PCIE GEN 3 EXPANSION (92-508234)

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Overview

The Trenton Systems PCIe Gen 3 expansion board allows a cost-effective, reliable, high-performance way to add up to 18 additional PCIe slots to almost any computer system. It's ideal for applications where a single computer needs to host many high-speed PCI Express slots. The uses range from GPU applications, such as AI and machine learning, as well as video walls, for large displays, storage, including NVMe, SAS, or SATA, test and measurement uses, such as industrial automation, and many others.

From a host computer, customers may use the Dolphin PXH832 host card with four SFF-8644 copper cables, up to 3 meters, that connect to Trenton Systems' PED8234 target board, which is plugged into any Trenton HDEC-form-factor backplane. You can put these HDEC backplanes into a 4U- or 5U-high chassis with various power supply options.
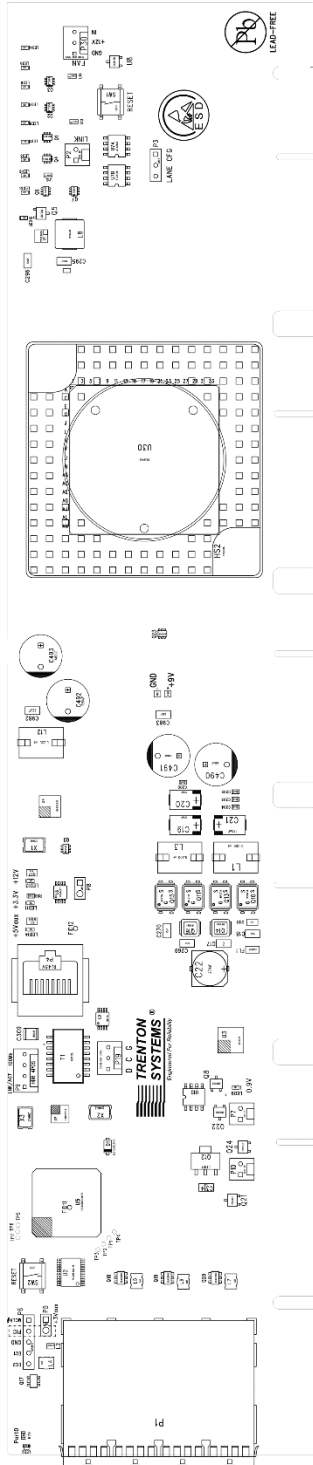
The key is that the Trenton PED8234 board plugs into the processor slot of an HDEC backplane. The PED8234 board has a Broadcom PEX 8796 switch, which takes the x16 PCIe Gen 3 that was cabled into the chassis, and then distributes 80 lanes down to the HDEC-form-factor backplane.
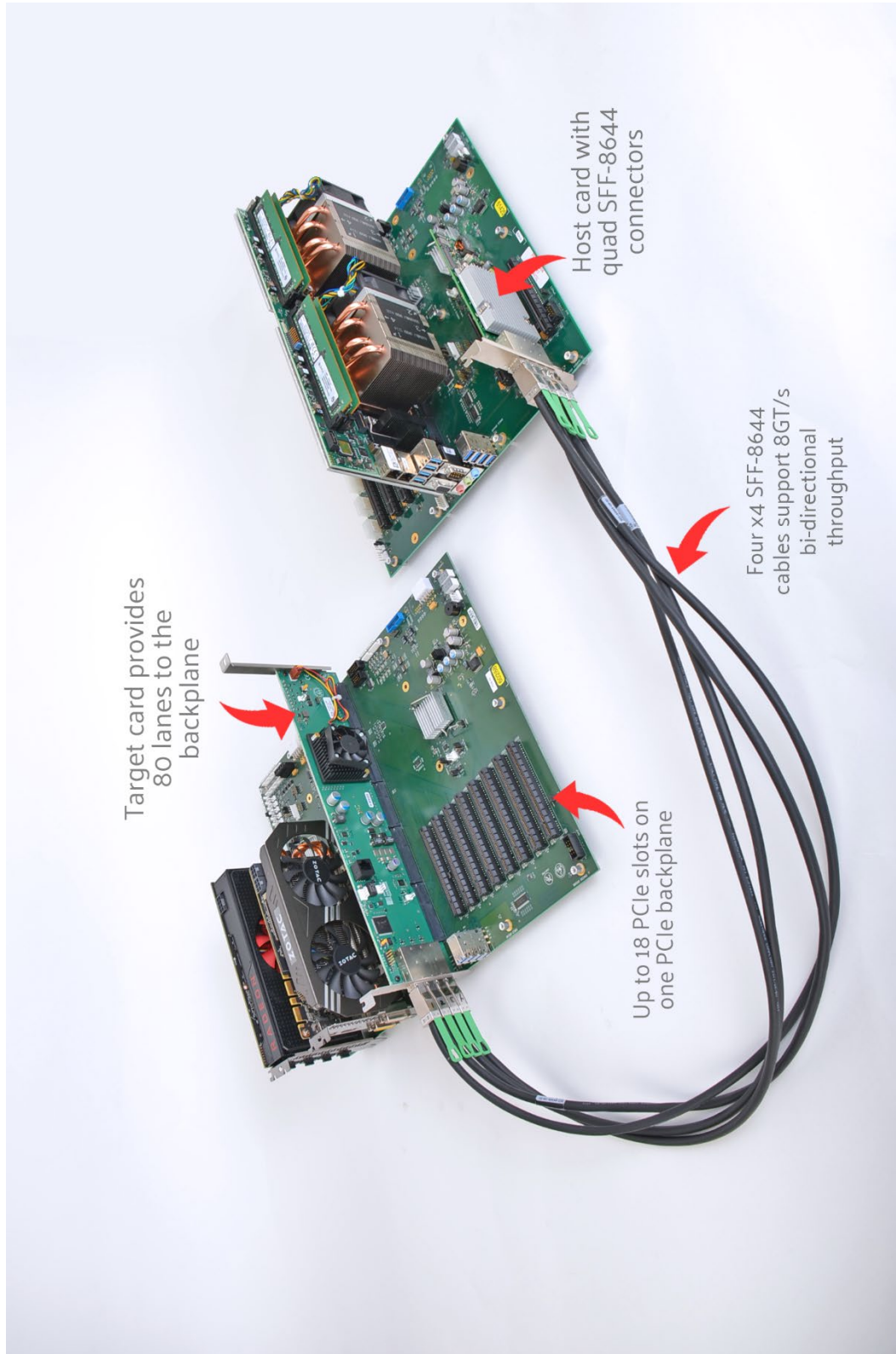
The PED8234 target board is mechanically secured into the chassis and benefits from active cooling, which is ideal for rugged, harsh environments. The Trenton PED8234 and Dolphin PXH832 I/O brackets can also be adjusted for chassis that use only half-height or full-height PCIe cards (the default bracket is the full-height plate).

You do not need an operating system or driver software for this PCIe expansion system, but there may be BIOS implications, depending on the type of cards used for a particular application. We will discuss these BIOS-level technical considerations later in this document.

Diagrams and Illustrations

Host card with quad SFF-8644 connectors

Four x4 SFF-8644 cables support 8GT/s bi-directional throughput

Target card provides 80 lanes to the backplane

Up to 18 PCIe slots on one PCIe backplane

Backplane and Chassis Options

a. **Backplane options**

The PED8234 board will work with any HDEC-form-factor backplane. For a complete list of HDEC backplanes, please see the Trenton Systems website. Below, we highlight the three most popular backplane options that provide the most PCIe expansion slots.

 i. HDB8228
   1. Four x16 and four x4 PCIe Gen 3 slots
   2. Fits into a 4U-high, 16.5-inch, short-depth chassis (THS4086)
 ii. HDB8259
   1. Four x16 and 10 x8 PCIe Gen 3 slots
   2. Fits into a 5U-high, XX-inch-short-depth chassis (THS5095, THS5087, or TSS5201) OR a 4U-high, 26-inch-depth chassis (THS4095)
 iii. HDB8231
   1. Two x8 and 16 x4 PCIe Gen 3 slots
   2. Fits into a 5U-high, XX-inch-short-depth chassis (THS5095, THS5087, or TSS5201) or a 4U-high, 26-inch-depth chassis (THS4095)

b. **Chassis options**

The PED8234 board and HDEC-form-factor backplanes will work with various chassis. For a complete list of chassis, please see the Trenton Systems website. Below, we highlight the most popular chassis options which provide the most PCIe expansion slots.

 i. THS4086
   1. 4U rackmount, 16.5-inch depth
   2. Ideal for short-depth, rugged applications
 ii. THS4095
   1. 4U rackmount, 26-inch depth
   2. Note the chassis has a front power supply, which allows for more slots out of the back of the chassis.
 iii. THS5095
   1. 5U rackmount, 19.5-inch depth
   2. Ideal for applications that require short depth with a 1200-watt, micro-redundant power supply.
 iv. THS5087
   1. 5U rackmount, 23-inch depth
   2. Ideal for applications that need a lot of redundant (N+1) power supply
 v. TSS5201
   1. 5U rackmount, 24.5-inch depth
   2. Forty-eight 2.5-inch drives that are all front-accessible.

Technical Considerations

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a. Bandwidth

The Dolphin PXH832 provides a high-performance, low-latency, transparent Broadcom (PLX) switch that transmits a x16 PCIe Gen 3 transparent link at 128 Gbit/s. On the Trenton Systems PED8234 target card, the x16 link connects to the Broadcom PEX 8796 non-blocking upstream port. Downstream from the PEX 8796 switch, there may be other various PCIe switches on the backplane, depending on your specific system.

b. Cables

    vi.   1 meter and 3 meters

    vii. If 2-meter or 3-meter cables are used, then the long-cable dip switch option on the Dolphin PXH832 should be selected (fourth switch down set to ON). The 1-meter cables need to have the short-cable dip switch option (fourth switch down set to OFF).

c. BIOS implications

The mainline BIOS shipped with all Trenton Systems products supports a wide variety of hardware and software combinations. This flexibility and robustness provide a stable, reliable platform for supporting many configurations of CPUs, PCIe devices, USB attachments, and other miscellaneous peripherals. There may be occasions during which the BIOS will run out of PCI resources, depending on the customer's configuration. A typical symptom would be that the BIOS and OS can see everything just fine until you plug in one additional PCIe card and there is not enough space, particularly under 4k memory space, to handle any further resources getting allocated. Trenton Systems' BIOS engineers can work with customers to ensure that the hardware is set up correctly and that all peripherals are seen as expected in the BIOS before handing over control to the operating system.

d. Reset propagation

If a reset triggers at the host computer, then Trenton Systems sends that reset through the PCIe link to the target PED8234 board. That reset is then propagated to the HDEC backplane and then to any PCIe cards. The exact reset propagation configuration should be the same regardless of the HDEC backplane used. When the host system generates a reset, the Dolphin card detects this and generates an I2C command down the PCIe cable. The microcontroller on the 8234 sees this and re-generates the reset to the target HDEC backplane, which will reset the PCIe cards.

e. LEDs – all LEDs are green unless otherwise stated

    viii. LED1 – PLX switch fatal (red) (development use)

    ix.   LED2 – Upstream PCIe link good

    x.   LED3 and LED16 – GPIO configurable (development use)

      xi.   LED4, LED5, LED6, LED7, and LED8 – Downstream PCIe link good (there are five x16 links to the backplane)

      xii.   LED9 – 0.9V good

      xiii.   LED10 – 1.8V good

      xiv.   LED11 – 3.3V good

      xv.   LED12 – SPD good (yellow) (development use)

      xvi.   LED13 – 12V good

      xvii.   LED14 – 5V aux good

      xviii.   LED15 – EEPROM good (development use)

      xix.   LED17 – Ethernet link good

      xx.   LED18 – PIC microcontroller (bi-color, red and green) (development use)

f.   Connectors

      xxi.   P1 – Four x4 PCIe Gen 3 connections

      xxii.   P2 – Upstream PCIe link good (LED2)

      xxiii.   P3 – Lane config (development use)

      xxiv.   P4 – PIC power good (development use)

      xxv.   P5 – Configuration (development use)

      xxvi.   P6 – 0.9V power good (LED9)

      xxvii.   P7 – Configuration (development use)

      xxviii.   P8 – PIC GPIO (development use)

8234 LED to Backplane Slot Mapping

8234 LED	8234 PLX Port #	8228 Slot
	Port 21	PCIE1 (x4)
LED8	Port 4	PCIE2 (x16)
LED4	Port 20	PCIE3 (x4)
LED5	Port 16	PCIE4 (x16)
	Port 22	PCIE5 (x4)
LED7	Port 8	PCIE6 (x16)
	Port 23	PCIE7 (x4)
LED6	Port 12	PCIE8 (x16)
8234 LED	**8234 PLX Port #**	**8259 Slot**
LED4	Port 20	8259-8780 Upstream Port (x8)
	Port 21	PCIE1 (x8)
LED7	Port 8	PCIE2 (x16)
		PCIE15 (x8)
		PCIE3-8780 Dnstream Port (x8)
LED5	Port 16	PCIE4 (x16)
		PCIE5-8780 Dnstream Port (x8)
LED6	Port 12	PCIE6 (x16)

8234 LED	8234 PLX Port #	8231 Slot
		PCIE7-8780 Dnstream Port (x8)
LED8	Port 4	PCIE8 (x16)
		PCIE9-8780 Dnstream Port (x8)
		PCIE10-8780 Dnstream Port (x8)
		PCIE11-8780 Dnstream Port (x8)
		PCIE12-8780 Dnstream Port (x8)
		PCIE13-8780 Dnstream Port (x8)
		PCIE14-8780 Dnstream Port (x8)
8234 LED	**8234 PLX Port #**	**8231 Slot**
	Port 7	PCEI1 (x4)
	Port 6	PCIE2 (x4)
	Port 5	PCIE3 (x4)
LED8	Port 4	PCIE4 (x4)
	Port 19	PCIE5 (x4)
	Port 18	PCIE6 (x4)
	Port 17	PCIE7 (x4)
LED5	Port 16	PCIE8 (x4)
LED7	Port 8	PCIE9 (x4)
	Port 9	PCIE10 (x4)
	Port 10	PCIE11 (x4)
	Port 11	PCIE12 (x4)
LED4	Port 20	PCIE13 (x8)
	Port 21	PCIE14 (x8)
LED6	Port 12	PCIE15 (x4)
	Port 13	PCIE16 (x4)
	Port 14	PCIE17 (x4)
	Port 15	PCIE18 (x4)