A product Line of
Diodes Incorporated

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
- 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 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.

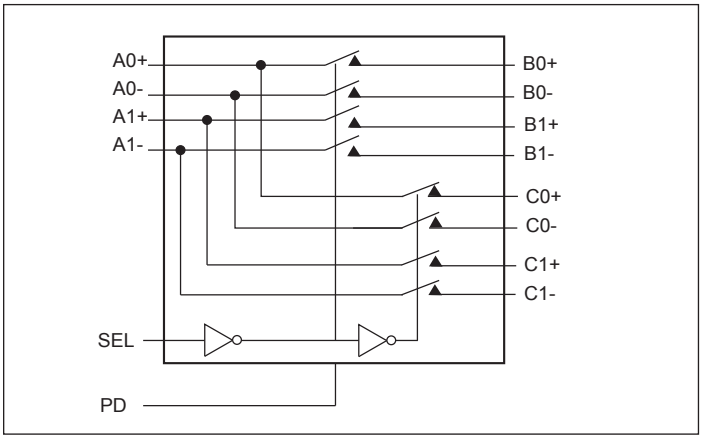
Applications

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

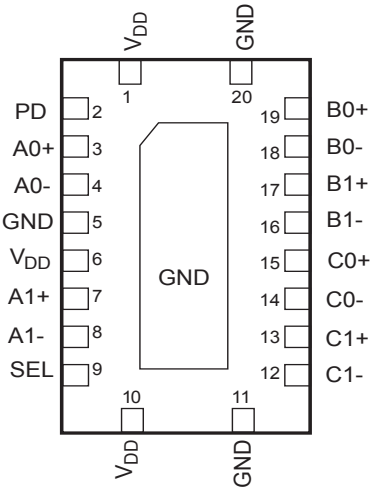
Block Diagram



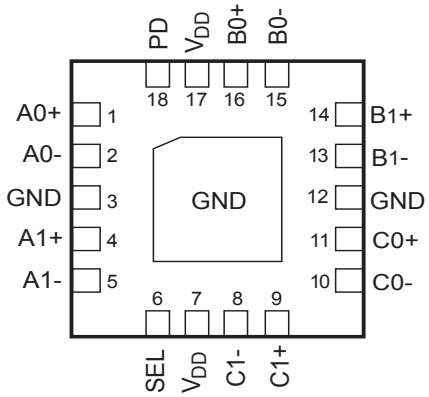
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- 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 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
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_{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}
$V_{I/O-CM}$	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_{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

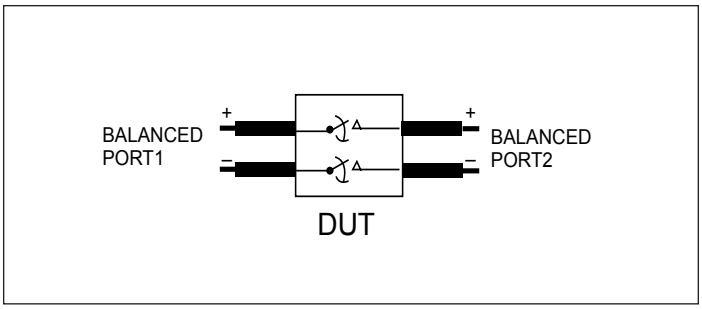
Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
t_{PZH}, t_{PZL}	Line Enable Time - SEL to A_N, B_N, C_N			25	30	ns
t_{PHZ}, t_{PLZ}	Line Disable Time - SEL to A_N, B_N, C_N			5	25	
t_{PLH}	Propagation Delay, LOW to HIGH		17		36	ps
t_{PHL}	Propagation Delay, HIGH to LOW		21		39	ps
t_{b-b}	Bit-to-bit skew within the same differential pair			5	10	ps
t_{ch-ch}	Channel-to-channel skew				20	ps

Dynamic Electrical Characteristics

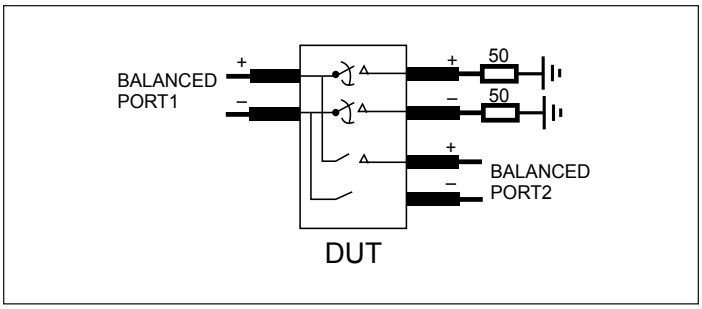
Parameter	Description	Test Conditions	Min.	Typ.[1]	Max.	Units
$DDIL^{(2,3)}$	Differential Insertion Loss (V_{IN} = -10dBm, DC = 0V)	f = 100MHz f = 100MHz-1.25GHz f = 1.25GHz-2.5GHz f = 2.5GHz-4GHz f = 5GHz		-0.4 -0.6 -1.0 -1.7 -2.1		dB
$DDIL_{OFF}^{(2,3)}$	Differential Off Isolation	f = 100MHz f = 100MHz-1.25GHz f = 1.25GHz-2.5GHz f = 2.5GHz-4GHz		-59 -37 -27 -21		dB
$DDRL^{(2)}$	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
$DDNEXT^{(2,3)}$	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:

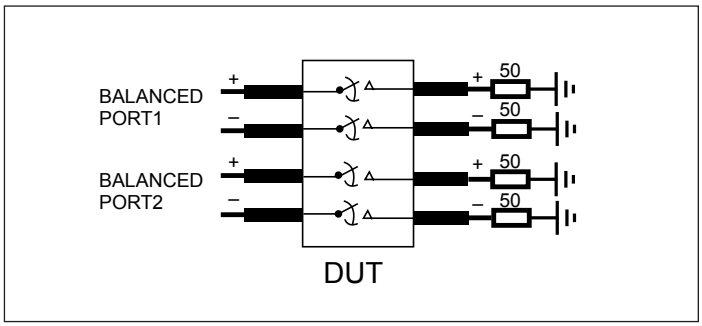
1. Guaranteed by design. Typical values are at V_{DD} = 3.3V , T_A = 25°C ambient and maximum loading.
2. S parameters are measured with our evaluation board made with Rogers (R04350) material. Trace width is 30 mil, length 540 mil, trace impedance is 50 Ohm (+/5%) and total insertion loss of the trace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



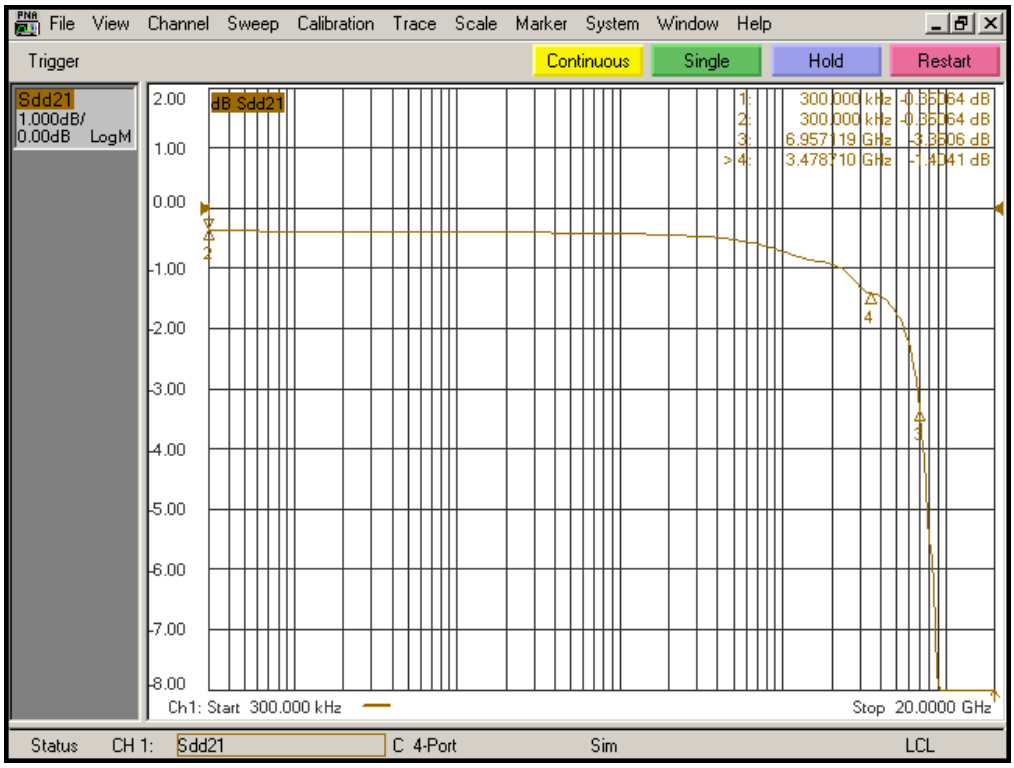
Diff. Insertion Loss and Return Test Circuit



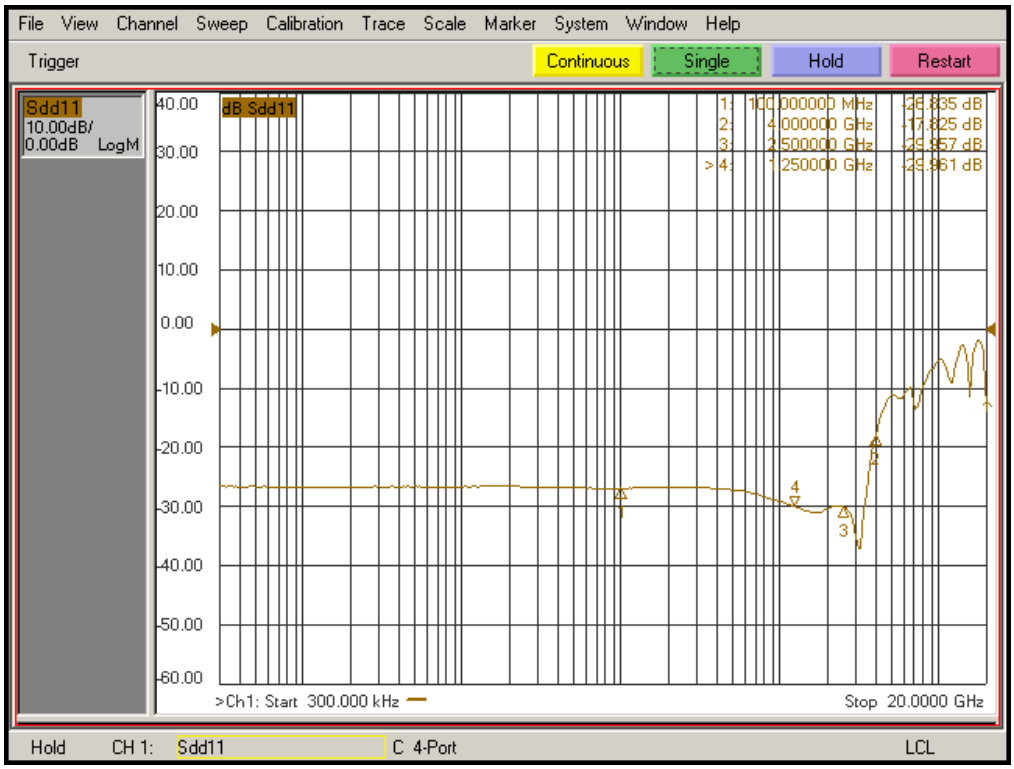
Diff. Off Isolation Test Circuit



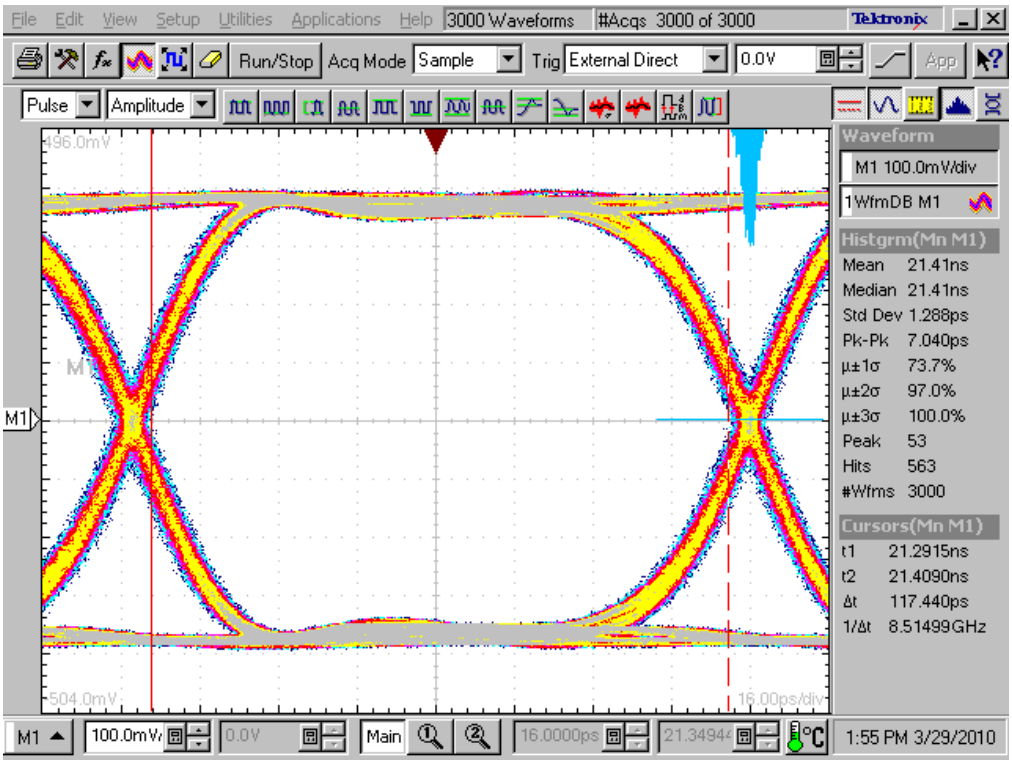
Diff. Near End Xtalk Test Circuit



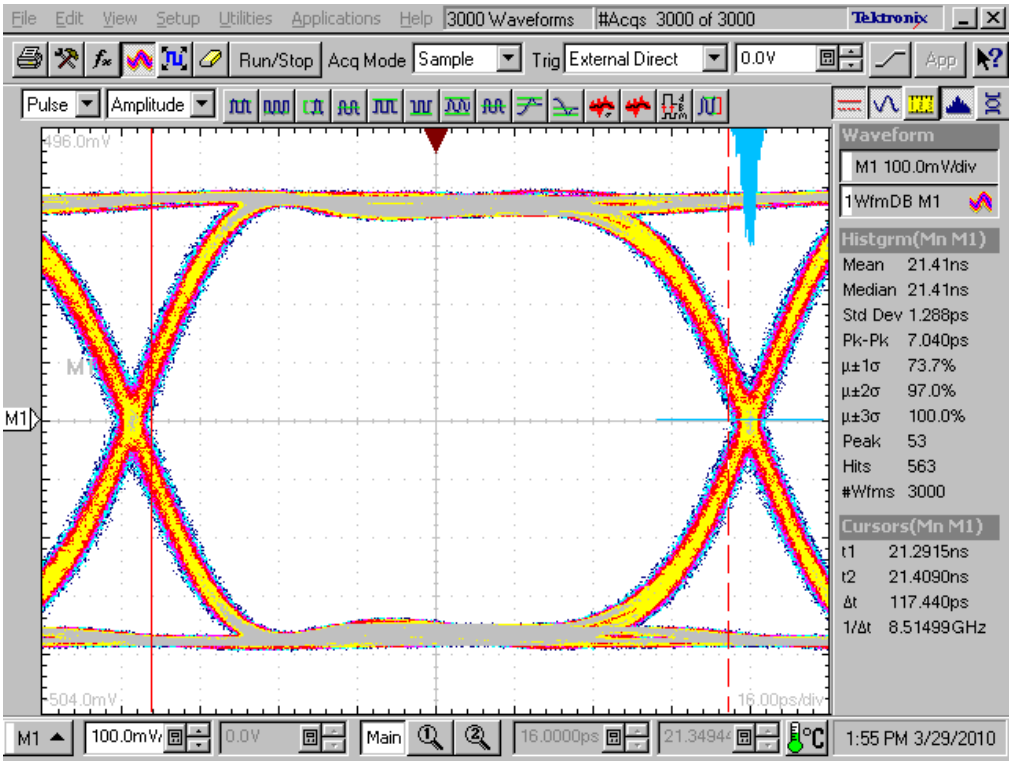
Differential Insertion Loss



Differential Return Loss

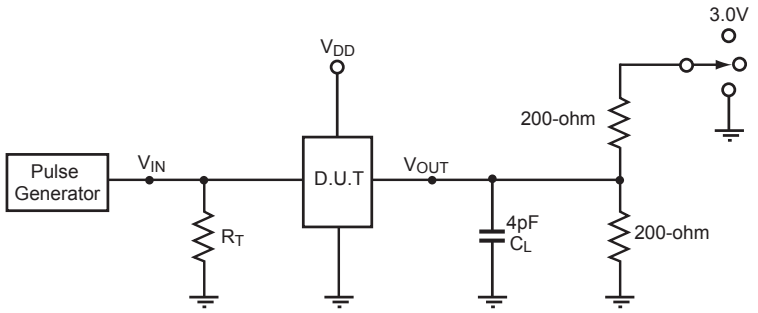


Differential Off Isolation



Differential Crosstalk

Test Circuit for Electrical Characteristics(1-5)



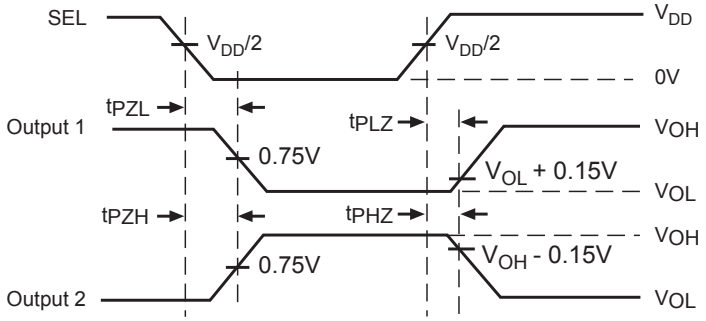
Notes:

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, $Z_O = 50\Omega$, $t_R \leq 2.5$ns, $t_F \leq 2.5$ns.
5. The outputs are measured one at a time with one transition per measurement.

Switch Positions

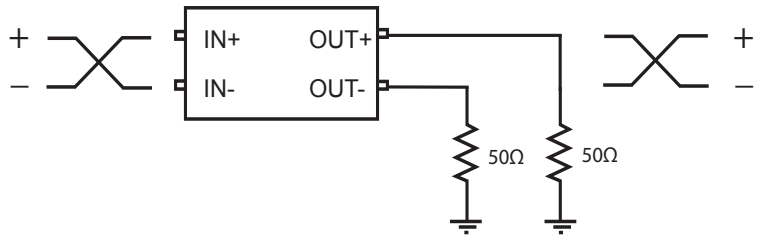
Test	Switch
t_{PLZ}, t_{PZL}	3.0V
t_{PHZ}, t_{PZH}	GND

Switching Waveforms

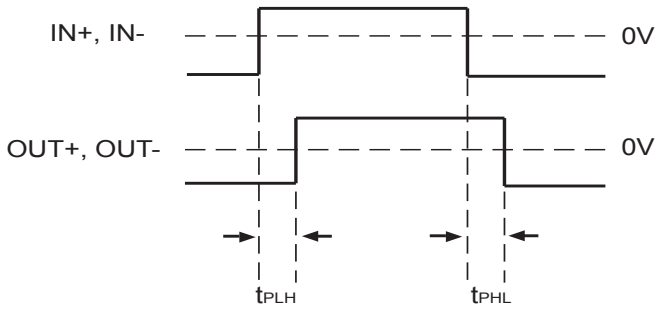


Voltage Waveforms Enable and Disable Times

Test Circuit for Propagation Delay



Differential Input/Output Signal Waveform



Part Marking

ZB Package

PI3PCIE
3212ZBE
YYWWXX

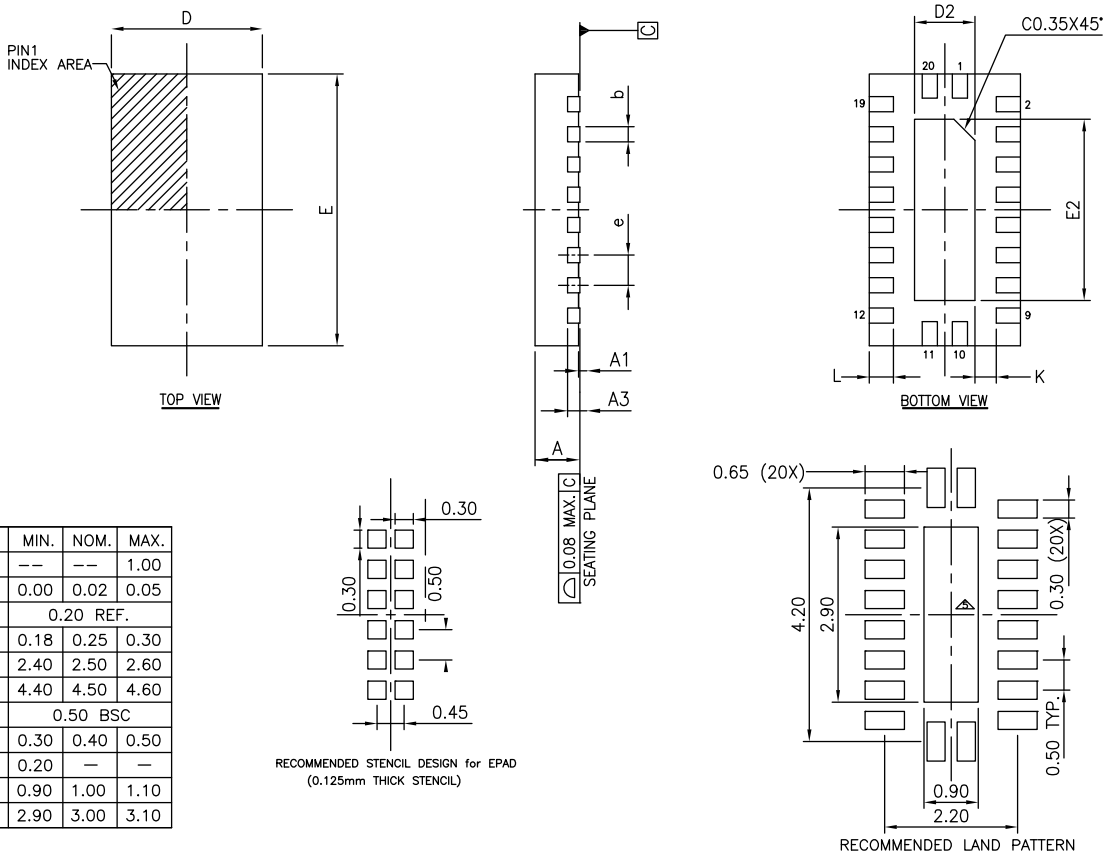
YY: Year
WW: Workweek
1st X: Assembly Code
2nd X: Fab Code

XUA Package

ZT
YW

ZT: PI3PCIE3212
Y: Year
W: Workweek

Packaging Mechanical: 20-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

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).

PERICOM Enabling Serial Connectivity

DATE: 10/20/14

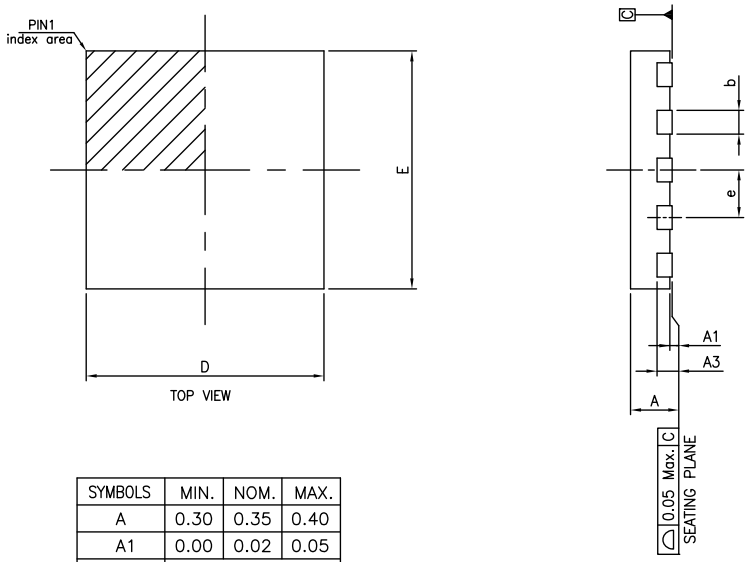
DESCRIPTION: 20-Contact, Very Thin Quad Flat No-Lead (TQFN)

PACKAGE CODE: ZB (ZB20)

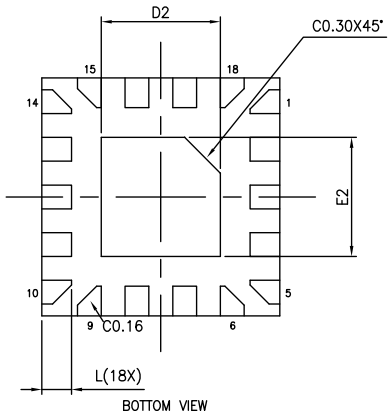
DOCUMENT CONTROL #: PD-2104 REVISION: B

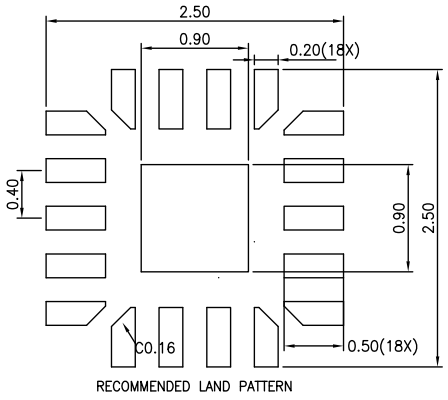
14-0265

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:

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

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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.

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