

## Signal Descriptions

| Pin Number                            | Pin Name        | Type                                         | Description                                                                                                                                                                                        |
|---------------------------------------|-----------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1,<br>2                               | AI+,<br>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. |
| 37,<br>36                             | AOa+,<br>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,<br>4                               | AOb+,<br>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,<br>6                               | BI+,<br>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. |
| 33,<br>32                             | BOa+,<br>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,<br>8                               | BOB+,<br>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.                                                                          |
| 10,<br>11                             | CI+,<br>CI-     | Differential input                           | Differential input pair from PCIE signal source. Signal is passed through the COa+, COa- pin respectively When SEL=0. Signal is passed through to the COB+, COB- pin respectively when SEL = 1.    |
| 28,<br>27                             | COa+,<br>COa-   | Differential pass-through input              | Differential analog pass-through output. Signal from CI+ and CI- is passed through COa+, COa- pin respectively when SEL = 0.                                                                       |
| 12,<br>13                             | COB+,<br>COB-   | Differential pass-through input              | Differential analog pass-through output. Signal from CI+ and CI- is passed through COB+, COB- pin respectively when SEL = 1.                                                                       |
| 14,<br>15                             | DI+,<br>DI-     | Differential input                           | Differential input pair from PCIE signal source. Signal is passed through the DOa+, DOa- pin respectively When SEL=0. Signal is passed through to the DOB+, DOB- pin respectively when SEL = 1.    |
| 24,<br>23                             | DOa+,<br>DOa-   | Differential pass-through input              | Differential analog pass-through output. Signal from DI+ and DI- is passed through DOa+, DOa- pin respectively when SEL = 0.                                                                       |
| 16,<br>17                             | DOB+,<br>DOB-   | Differential pass-through input              | Differential analog pass-through output. Signal from DI+ and DI- is passed through DOB+, DOB- pin respectively when SEL = 1.                                                                       |
| 18, 20, 22, 25, 29,<br>35, 38, 40, 42 | GND             | Ground input                                 | Ground                                                                                                                                                                                             |
| 30                                    | SEL             | 3.6V tolerant low-voltage single-ended input | SEL controls the mux through a flow-through latch.                                                                                                                                                 |
| 9, 19, 21, 26, 31,<br>34, 39, 41      | V <sub>DD</sub> | 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 VDD    |
| 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.

## Recommended Operating Conditions

| Symbol            | Parameter                                            | Conditions | Min | Typ | Max | Units   |
|-------------------|------------------------------------------------------|------------|-----|-----|-----|---------|
| V <sub>DD</sub>   | 3.3V Power Supply                                    |            | 3.0 | 3.3 | 3.6 | V       |
| I <sub>DD</sub>   | Total current from V <sub>DD</sub><br>3.3V supply    |            | 0   |     | 2.5 | mA      |
| T <sub>CASE</sub> | Case temperature range<br>for operation within spec. |            | -40 |     | 85  | Celsius |

## DC Electrical Characteristics (T<sub>A</sub> = -40°C to +85°C, V<sub>DD</sub> = 3.3V ± 10%)

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

Note:

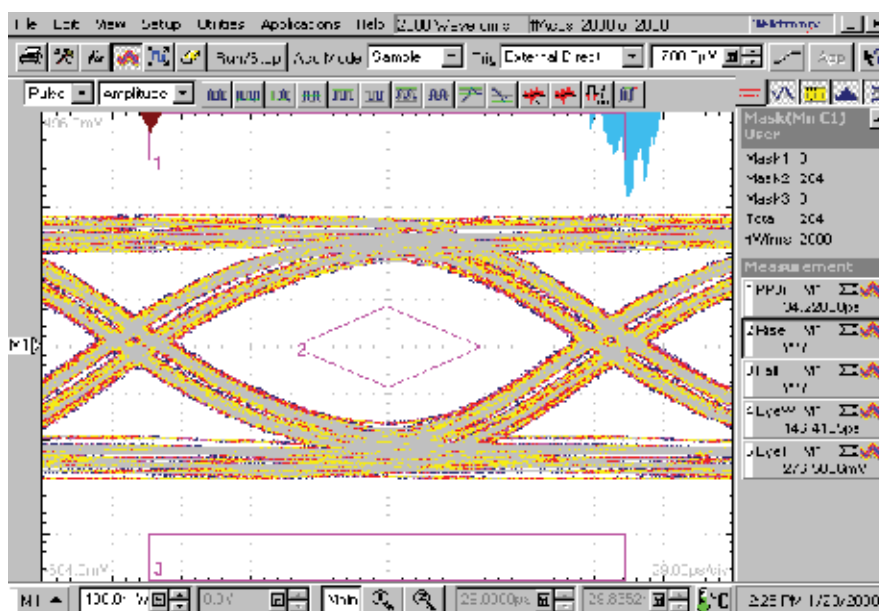
- Typical values are at V<sub>DD</sub> = 3.3V, T<sub>A</sub> = 25°C ambient and maximum loading.

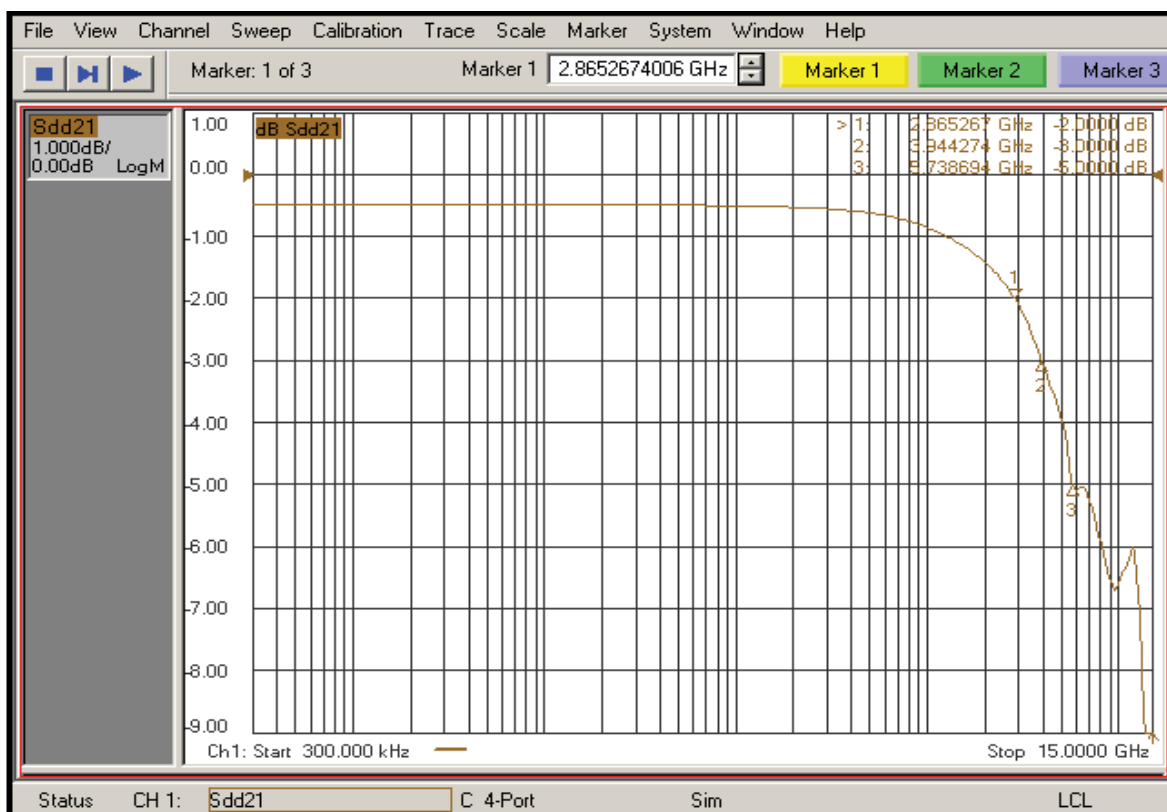
**Dynamic Electrical Characteristics for xI±, xOy±**

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

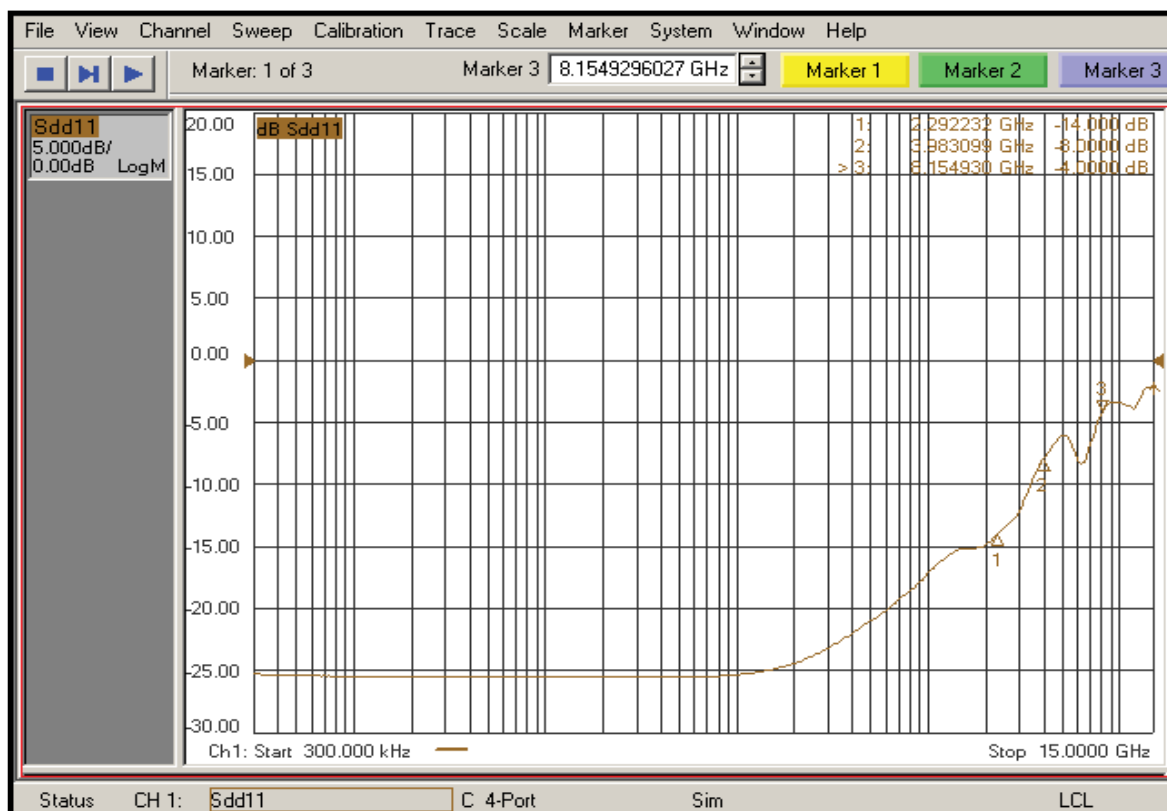
**Switching Characteristics (T<sub>A</sub> = -40° to +85°C, V<sub>DD</sub> = 3.3V±10%)**

| Parameter                           | Description                                       | Test Conditions                                   | Min. | Typ. | Max. | Units |
|-------------------------------------|---------------------------------------------------|---------------------------------------------------|------|------|------|-------|
| t <sub>PZH</sub> , t <sub>PZL</sub> | Line Enable Time - SEL to xI±, xOy±               | See "Test Circuit for Electrical Characteristics" | 0.5  |      | 12.0 | ns    |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Line Disable Time - SEL to xI±, xOy±              | See "Test Circuit for Electrical Characteristics" | 0.5  |      | 12.0 | ns    |
| t <sub>b-b</sub>                    | Bit-to-bit skew within the same differential pair | See "Test Circuit for Electrical Characteristics" |      |      | 7    | ps    |
| t <sub>ch-ch</sub>                  | Channel-to-channel skew                           | See "Test Circuit for Electrical Characteristics" |      |      | 35   | ps    |

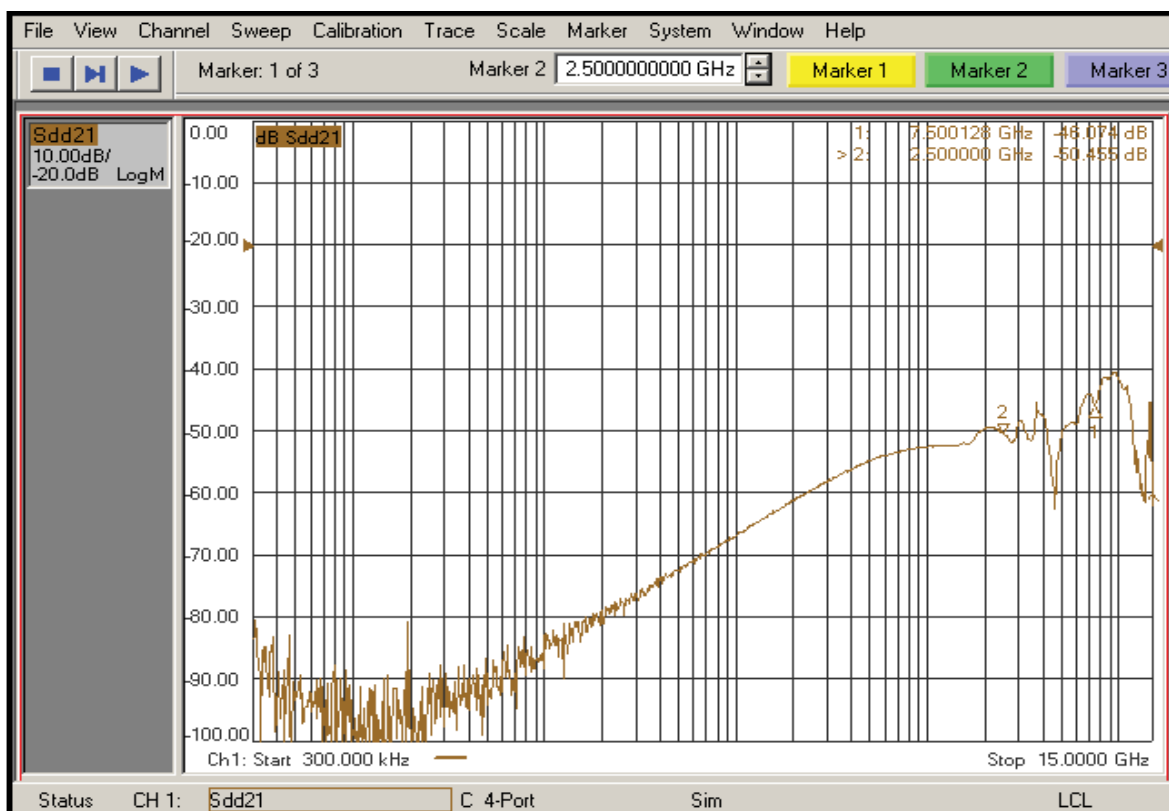

**5.0 Gbps Receive Eye Mask -3.5dB WITH the Switch**



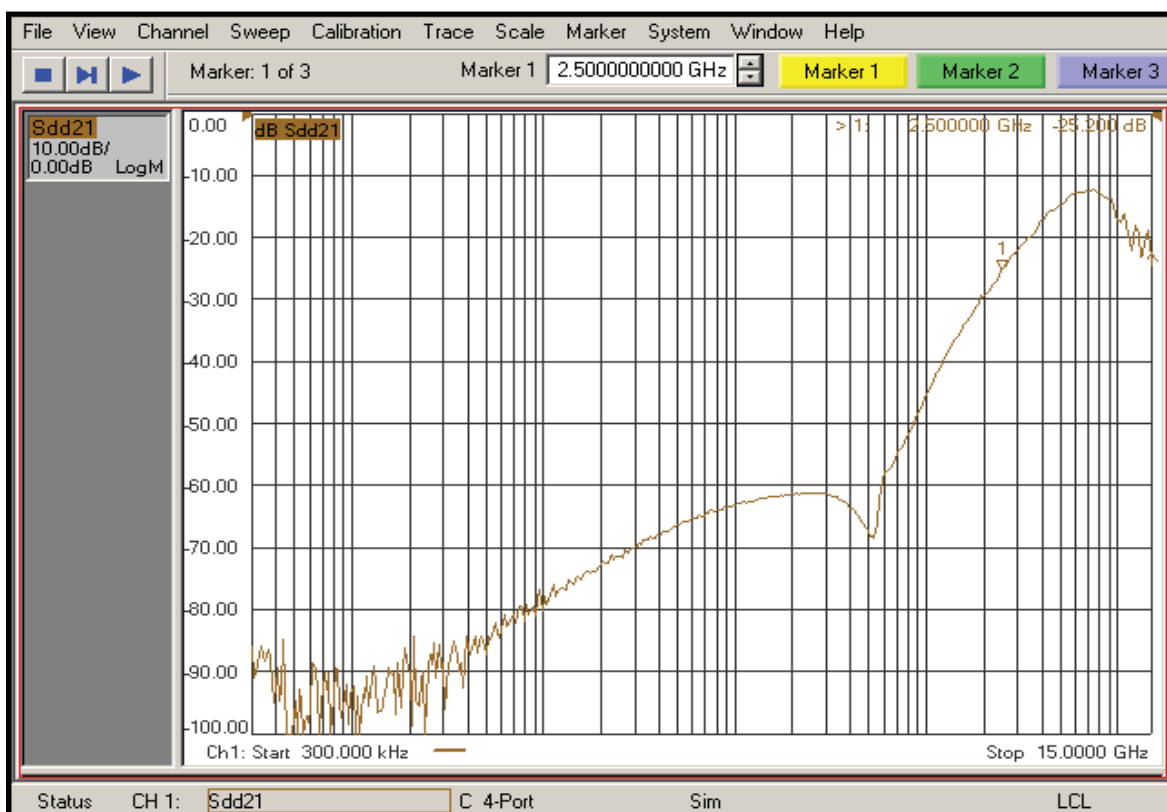
**Differential Insertion Loss**



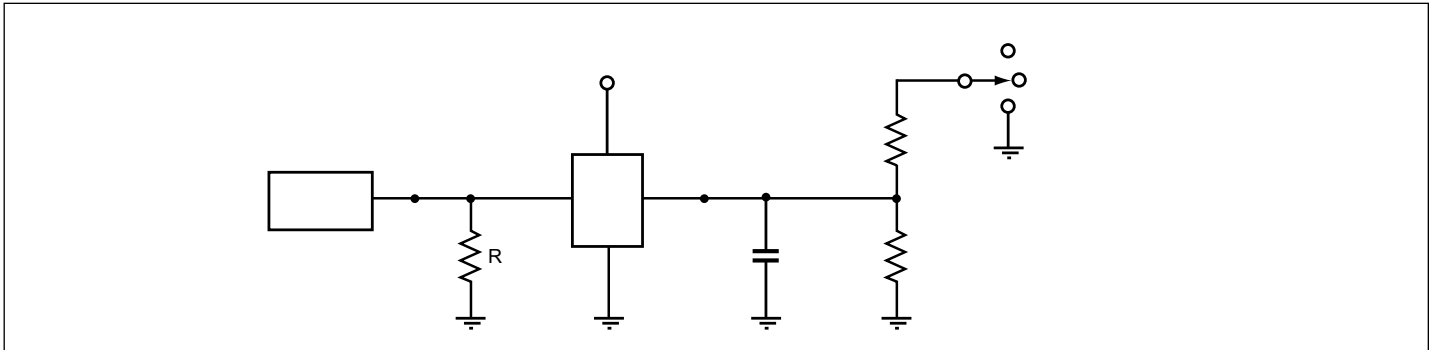
**Differential Return Loss**



**Differential Off Isolation**



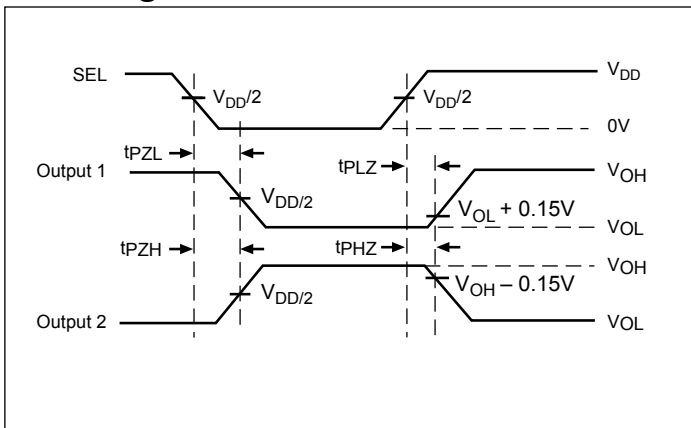
**Differential Crosstalk**



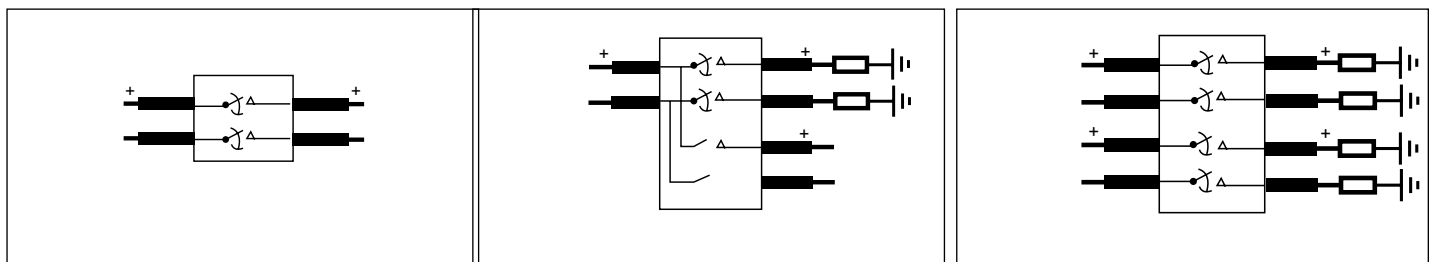
**Notes:**

1.  $C_L$  = Load capacitance: includes jig and probe capacitance.
2.  $R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator
3. 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.
4. All input impulses are supplied by generators having the following characteristics:  $PRR \leq \text{MHz}$ ,  $Z_O = 50\Omega$ ,  $t_r \leq 2.5\text{ns}$ ,  $t_f \leq 2.5\text{ns}$ .
5. The outputs are measured one at a time with one transition per measurement.

**Switching Waveforms**



**Voltage Waveforms Enable and Disable Times**



**Diff. Insertion Loss and Return Test Circuit**

**Diff. Off Isolation Test Circuit**

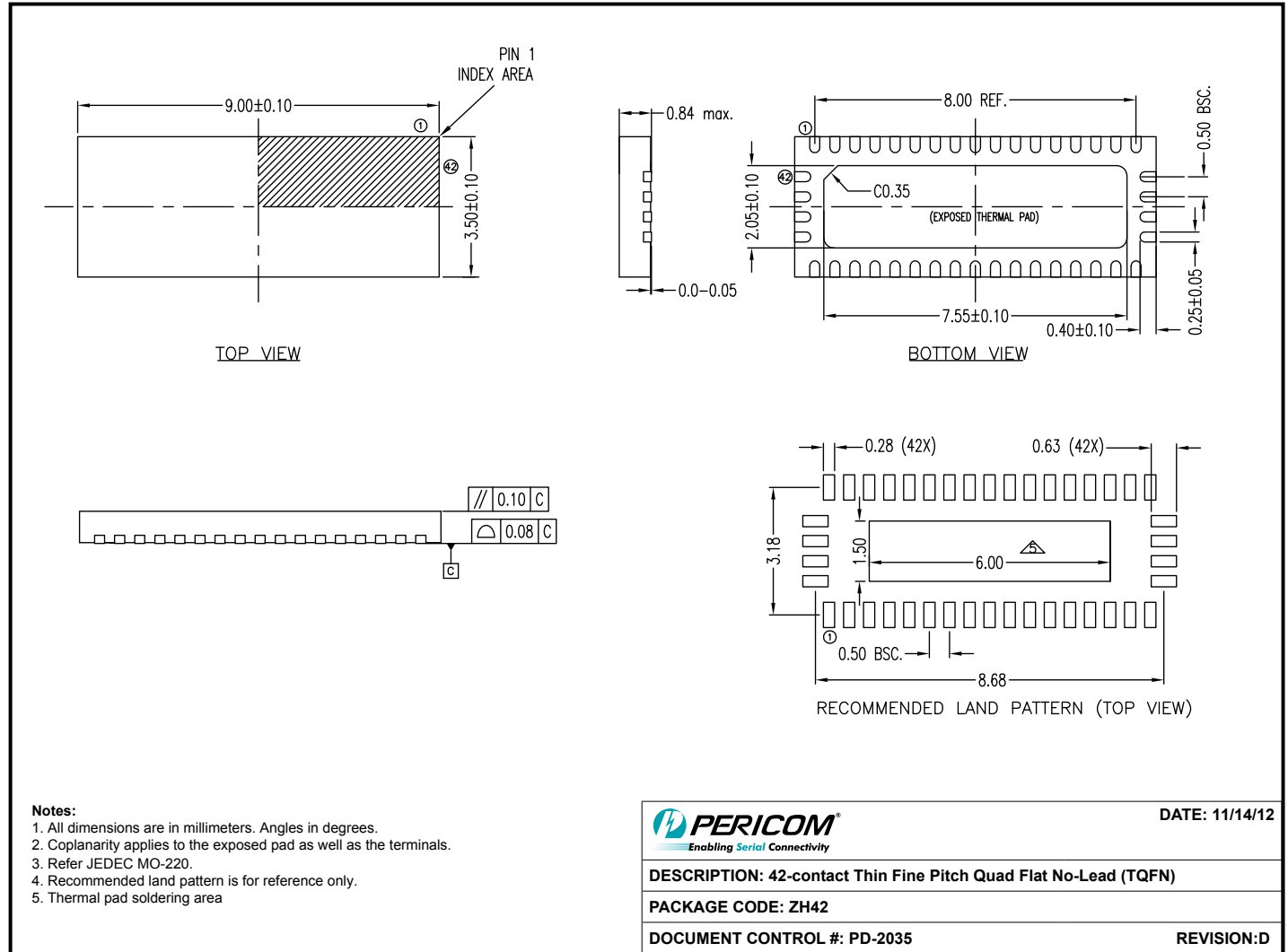
**Diff. Near End Xtalk Test Circuit**

## Application Information

### Differential Inputs/Output Characteristics for PCIe® 2.0 speeds

| Symbol                  | Parameter                               | Min    | Nom    | Max    | Units | Comments                                                                                                                                                   |
|-------------------------|-----------------------------------------|--------|--------|--------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tbit                    | Unit Interval                           | 199.94 | 200.00 | 200.06 | ps    | Defined by PCIe 2.0 spec.                                                                                                                                  |
| V <sub>RX-DIFFp-p</sub> | Differential Input Peak-to-Peak Voltage | TBD    |        | 1.200  | V     | VRX-DIFFp-p = 2* VRX-D+ - VRX-D- . Applies to IN_S and RX_IN signals.                                                                                      |
| T <sub>RX-EYE</sub>     | Minimum Eye Width at IN_D input pair.   | TBD    |        |        | Tbit  |                                                                                                                                                            |
| V <sub>CM-AC-pp</sub>   | AC Peak Common-Mode Input Voltage       |        |        | 100    | mV    | <p>VCM-AC-pp =  VRX-D+ + VRX-D- /2 - VRX-CM-DC.</p> <p>VRX-CM-DC = DC(avg) of  VRX-D++VRX-D- /2</p> <p>VCM-AC-pp includes all frequencies above 30kHz.</p> |
| Z <sub>RX-DIFF-DC</sub> | Dc Differential Input Impedance         | 80     | 100    | 120    | Ω     | Rx DC Differential Mode impedance                                                                                                                          |
| Z <sub>RX-DC</sub>      | 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 <sub>RX-Bias</sub>    | Rx input termination voltage            | 0      |        | 2.0    | V     | Intended to limit power-up stress on PCIe output buffers.                                                                                                  |

### Packaging Mechanical: 42-Contact TQFN (ZH)



12-0529

Note: For latest package info, please check: <http://www.pericom.com/products/packaging/mechanicals.php>

### Ordering Information

| Ordering Code  | Package Code | Package Description              |
|----------------|--------------|----------------------------------|
| PI3PCIE2415ZHE | ZH           | Pb-free & Green, 42-contact TQFN |

#### Notes:

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://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