PI3PCIE3212

3.3V, PCI Express® 3.0, 1-Lane, 2-Channel, 8Gbps, 2:1 Mux/DeMux Switch w/ Single Enable

Features

➜ 2 Differential Channel, 2:1 Mux/DeMux

➜ PCI Express® 3.0 performance, 8.0Gbps

➜ Bi-directional operation

➜ 3dB Bandwidth: 8.1GHz

➜ Low Bit-to-Bit Skew, 10ps max

➜ Low channel-to-channel skew: 20ps max

➜ Low insertion loss: -1.7dB @4GHz (8.0Gbps)

➜ Low return loss: -13.5dB @4GHz (8.0Gbps)

➜ Low Crosstalk: -32dB@4GHz (8.0Gbps)

➜ Low Off Isolation: -21dB@4GHz (8.0Gbps)

➜ Supply Voltage: 3.3V ± 10%

➜ Industrial Temperature Range: -40°C to 85°C

➜ Low Current: 0.2mA typ.

➜ Packaging (Pb-free & Green):

   ▫ – 20-contact TQFN (2.5 × 4.5mm)
   ▫ – 18 contact, X2QFN(XUA18), 2x2mm

Description

The PI3PCIE3212 is a PCIe Gen3.0, 8Gbps, 4 to 2 differential, bi-directional channel multiplexer/demultiplexer switch. Due to its low bit-to-bit skew, high channel-to-channel noise isolation and bandwidth, this product is ideal for PCI Express® 3.0 signal switching at 8.0Gbps.

Applications

Switch a PCI Express 3.0 lane output between two PCI Express lane inputs. Applications include NBs, PCs, servers, and other embedded devices. Routing of PCI Express 3.0, DP1.2, USB3.0, SAS2.0, SATA3.0, XAUI, RXAUI signals with low signal attenuation.
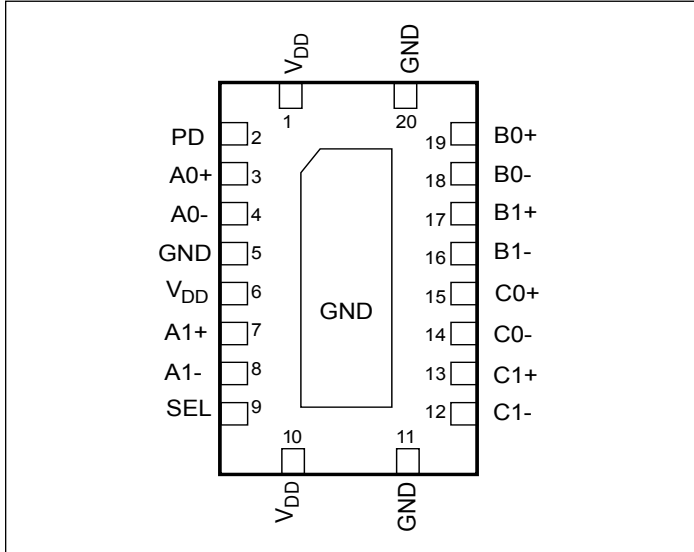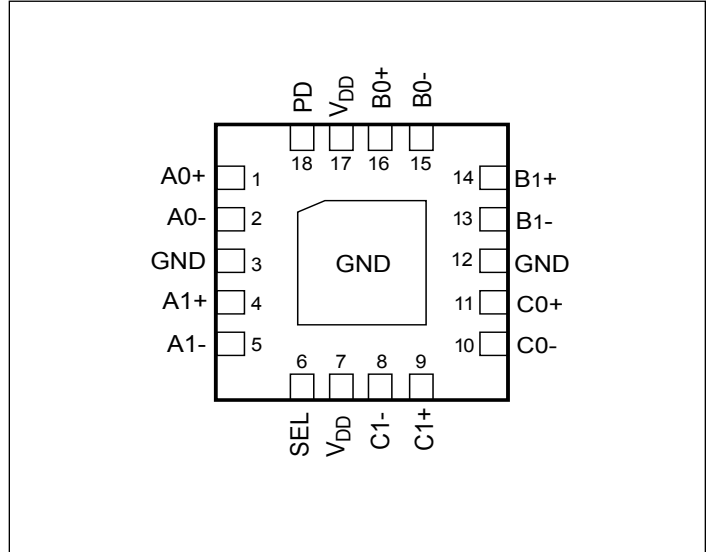
Block Diagram
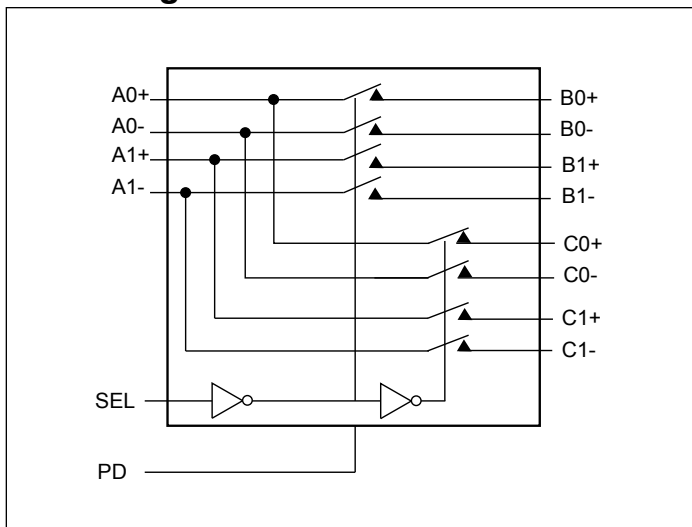
Truth Table

Function	SEL	PD
A to B	L	L
A to C	H	L
All ports Hi-Z, IC Power Down	X	H

Pin Configuration (Top-side view)

20-contact TQFN

18-contact X2QFN

Pin Description

20-TQFN Pin #	18-X2QFN Pin #	Pin Name	I/O	Description
3 4	1 2	A0+ A0−	I/O	Signal I/O, Channel 0, Port A
7 8	4 5	A1+ A1−	I/O	Signal I/O, Channel 1, Port A
19 18	16 15	B0+ B0−	I/O	Signal I/O, Channel 0, Port B
17 16	14 13	B1+ B1−	I/O	Signal I/O, Channel 1, Port B
15 14	11 10	C0+ C0−	I/O	Signal I/O, Channel 0, Port C
13 12	9 8	C1+ C1−	I/O	Signal I/O, Channel 1, Port C
9	6	SEL	I	Operation mode Select (when SEL=0: A→B, when SEL=1: A→C)
2	18	PD	I	PD = 1, Power down is enabled. Please see Truth Table.
1, 6, 10	7, 17	V_{DD}	Pwr	3.3V ±10% Positive Supply Voltage
5, 11, 20	3, 12, Center Pad	GND	Pwr	Power ground

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
Channel DC Input Voltage ....–0.5V to 1.5V
DC Output Current 120mA
Power Dissipation 0.5W
SEL/PD DC Input Voltage ....–0.5V to 4.6V
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 = OV or V_{DD}		0.2	1	mA
I_{DD_PD}	Power down current	PD = 1		20	40	µA
$V_{I/O}$-DIF	Differential Voltage (differential pins)				1.6	V_{ppd}
$V_{I/O\text{-CM}}$	Common Mode Voltage (differential pins)		0		0.8	V
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} - SEL, PD	Input HIGH Voltage, SEL, PD Input		2		3.6	V
V_{IL} - SEL, PD	Input LOW Voltage, SEL, PD Input		0		0.8	V
V_{IK}	Clamp Diode Voltage	V_{DD} = Max., I_{IN} = –18mA		–0.7	–1.2	
I_{IH}	Input HIGH Current, SEL, PD	V_{DD} = Max., V_{IN} = V_{DD}			±5	µA
I_{IL}	Input LOW Current, SEL, PD	V_{DD} = Max., V_{IN} = 0V			±5	
I_{IH}	Input HIGH Current, A_X, B_X, C_X	V_{DD} = Max., V_{IN} = 1.5V	–10		+10	µA
I_{IL}	Input LOW Current, A_X, B_X, C_X	V_{DD} = Max., V_{IN} = 0V	–10		+10	
I_{OZH}	HighZ HIGH Current, B_X, C_X	V_{DD} = Max., V_{IN} = 1.5V	–10		+10	µA
I_{OZL}	HighZ LOW Current, B_X, C_X	V_{DD} = Max., V_{IN} = 0V	–10		+10	µA

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			25	30	ns
t_{PHZ}, t_{PLZ}	Line Disable Time - SEL to A_N, B_N, C_N			5	25	
t_{PLH}	Propagation Delay, LOW to HIGH		17		36	ps
t_{PHL}	Propagation Delay, HIGH to LOW		21		39	ps
t_{b-b}	Bit-to-bit skew within the same differential pair			5	10	ps
t_{ch-ch}	Channel-to-channel skew				20	ps

Dynamic Electrical Characteristics

| Parameter	Description	Test Conditions	Min.	Typ.[1]	Max.	Units
DDIL[2, 3]	Differential Insertion Loss (V_{IN} = -10dBm, DC = 0V)	f = 100MHz		-0.4		dB
		f = 100MHz-1.25GHz		-0.6		
		f = 1.25GHz-2.5GHz		-1.0		
		f = 2.5GHz-4GHz		-1.7		
		f = 5GHz		-2.1		
DDIL$_{OFF}$[2, 3]	Differential Off Isolation	f = 100MHz		-59		dB
		f = 100MHz-1.25GHz		-37		
		f = 1.25GHz-2.5GHz		-27		
		f = 2.5GHz-4GHz		-21		
DDRL[2]	Differential Return Loss	f = 100MHz		-27		dB
		f = 100MHz-1.25GHz		-23.3		
		f = 1.25GHz-2.5GHz		-23.3		
		f = 2.5GHz-4GHz		-13.5		
DDNEXT[2, 3]	Near End Crosstalk	f = 100MHz		-57		dB
		f = 100MHz-1.25GHz		-38		
		f = 1.25GHz-2.5GHz		-33		
		f = 2.5GHz-4GHz		-32		
BW	-3dB Bandwidth			8.1		GHz

Notes:
1. Guaranteed by design. Typical values are at V_{DD} = 3.3V , T_A = 25°C ambient and maximum loading.
2. S parameters are measured with our evaluation board made with Rogers (R04350) material. Trace width is 30 mil, length 540 mil, trace impedance is 50 Ohm (+/-5%) and total insertion loss of the trace is 0.5dB@4GHz.
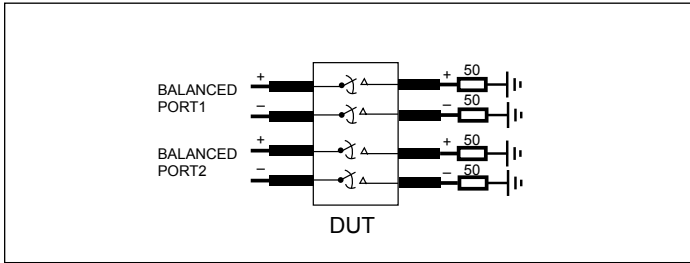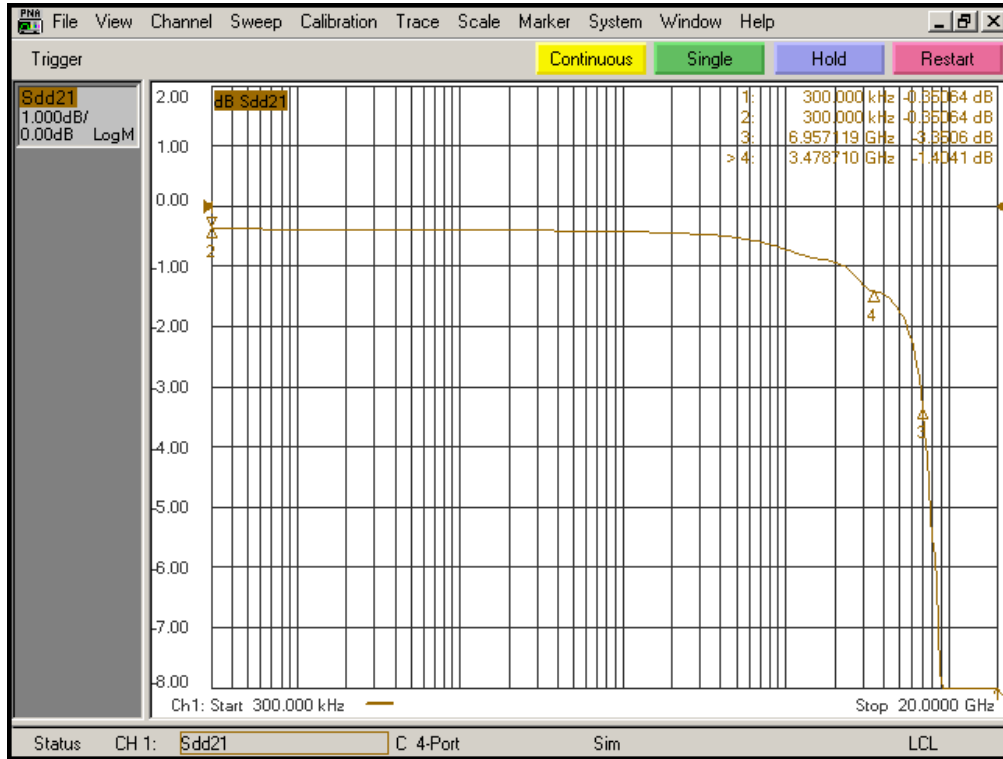3. Measurement done with fixture deembedding.
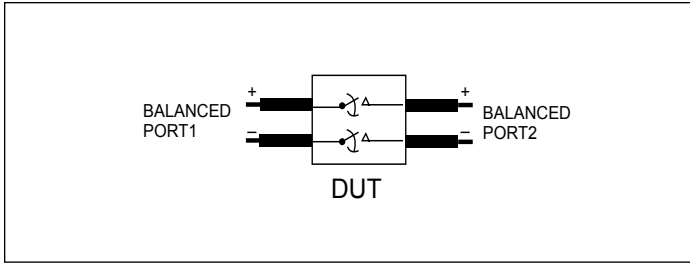
Diff. Insertion Loss and Return Test Circuit
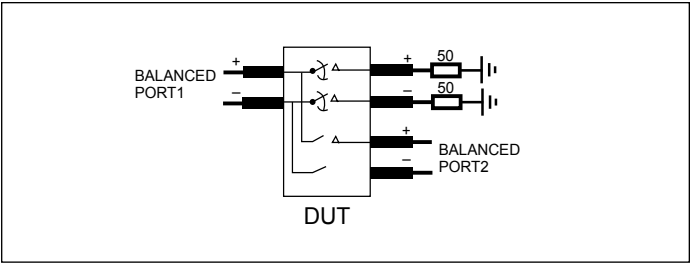
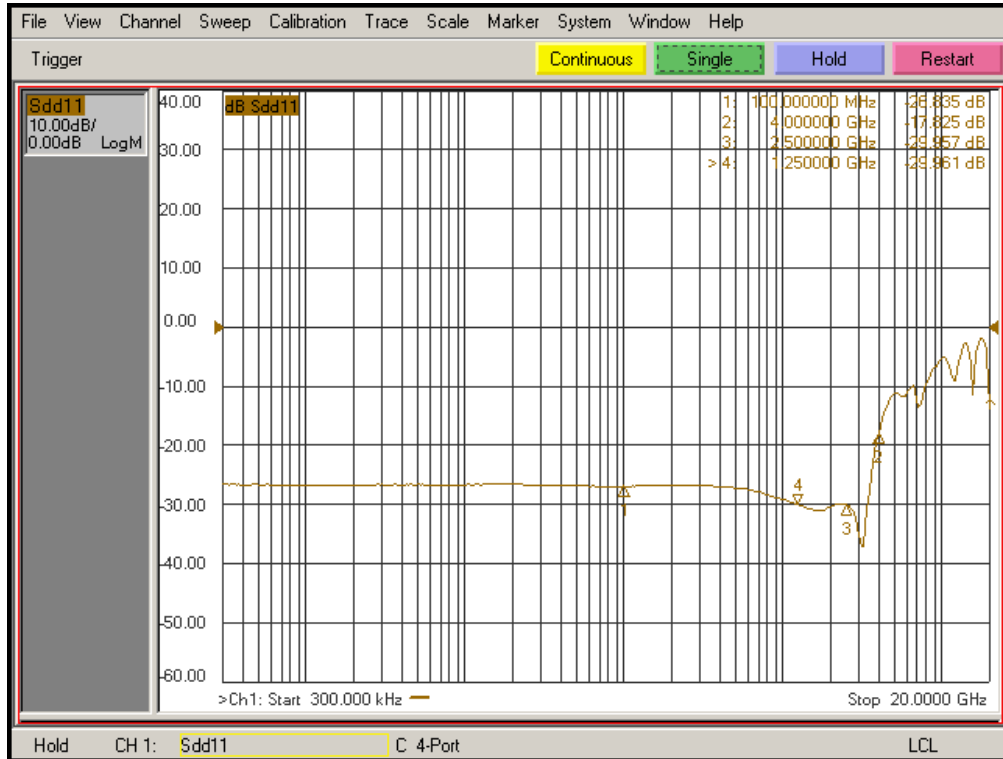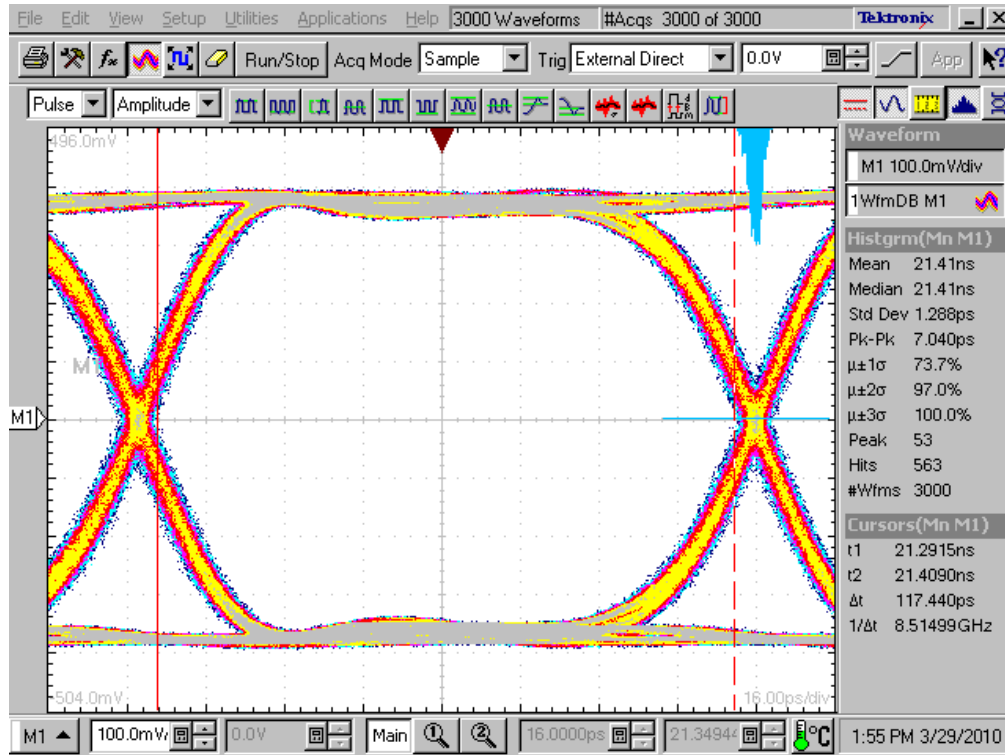**Diff. Off Isolation Test Circuit**
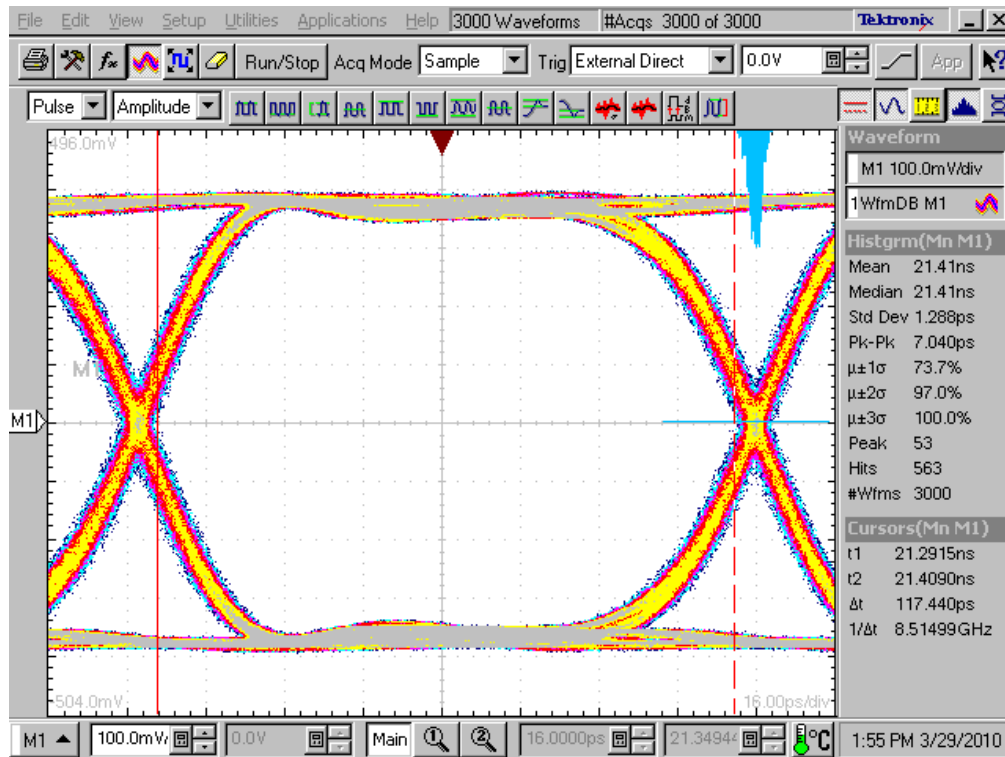

Diff. Near End Xtalk Test Circuit
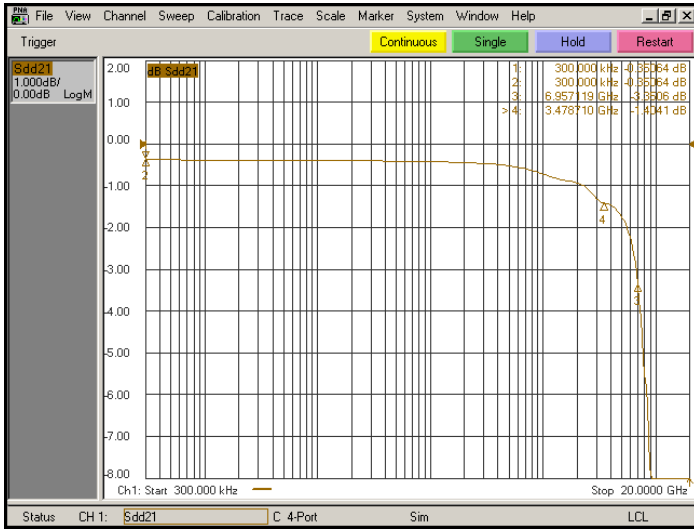
Differential Insertion Loss

Differential Return Loss

Differential Off Isolation

Differential Crosstalk

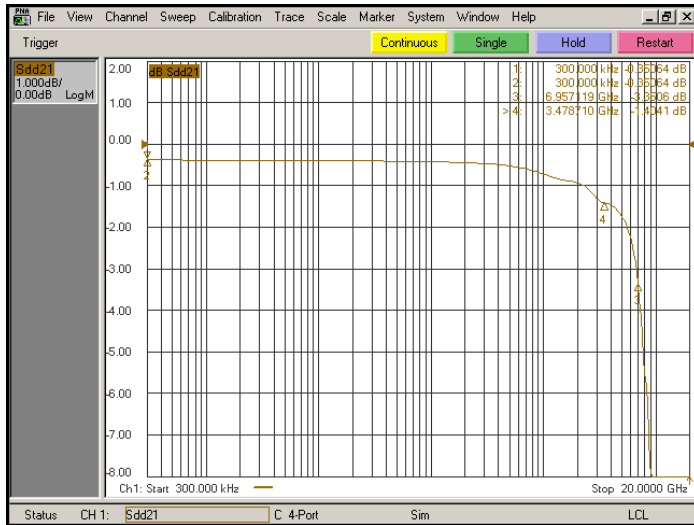www.diodes.com   02/17/17
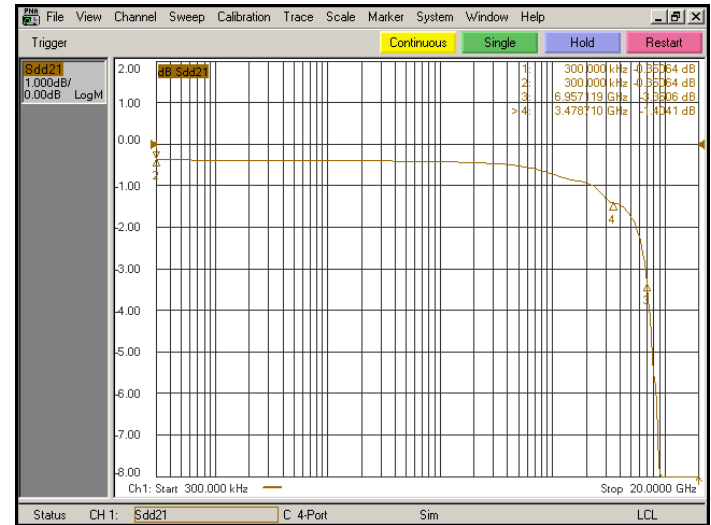
17-0033

5.0 Gbps RX signal eye without PI3PCIE3212
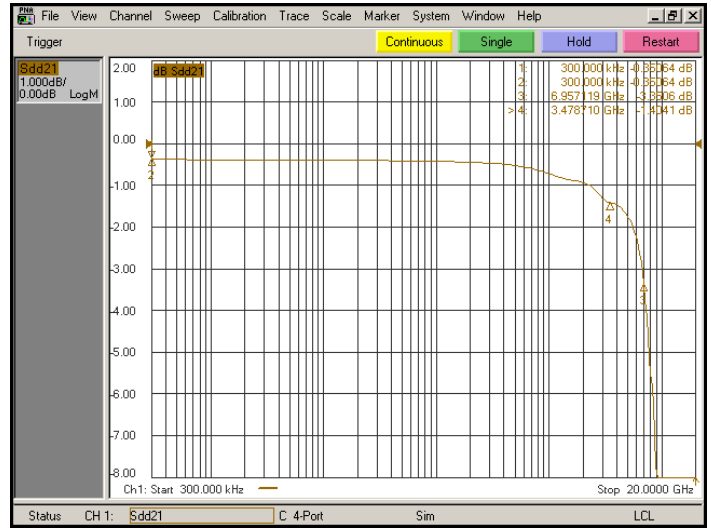
5.0 Gbps RX signal eye with PI3PCIE3212

8.0 Gbps RX signal eye without PI3PCIE3212

8.0 Gbps RX signal eye with PI3PCIE3212

www.diodes.com   02/17/17

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## Test Circuit for Electrical Characteristics[1-5]
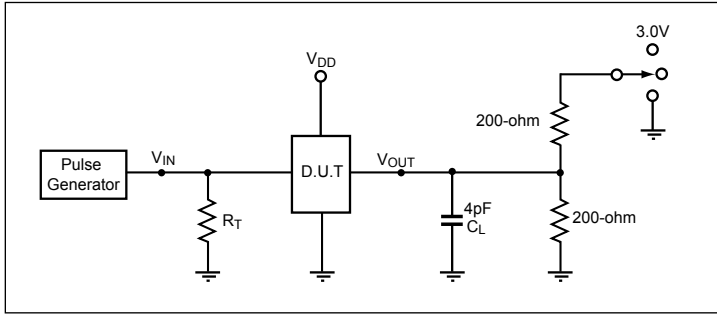
Notes:
1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. Output 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
   output 2 is for an 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 ≤ MHz, Z_O = 50Ω, t_R ≤ 2.5ns, t_F ≤ 2.5ns.
5. The outputs are measured one at a time with one transition per measurement.
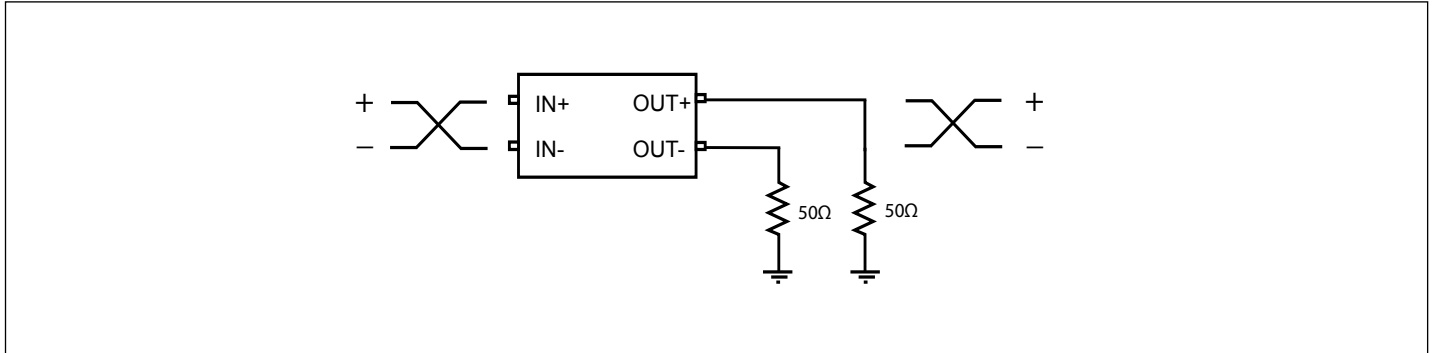
Switch Positions

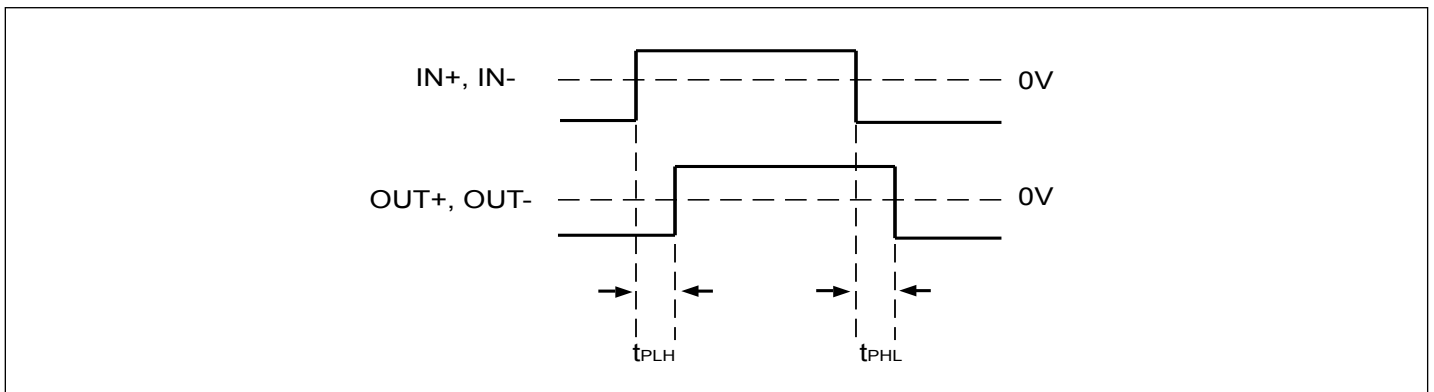| Test	Switch
t_{PLZ}, t_{PZL}	3.0V
t_{PHZ}, t_{PZH}	GND

Switching Waveforms
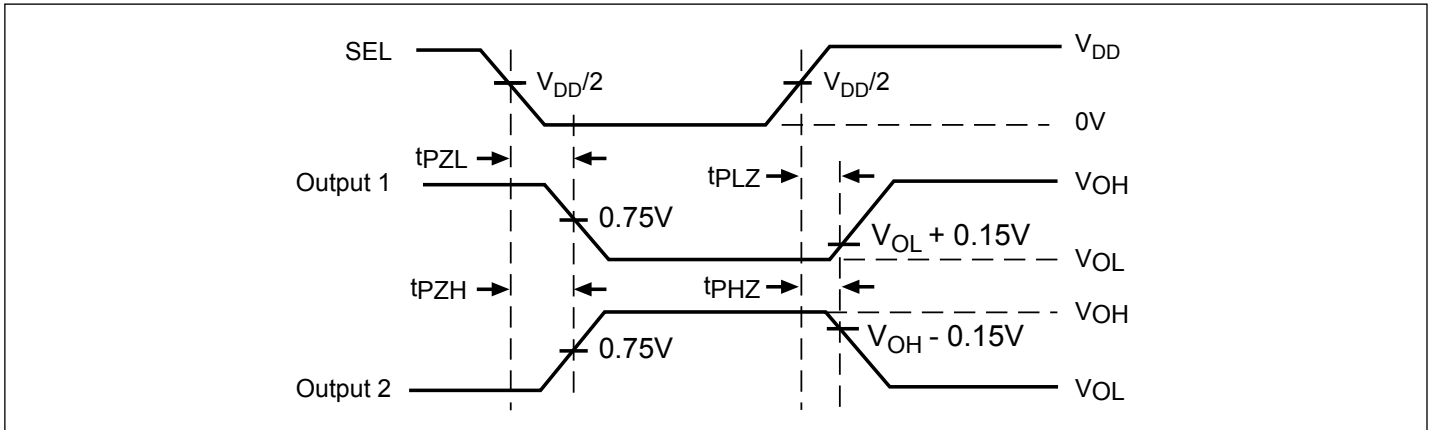
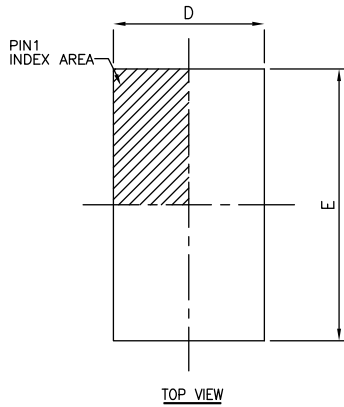**Voltage Waveforms Enable and Disable Times**
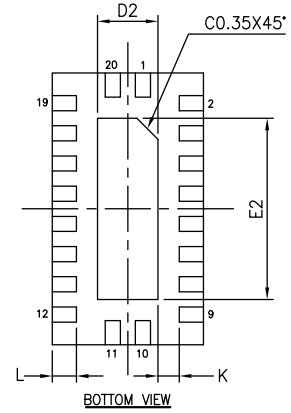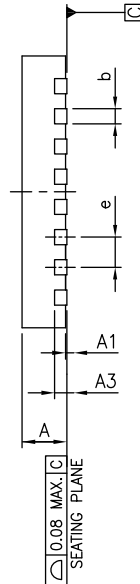
Test Circuit for Propagation Delay

Differential Input/Output Signal Waveform
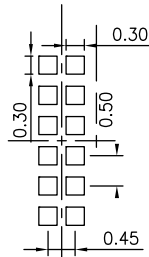
Packaging Mechanical: 20-Contact TQFN (ZB)

SYMBOLS	MIN.	NOM.	MAX.
A	--	--	1.00
A1	0.00	0.02	0.05
A3	0.20 REF.		
b	0.18	0.25	0.30
D	2.40	2.50	2.60
E	4.40	4.50	4.60
e	0.50 BSC		
L	0.30	0.40	0.50
K	0.20	—	—
D2	0.90	1.00	1.10
E2	2.90	3.00	3.10

RECOMMENDED STENCIL DESIGN for EPAD
(0.125mm THICK STENCIL)

RECOMMENDED LAND PATTERN

PERICOM®
Enabling Serial Connectivity

DATE: 10/20/14

DESCRIPTION: 20-Contact, Very Thin Quad Flat No-Lead (TQFN)

PACKAGE CODE: ZB (ZB20)

DOCUMENT CONTROL #: PD-2104   **REVISION: B**
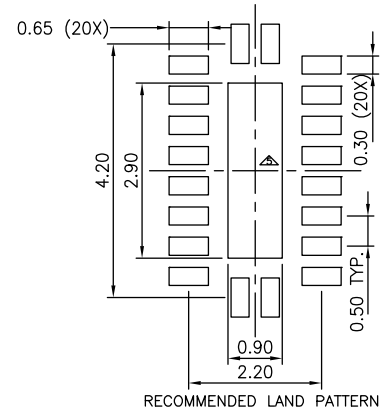
NOTE :
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED THERMAL PAD AS WELL AS THE TERMINALS.
3. REFER JEDEC MO-241
4. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.
5. THERMAL PAD SOLDERING AREA (MESH STENCIL DESIGN IS RECOMMENDED).

14-0265

Packaging Mechanical: 18-Contact XUA (X2QFN)

SYMBOLS	MIN.	NOM.	MAX.
A	0.30	0.35	0.40
A1	0.00	0.02	0.05
A3	0.127 REF.		
b	0.15	0.20	0.25
D	1.95	2.00	2.05
E	1.95	2.00	2.05
e	0.40 BSC		
L	0.15	0.25	0.35
D2	0.95	1.00	1.05
E2	0.95	1.00	1.05

NOTE :
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. REFER JEDEC MO-288
3. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.
   MESH STENCIL DESIGN IS RECOMMENDED.

PERICOM Enabling Serial Connectivity

DATE: 03/31/14

DESCRIPTION: 18-Pin, X2QFN 2X2mm

PACKAGE CODE: XUA (XUA18)

DOCUMENT CONTROL #: PD-2184   REVISION: --

14-0039

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 Type
PI3PCIE3212ZBEX	ZB	20-contact, Very Thin Quad Flat No-Lead (TQFN), Tape & Reel
PI3PCIE3212XUAEX	XUA	18-Pin, 2x2mm (X2QFN), Tape & Reel

Notes:

• Thermal characteristics can be found on the company web site at www.diodes.com/design/support/packaging/

• E = Pb-free and Green

• Adding an X suffix = Tape/Reel

17-0033

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