A product Line of
Diodes Incorporated

PI3DBS12212A

3.3V, 1-12Gbps 1-Lane 2:1 Mux/De-Mux Switch

Features

- 2 Differential Channel, 2:1 Mux/DeMux
- Up to 12 Gbps for applications including USB3.0, USB3.1, 10GE, Thunderbolt, MIPI D-PHY v1.2, PCIE v3.0, SAS3.0 and SATA3.0
- Bi-directional operation
- 3dB bandwith: 10.6GHz
- Low Bit-to-Bit Skew, 1ps typ
- Low channel-to-channel skew, 7ps typ
- Low insertion loss: -1.5dB@5 GHz, -1.7dB@6 GHz
- Return loss: -19.6dB@5 GHz, -17.2dB@6 GHz
- Low Crosstalk: -30.5dB@6 GHz
- Low Off Isolation: -17.1dB@6 GHz
- Low power consumption - 200µA typ
- Supply Voltage 3.3V
- Industrial Temperature Range: -40°C to 85°C
- ESD – 2KV Human Body Model (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 or your local Diodes representative.
  https://www.diodes.com/quality/product-definitions/
- Packaging (Pb-free & Green):
  - 20-contact, TQFN(ZB20), 2.5x4.5mm
  - 18 contact, X2QFN (XUA18), 2x2mm

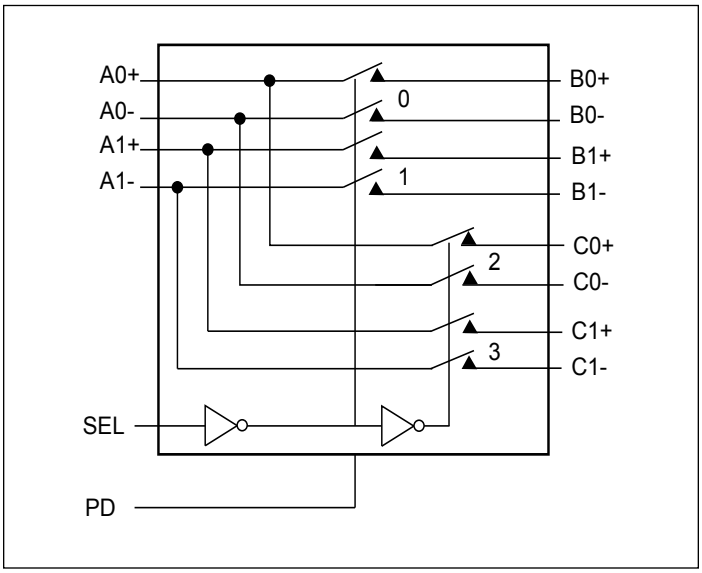
Description

The PI3DBS12212A is an 4 to 2 differential channel multiplexer/demultiplexer switch. This solution can switch multiple signal types up to data rate of 12Gbps. Using a unique design technique, Diodes has been able to minimize the impedance of the switch such that the attenuation observed through the switch is minimal. The unique design technique also offers a layout targeted for USB3.0, USB3.1, 10GE, Thunderbolt, MIPI D-PHY v1.2, PCIE v3.0, SAS3.0 and SATA3.0 signals, which minimizes the channel to channel skew as well as channel to channel crosstalk as required by high speed signals.

Application

Routing high speed differential signals such as USB3.0, USB3.1, 10GE, Thunderbolt, MIPI D-PHY v1.2, PCIE v3.0, SAS3.0 and SATA3.0.

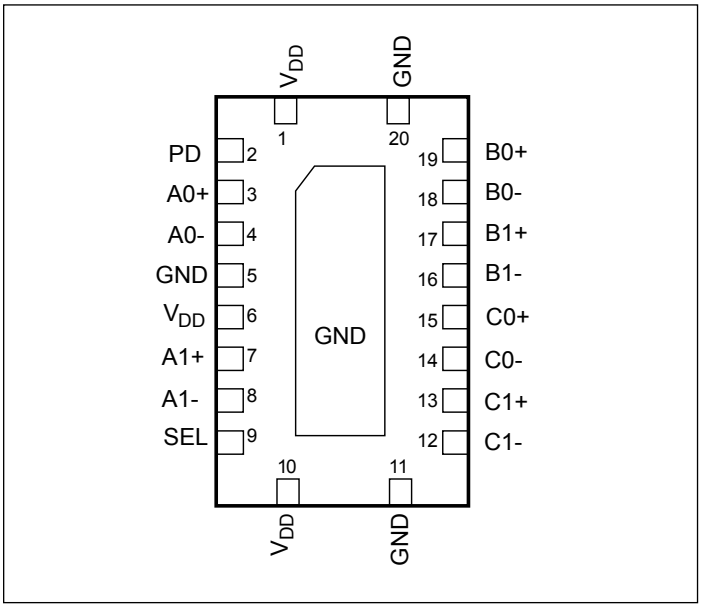
Block Diagram



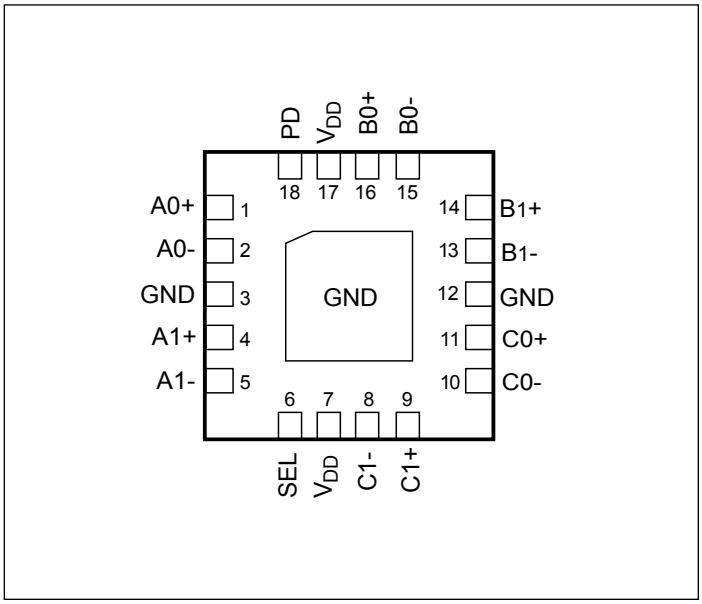
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen-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

20-contact TQFN



18-contact X2QFN



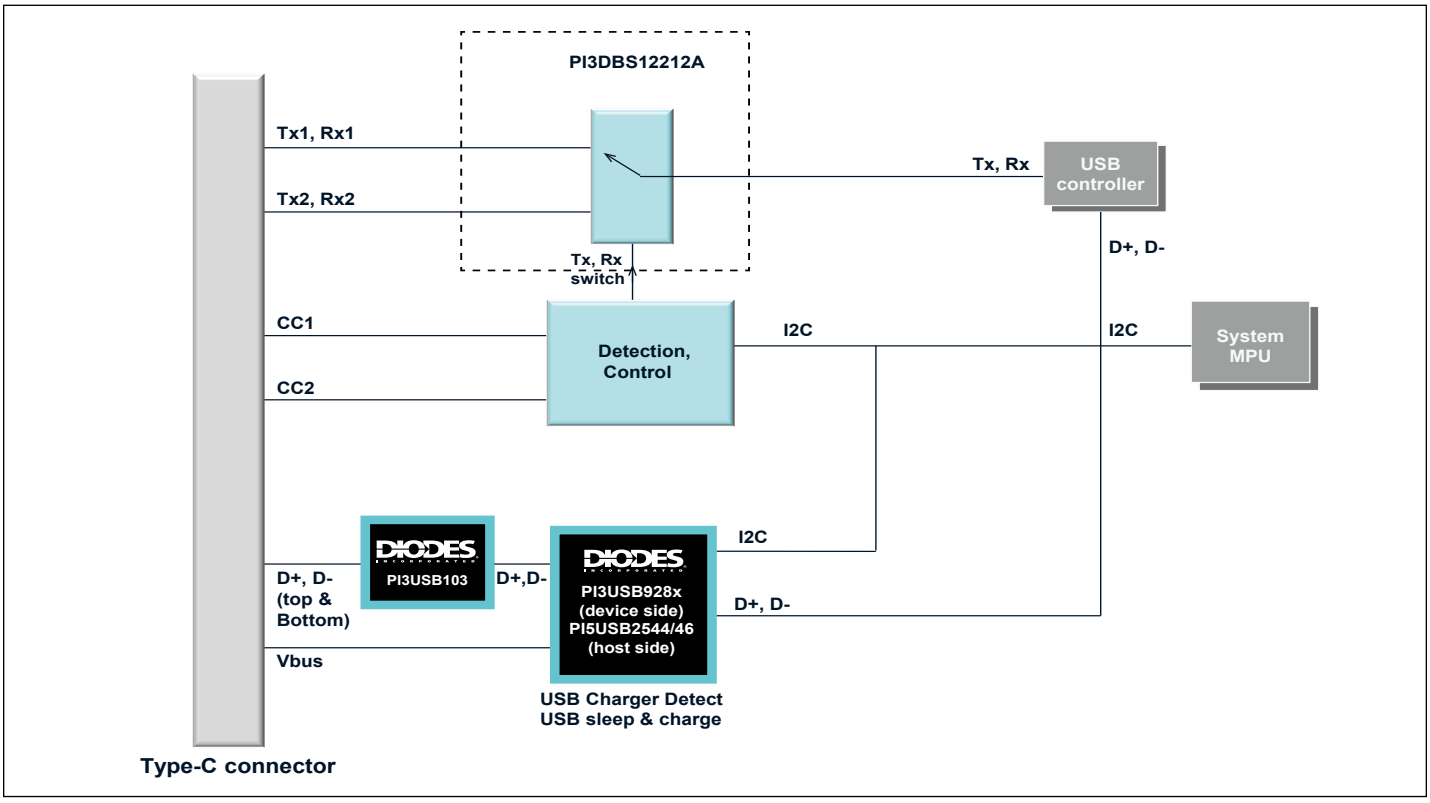
Pin Description

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

Truth Table

Function	SEL	PD
A_N to B_N	L	L
A_N to C_N	H	L
All Switches Hi-z	x	H

PI3DBS12212A Application in Type-C USB3.1 Switching



Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

Storage Temperature .....–65°C to +150°C
Junction Temperature..... 125°C
Supply Voltage to Ground Potential .....–0.5V to +3.7V
Channel DC Input Voltage .....–0.5V to 1.5V
DC Output Current 120mA
Power Dissipation 0.5W
Control Logic DC Input Voltage .....–0.5V to 3.7V
ESD.....2KV HBM

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		2.85	3.3	3.6	V
I_{DD}	Current consumption in normal operation	SEL = GND or V_{DD}, PD = Low		0.2	1	mA
I_{DDQ}	Current consumption when all switches are disabled	V_{DD} = 3.3V, PD = High		6		nA
P_{DD}	Total Power from V_{DD} 3.3V supply	Control pins = GND or V_{DD}		0.5		mW
P_{DDQ}	Power consumption when all switches are disabled	V_{DD} = 3.3V, PD = High		0.02		uW
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} - ctrl signal	Input HIGH voltage for SEL and PD	VDD=3.6V VDD=3.3V VDD=3.15V VDD=2.79V	2.0 1.85 1.7 1.7			V
V_{IL} - ctrl signal	Input LOW voltage for SEL and PD	VDD=3.3V			0.8	V
I_{DDQ}_ctrl	Quiescent IDD for SEL & PD	VDD=3.3V+/-10% Vsel/Vpd = VDD	**-5**		**5**	mA
		VDD=3.6V Vsel/Vpd >=2.0V			3.8	mA
		VDD=3.3V Vsel/Vpd >=1.85V			3.8	mA
		VDD=3.0V+/-7%(from 2.79V to 3.21V) Vsel/Vpd=1.8V+/-5%(from 1.7V to 1.9V)			3.8	mA
V_{IK}	Clamp Diode Voltage	V_{DD} = Max., I_{input} = –18mA		–0.7	–1.2	V

DC Electrical Characteristics for Switching over Operating Range Cont.

Parameters	Description	Test Conditions(1)	Min.	Typ.(1)	Max.	Units
I_{IH}	Input HIGH Current for SEL and PD	V_{DD} = Max., V_{input} = V_{DD}	-5		5	µA
I_{IL}	Input LOW Current for SEL and PD	V_{DD} = Max., V_{input} = 0V	-5		5	
I_{OZH}	HighZ HIGH Current, switch I/O pins	V_{DD} = 3.3V., V_{input} = 1.0V	–10		+10	µA
I_{OZL}	HighZ LOW Current, switch I/O pins	V_{DD} = Max., V_{input} = 0V	–10		+10	µA
V_p	Max voltage pass through tolerance analog switches (See Test Circuit)	V_{DD} = 3.3V, I_{PASS} = 10mA		1		V
V_{IN}	Analog Signal to input of switch			1.2	1.3	V

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

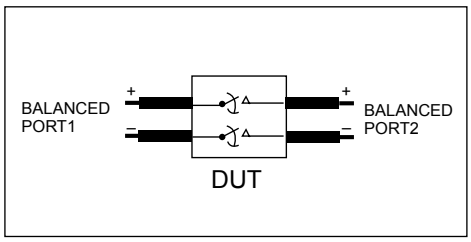
Dynamic Electrical Characteristics

Parameter	Description	Test Conditions	Min.	Typ.(1)	Max.	Units
DDIL	Insertion Loss	f=2.5GHz f=4.0GHz f=5.0GHz f=6GHz		-0.9 -1.3 -1.5 -1.7		dB
DDRL	Differential Return Loss	f= 2.5GHz f= 4.0GHz f= 5.0GHz f= 6.0GHz		-26.4 -22.4 -19.6 -17.2		dB
DDOI	Differential OFF Isolation	f= 2.5GHz f= 4.0GHz f= 5.0GHz f= 6.0GHz		-24.9 -18.9 -17.4 -17.1		dB
DDXT	Differential Crosstalk	f= 2.5GHz f= 4.0GHz f= 5.0GHz f= 6.0GHz		-33.3 -31.9 -31.1 -30.5		dB
BW	3dB Bandwidth			10.6		GHz

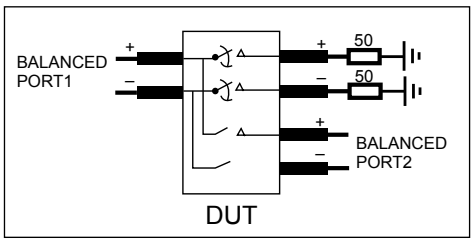
Notes:
1. Guaranteed by design. Typical values are at V_{DD} = 3.3V , T_A = 25°C ambient and maximum loading.

Switching Characteristics (V_{DD} = 3.0V to 3.6V)

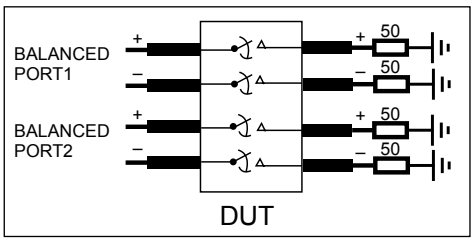
Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
tPZH, tPZL	Line Enable Time - SEL to AN, BN, CN			25	30	ns
tPHZ, tPLZ	Line Disable Time - SEL to AN, BN, CN			5	25	
t_{PLH}	Propagation Delay, LOW to HIGH		17		36	ps
t_{PHL}	Propagation Delay, HIGH to LOW		21		39	ps
tb-b	Bit-to-bit skew within the same differential pair			1	10	ps
tch-ch	Channel-to-channel skew				20	ps



Diff. Insertion Loss and Return Loss Test Circuit

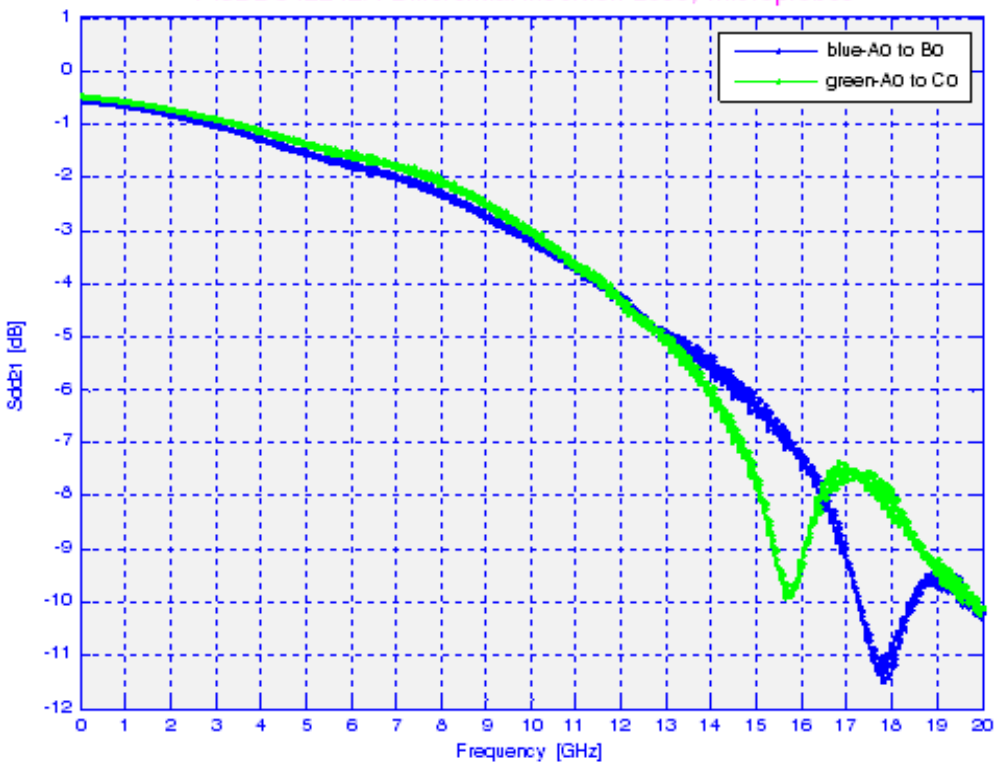


Diff. Off Isolation Test Circuit

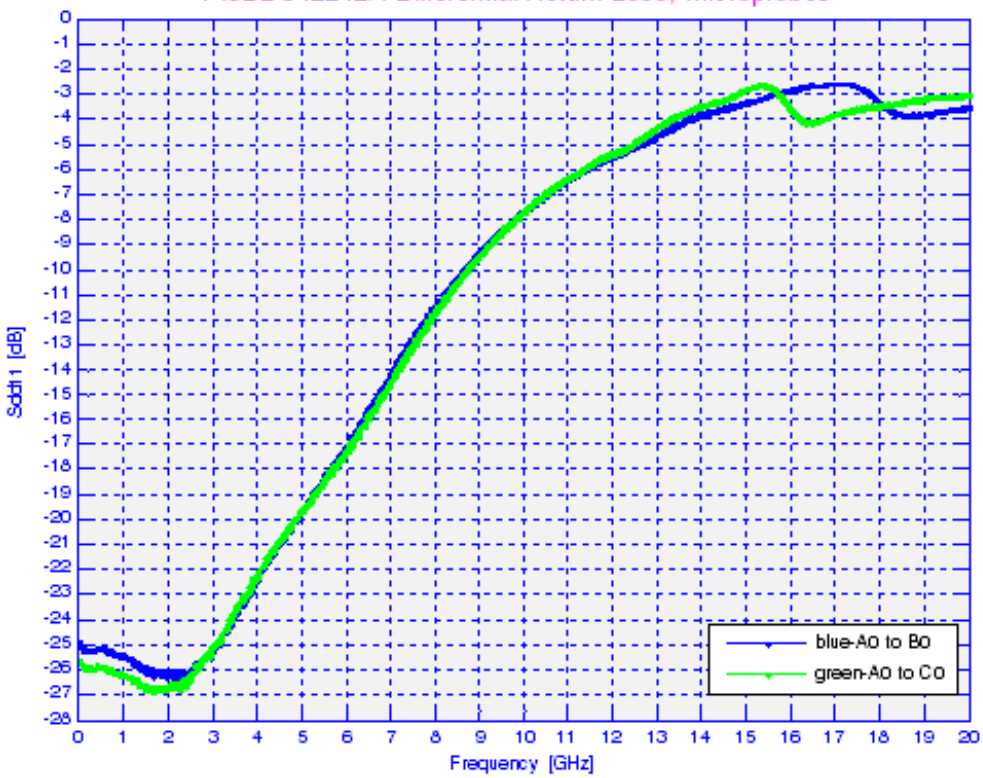


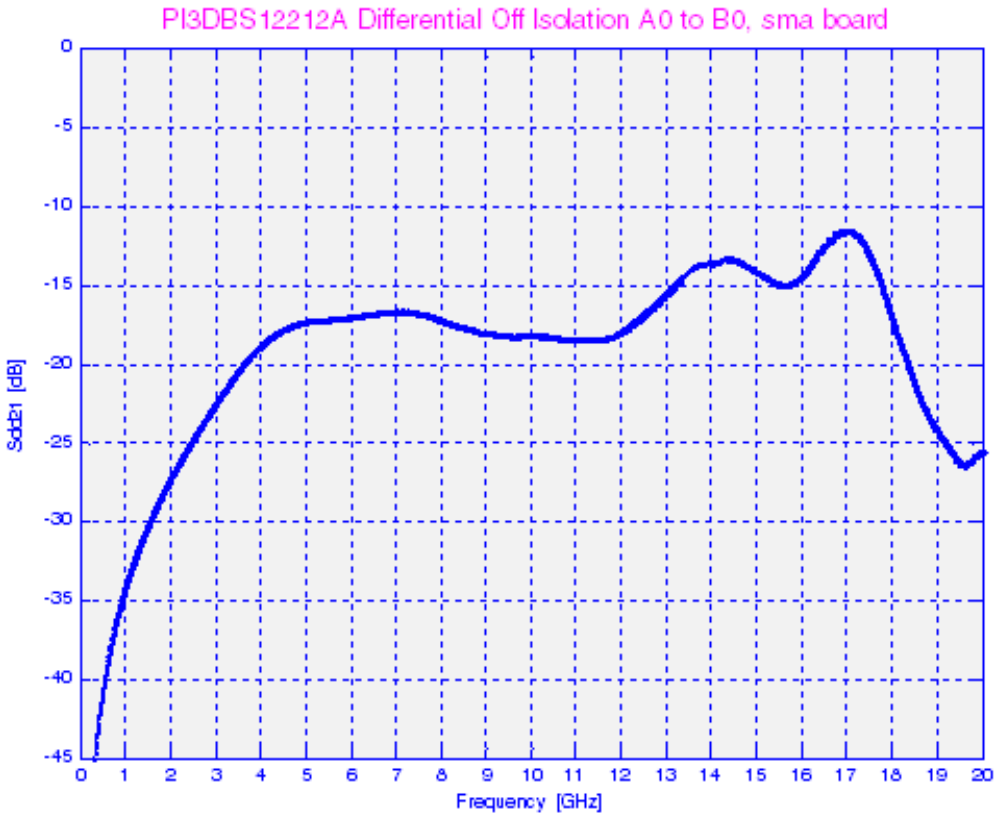
Diff. Near End Xtalk Test Circuit

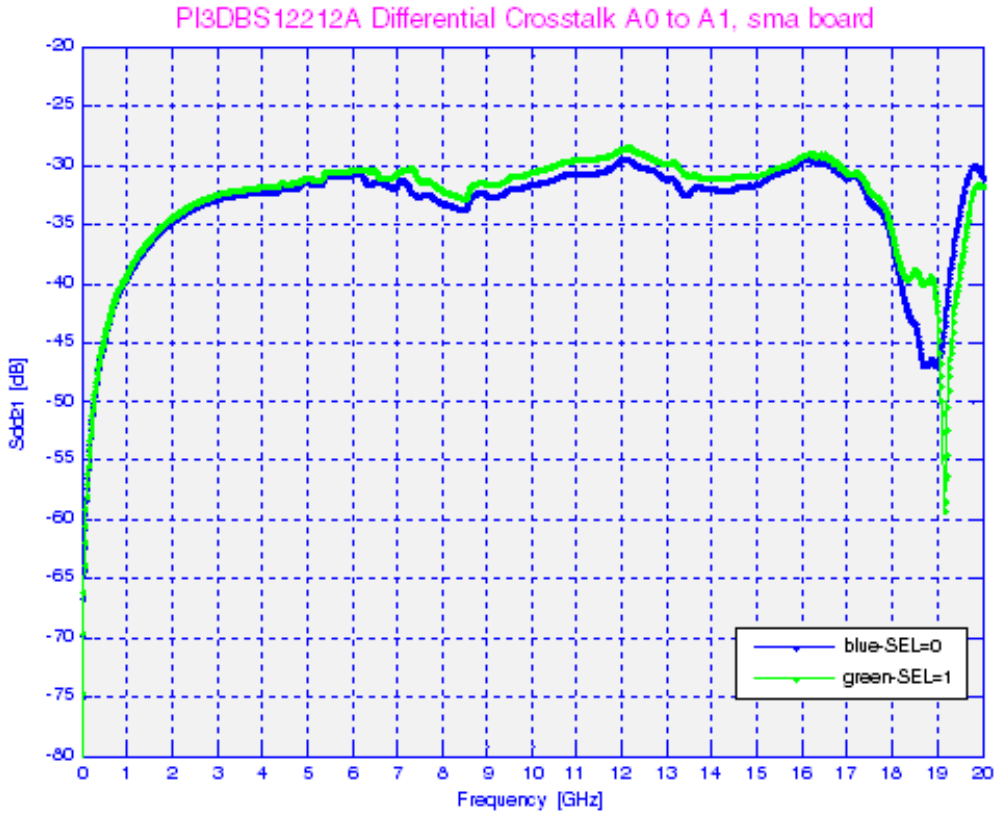
PI3DBS12212A Differential Insertion Loss, microprobes



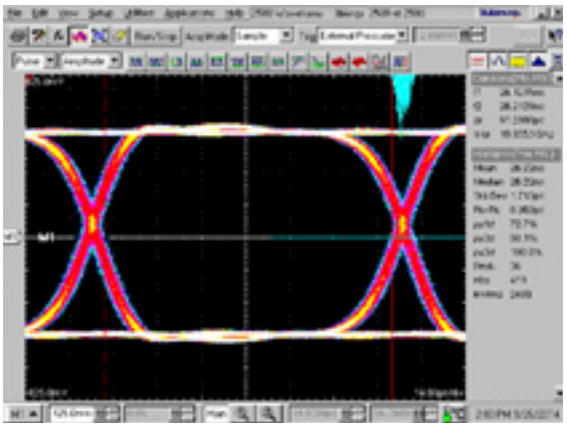
PI3DBS12212A Differential Return Loss, microprobes



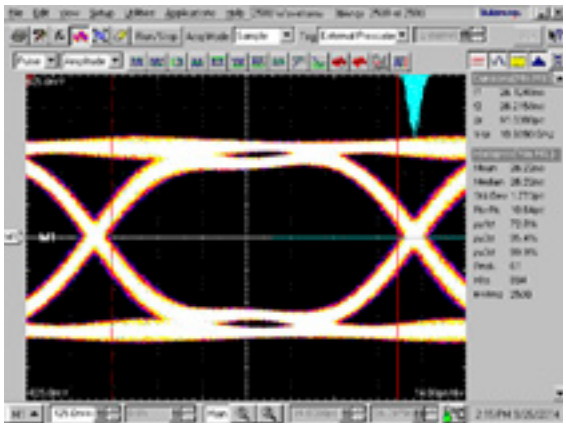




Before Switch

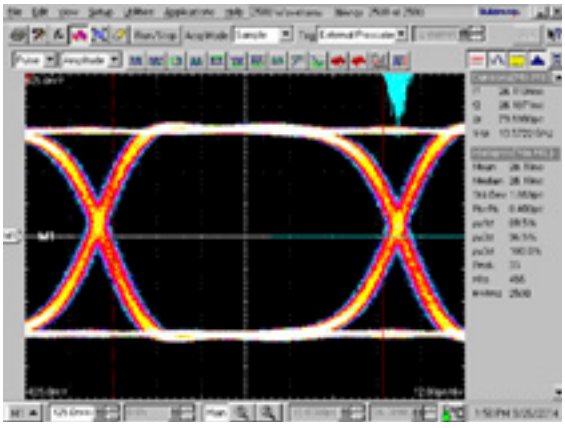


After Switch

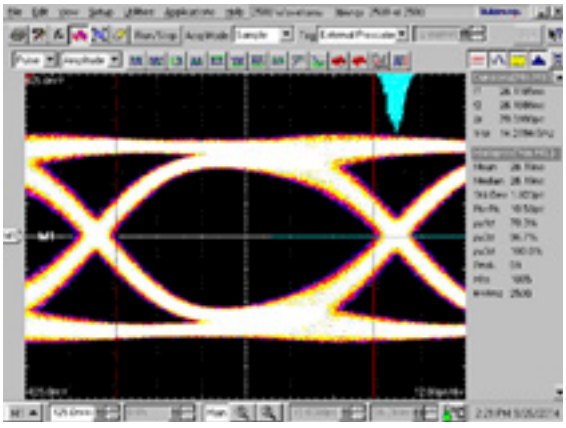


Eye Opening at 10Gb/s using PRBS15 pattern

Before Switch

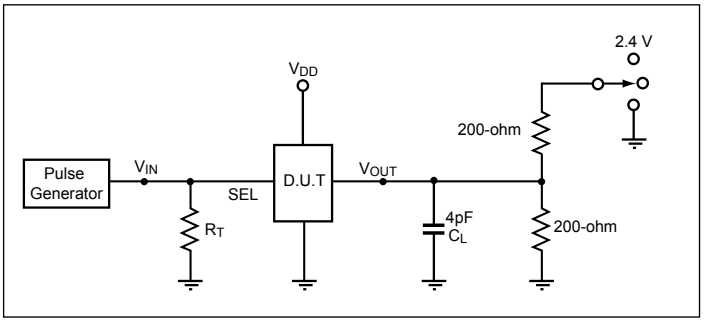


After Switch



Eye Opening at 12Gb/s using PRBS15 pattern

Test Circuit for Electrical Characteristics(1-5)



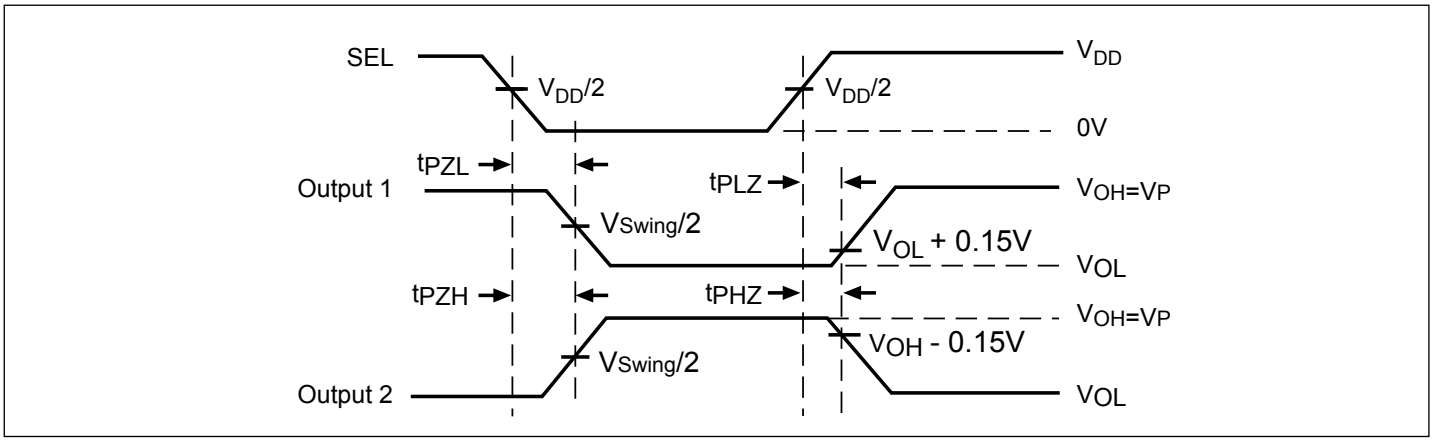
Switch Positions

Test	Switch
t_{PLZ}, t_{PZL}	2.4V
t_{PHZ}, t_{PZH}	GND

Notes:

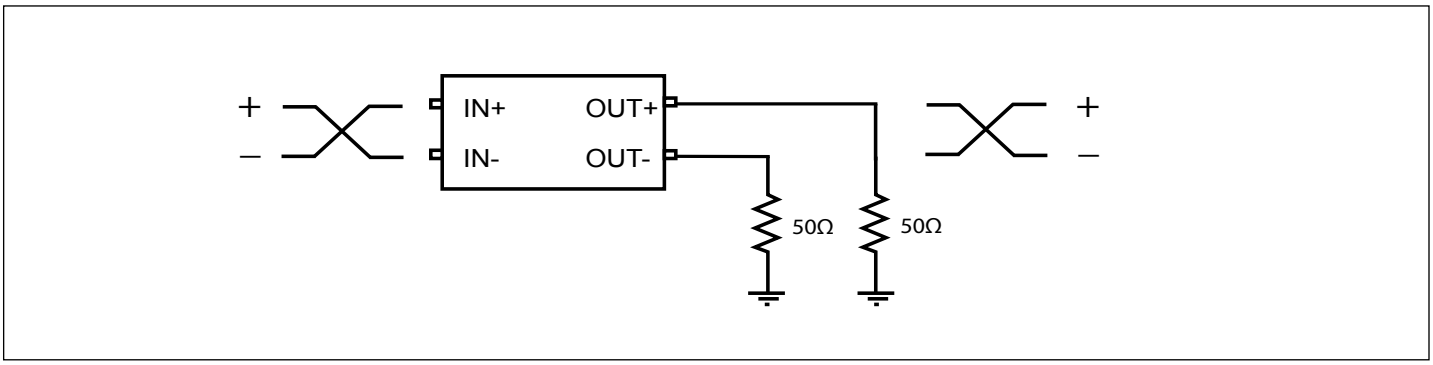
1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. Output 1 is for an output with internal conditions such that the output is low except when disabled by the output control. output 2 is for an output with 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.

Switching Waveforms

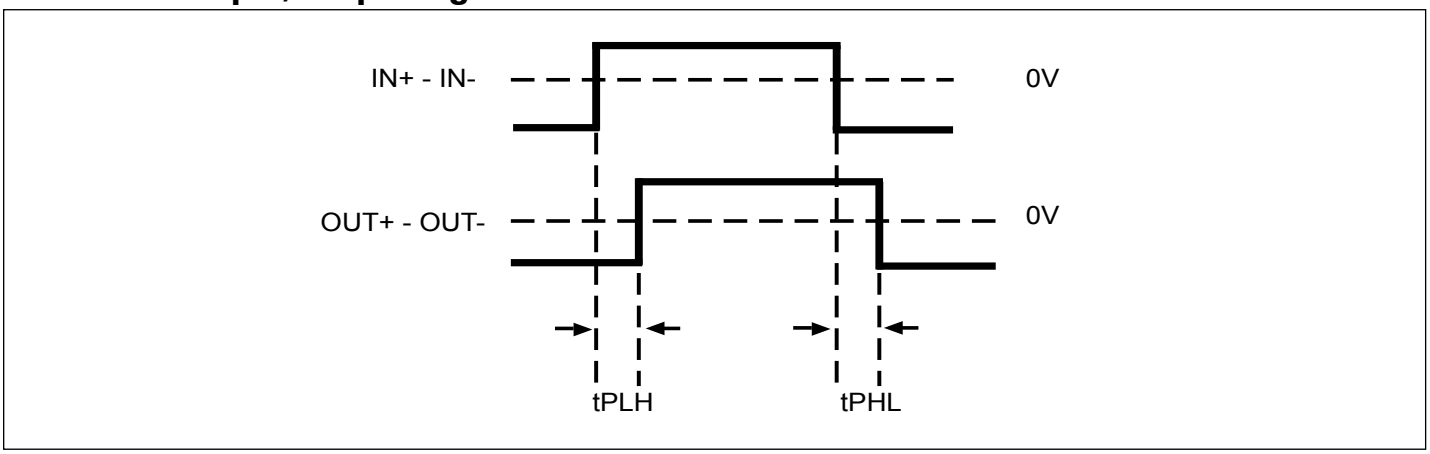


Voltage Waveforms Enable and Disable Times

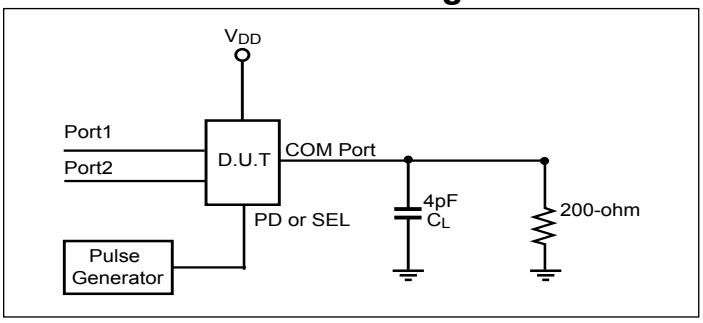
Test Circuit for Propagation Delay



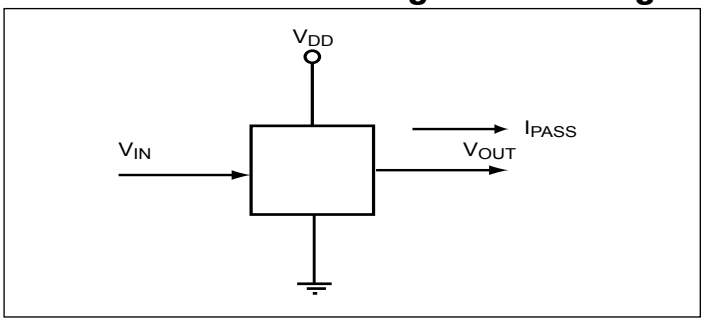
Differential Input/Output Signal Waveform



Test Circuit for SEL Switching Time



Test Circuit for Max Voltage Pass Through



Part Marking

ZB Package

PI3DBS12
212AZBE
YYWWXX

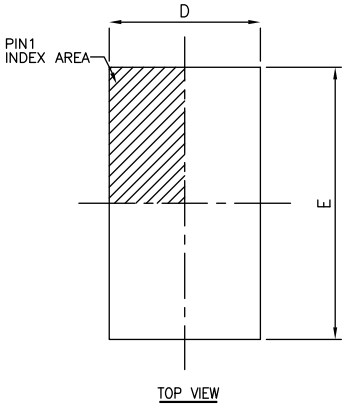
YY: Year
WW: Workweek
1st X: Assembly Code
2nd X: Fab Code

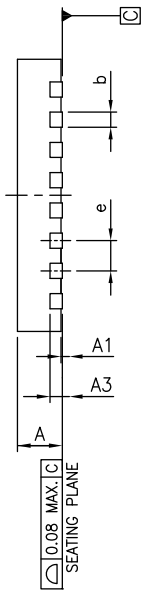
XUA Package

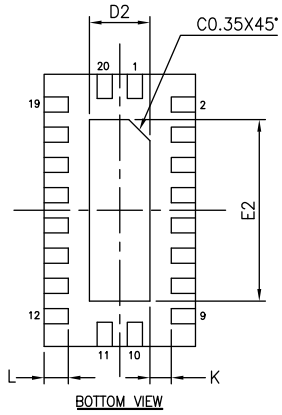
DA
YW

DA: PI3DBS12212A
Y: Year
W: Workweek
Note: Date Code per MA-1251

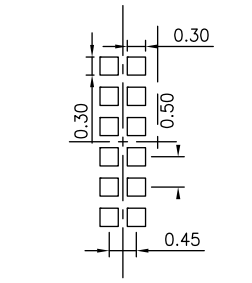
Packaging Mechanical: 20-TQFN (ZB)

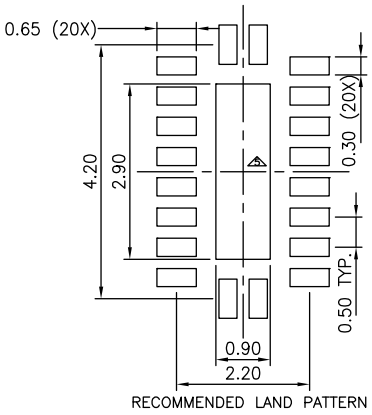






SYMBOLS	MIN.	NOM.	MAX.
A	--	--	1.00
A1	0.00	0.02	0.05
A3		0.20 REF.	
b	0.18	0.25	0.30
D	2.40	2.50	2.60
E	4.40	4.50	4.60
e		0.50 BSC	
L	0.30	0.40	0.50
K	0.20	—	—
D2	0.90	1.00	1.10
E2	2.90	3.00	3.10





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

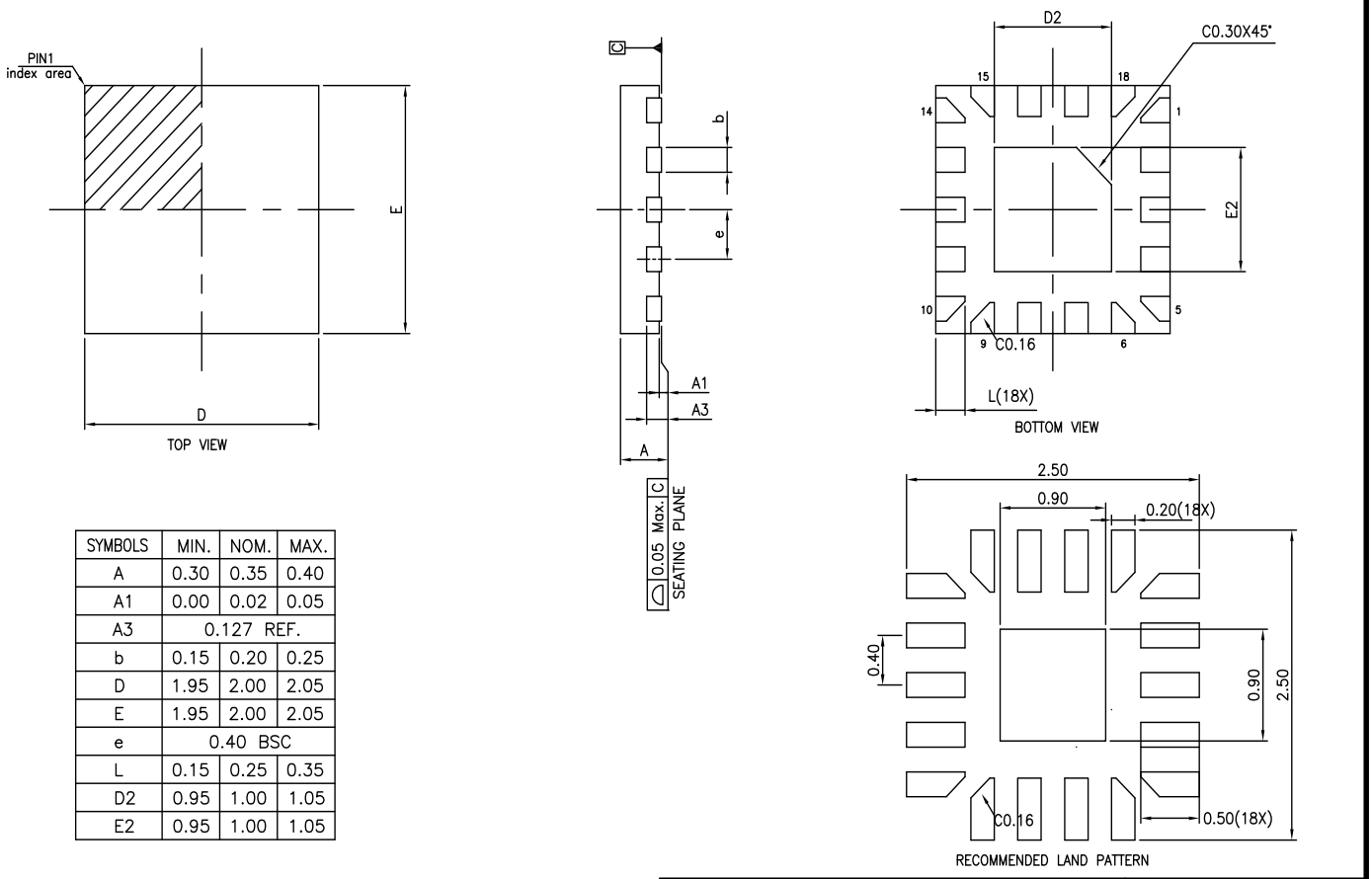
DESCRIPTION: 20-Contact, Very Thin Quad Flat No-Lead (TQFN)

PACKAGE CODE: ZB (ZB20)

DOCUMENT CONTROL #: PD-2104 REVISION: B

14-0265

Packaging Mechanical: 18-X2QFN (XUA)



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 Number	Package Code	Package Description
PI3DBS12212AZBEX	ZB	20-Contact, Very Thin Quad Flat No-Lead (TQFN)
PI3DBS12212AXUAEX	XUA	18-Contact, 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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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.

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