

**3.3V, PCI Express® 1-lane,
2:1 Mux/DeMux Switch**
Features

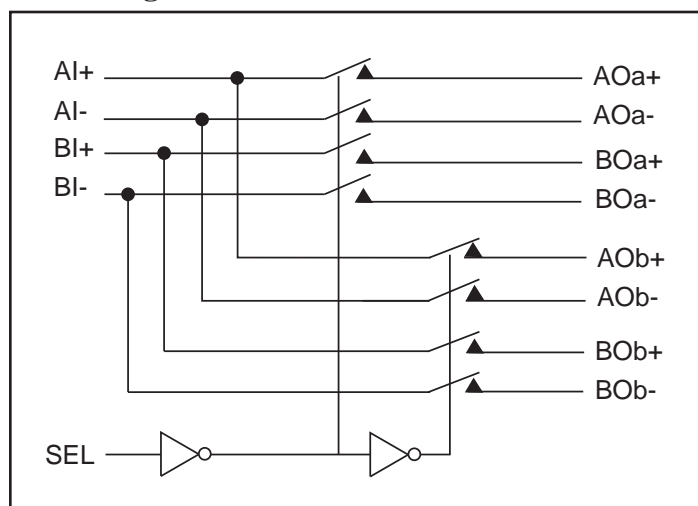
- 2 Differential Channel, 2:1 Mux/DeMux
- PCI Express® 2.0 Performance, 5.0Gbps
- Pinout optimized for placement between two PCIe slots
- Bi-directional operation
- Low Bit-to-Bit Skew, 5ps max
- Low Crosstalk: -26dB@5 GHz
- Low Off Isolation: -20dB@5 GHz
- V_{DD} Operating Range: +3.3V
- ESD Tolerance: 2kV HBM
- Packaging (Pb-free & Green):
 - 28 contact TQFN (ZH)

Description

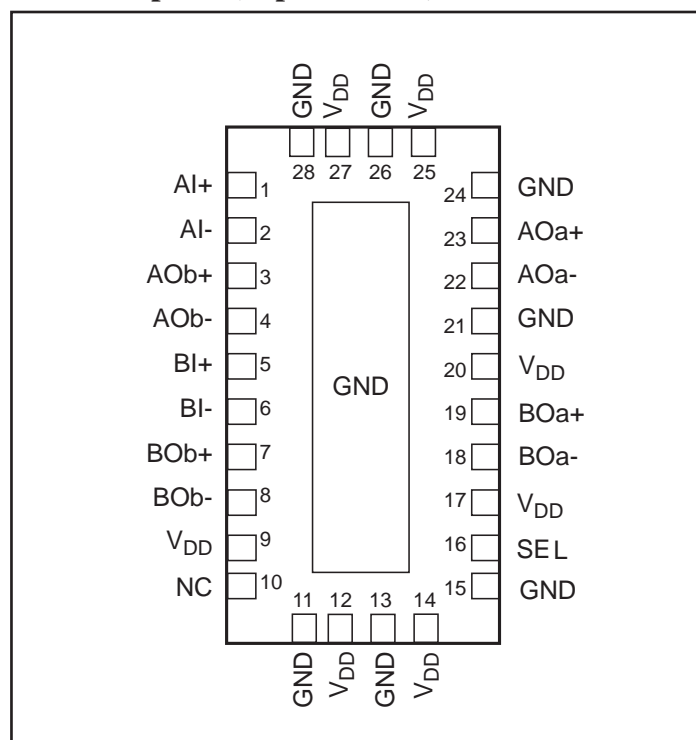
Pericom Semiconductor's PI3PCIE2215 is a 4 to 2 differential channel multiplexer/demultiplexer switch. The PI3PCIE family of switch solutions is fully compliant with PCIe® signals at 5.0Gbps. Due to its low bit-to-bit skew, high channel-to-channel noise isolation and high bandwidth, this product is ideal for PCI Express switching.

Application

Switch a PCI Express® lane output between two PCI Express lane inputs

Block Diagram

Truth Table

| Function | SEL |
|-------------|-----|
| xly to xOay | L |
| xly to xOby | H |

Pin Description (Top-side view)


Signal Descriptions

| Pin Number | Pin Name | Type | Description |
|--|-----------------|--|--|
| 1 2 | AI+ AI- | Differential input | Differential input pair from PCIE signal source. Signal is passed through to the AOa+, AOa- pin respectively when SEL=0. Signal is passed through to the AOb+, AOb- pin respectively when SEL = 1. |
| 23 22 | AOa+ AOa- | Differential pass-through input | Differential analog pass-through output. Signal from AI+ and AI- is passed through AOa+ and AOa- respectively when SEL=0. |
| 3 4 | AOb+ AOb- | Differential pass-through input | Differential analog pass-through output. Signal from AI+ and AI- is passed through AOa+ and AOa- respectively when SEL=1. |
| 5 6 | BI+ BI- | Differential input | Differential input pair from PCIE signal source. Signal is passed through to the BOa+, BOa- pin respectively when SEL=0. Signal is passed through to the BOB+, BOB- pin respectively when SEL = 1. |
| 19 18 | BOa+ BOa- | Differential pass-through input | Differential analog pass-through output. Signal from BI+ and BI- is passed through BOa+ and BOa- respectively when SEL=0. |
| 7 8 | BOB+ BOB- | Differential pass-through input | Differential analog pass-through output. Signal from BI+ and BI- is passed through BOB+ and BOB- respectively when SEL=1. |
| 11, 13, 15, 21, 24, 26, 28, (center pad) | GND | Ground input | Ground |
| 10 | NC | - | No Connect - Reserved, do not connect |
| 16 | SEL | 3.6V tolerant low-voltage single-ended input | SEL controls the mux through a flow-through latch. |
| 9, 12, 14, 17, 20, 25, 27 | V _{DD} | Power supply | Power, 3.3V ±10% |

Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

| | |
|--|--------------------------|
| Storage Temperature | -65°C to +150°C |
| Supply Voltage to Ground Potential | -0.5V to +4.6V |
| DC Input Voltage | -0.5V to V _{DD} |
| DC Output Current | 120mA |
| Power Dissipation | 0.5W |

Note: Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Electrical Characteristics

Recommended Operating Conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------|--|------------|-----|-----|-----|---------|
| V _{DD} | 3.3V Power Supply | | 3.0 | 3.3 | 3.6 | V |
| I _{DD} | Total current from V _{DD} 3.3V supply | | 0 | | 2.5 | mA |
| TCASE | Case temperature range for operation within spec. | | -40 | | 85 | Celsius |

DC Electrical Characteristics (T_A = -40°C to +85°C, V_{DD} = 3.3V ± 10%)

| Parameter | Description | Test Conditions | Min | Typ ⁽¹⁾ | Max | Units |
|------------------------------------|----------------------------------|--|-----|--------------------|-----|-------|
| V _{IH-SEL} ⁽²⁾ | Input high level, SEL input | | 2.0 | | 3.6 | V |
| V _{IL-SEL} ⁽²⁾ | Input Low Level, SEL input | | 0 | | 0.8 | V |
| I _{IN_SEL} ⁽²⁾ | Input Leakage Current, SEL input | Measured with input at V _{IH-SEL} max and V _{IL-SEL} min | -10 | | 10 | µA |
| R _{ON} | On Resistance | V _{DD} = Min., V _{IN} = 1.3V, I _{IN} = 40mA | | | 12 | Ohm |
| C _{ON} | On Channel Capacitance | V _{IN} = 0, V _{DD} = 3.3V | | 2.0 | | pF |

Note:

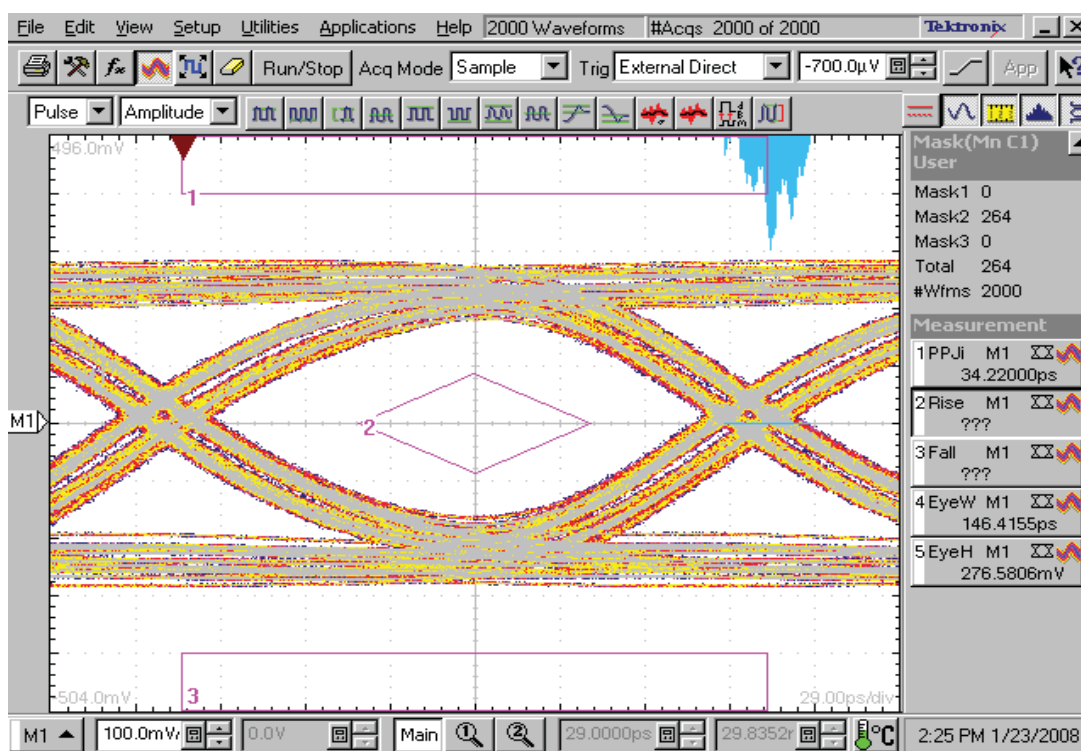
1. Typical values are at V_{DD} = 3.3V, T_A = 25°C ambient and maximum loading.

Dynamic Electrical Characteristics for xI±, xOy±

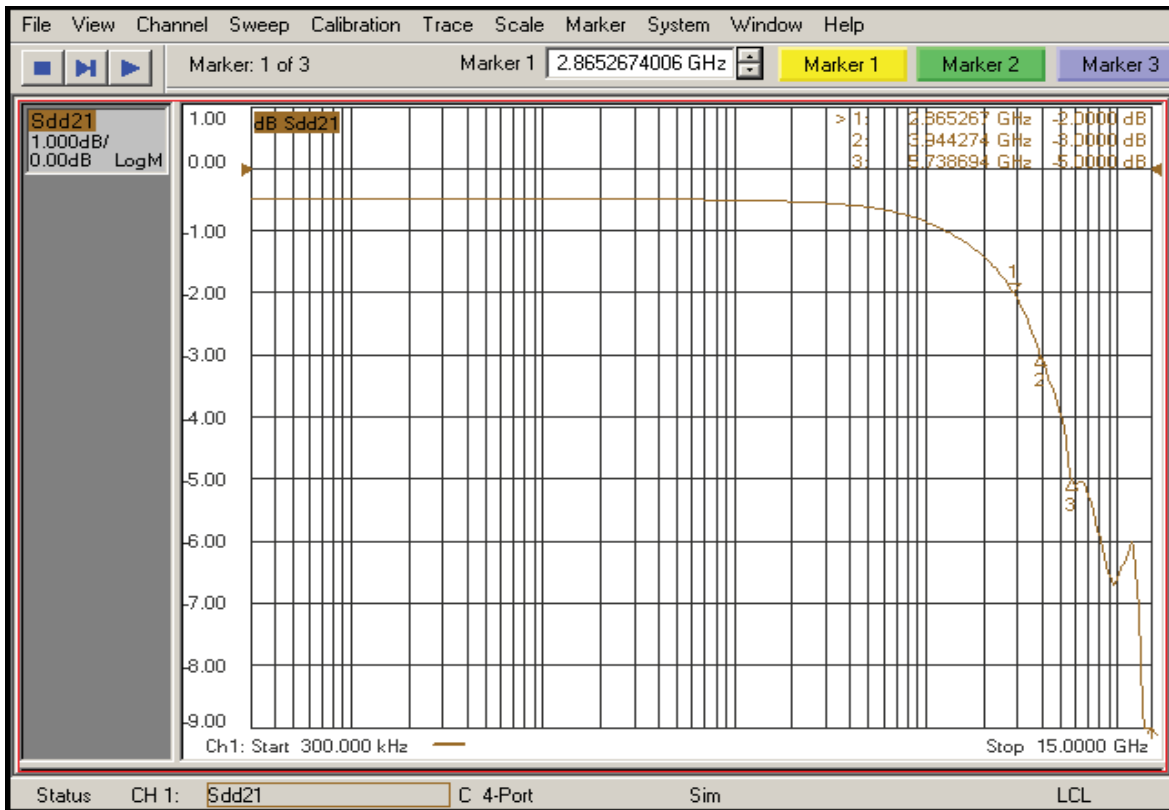
| Parameter | Description | Test Conditions | Min. | Typ. ⁽¹⁾ | Max. | Units |
|---------------------|-----------------------------|--|------------------------------|-----------------------|-------------------------|-------|
| DDIL | Differential Insertion Loss | f=1.2GHz f=2.5GHz f=5.0GHz f=7.5GHz | -1.5 -2.0 -5.0 -9.0 | | | dB |
| DDIL _{OFF} | Differential Off Isolation | f= 0 to 3.0GHz | | | -20.0 | |
| DDRL | Differential Return Loss | f= 0 to 2.8GHz f= 2.8 to 5.0GHz f= 5.0 to 7.5GHz | | -14.0 -8.0 -4.0 | | |
| DDNEXT | Near End Crosstalk | f= 0 to 2.5GHz f= 2.5 to 5.0GHz f= 5.0 to 7.5GHz | | | -32.0 -26.0 -20.0 | |

Switching Characteristics ($T_A = -40^\circ$ to $+85^\circ\text{C}$, $V_{DD} = 3.3\text{V} \pm 10\%$)

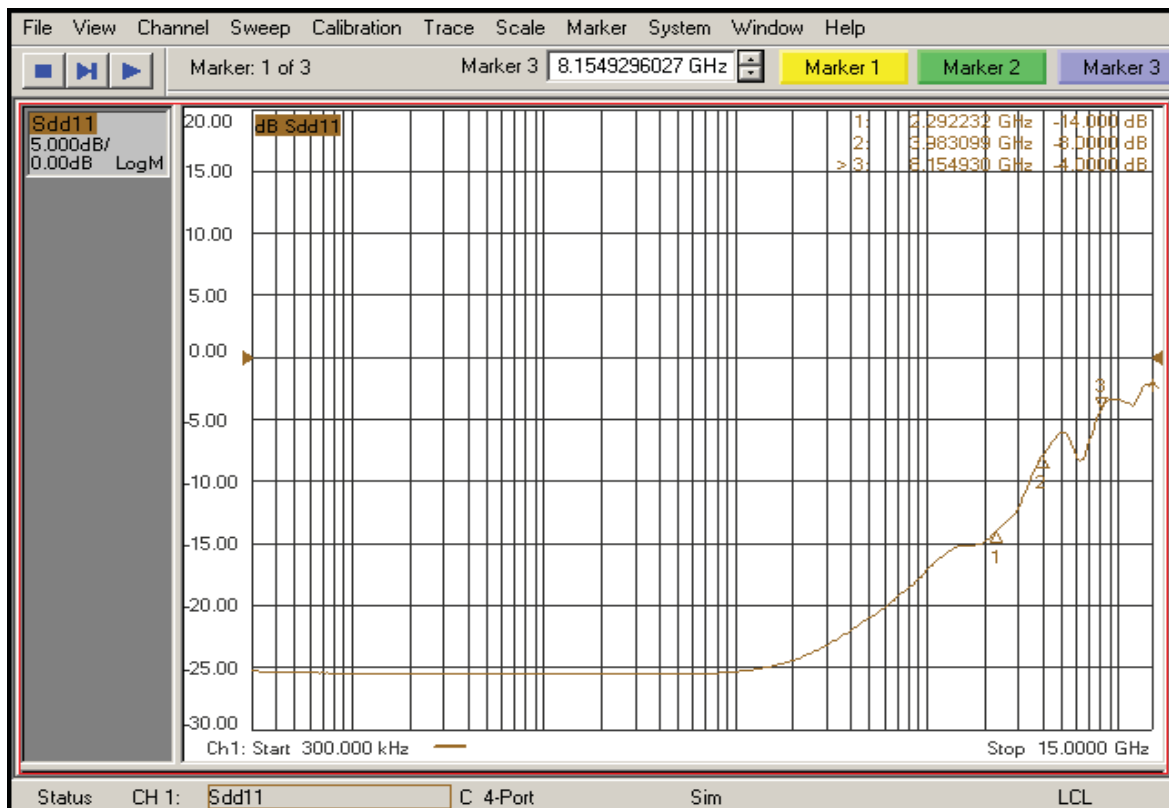
| Parameter | Description | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------|---|---|------|------|------|-------|
| tPZH, tPZL | Line Enable Time - SEL to xI+/-, xOy+/- | See "Test Circuit for Electrical Characteristics" | 0.5 | | 12.0 | ns |
| tPHZ, tPLZ | Line Disable Time - SEL to xI+/-, xOy+/- | See "Test Circuit for Electrical Characteristics" | 0.5 | | 12.0 | ns |
| t _{b-b} | Bit-to-bit skew within the same differential pair | See "Test Circuit for Electrical Characteristics" | | | 7 | ps |
| t _{ch-ch} | Channel-to-channel skew | See "Test Circuit for Electrical Characteristics" | | | 35 | ps |



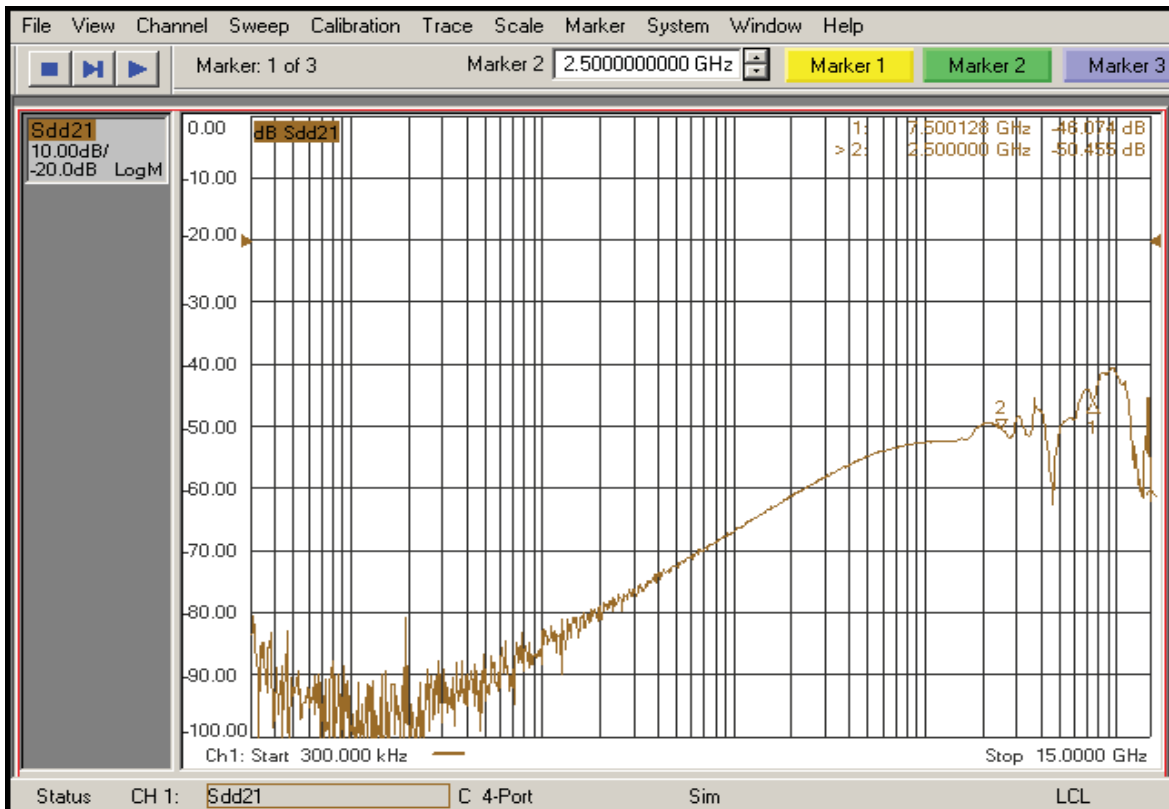
5.0 Gbps Receive Eye Mask (-3.5dB)



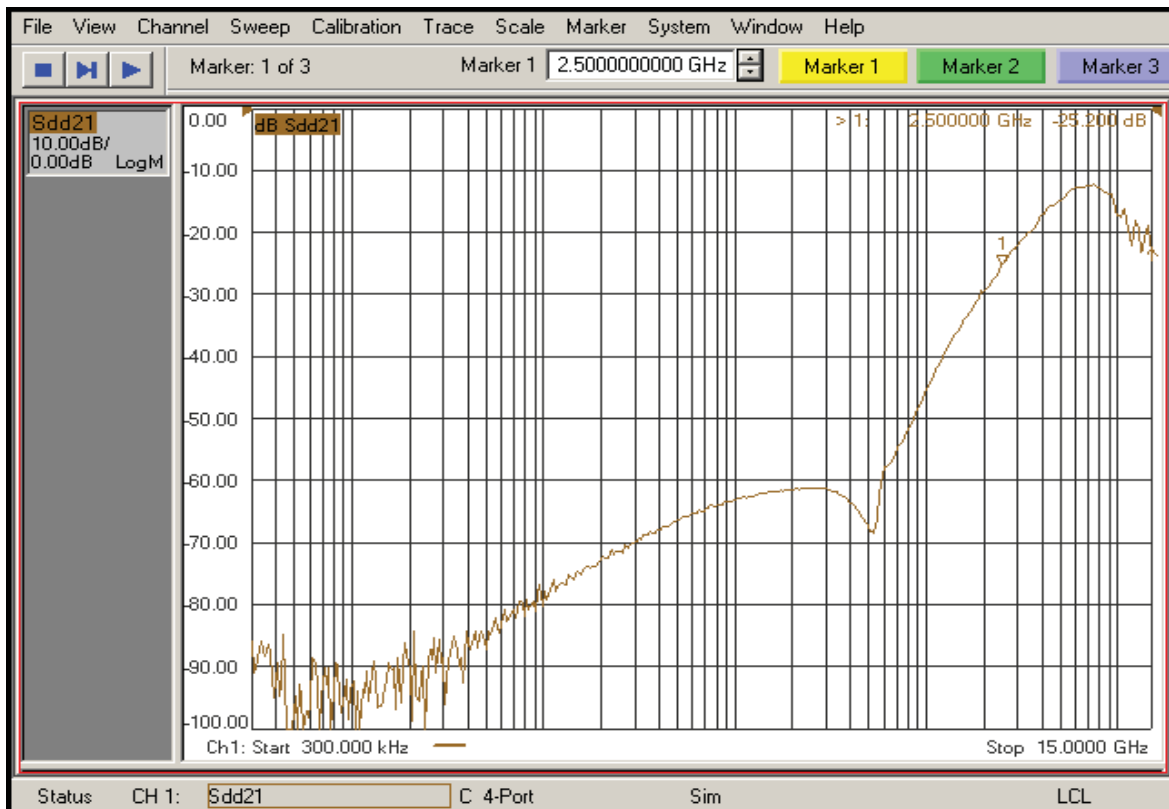
Differential Insertion Loss



Differential Return Loss

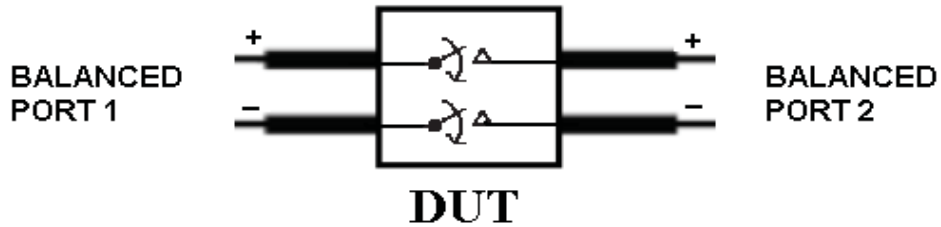


Differential Off Isolation

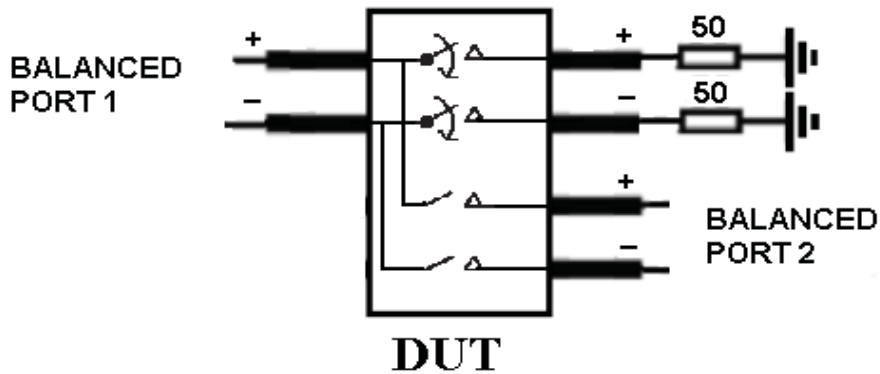


Differential Crosstalk

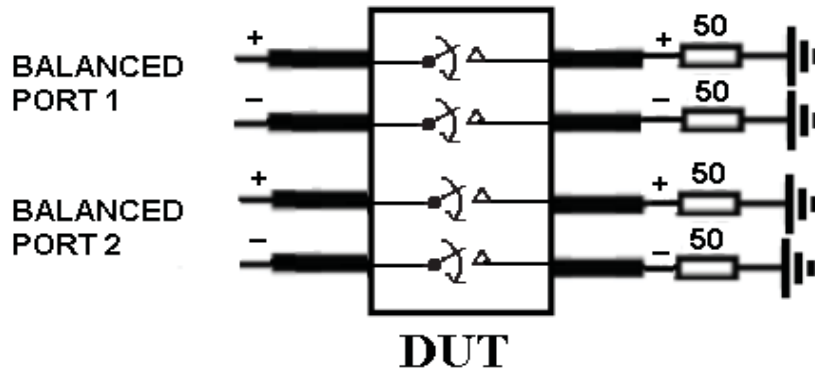
Differential Insertion Loss and Return Loss Test Circuit



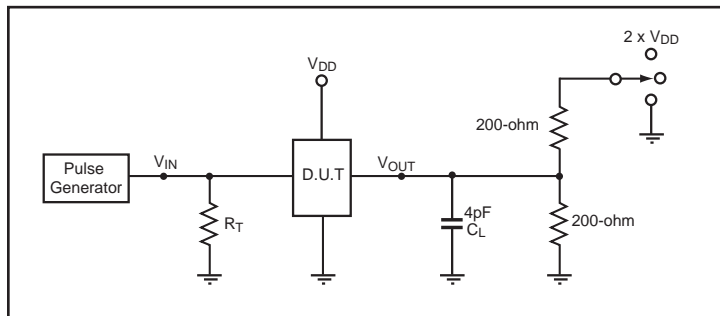
Differential Off Isolation Test Circuit



Differential Near End Crosstalk Test Circuit



Test Circuit for Electrical Characteristics⁽¹⁻⁵⁾



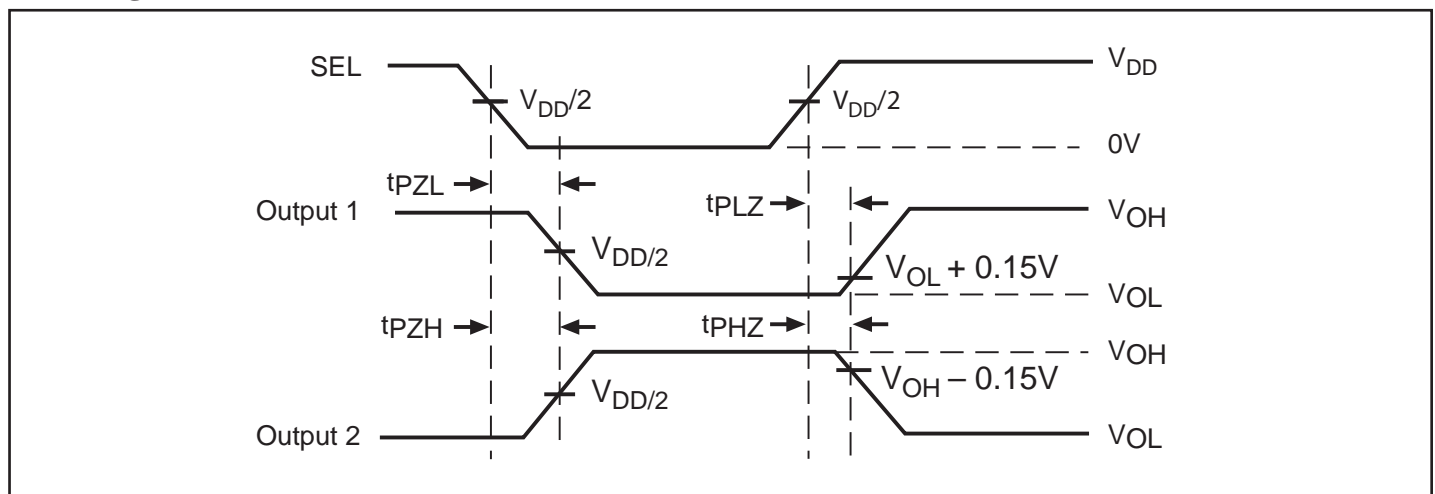
Switch Positions

| Test | Switch |
|-----------------------|-------------------|
| t_{PLZ} , t_{PZL} | $2 \times V_{DD}$ |
| t_{PHZ} , t_{PZH} | GND |
| Prop Delay | Open |

Notes:

- C_L = Load capacitance: includes jig and probe capacitance.
- R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
- Output 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
output 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input impulses are supplied by generators having the following characteristics: PRR \leq MHz, $Z_O = 50\Omega$, $t_R \leq 2.5ns$, $t_F \leq 2.5ns$.
- The outputs are measured one at a time with one transition per measurement.

Switching Waveforms



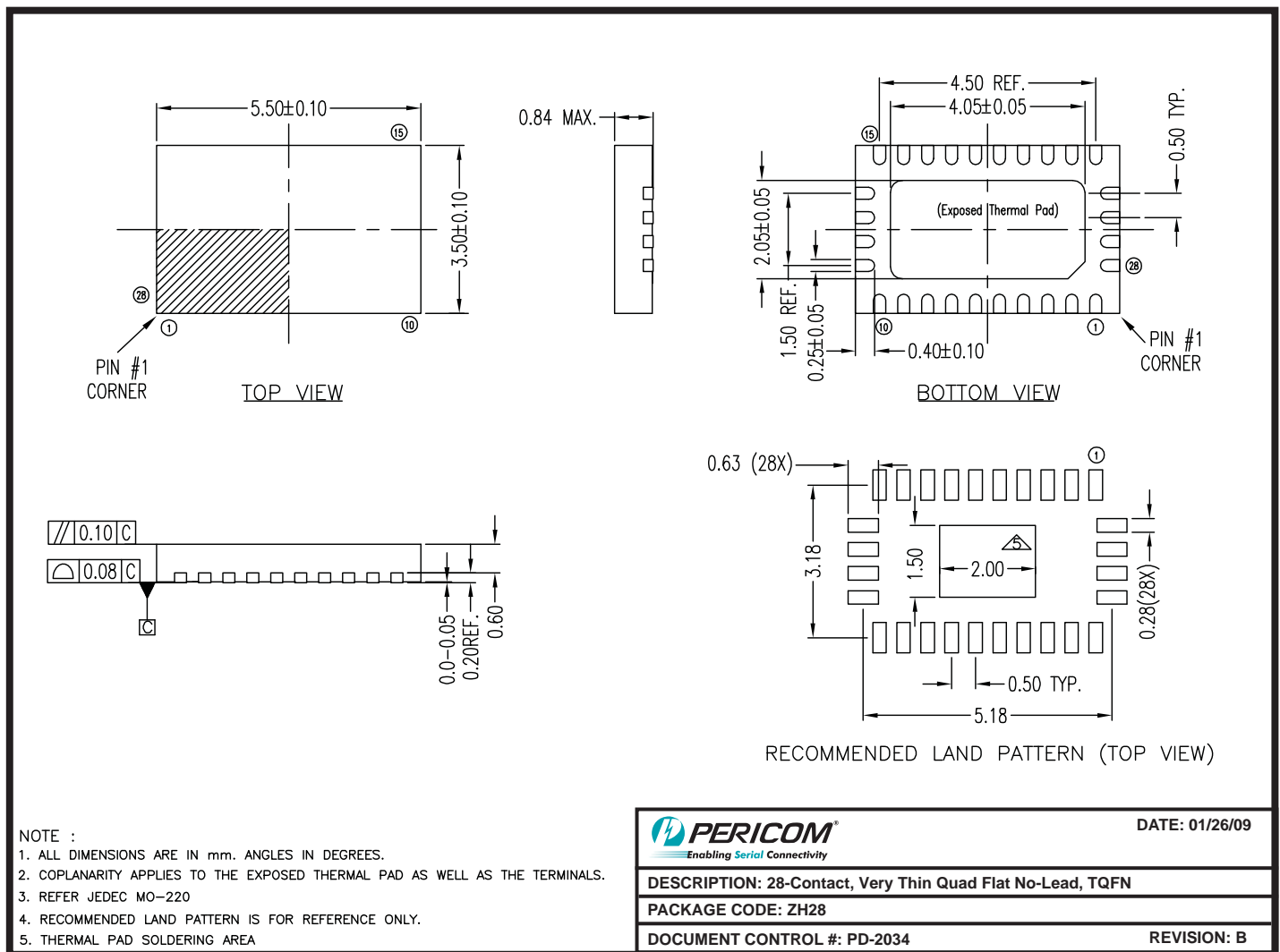
Voltage Waveforms Enable and Disable Times

Applications Information

Differential Inputs/Output Characteristics for Gen2 speeds

| Symbol | Parameter | Min | Nom | Max | Units | Comments |
|--------------------------|---|--------|--------|--------|-------|---|
| Tbit | Unit Interval | 199.94 | 200.00 | 200.06 | ps | Defined by Gen2 spec. |
| V _{VRX-Diffp-p} | Differential Input Peak to Peak Voltage | TBD | | 1.200 | V | $V_{RX-DIFFp-p} = 2 * V_{RX-D+} - V_{RX-D-} $. Applies to IN_S and RX_IN signals. |
| T _{RX-EYE} | Minimum Eye Width at IN_D input pair. | TBD | | | Tbit | |
| V _{CM-AC-pp} | AC Peak Common-Mode Input Voltage | | | 100 | mV | $V_{CM-AC-pp} = V_{RX-D+} + V_{RX-D-} /2 - V_{RX-CM-DC}$. $V_{RX-CM-DC} = DC(avg)$ of $ V_{RX-D+} + V_{RX-D-} /2$ VCM-AC-pp includes all frequencies above 30kHz. |
| Z _{RX-DIFF-DC} | DC Differential Input Impedance | 80 | 100 | 120 | Ω | Rx DC Differential Mode impedance |
| Z _{RX-DC} | DC Input Impedance | 40 | 50 | 60 | Ω | Required IN_D+ as well as IN_D- DC impedance (50 Ω +/- 20% tolerance). Includes mux resistance. |
| V _{RX-Bias} | Rx input termination voltage | 0 | | 2.0 | V | Intended to limit power-up stress on PCIE output buffers. |

Package Mechanical: 28-Contact TQFN (ZH)



09-0066

Ordering Information

| Ordering Code | Package Code | Package Type |
|----------------|--------------|----------------------------------|
| PI3PCIE2215ZHE | ZH | Pb-free & Green, 28-Contact TQFN |

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- "E" denotes Pb-free and Green
- Adding an "X" at the end of the ordering code denotes tape and reel packaging