 | 100, 125, 250MHz                       | 20 TSSOP       |
| 874003-05   | PCIe Gen2. Part of Virtex6 ref. design  | 1                | 3       | 100MHz                 | 100, 125, 250MHz                       | 20 TSSOP       |
| 874001-05   | PCIe Gen2. Part of Virtex6 ref. design  | 1                | 1       | 100MHz                 | 100, 125, 250, 500MHz                  | 20 TSSOP       |
| 8714004     | PCIe Gen2. External feedback, low phase noise, individual output divides, MLVDS output. | 1                | 4       | 19.6 - 165MHz          | 98 - 165MHz, individual output divides | 40 VFQFN       |
| 8743004     | PCIe Gen2. External feedback, low phase noise, individual output divides, MLVDS output. | 1                | 4       | 19.6 - 165MHz          | 98 - 165MHz, individual output divides | 40 VFQFN       |
| 871S1022*   | PCIe Gen2. Selectable frequency synthesizer, low phase noise outputs, SSC capable       | 2 (XTAL or Diff) | 4       | 25MHz (xtal) or 100MHz | 100, 125, 250, 500MHz                  | 32 VFQFN       |

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