A Product Line of
Diodes Incorporated

PI3USB302-A

3.3V, USB 3.0, 1-Port, 2:1 Mux/DeMux Switch

Features

- 2 Differential Channel, 2:1 Mux/DeMux
- USB 3.0 SuperSpeed Switch
- Bi-directional Operation
- Low Bit-to-Bit Skew, 10 ps max
- 3 dB Bandwidth = 8.1 GHz
- Low channel-to-channel skew: 20 ps max
- Low insertion loss: -1 dB @ 2.5 GHz (5.0 Gbps)
- Low Crosstalk: -33 dB @ 2.5 GHz (5.0 Gbps)
- Low Off Isolation: -27 dB @ 2.5 GHz (5.0 Gbps)
- Low Return Loss: -23.3 dB @ 2.5GHz (5.0Gbps)
- V_{DD} Operating Range: 3.3 V +/-10%
- ESD Tolerance: 2 kV HBM
- Low current: 0.2 mA 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, 2.5 × 4.5mm TQFN (ZB)

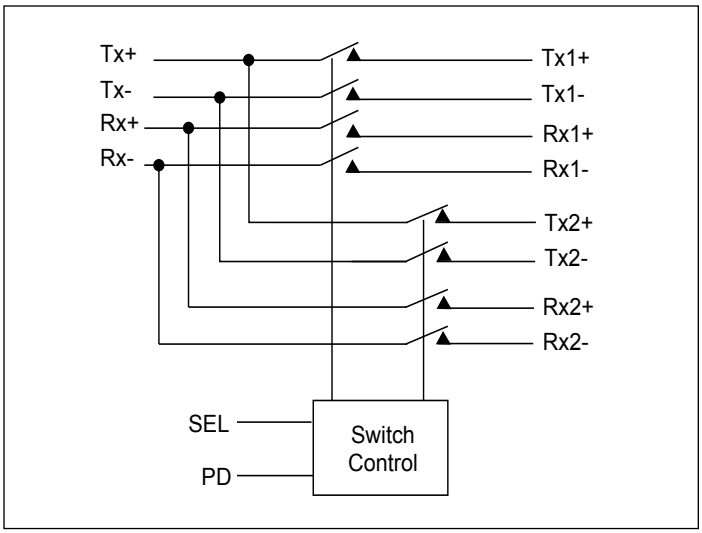
Description

Diodes' PI3USB302-A is a 2-differential channel bi-directional multiplexer/demultiplexer switch. Due to its low bit-to-bit skew, high channel-to-channel noise isolation and bandwidth, this product is ideal for USB 3.0 signal switching at 5.0 Gbps.

Application

Routing USB 3.0 SuperSpeed signals

Block Diagram



Truth Table

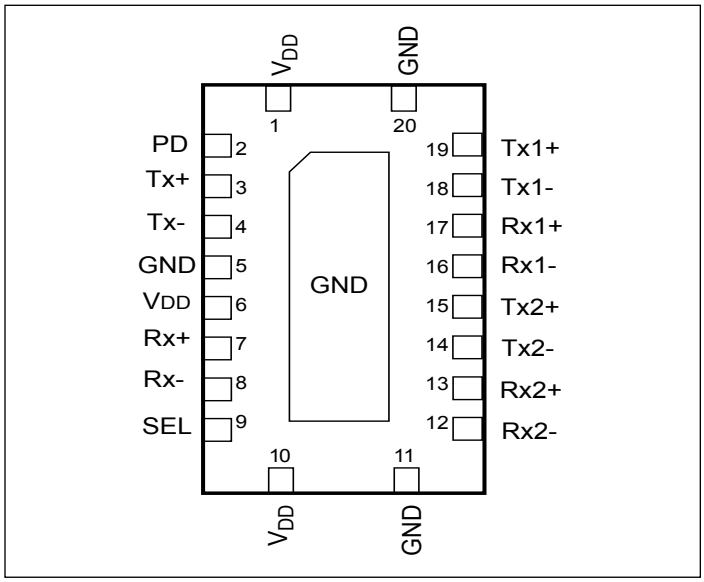
Function	SEL	PD
Port 1 is active	L	L
Port 2 is active	H	L
Both Ports Hi-z, IC power down	x	H

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.

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Pin Configuration (Top-side view)



Pin Description

Pin #	Pin Name	I/O	Description
2	PD	I	Power Down input. see truth table on page 1 for functionality
3	Tx+	I/O	Signal I/O, Transmit differential pair from common port
4	Tx-	I/O	
7 8	Rx+ Rx-	I/O	Signal I/O, Receive differential pair from common port
9	SEL	I	Operation mode Select (when SEL=0: port 1 is active, when SEL=1: port 2 is active
14 15	Tx2- Tx2+	I/O	Signal I/O, Transmit differential pair, port 2
12	Rx2-	I/O	Signal I/O, Receive differential pair, port 2
13	Rx2+	I/O	
17 16	Rx1+ Rx1-	I/O	Signal I/O, Receive differential pair, port 1
19 18	Tx1+ Tx1-	I/O	Signal I/O, Transmit differential pair, port 1
6, 10, 1	V_{DD}	Pwr	3.3V ±10% Positive Supply Voltage
5, 11, 20, Center Pad	GND	Pwr	Power ground

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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
SEL/PD DC Input Voltage	–0.5V to 4.6V
DC Output Current	120mA
Power Dissipation	0.5W

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 = 0V or V_{DD},		0.2	1	mA
I_{DD_PD}	Power down current	PD = 1		20	40	uA
T_{CASE}	Case temperature range for operation within spec.		-40		85	°C
T_j	Junction Temperature	Absolute			125	°C
		Operating			85	

DC Electrical Characteristics for Switching over Operating Range

Parameters	Description	Test Conditions(1)	Min	Typ(1)	Max	Units
$V_{IH\text{-}SEL, PD}$	Input HIGH Voltage, SEL, PD Input		2		3.6	V
$V_{IL\text{-}SEL, PD}$	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 Input	V_{DD} = Max, V_{IN} = V_{DD}	-5		+5	µA
I_{IL}	Input LOW Current, SEL, PD Input	V_{DD} = Max, V_{IN} = 0V	-5		+5	
I_{IH}	Input High Current, T_X, R_X	V_{DD} = Max, V_{IN} = 1.5V	-10		+10	
I_{IL}	Input LOW Current, T_X, R_X	V_{DD} = Max, V_{IN} = 0V	-10		+10	
I_{OZH}	High Z HIGH Current, T_X, R_X	V_{DD} = Max, V_{IN} = 1.5V	-10		+10	µA
I_{OZL}	High Z LOW Current, T_X, R_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			25	30	ns
t_{PHZ}, t_{PLZ}	Line Disable Time			5	25	
$t_{b\text{-}b}$	Bit-to-bit skew within the same differential pair			5	10	ps
$t_{ch\text{-}ch}$	Channel-to-channel skew				20	

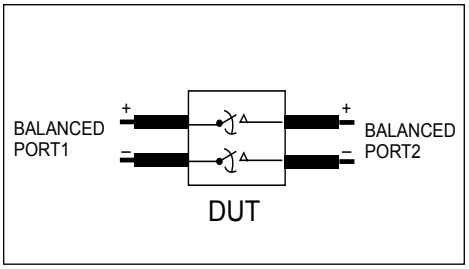
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Dynamic Electrical Characteristics

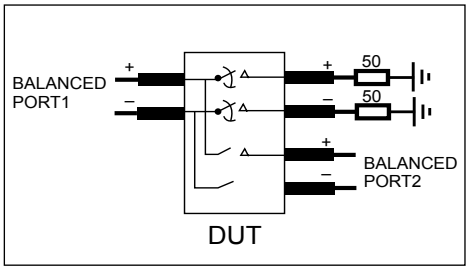
Parameter	Description	Test Conditions	Min.	Typ.(1)	Max.	Units
$DDIL^{(2,3)}$	Differential Insertion Loss (V_{IN} = -10dBm, DC = 0V)	f= 100MHz f= 1.25GHz f= 2.5GHz f=4.0GHz		-0.4 -0.6 -1.0 -1.7		dB
$DDIL_{OFF}^{(2,3)}$	Differential Off Isolation	f= 100MHz f= 1.25GHz f= 2.5GHz f=4.0GHz		-59 -37 -27 -21		dB
$DDRL^{(2)}$	Differential Return Loss	f= 100MHz f= 1.25GHz f= 2.5GHz f= 4.0GHz		-27 -23.3 -23.3 -13.5		dB
$DDNEXT^{(2,3)}$	Near End Crosstalk	f= 100MHz f= 1.25GHz f= 2.5GHz f= 4.0GHz		-57 -38 -33 -32		dB
BW	-3dB Bandwidth			8.1		GHz

Notes:

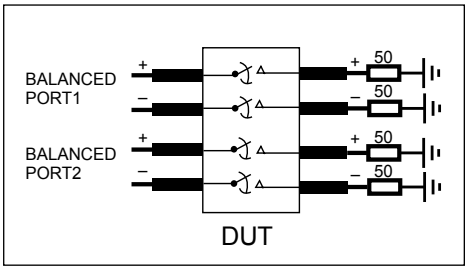
1. Guaranteed by design. Typical values are at V_{DD} = 3.3V , T_A = 25°C ambient and maximum loading.
2. S parameters are measured with our evaluation board made with Rogers (R04350) material. Trace width is 30 mil, length 540 mil, trace impedance is 50 Ω (+/- 5%) and total insertion loss of the trace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



Differential Insertion Loss and Return Test Circuit



Differential Off Isolation Test Circuit

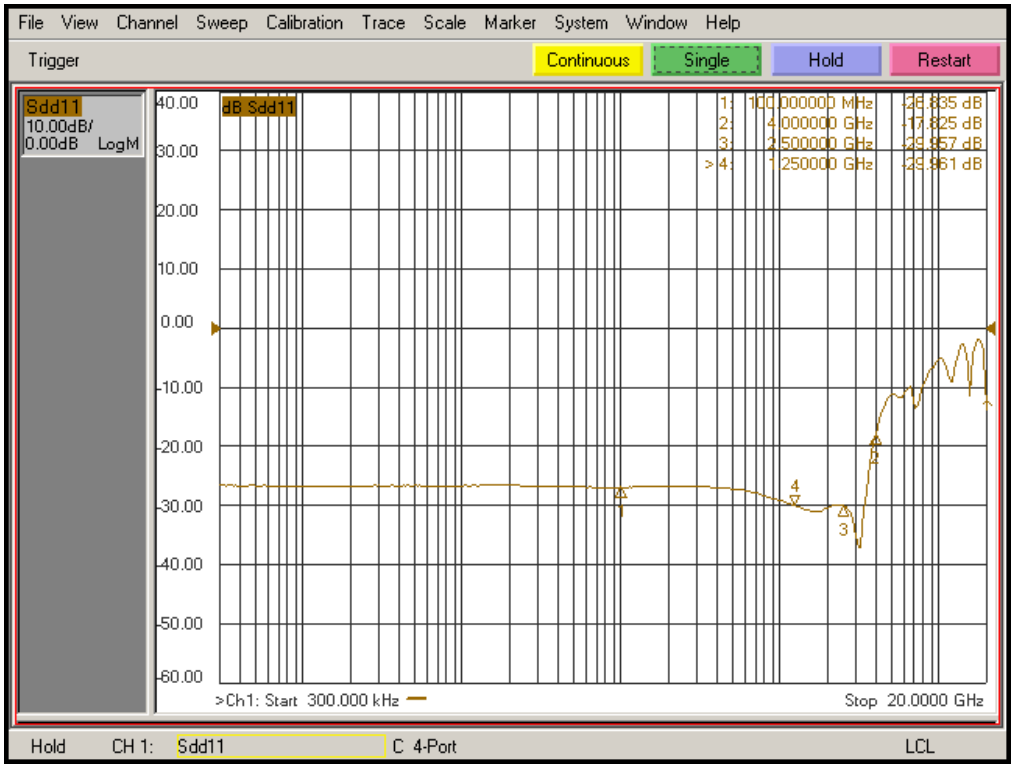


Differential Near End Xtalk Test Circuit

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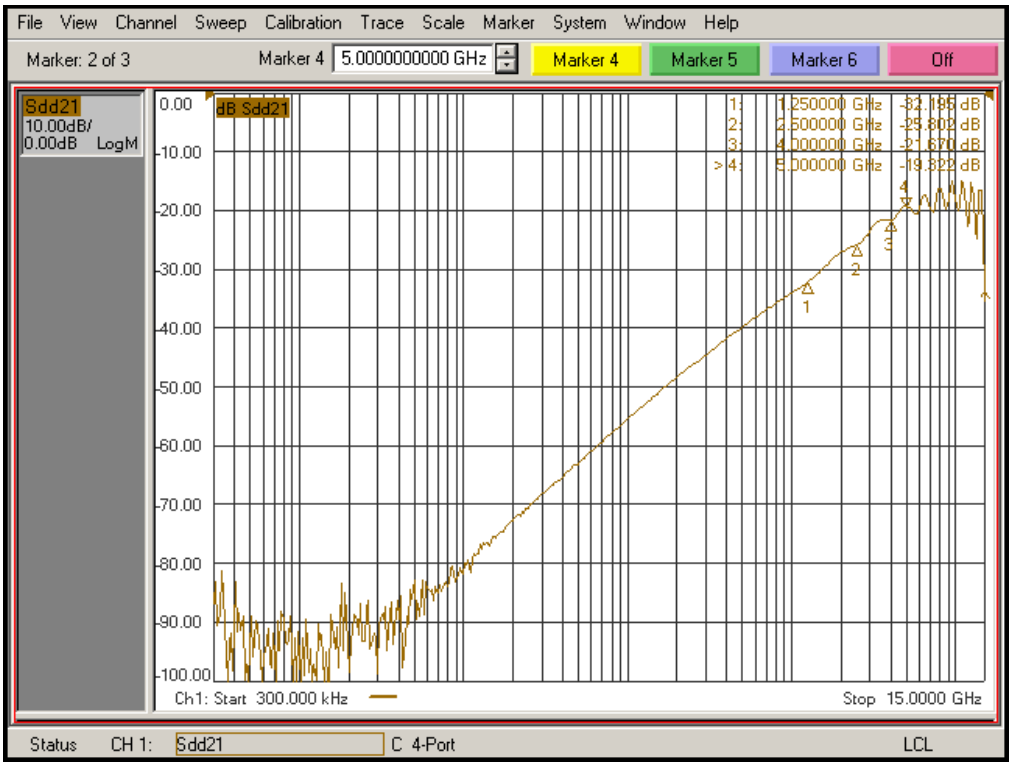


Differential Insertion Loss

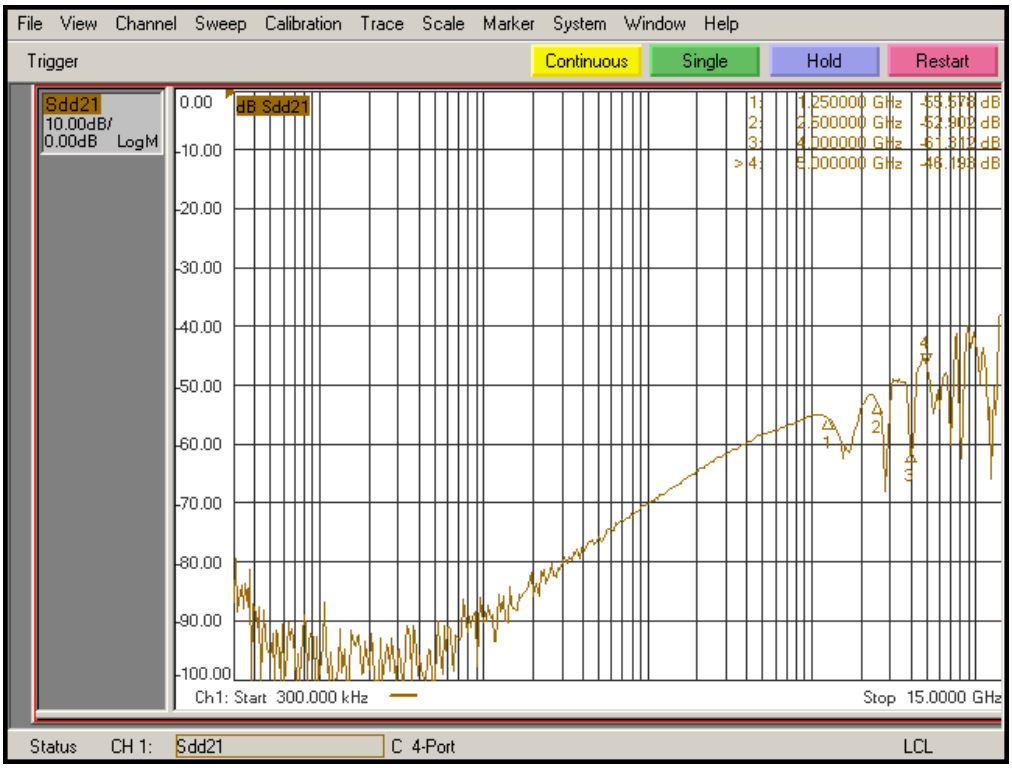


Differential Return Loss

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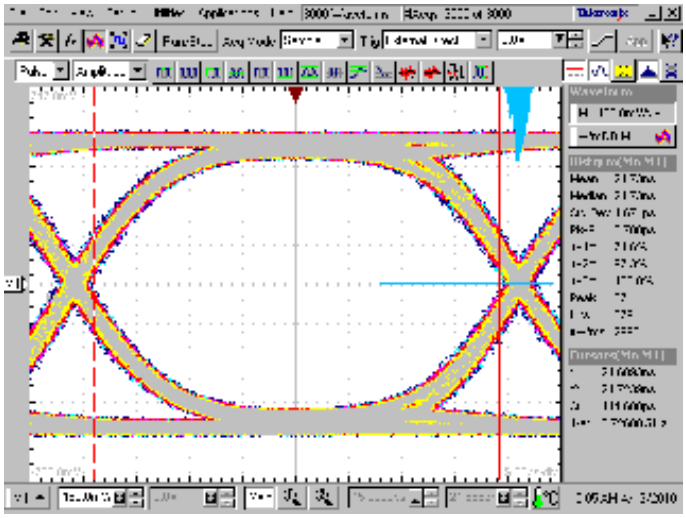


Differential Off Isolation

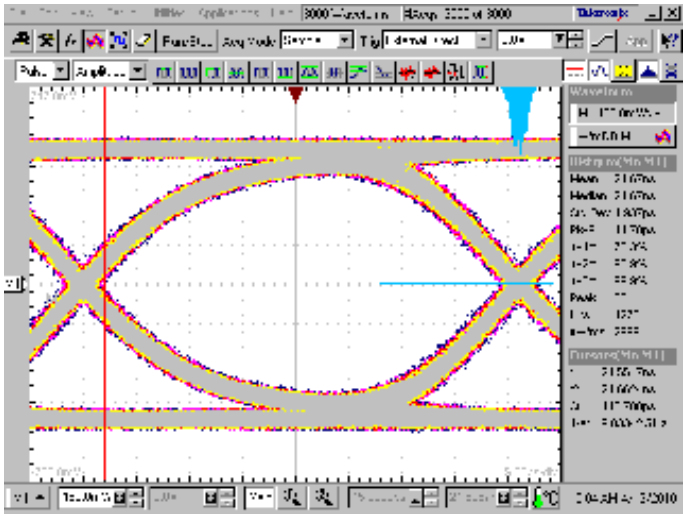


Differential Crosstalk

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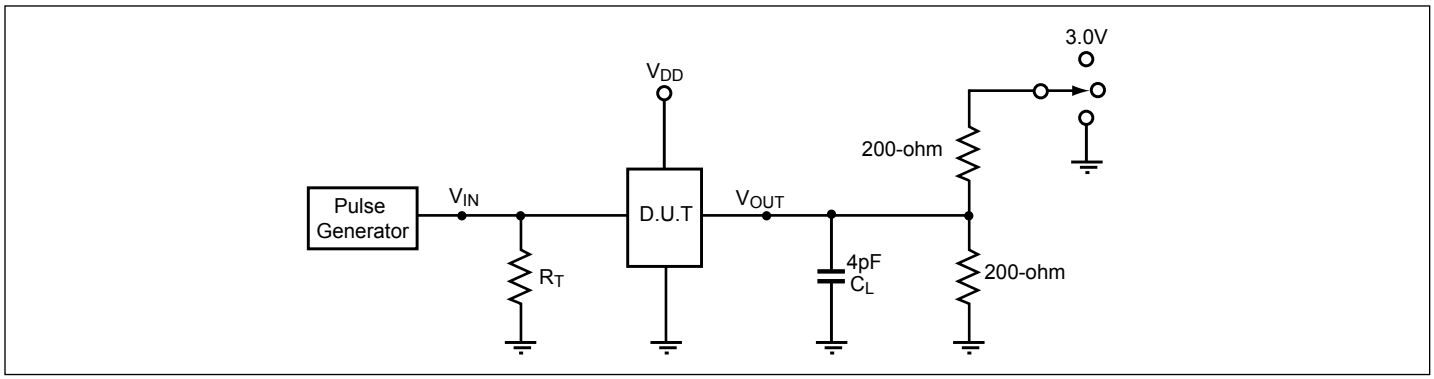
5.0 Gbps RX signal eye without PI3USB302-A



5.0 Gbps RX signal eye with PI3USB302-A

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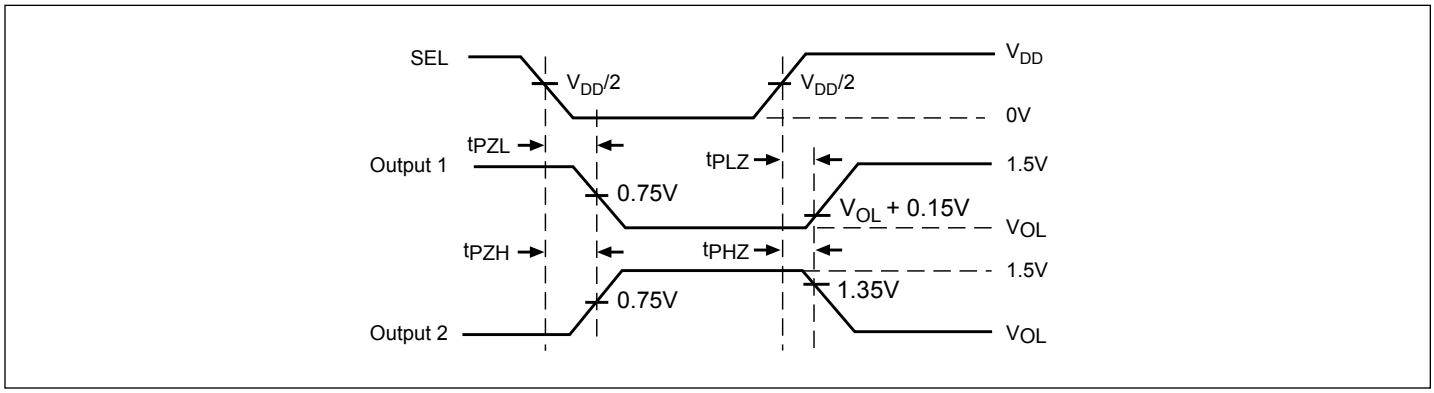
Test Circuit for Electrical Characteristics



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

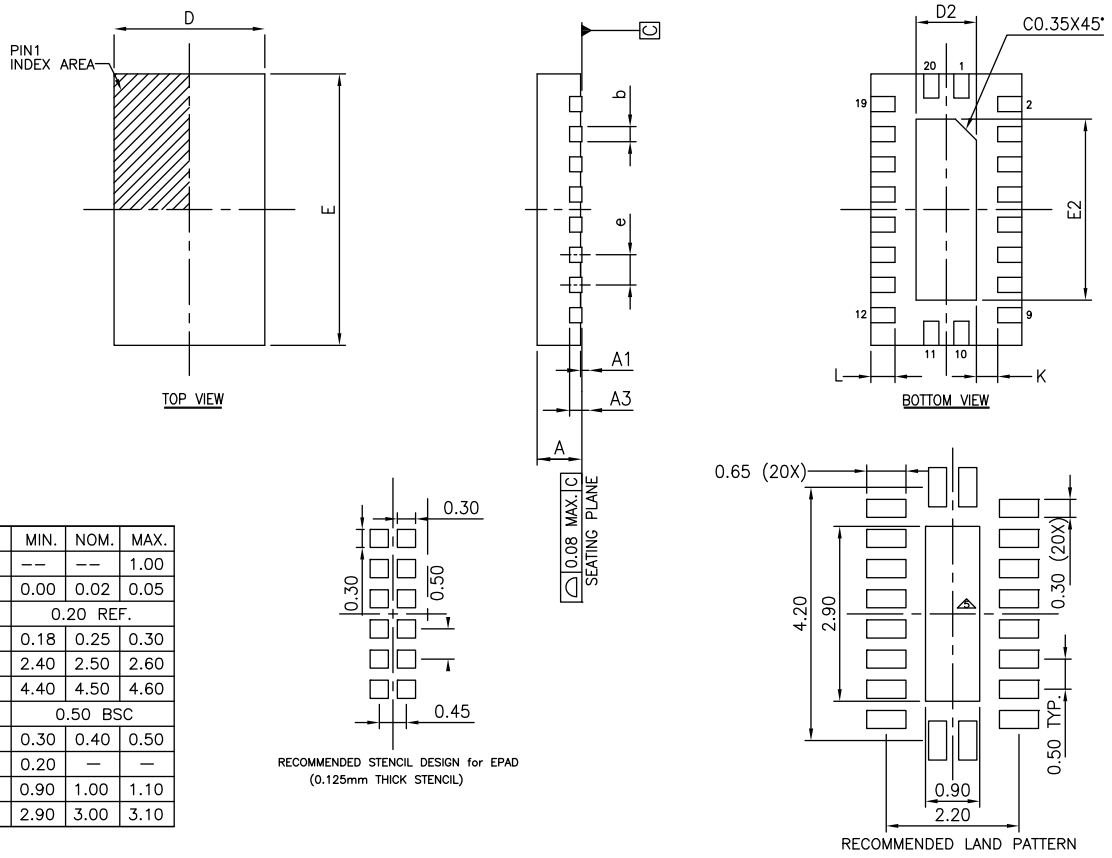
Part Marking

PI3USB3
02-AZBE
YYWWXX̄

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

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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

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
PI3USB302-AZBEX	ZB	20-Contact, Very Thin Quad Flat No-Lead (TQFN)

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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