

PCI Express® Gen 4 & Gen 5 Card Edge Connectors

Product Presentation

Amphenol Information Communications
and Commercial Products



Amphenol ICC

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2. Product Overview
3. Signal Integrity Performance
4. Features & Benefits
5. Part Numbers
6. Markets & Applications

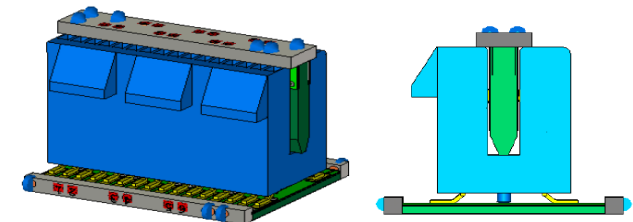
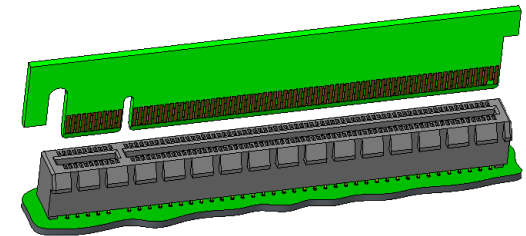
- Amphenol PCIe Gen 4 & Gen 5 CEM connectors meet and outperform industry standard PCIe 4.0 & 5.0 (Proposed) requiring higher speed performance. The optimized series supports backwards mating and is footprint compatible with PCIe 3/2/1.
- These 1.00mm pitch, vertical card edge connectors enable all Generations of PCI Express® signaling in desktop PCs, workstations, and servers. The connector designs provide support for 2.5GT/s (Gen 1), 5.0GT/s (Gen 2), 8.0GT/s (Gen 3) and recently upgrade to 16GT/s (Gen 4), even further to 32GT/s per differential signal pair.
- The base connector family provides x1, x4, x8, or x16 link widths to suit different bandwidth requirements. The basic bandwidth (x1) version supports a single PCI Express lane and is typically used for I/O cards in desktop PCs. The x4 and x8 connectors provide 64 and 98 contacts, respectively, for server I/O. The high bandwidth versions (x16 lanes and higher) are used for applications that require even more bandwidth, such as graphics cards in desktop PCs or riser cards in servers.
- Amphenol's expansive range of vertical PCIe Gen 4 and Gen 5 connectors will include options for surface mount (SMT), through hole solder, press-fit (PF) and straddle mount terminations.
- Apart from vertical type PCIe Gen 4, we also provide right angle SMT (5.8mm stack height is being tooled up, 17.1mm will be tooled up soon)

PCIe Gen 4 and Gen 5

Product Overview



- **Extending differential signaling to 16GT/s and 32GT/s for next Generation systems**
- **PCIe connector overpass Gen 4 and Gen 5 high speed performance**
 - Footprint backward compatible with Gen 3/2/1 (Straddle mount excepted)
 - 85ohms reference impedance
 - Data rate: 16 GT/s, up to 32GT/s.
- **Product configuration includes x1, x4, x8,x16 (36/64/98/164), extend to X24, X32 for riser card application.**
- **PCB module expectation: Golden finger(add-in card):**
 - Pad dim (Gen 4) =0.70x3.91mm;
 - Pad dim (Gen 5) =0.60x3.00mm (Proposed);
 - Thickness=1.57±0.13mm
- **Reference to Gen 3 electrical, mechanical and environment spec**
- **Halogen-free compliant**
- **Amphenol Vertical & right angle PCIe Gen 4 & Gen 5 Project timeline**
 - Vertical SMT Gen 4 & Gen 5 – in mass production
 - Vertical TH Gen 4 – in mass production
 - Vertical PF Gen 4 – in mass production
 - Straddle mount Gen 4 & 5– tooled and samples ready
 - right angle Gen 4 SMT –ready by Q3' 2019



PCIe Gen 4 and Gen 5

Overall Features & Benefits

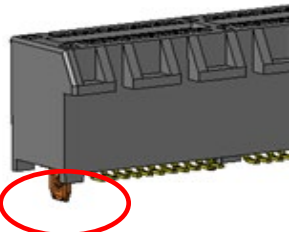


| Features | Benefits |
|---|---|
| <ul style="list-style-type: none">▪ A variety of termination types are available | <ul style="list-style-type: none">▪ Able to meet different customer soldering requirements |
| <ul style="list-style-type: none">▪ Aside from X1, X4, X8, X16 standard links as per PCI-SIG CEM specification, X24, X32 are also available | <ul style="list-style-type: none">▪ Our connectors provide excellent performance and additional options for extreme bandwidth application |
| <ul style="list-style-type: none">▪ Backward mating and footprint compatible | <ul style="list-style-type: none">▪ Outperform Gen 4/5 specification, but also backward compatible to Gen 1/2/3 specification, with the exception of Gen 5 straddle mount |
| <ul style="list-style-type: none">▪ Capable to support up to 32GT/s without altering design | <ul style="list-style-type: none">▪ Customers can upgrade directly to next-Generation systems without additional cost in system redesign |
| <ul style="list-style-type: none">▪ RoHS compliant | <ul style="list-style-type: none">▪ Fully complies with environmental, health and safety requirements |
| <ul style="list-style-type: none">▪ Low-Halogen material | <ul style="list-style-type: none">▪ Meets next-Generation requirements |

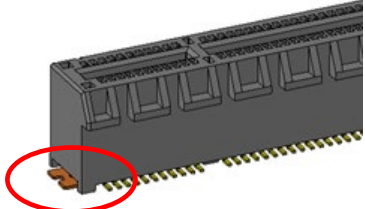
More User-Friendly Design Features to Support Customer Extreme Applications



- PCIe SMT with blade hold down or solder tab options.

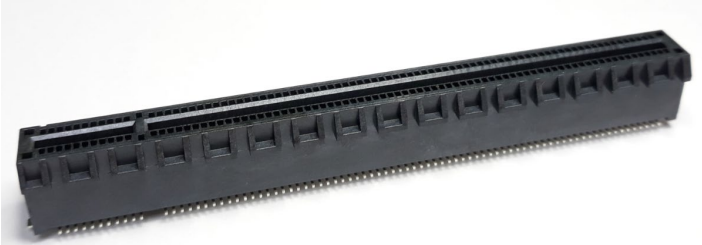


Blade HD



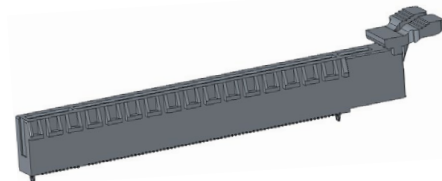
Solder tab

- 230pin (x24), 280pin (x32) PCIe Gen 4 SMT
- Support riser card application with increased number of required lanes



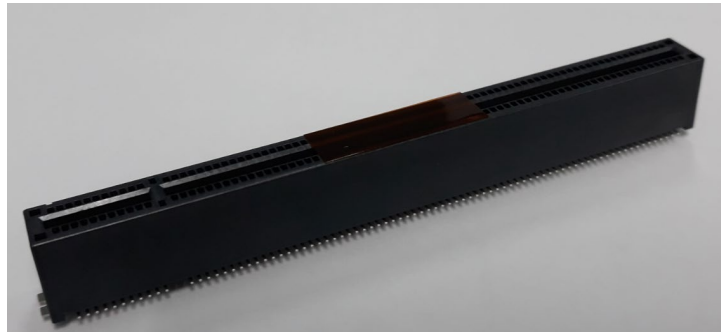
- SMT with blade hold down and latch

- Latch can help to lock module card for high criterion shock & vibration test



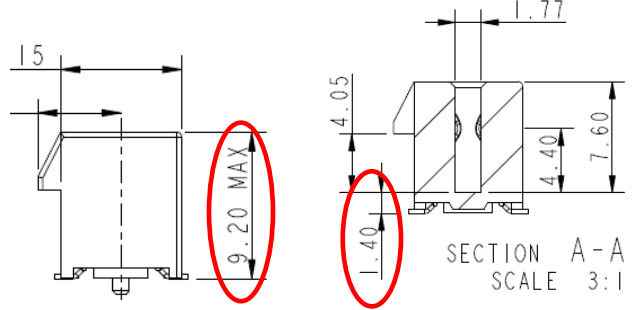
- SMT without ridges

- To accommodate with longer pin add-in card



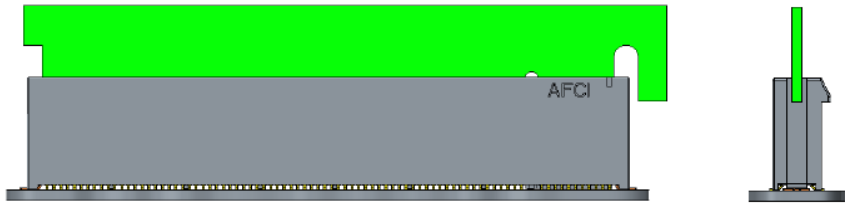
Ultra Low Profile SMT

- Total height vs Standard PCIe: 9.2mm vs 11.25mm
- Seating height vs Standard PCIe: 1.4mm vs 3.4mm



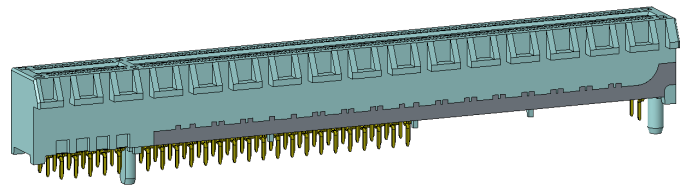
Extended height SMT (will tool soon)

- Higher seating height by increasing seating height
- Allow other components layout under add-in card



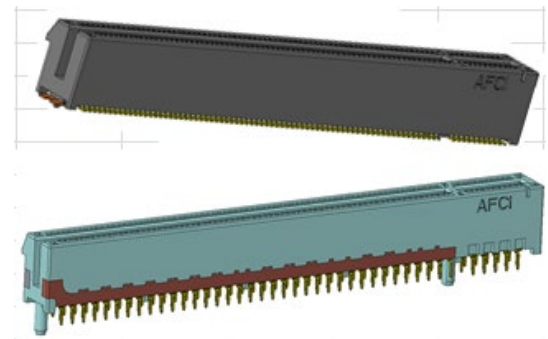
TH with 98pos in 164pos Housing

- To accommodate with shorter pin add-in card



Open side wall SMT & TH & PF

- To accommodate with longer add-in card



PCIe Gen 4 and Gen 5

Base Part Numbers

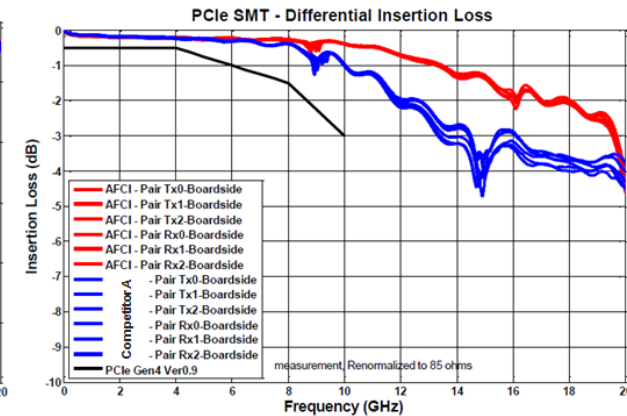
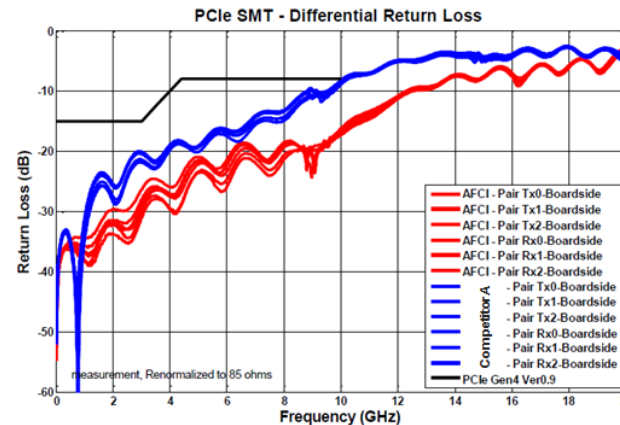
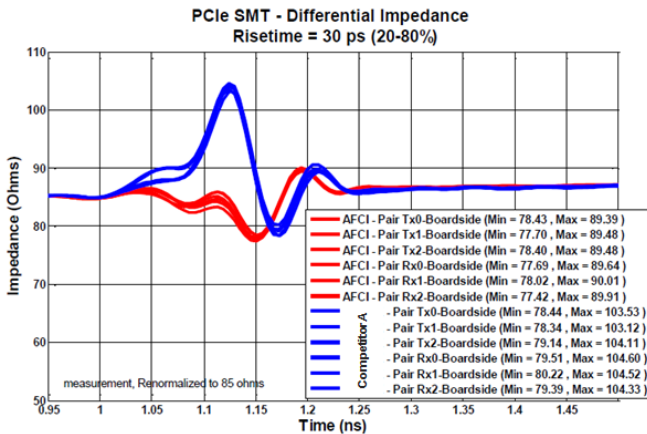


| Description | Performance | Termination | Position | Part Numbers |
|-------------|-------------|-------------------------|--------------------|--------------|
| PCIe Gen 5 | 32GT/s | Vertical SMT | 36, 64, 98, 164pos | 10146070* |
| PCIe Gen 5 | 32GT/s | Straddle mount | 36, 64, 98, 164pos | 10153226* |
| PCIe Gen 4 | 16GT/s | Vertical SMT | 36, 64, 98, 164pos | 10146065* |
| PCIe Gen 4 | 16GT/s | Vertical SMT ULP | 36, 64, 98, 164pos | 10146788* |
| PCIe Gen 4 | 16GT/s | Vertical SMT high rise | 36, 64, 98, 164pos | 10153927* |
| PCIe Gen 4 | 16GT/s | Vertical SMT | 230, 280pos | 10139595* |
| PCIe Gen 4 | 16GT/s | Vertical SMT with latch | 36, 64, 98, 164pos | 10147430* |
| PCIe Gen 4 | 16GT/s | Vertical SMT open wall | 36, 64, 98, 164pos | 10146067* |
| PCIe Gen 4 | 16GT/s | Vertical PF | 36, 64, 98, 164pos | 10145445* |
| PCIe Gen 4 | 16GT/s | Vertical PTH | 36, 64, 98, 164pos | 10142333* |
| PCIe Gen 4 | 16GT/s | Vertical PTH with latch | 36, 64, 98, 164pos | 10152821* |
| PCIe Gen 4 | 16GT/s | Vertical PTH open wall | 36, 64, 98, 164pos | 10148195* |
| PCIe Gen 4 | 16GT/s | Straddle mount | 36, 64, 98, 164pos | 10146027* |
| PCIe Gen 4 | 16GT/s | right angle SMT | 36, 64, 98, 164pos | 10151422* |

*denotes base part number. Please contact Amphenol ICC for complete part numbers.

SI Performance competition Analysis

Amphenol Vertical Gen 4 SMT vs Competitor

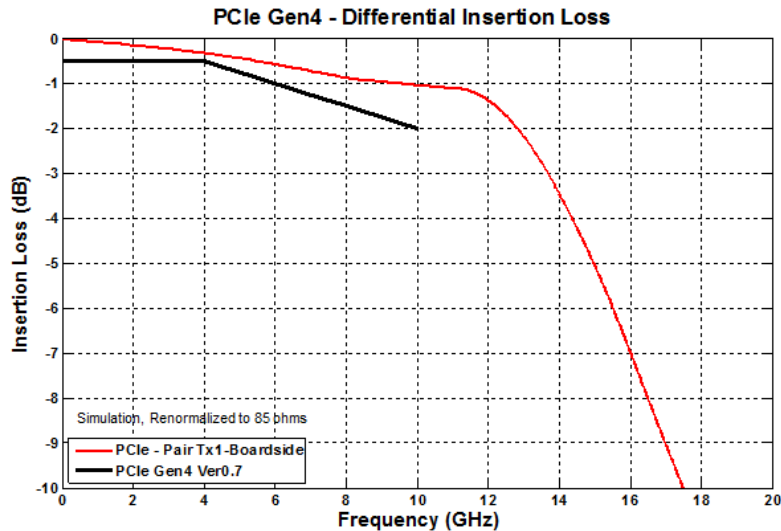


This measurement test done in our SI lab based on same test method setting up with both competitor's sample and our sample !!

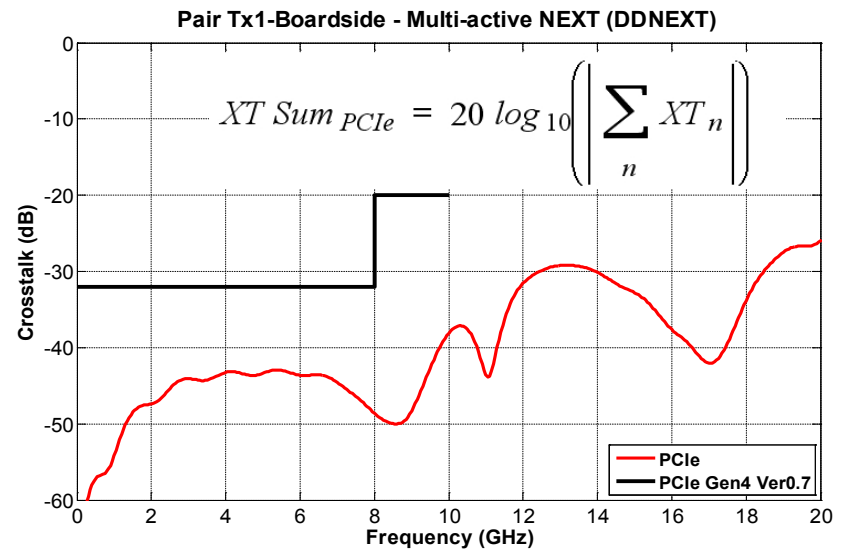
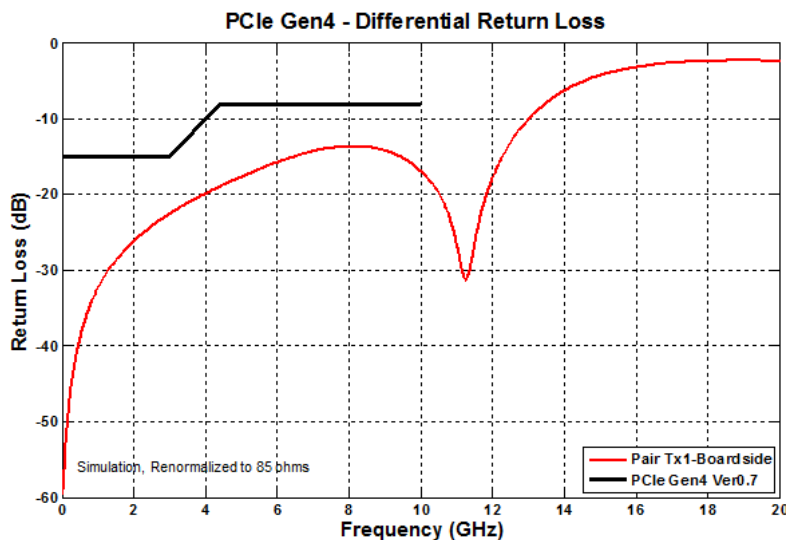
Amphenol's CEM connector has superior impedance, insertion loss and return loss when compared to competitors' products in the market

Vertical PCIe Gen 4 Press-Fit

SI simulation performance @ 16GT/s

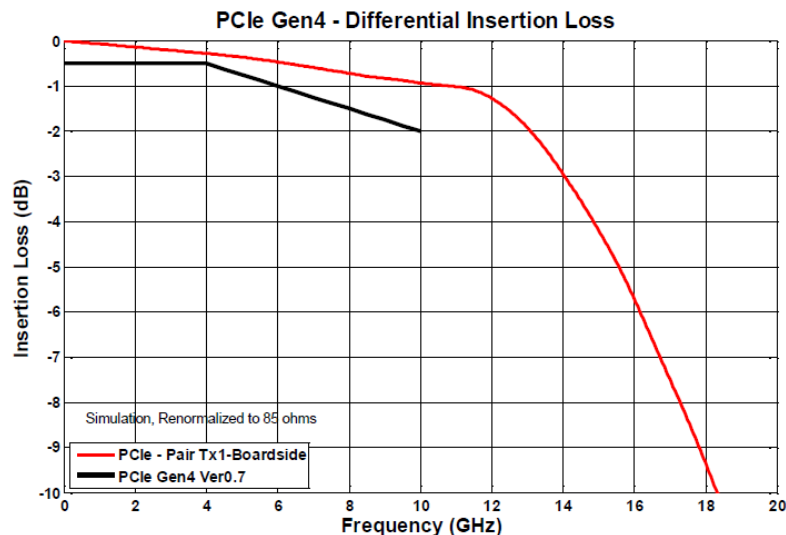


1. Superior insertion loss up to 10GHz
2. Well engineered crosstalk with sufficient margin
3. Competitive return loss with good margin up to 10GHz

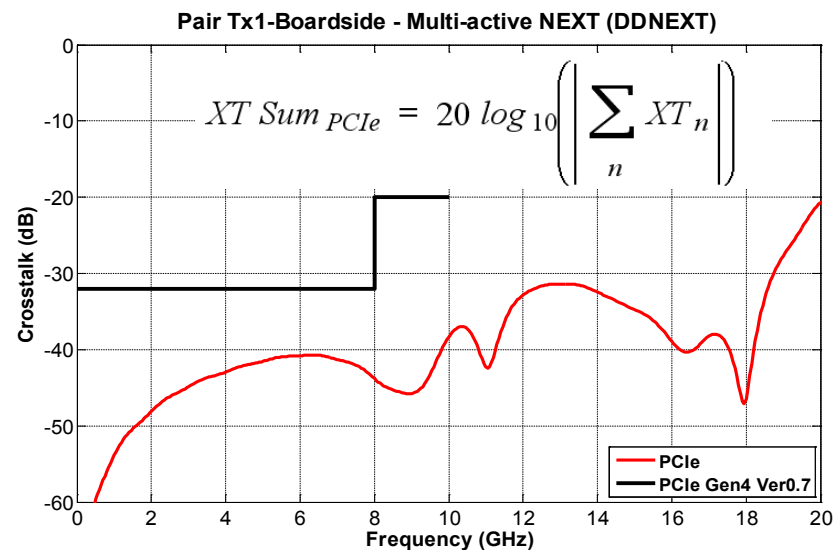
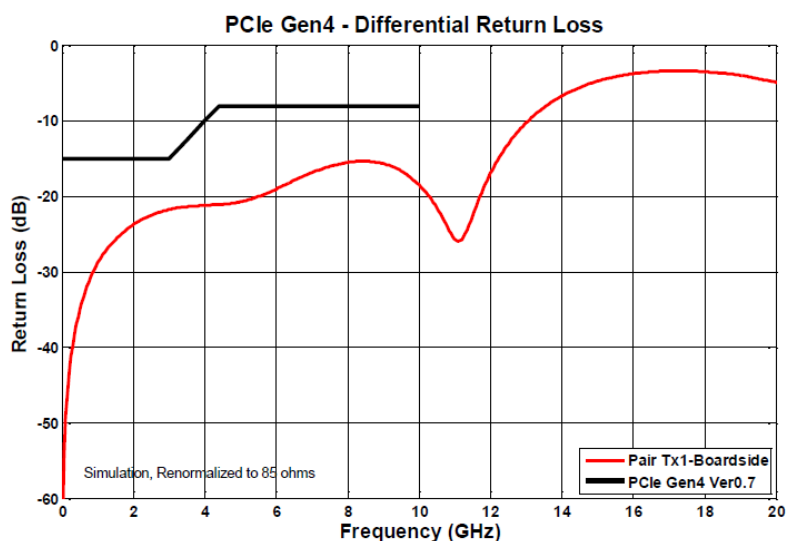


Vertical PCIe Gen 4 PTH

SI simulation performance @ 16GT/s

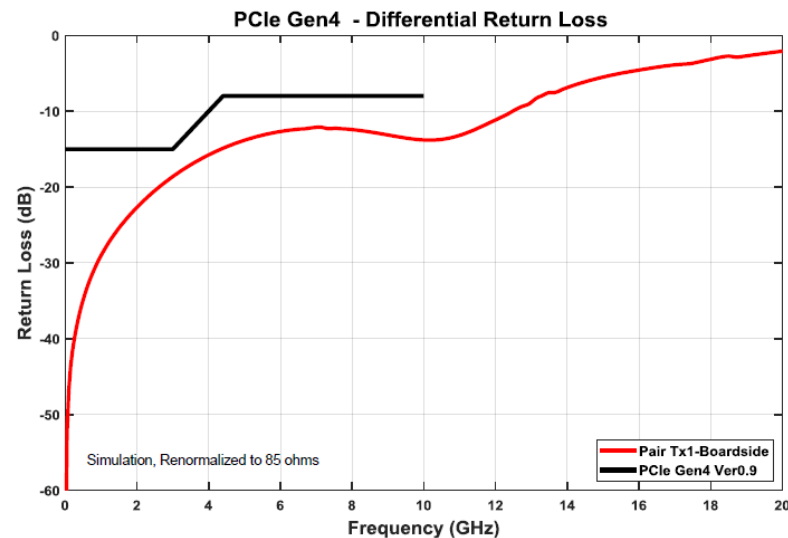
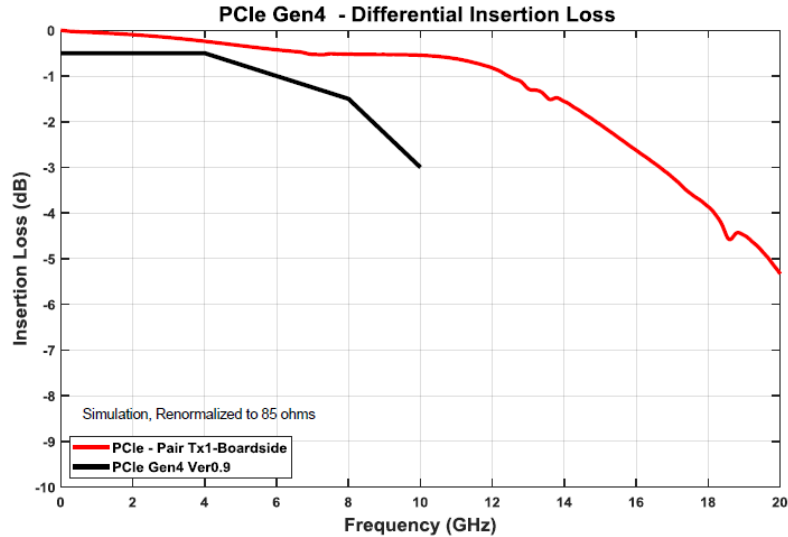


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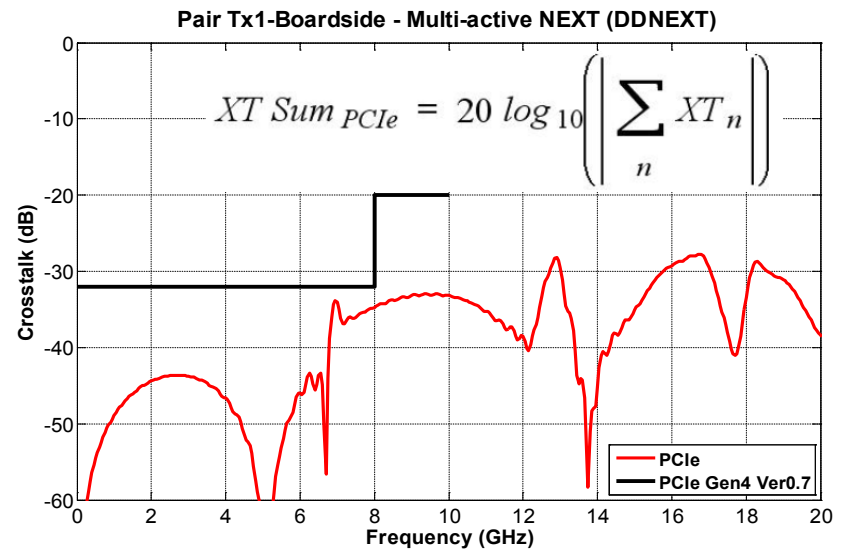


PCIe Gen 4 Straddle Mount

SI simulation performance @ 16GT/s

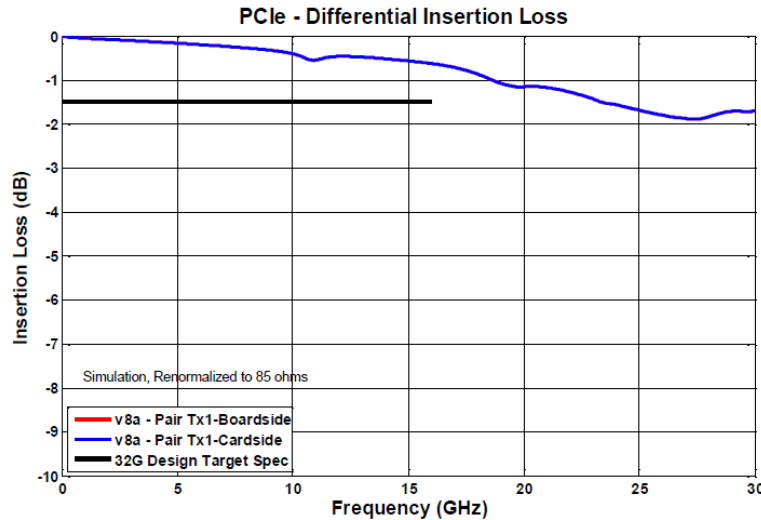


1. Superior insertion loss up to 10GHz
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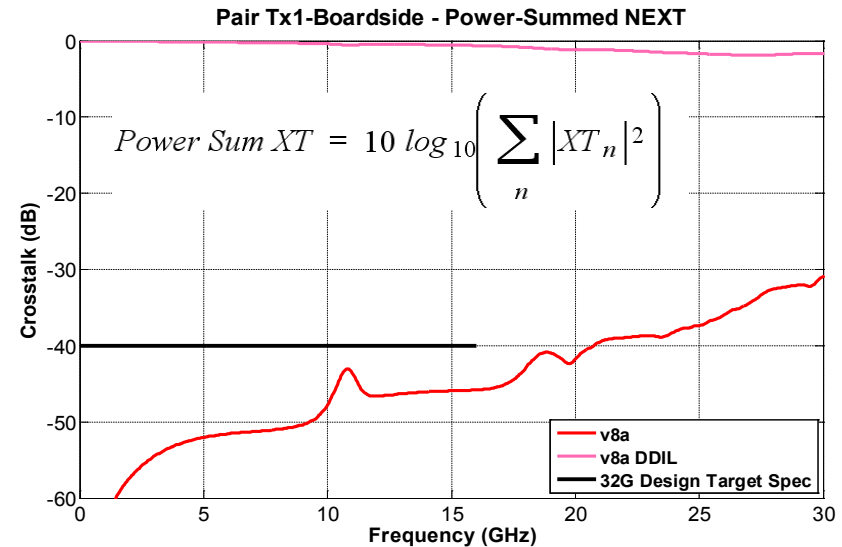
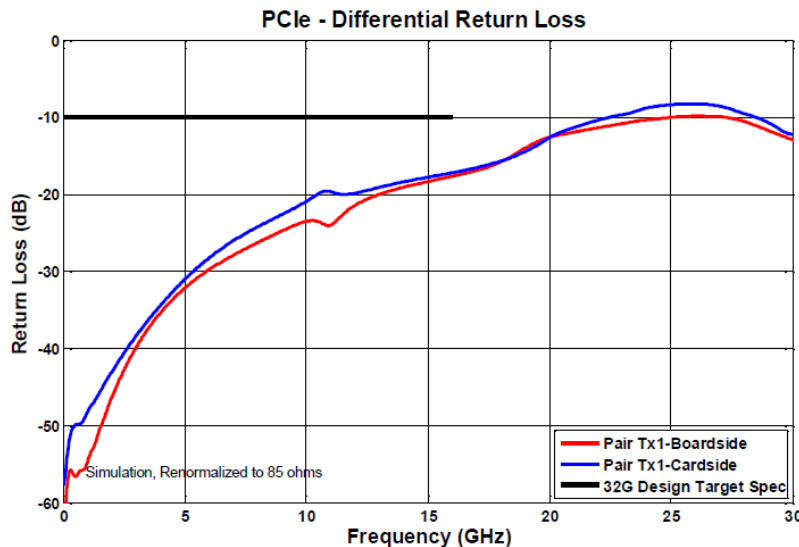


PCIe Gen 5 SMT

SI simulation performance @ 32GT/s

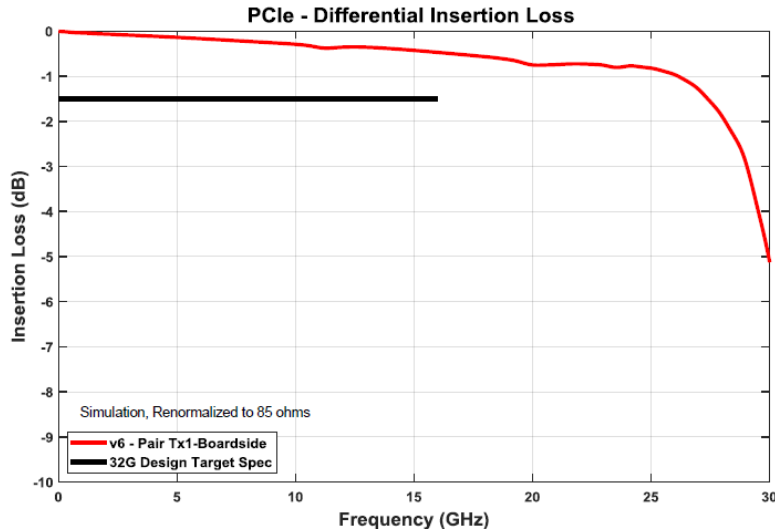


1. Superior insertion loss up to 16GHz
2. Well engineered crosstalk below -40dB up to 16GHz
3. Return loss with good margin up to 16GHz

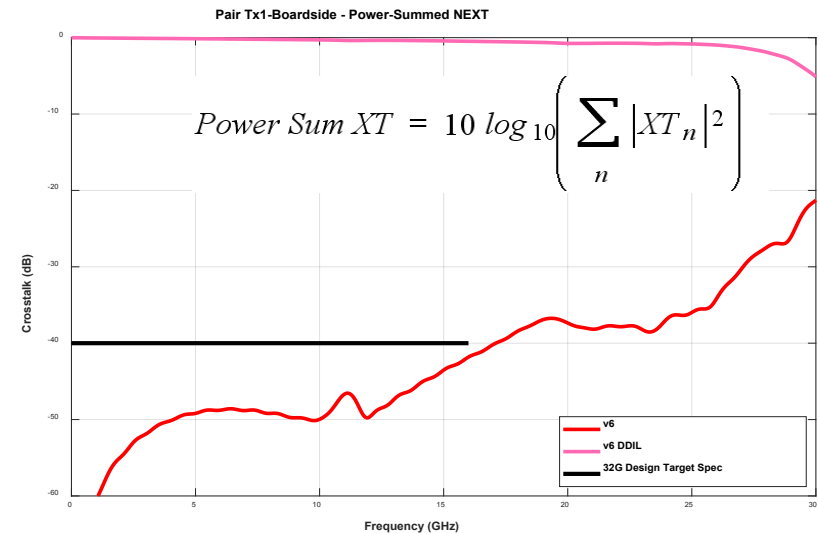
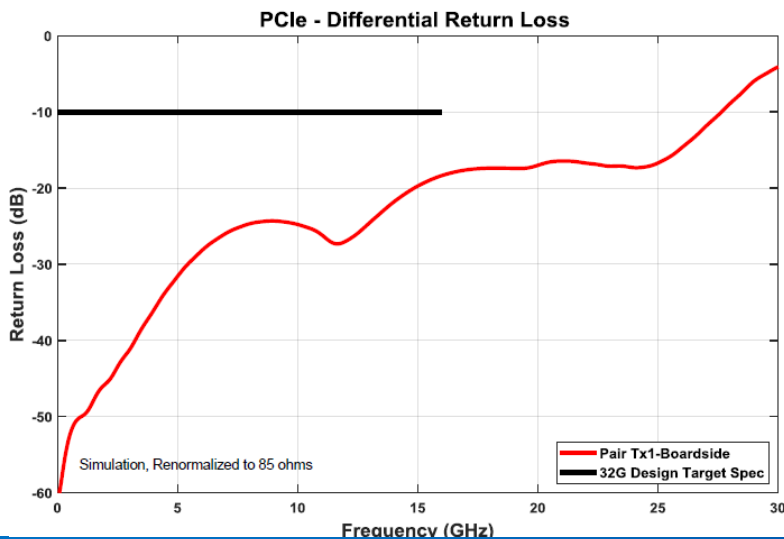


PCIe Gen 5 Straddle Mount

SI simulation performance @ 32GT/s



1. Superior insertion loss up to 16GHz
2. Well engineered crosstalk below -40dB up to 16GHz
3. Return loss with good margin up to 16GHz
4. First product to the market

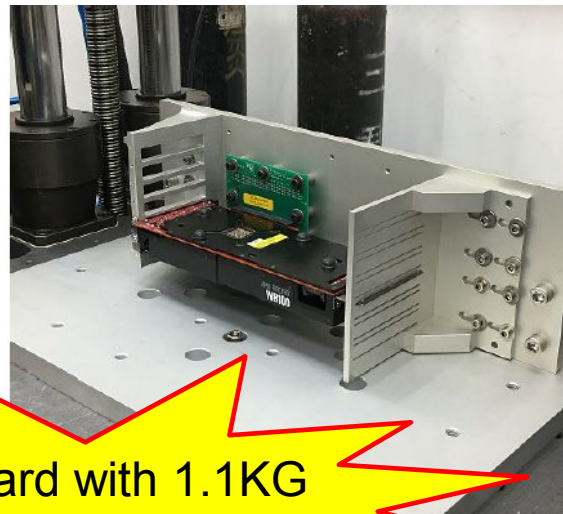
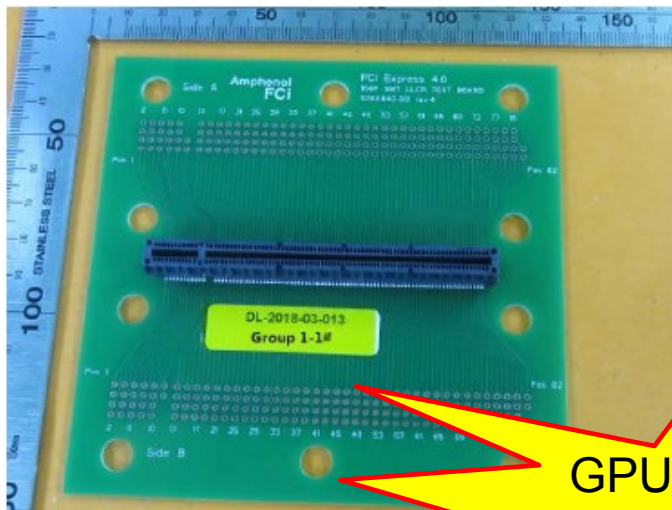


Our PCIe Gen 4 Can Withstand Special Weight GPU Shock Test



TEST METHODS/REQUIREMENTS

| Test Items | Test method | Condition | Requirement |
|--------------------|-------------|--|--|
| Visual Examination | EIA-364-18B | 10x magnification | No detrimental condition |
| LLCR | EIA-364-23C | 20mV max, 100mA max | Initial LLCR $\leq 30\text{m}\Omega$, After test: $\Delta R \leq 10\text{m}\Omega$ |
| Mechanical Shock | EIA-364-27C | Condition - A (50G, 11ms, half-sine pulses type) +Z axis 3times and then -Z axis 3times | No damage |



GPU card with 1.1KG weight

Our PCIe Gen 4 Can Withstand Special Weight GPU Shock Test

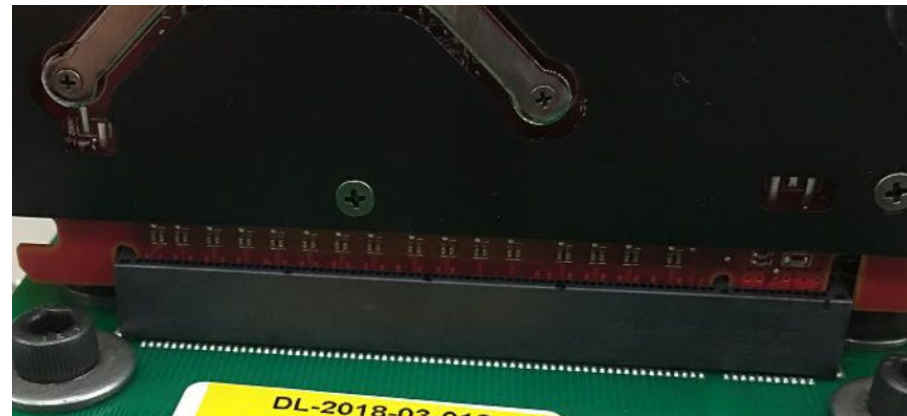
MECHANICAL SHOCK TEST RESULTS

| Step | Test | Requirement | Step Description | Results | Comment |
|------|--------------------|----------------------------------|------------------|---|---------|
| 1 | Visual Examination | No detriment | Initial | No detriment | Pass |
| 2 | LLCR | $\leq 30\text{m}\Omega$ | Initial LLCR | $\leq 12.67\text{m}\Omega$ | Pass |
| 3 | Mechanical Shock* | No damage | Mechanical Shock | No damage | Pass |
| 4 | LLCR | $\Delta R \leq 10\text{m}\Omega$ | Final LLCR | $\Delta R \leq 9.78\text{m}\Omega$ | Pass |
| 5 | Visual Examination | No detriment | Final | No degradation <u>Details see Fig. 4~6</u> | Pass |

* . Mechanical shock testing was performed, and result reported, under the KING DESIGN LAB report number 180315-03-ST03.

Conclusion:

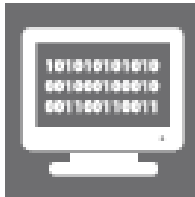
Apart from excellent electronic performance, our connector is also with much more robust mechanical performance (without any deformation or crack) while withstanding high weight special GPU card shock testing



Parts after shock & vibration testing

PCIe Gen 4 and Gen 5

Markets & Applications



- Servers
- Workstations



- Desktop PCs
- Notebook PCs



- Routers
- Switches
- Base Stations



- Embedded Systems

Amphenol ICC

Thank You!