

**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
- Bidirectional 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.
- 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):
  - – 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, bidirectional-channel multiplexer/demultiplexer switch. This product is ideal for PCI Express® 3.0 signal switching at 8.0Gbps due to its low bit-to-bit skew, high channel-to-channel noise isolation, and bandwidth.

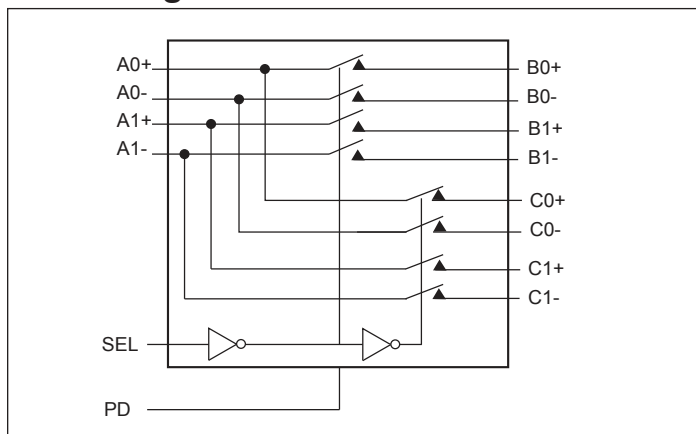
**Applications**

The PI3PCIE3212 switches a PCI Express 3.0 lane output between two PCI Express lane inputs. Applications include NBs, PCs, servers, and other embedded devices. The PI3PCIE3212 can route PCI Express 3.0, DP1.2, USB3.0, SAS2.0, SATA3.0, XAUI, RXAUI signals with low signal attenuation.

**Truth Table**

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

**Block Diagram**

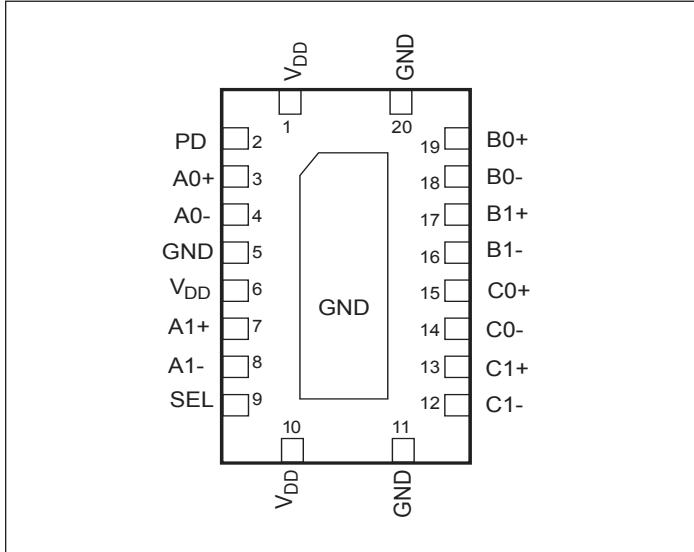


**Notes:**

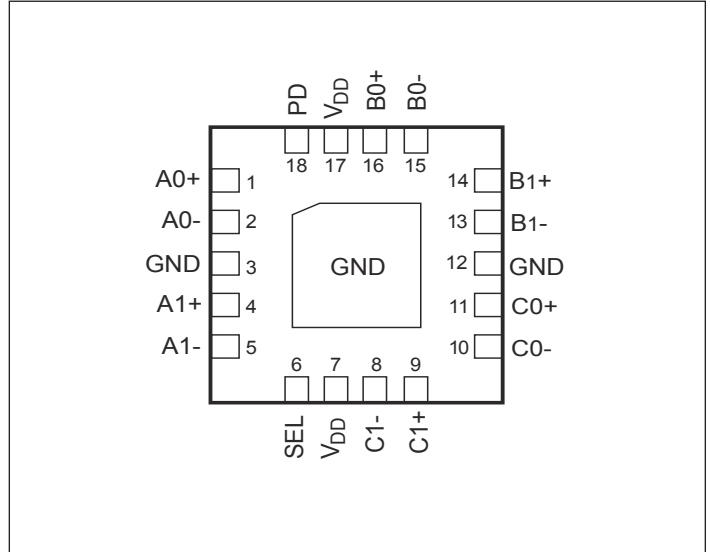
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, “Green” and Lead-free.
3. Halogen- and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

### 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	1	A0+	I/O	Signal I/O, Channel 0, Port A
4	2	A0-		
7	4	A1+	I/O	Signal I/O, Channel 1, Port A
8	5	A1-		
19	16	B0+	I/O	Signal I/O, Channel 0, Port B
18	15	B0-		
17	14	B1+	I/O	Signal I/O, Channel 1, Port B
16	13	B1-		
15	11	C0+	I/O	Signal I/O, Channel 0, Port C
14	10	C0-		
13	9	C1+	I/O	Signal I/O, Channel 1, Port C
12	8	C1-		
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 <sub>DD</sub>	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
ESD (HBM) .....	2kV

### 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 <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> 3.3V supply	SEL = OV or V <sub>DD</sub>		0.2	1	mA
I <sub>DD_PD</sub>	Power down current	PD = 1		20	40	μA
V <sub>I/O-DIF</sub>	Differential Voltage (differential pins)				1.6	V <sub>ppd</sub>
V <sub>I/O-CM</sub>	Common Mode Voltage (differential pins)		0		0.8	v
T <sub>A</sub>	Operating temperature range		-40		85	°C

## DC Electrical Characteristics for Switching over Operating Range

Parameters	Description	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(1)</sup>	Max.	Units
V <sub>IH</sub> - SEL, PD	Input HIGH Voltage, SEL, PD Input		2		3.6	V
V <sub>IL</sub> - SEL, PD	Input LOW Voltage, SEL, PD Input		0		0.8	
V <sub>IK</sub>	Clamp Diode Voltage	V <sub>DD</sub> = Max., I <sub>IN</sub> = -18mA		-0.7	-1.2	
I <sub>IH</sub>	Input HIGH Current, SEL, PD	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>DD</sub>			±5	μA
I <sub>IL</sub>	Input LOW Current, SEL, PD	V <sub>DD</sub> = Max., V <sub>IN</sub> = 0V			±5	
I <sub>IH</sub>	Input HIGH Current, A <sub>X</sub> , B <sub>X</sub> , C <sub>X</sub>	V <sub>DD</sub> = Max., V <sub>IN</sub> = 1.5V	-10		+10	μA
I <sub>IL</sub>	Input LOW Current, A <sub>X</sub> , B <sub>X</sub> , C <sub>X</sub>	V <sub>DD</sub> = Max., V <sub>IN</sub> = 0V	-10		+10	
I <sub>IOZH</sub>	HighZ HIGH Current, B <sub>X</sub> , C <sub>X</sub>	V <sub>DD</sub> = Max., V <sub>IN</sub> = 1.5V	-10		+10	μA
I <sub>IOZL</sub>	HighZ LOW Current, B <sub>X</sub> , C <sub>X</sub>	V <sub>DD</sub> = Max., V <sub>IN</sub> = 0V	-10		+10	μA

### Note:

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

### Switching Characteristics

Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
tPZH, tPZL	Line Enable Time - SEL to A <sub>N</sub> , B <sub>N</sub> , C <sub>N</sub>			25	30	ns
tPHZ, tPLZ	Line Disable Time - SEL to A <sub>N</sub> , B <sub>N</sub> , C <sub>N</sub>			5	25	
tPLH	Propagation Delay, LOW to HIGH		17		36	ps
tPLL	Propagation Delay, HIGH to LOW		21		39	ps
t <sub>b-b</sub>	Bit-to-bit skew within the same differential pair			5	10	ps
t <sub>ch-ch</sub>	Channel-to-channel skew				20	ps

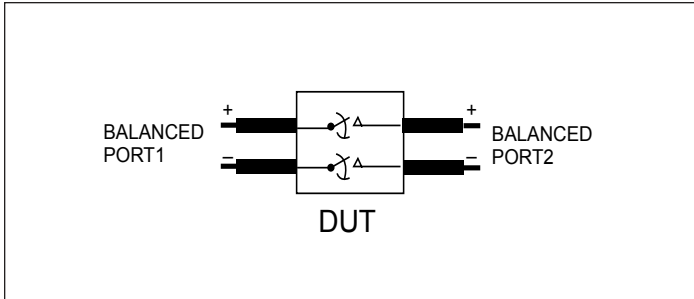
### Dynamic Electrical Characteristics

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

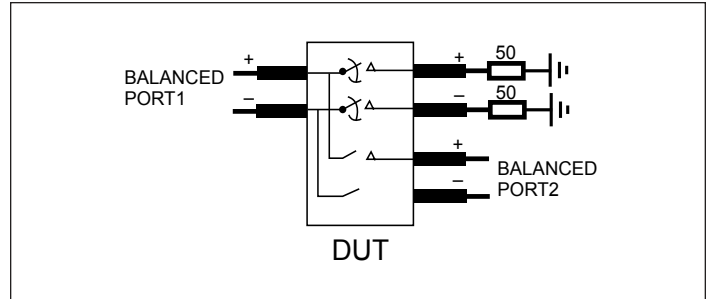
#### Notes:

- Guaranteed by design. Typical values are at V<sub>DD</sub> = 3.3V, T<sub>A</sub> = 25°C ambient and maximum loading.
- 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.
- Measurement done with fixture deembedding.

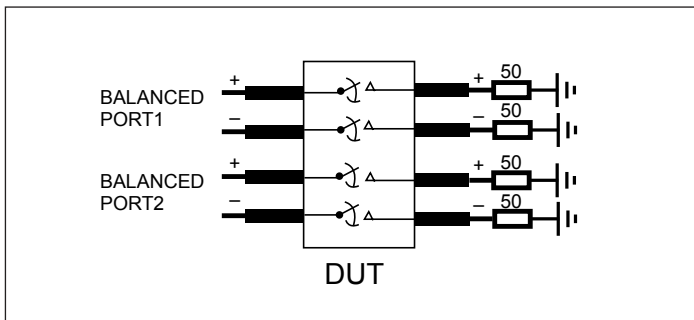
**PI3PCIE3212**



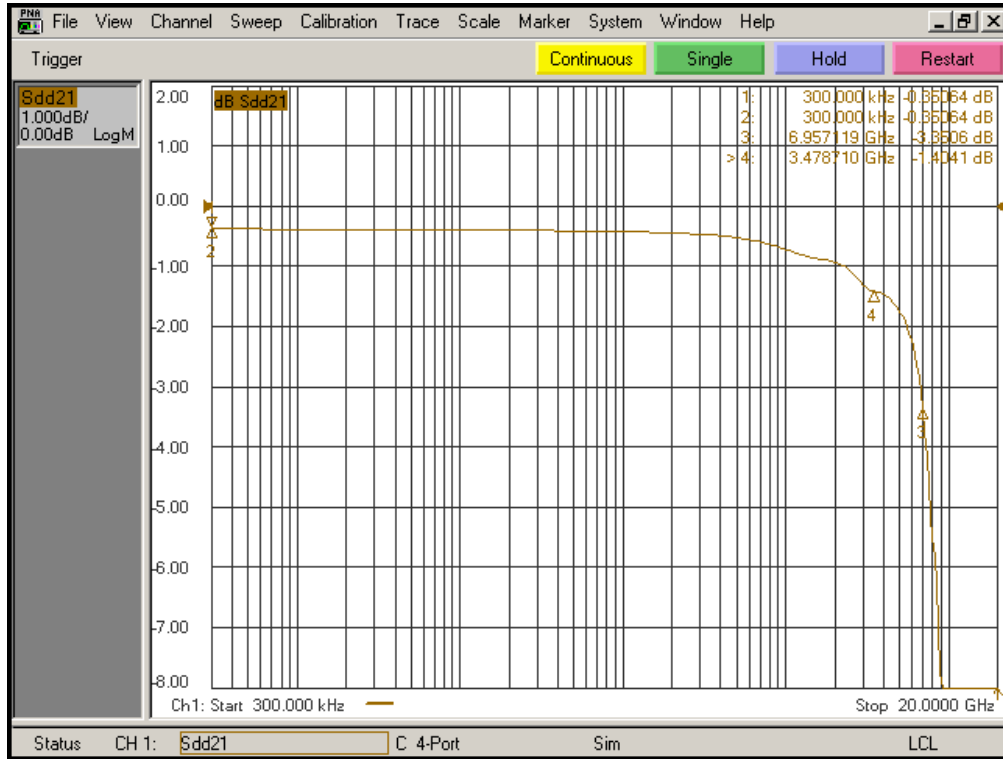
**Diff. Insertion Loss and Return Test Circuit**



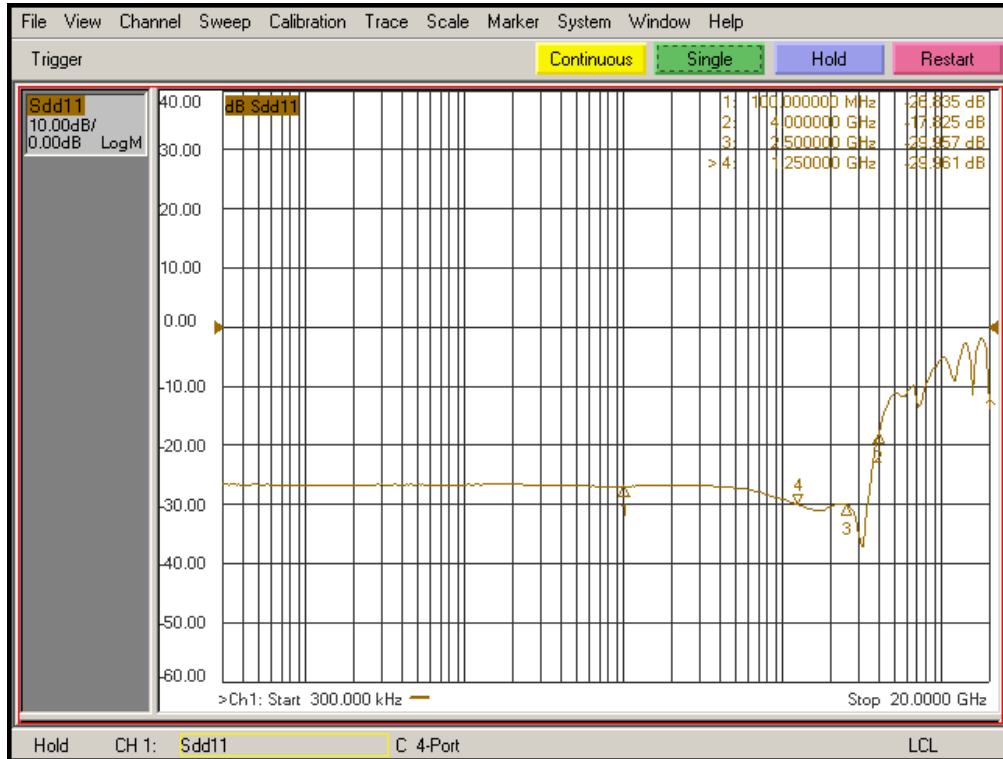
**Diff. Off Isolation Test Circuit**



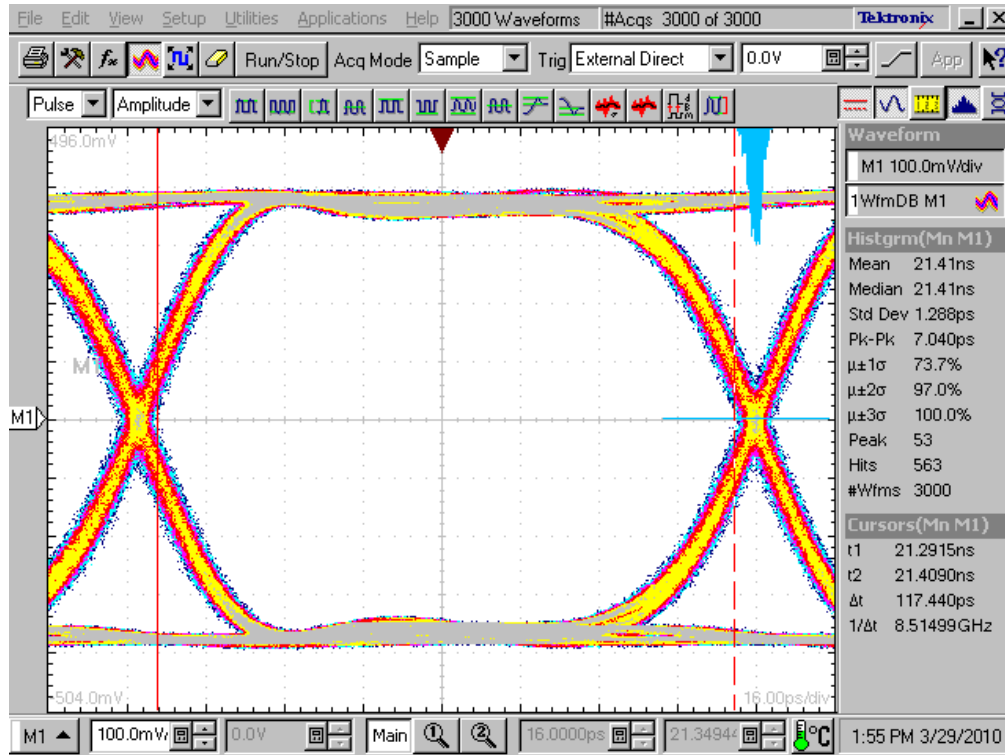
**Diff. Near End Xtalk Test Circuit**



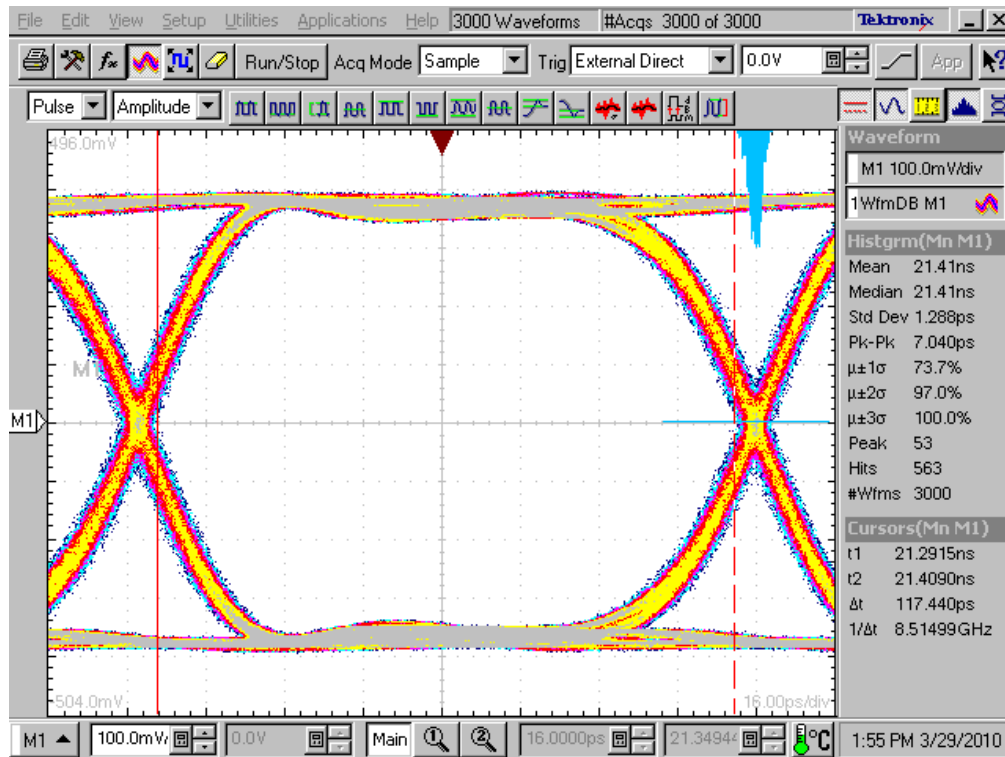
**Differential Insertion Loss**



**Differential Return Loss**

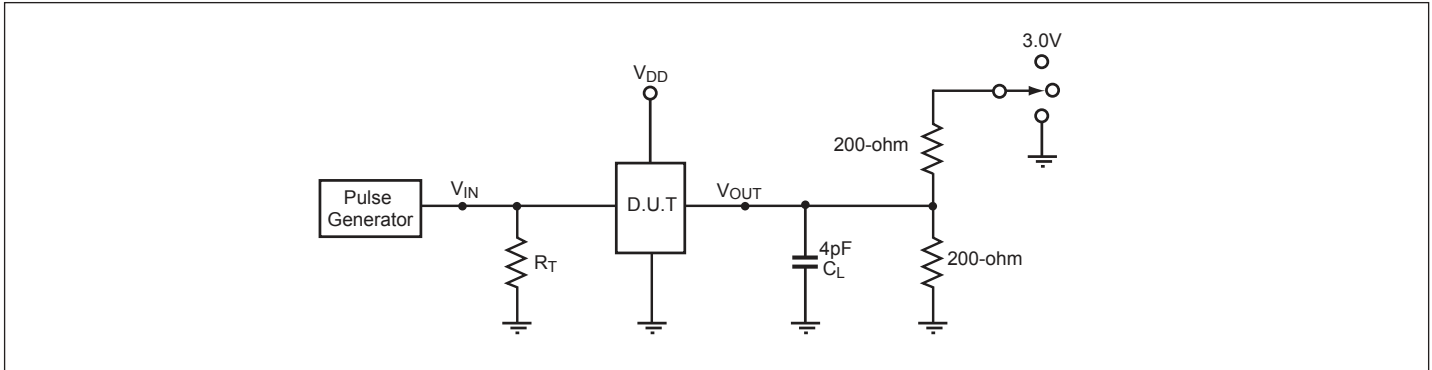


**Differential Off Isolation**



**Differential Crosstalk**

**Test Circuit for Electrical Characteristics<sup>(1-5)</sup>**



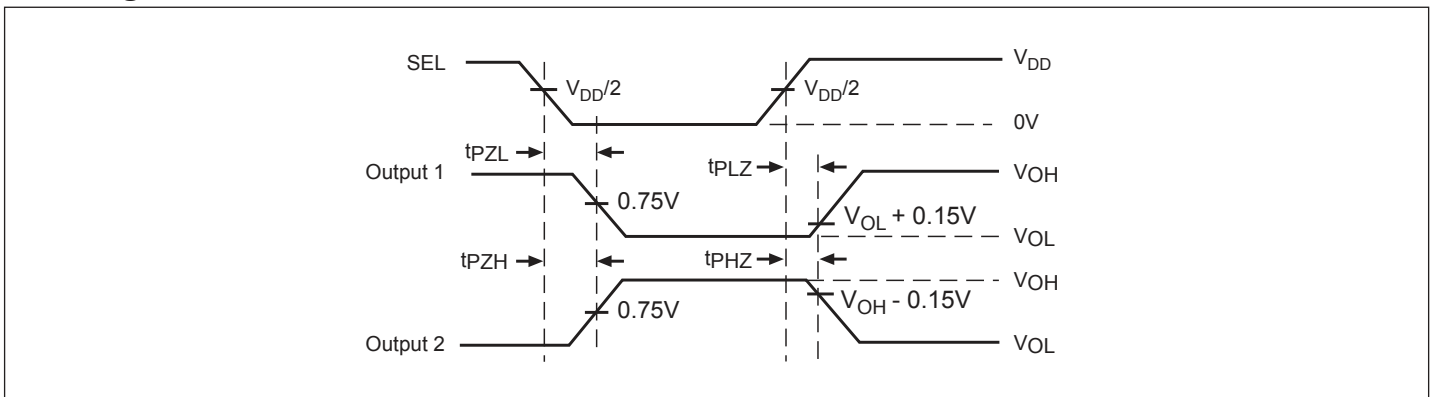
**Notes:**

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

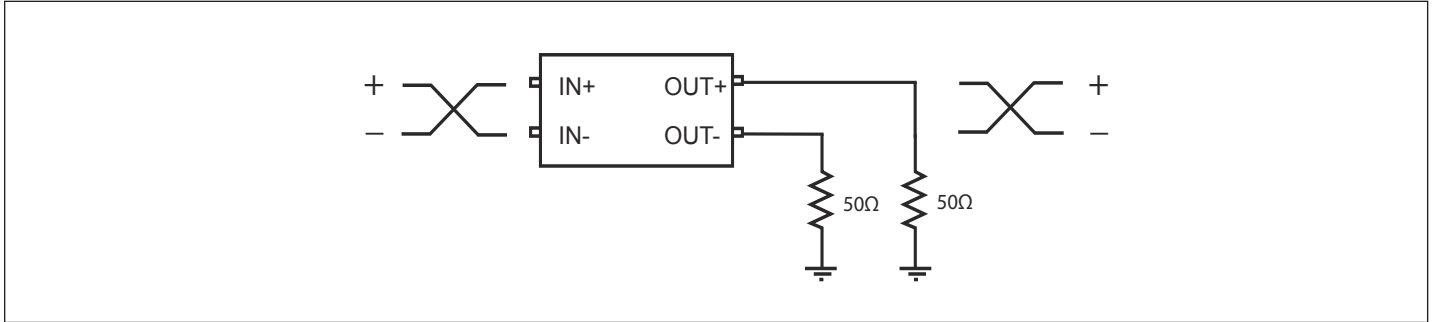
**Switching Waveforms**



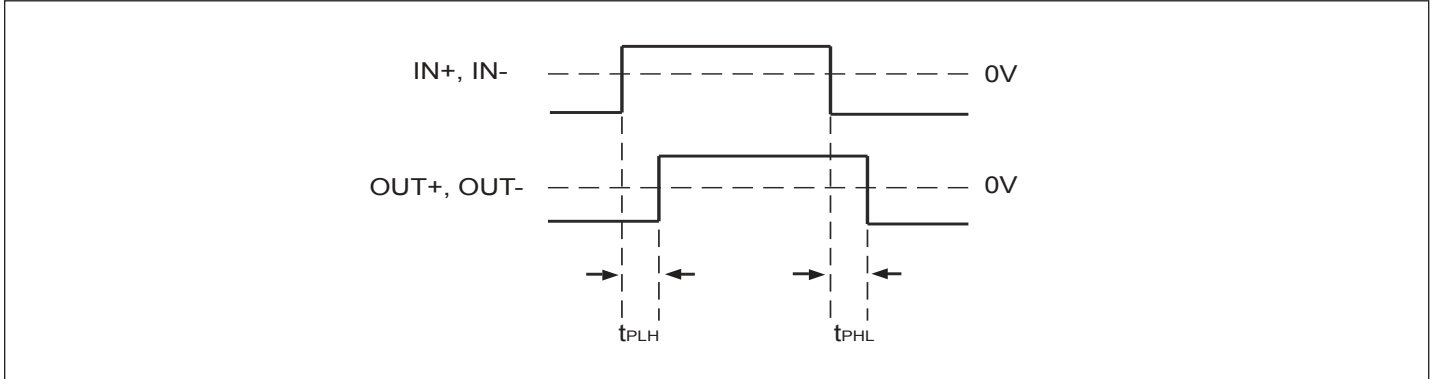
**Voltage Waveforms Enable and Disable Times**



**Test Circuit for Propagation Delay**

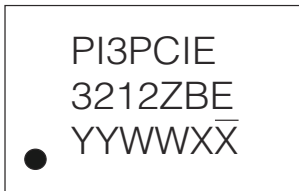


**Differential Input/Output Signal Waveform**



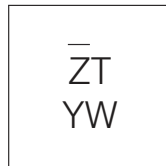
**Part Marking**

ZB Package



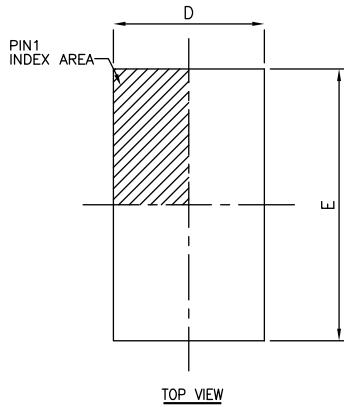
YY: Year  
WW: Workweek  
1st X: Assembly Code  
2nd X: Fab Code

XUA Package

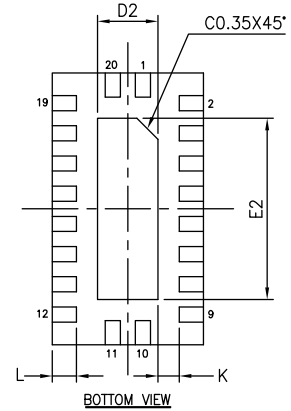
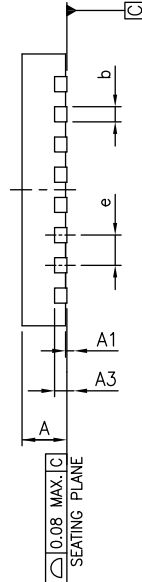


ZT: PI3PCIE3212  
Y: Year  
W: Workweek

**Packaging Mechanical: 20-TQFN (ZB)**

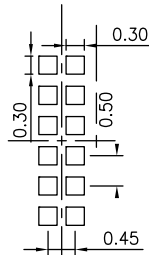


TOP VIEW

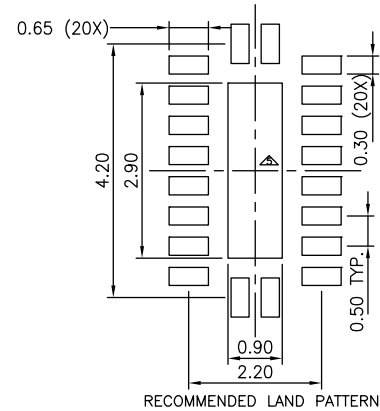


BOTTOM VIEW

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

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



DATE: 10/20/14

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

PACKAGE CODE: ZB (ZB20)

DOCUMENT CONTROL #: PD-2104

REVISION: B

**Packaging Mechanical: 18-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)
PI3PCIE3212XUAEX	XUA	18-Pin, 2x2mm (X2QFN)

**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.
4. E = Pb-free and Green
5. X suffix = Tape/Reel

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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.

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