

PI3PCIE3242A

3.3V PCI Express® 3.0 4 Channel 2x2 Exchange Switch

Features

- 4 Differential Channel 2x2 Exchange Switch
- PCI Express® 3.0 performance, 8.0 Gbps
- Bi-directional operation
- Low Bit-to-Bit Skew: 10ps (between ± signals)
- Low Crosstalk: -29dB @ 2.5GHz (5Gbps)
-20dB @ 4.0GHz (8Gbps)
- Low Insertion Loss: -1.1dB @ 2.5GHz (5Gbps)
-1.45dB @ 4.0GHz (8Gbps)
- V_{DD} Operating Range: 3.3V ±10%
- Industrial Temperature Range: -40°C to 85°C
- ESD Tolerance: 2kV HBM
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. “Green” Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative.
<https://www.diodes.com/quality/product-definitions/>
- Packaging (Pb-free & Green):
 - 30-contact, TQFN (ZL30), 2.5 x 4.5mm.

Description

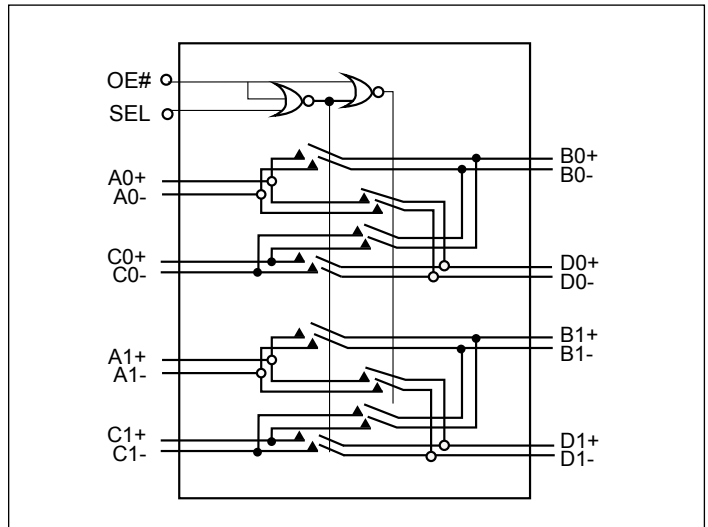
The PI3PCIE3242A is a differential exchange switch featuring pass-through pinout. It supports one full PCI Express® lane 2x2 Exchange Switch operating at 8.0Gbps PCIe® 3.0 performance.

With the select control input low, Port A connects to Port B, and Port C connects to port D for an 8-channel differential pass-through. When the select control input is high Port A connects to Port D, and Port B connects to Port C.

Truth Table

| Function | SEL | OE# |
|------------------------------------|-----|-----|
| Ax = Bx Cx = Dx | 0 | 0 |
| Ax = Dx Cx = Bx | 1 | 0 |
| Ax, Bx, Cx, Dx = Hi-Z (disconnect) | x | 1 |

Block Diagram

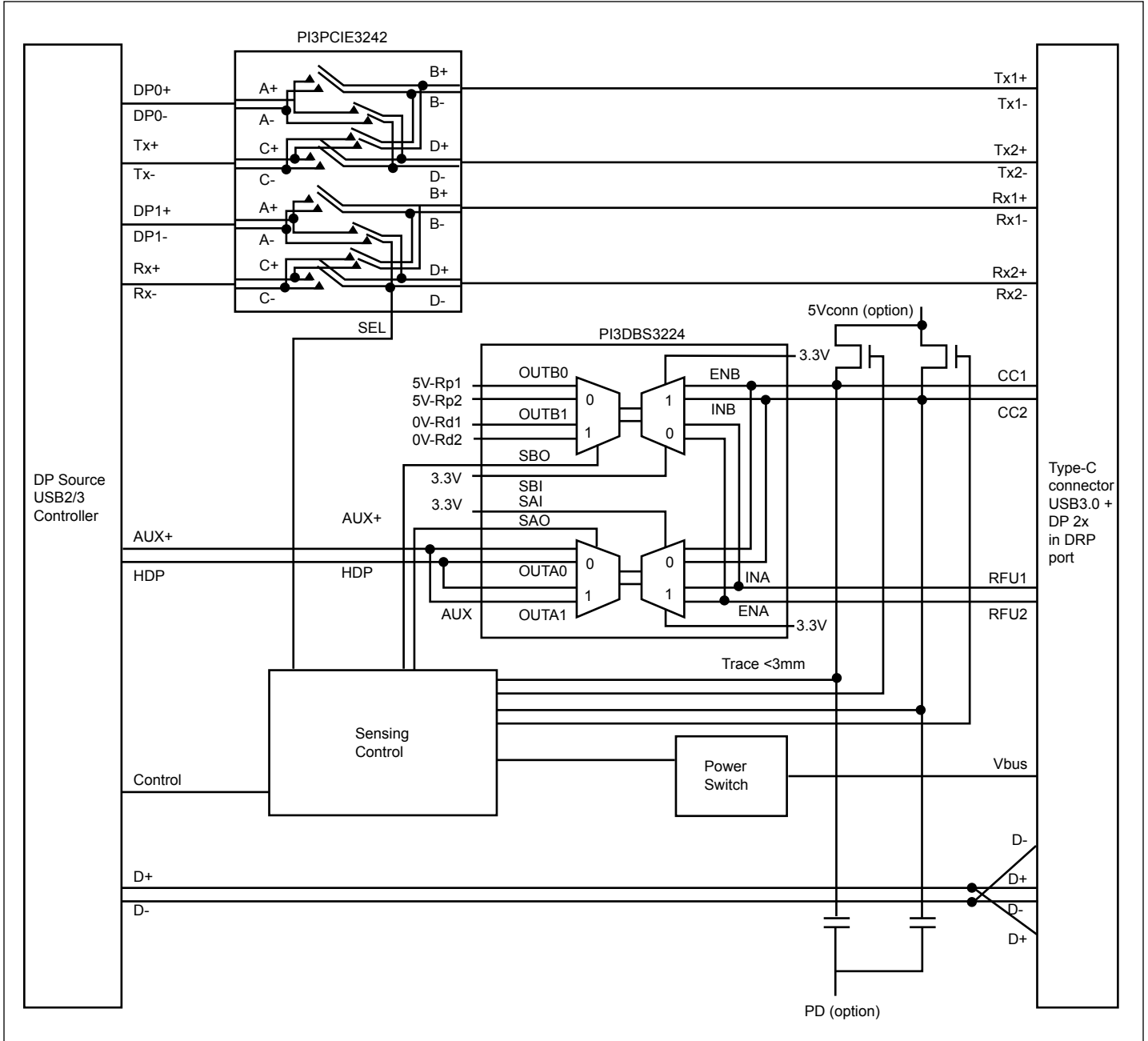


Notes:

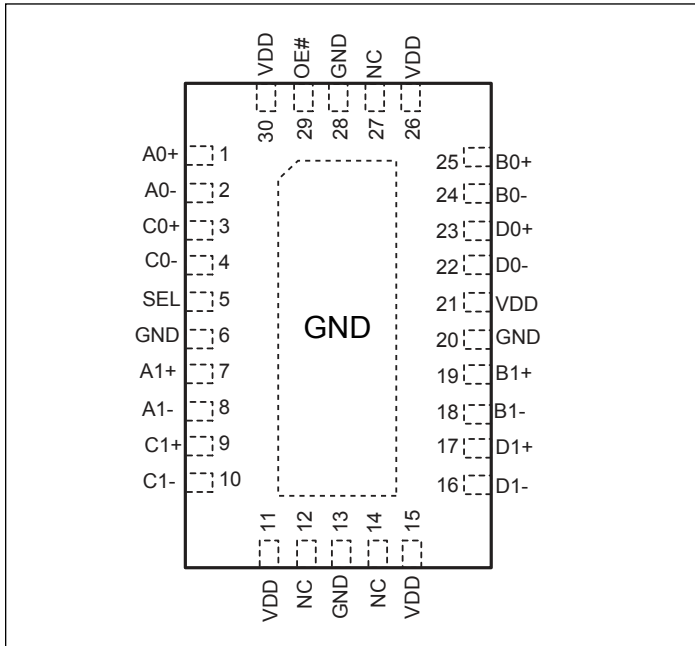
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, “Green” and Lead-free.
3. Halogen- and Antimony-free “Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

PI3PCIE3242A

**Application Diagram in Switching 2 Lanes of DP1.2 & USB 3.0 Signals Over Type C Connector
Notebook or Tablet**



Pin Diagram



Pin Description

| Pin # | Pin Name | I/O | Description |
|------------------------------|-----------------|-----|---|
| 1, 2 | A0+, A0- | I/O | Signal I/O, Channel 0, Port A |
| 7, 8 | A1+, A1- | I/O | Signal I/O, Channel 1, Port A |
| 25, 24 | B0+, B0- | I/O | Signal I/O, Channel 0, Port B |
| 19, 18 | B1+, B1- | I/O | Signal I/O, Channel 1, Port B |
| 3, 4 | C0+, C0- | I/O | Signal I/O, Channel 0, Port C |
| 9, 10 | C1+, C1- | I/O | Signal I/O, Channel 1, Port C |
| 23, 22 | D0+, D0- | I/O | Signal I/O, Channel 0, Port D |
| 17, 16 | D1+, D1- | I/O | Signal I/O, Channel 1, Port D |
| 29 | OE# | I | Output Enable, active low. When OE# = 0 the device I/O is enabled. When OE#=1, all I/O are high impedance |
| 5 | SEL | I | Operation mode Select (when SEL=0: A→B, C→D, when SEL=1: A→D, C→B) |
| 11, 15, 21, 26, 30 | V _{DD} | Pwr | 3.3V ±10% Positive Supply Voltage |
| 6, 13, 20, 28, Center Pad | GND | Pwr | Power ground |
| 12, 14, 27 | NC | | No Connect |

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 +3.7V |
| DC Input Voltage | -0.5V to V _{DD} |
| DC Output Current | 120mA |
| Power Dissipation | 0.5W |
| Junction Temperature | 125°C |

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 | SEL and OE# at OV or V _{DD} | | | 200 | μA |
| T _A | Operating temperature range | | -40 | | 85 | °C |

DC Electrical Characteristics for Switching over Operating Range

| Parameters | Description | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽¹⁾ | Max. | Units |
|-----------------|---|---|------------------------|---------------------|------------------------|-------|
| V _{IH} | Input HIGH Voltage | Guaranteed HIGH level | 0.65 x V _{DD} | | | V |
| V _{IL} | Input LOW Voltage | Guaranteed LOW level | -0.5 | | 0.35 x V _{DD} | |
| V _{IK} | Clamp Diode Voltage | V _{DD} = Max., I _{IN} = -18mA | | -0.7 | -1.2 | |
| I _{IH} | Input HIGH Current, SEL | V _{DD} = Max., V _{IN} = V _{DD} | -10 | | +10 | μA |
| I _{IL} | Input LOW Current, SEL | V _{DD} = Max., V _{IN} = GND | -10 | | +10 | |
| I _{IH} | Input HIGH Current, A _X , B _X , C _X , D _X | V _{DD} = Max., V _{IN} = 1.8V | -10 | | +10 | μA |
| I _{IL} | Input LOW Current, A _X , B _X , C _X , D _X | V _{DD} = Max., V _{IN} = 0V | -10 | | +10 | |

Note:

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

Switching Characteristics

| Parameters | Description | Test Conditions | Min. | Typ. | Max. | Units |
|-------------------------------------|--|-----------------|------|------|------|-------|
| t _{PZH} , t _{PZL} | Line Enable Time - SEL to A _N , B _N , C _N , D _N | | 0.5 | | 45 | ns |
| t _{PHZ} , t _{PLZ} | Line Disable Time - SEL to A _N , B _N , C _N , D _N | | 0.5 | | 25 | |
| t _{b-b} | Bit-to-bit skew within the same differential pair | | | | 10 | ps |
| t _{ch-ch} | Channel-to-channel skew | | | | 20 | |

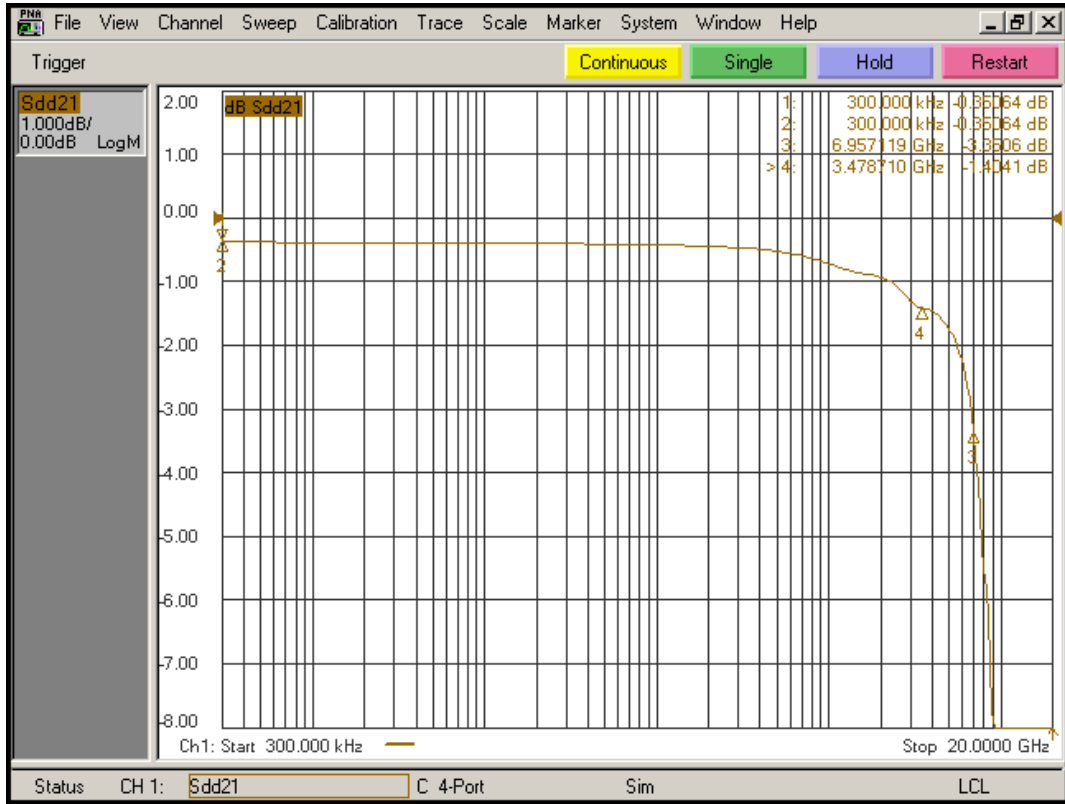
Dynamic Electrical Characteristics

| Parameter | Description | Test Conditions | Min. | Typ. ⁽¹⁾ | Max. | Units |
|---------------------|---|---|------|--------------------------------------|--------------------------------------|-------|
| DDIL | Differential Insertion Loss ($V_{IN} = -10\text{dBm}$, $DC = 0V$) | $f=1.2\text{GHz}$ $f=2.5\text{GHz}$ $f=4.0\text{GHz}$ $f=5.0\text{GHz}$ $f=7.5\text{GHz}$ | | -0.8 -1.0 -1.3 -1.8 -4.5 | -1.0 -1.2 -1.9 -2.6 -5.6 | dB |
| DDIL _{OFF} | Differential Off Isolation | $f= 4.0\text{GHz}$ | | -19 | | dB |
| DDRL | Differential Return Loss | $f= 0$ to 2.8GHz $f= 2.8$ to 5.0GHz $f= 5.0$ to 8.0GHz | | -26 -14 -7.5 | | dB |
| DDNEXT | Near End Crosstalk | $f= 0$ to 2.8GHz $f= 2.8$ to 5.0GHz $f= 5.0$ to 8.0GHz | | -26 -20 -16 | | dB |
| V _{IF} | Max Signal Frequency Range | Insertion loss 1.5dB, $V_{IN}=0.623\text{Vpp}$, $DC=0V$ | | 4.0 | | GHz |
| | | Insertion loss 1.5dB, $V_{IN}=0.623\text{Vpp}$, $DC=0.9V$ | | 4.0 | | |
| | | Insertion loss 3dB, $V_{IN}=0.623\text{Vpp}$, $DC=0V$ | | 8.0 | | |
| | | Insertion loss 3dB, $V_{IN}=0.623\text{Vpp}$, $DC=0.9V$ | | 8.0 | | |
| BW | -3dB Bandwidth | | | 6.5 | | GHz |

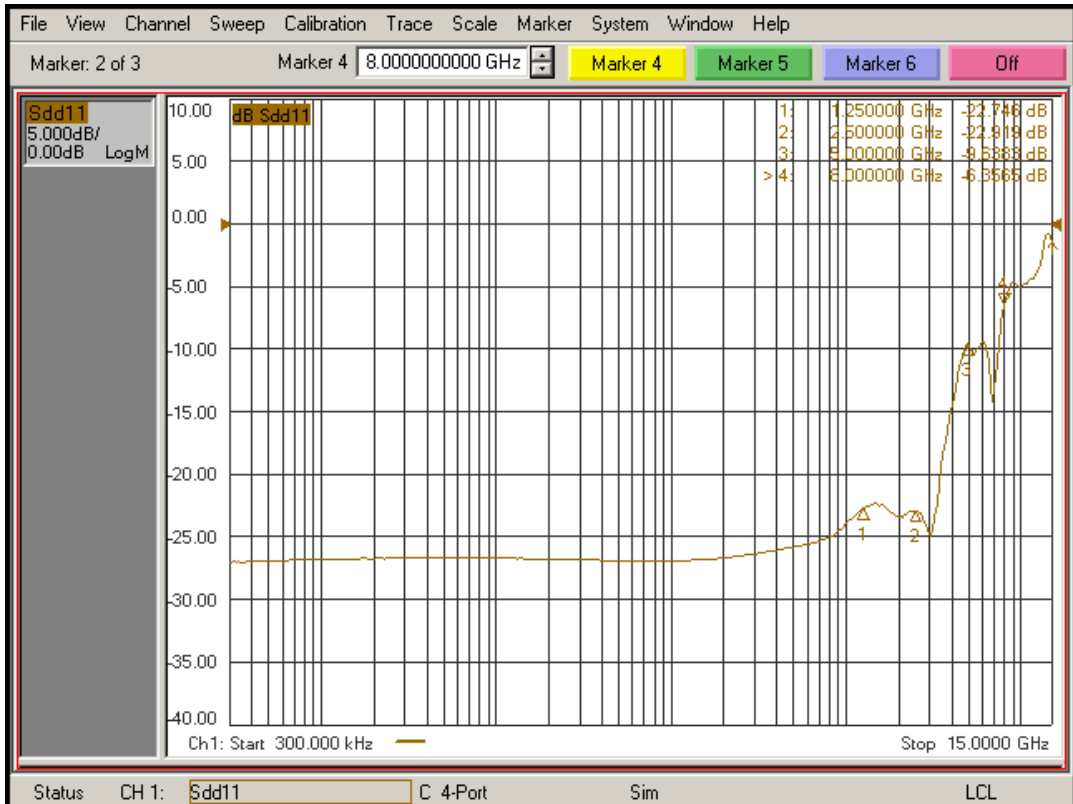
Notes:

1. Guaranteed by design. Typical values are at $V_{DD} = 3.3V$, $T_A = 25^\circ\text{C}$ ambient and maximum loading.

PI3PCIE3242A

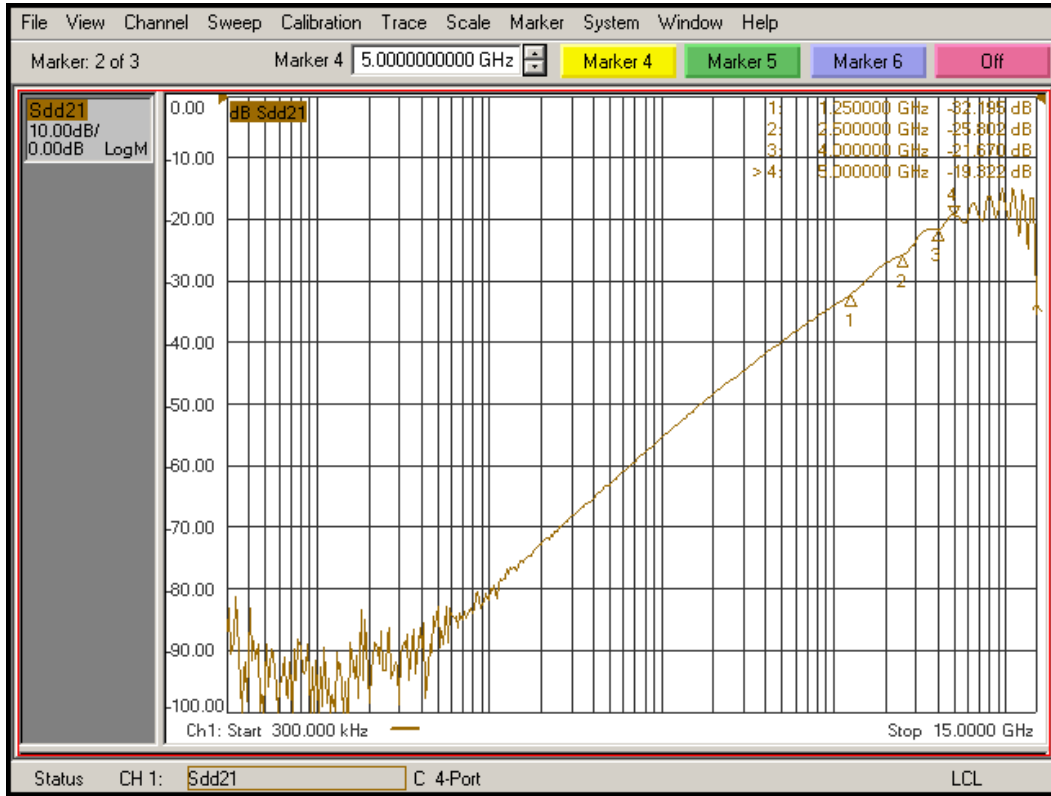


Differential Insertion Loss

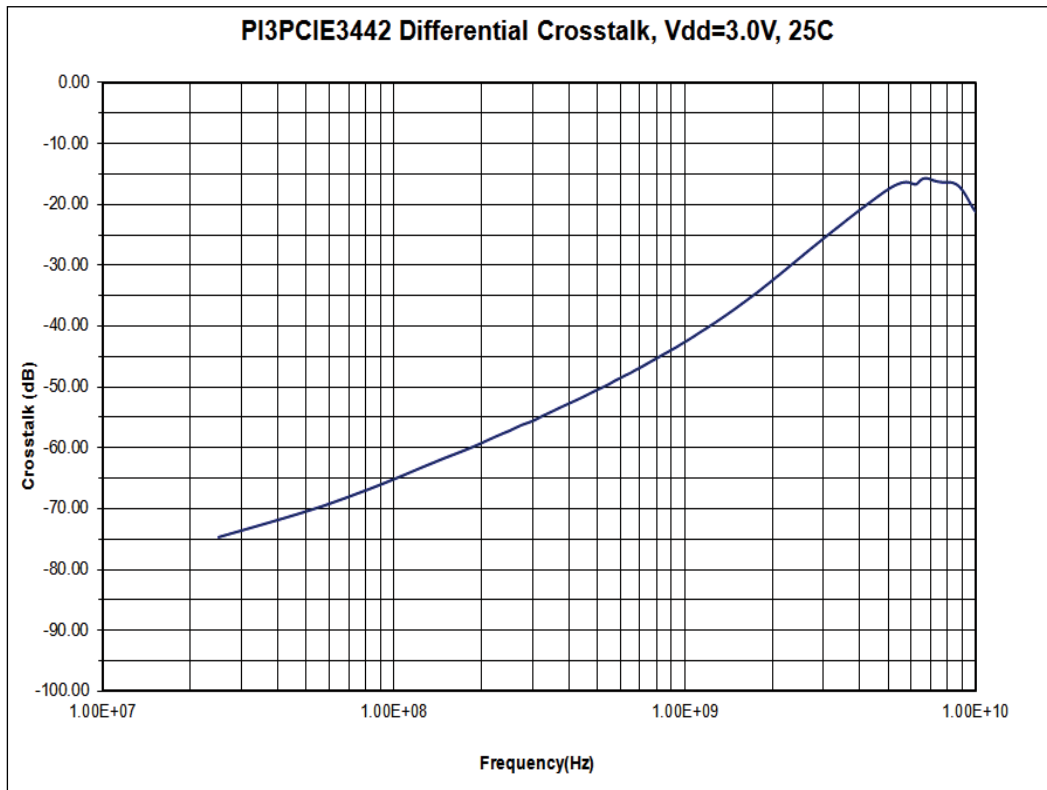


Differential Return Loss

PI3PCIE3242A

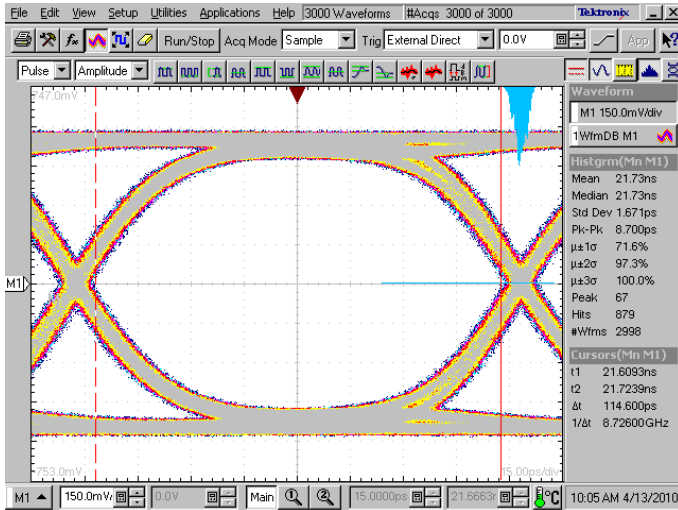


Differential Off Isolation

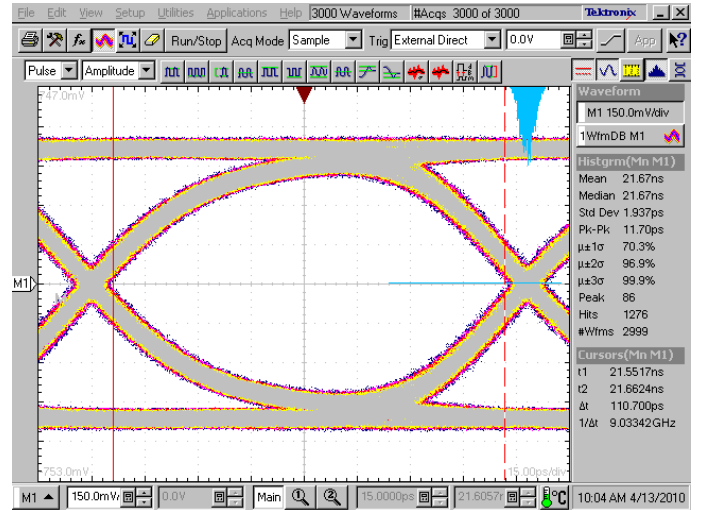


Differential Crosstalk

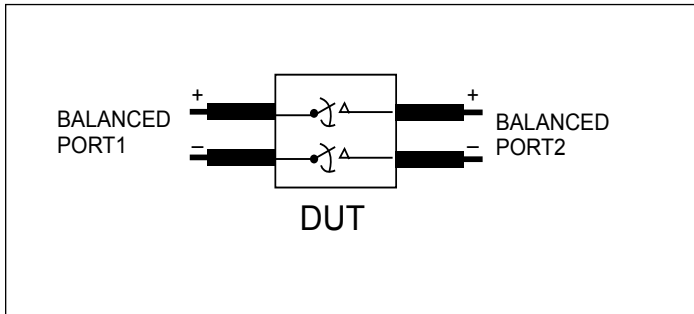
PI3PCIE3242A



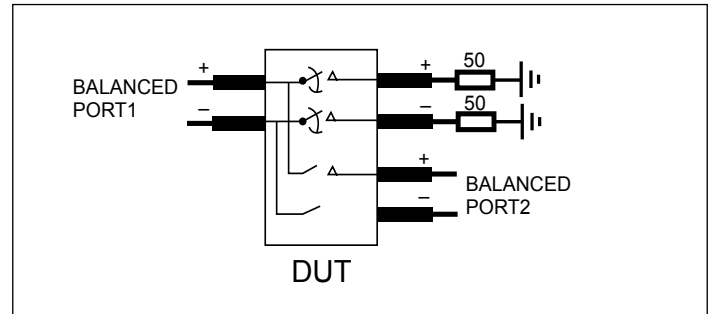
8.0 Gbps RX signal eye without PI3PCIE3242A



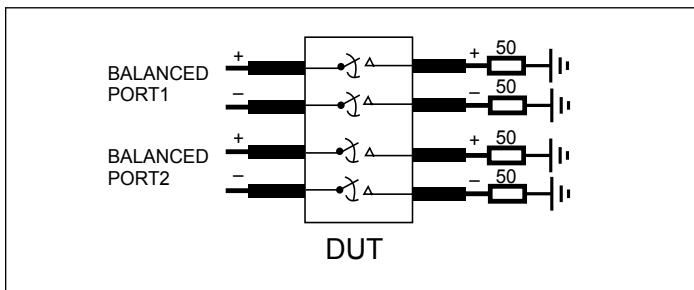
8.0 Gbps RX signal eye with PI3PCIE3242A



Differential Insertion Loss and Return Test Circuit

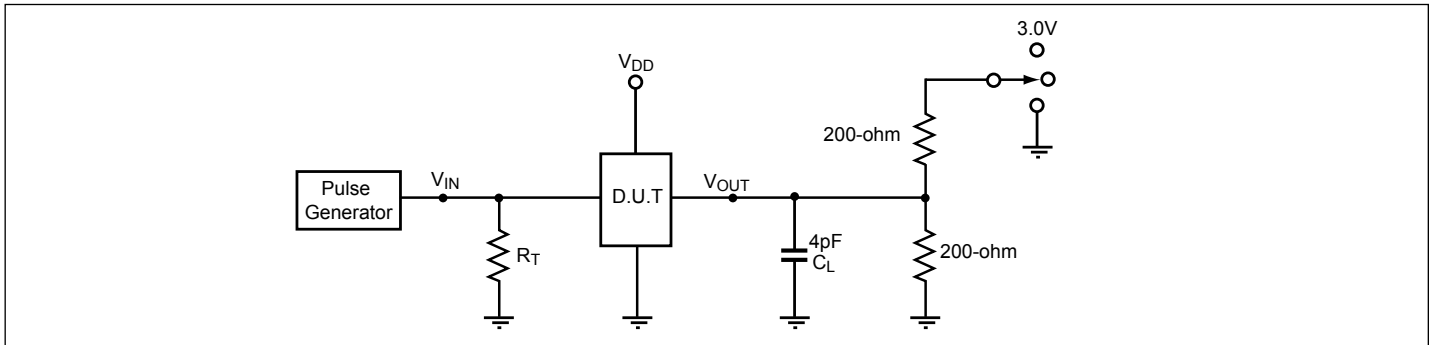


Differential Off Isolation Test Circuit



Differential Near End Xtalk Test Circuit

Test Circuit for Electrical Characteristics



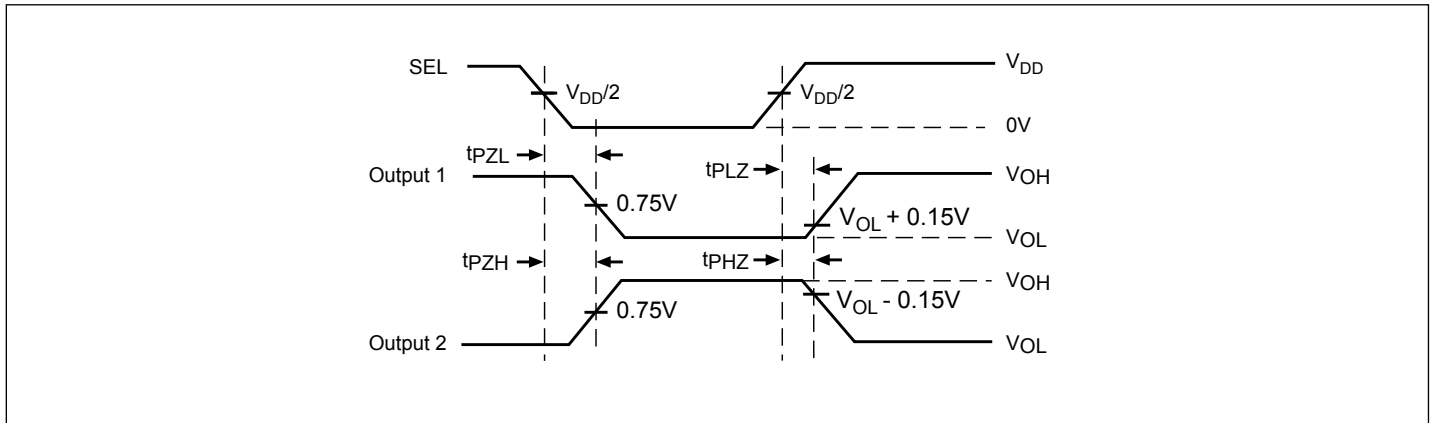
Notes:

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.

Switch Positions

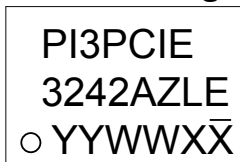
| Test | Switch |
|-----------------------|--------|
| t_{PLZ} , t_{PZL} | 3.0V |
| t_{PHZ} , t_{PZH} | GND |
| Prop Delay | Open |

Switching Waveforms



Voltage Waveforms Enable and Disable Times

Part Marking



YY : Year
 WW : Workweek
 1st X: Assembly Code
 2nd X: Fab Code

PI3PCIE3242A

Packaging Mechanical: 30-TQFN (2.5x4.5mm)

| SYMBOLS | MIN. | NOM. | MAX. |
|---------|------|-------|------|
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | 0.02 | 0.05 |
| A3 | | 0.203 | REF. |
| b | 0.15 | 0.20 | 0.25 |
| D | 2.40 | 2.50 | 2.60 |
| E | 4.40 | 4.50 | 4.60 |
| D2 | 1.15 | 1.20 | 1.25 |
| E2 | 3.15 | 3.20 | 3.25 |
| e | | 0.40 | BSC |
| L | 0.25 | 0.30 | 0.35 |
| K | 0.20 | — | — |

Notes:
 1. All dimensions are in mm. Angles in degrees.
 2. Refer JEDEC MO-220.
 3. Recommended land pattern is for reference only.

PERICOM
Enabling Serial Connectivity

DATE: 10/21/13

DESCRIPTION: 30-contact, Thin Fine Pitch Quad Flat No lead Package (TQFN)

PACKAGE CODE: ZL

DOCUMENT CONTROL #: PD-2172

REVISION: --

14-0006

For latest package info.

please check: <http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/>

Ordering Information

| Ordering Code | Package Code | Package Description |
|------------------|--------------|--|
| PI3PCIE3242AZLEX | ZL | 30-contact, Thin Fine Pitch Quad Flat No-Lead (TQFN) |

Notes:

- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
- See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
- E = Pb-free and Green
- X suffix = Tape/Reel

IMPORTANT NOTICE

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and definitive format released by Diodes Incorporated.

LIFE SUPPORT

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or

2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

Copyright © 2020, Diodes Incorporated

www.diodes.com