A Product Line of
Diodes Incorporated

PI2DBS32212

1.8 V, 1-to-32 Gbps 1-Lane 2:1 Mux/De-Mux Switch

Features

- 2 Differential-Channel, 2:1 Mux/DeMux
- Up to 32 Gbps for Applications including PCIe® 5.0, USB 3.0/3.1, USB 3.2 Gen 1x1/Gen 2x1, USB4 Gen 2x1/Gen 3x1, 10GE, Thunderbolt 3, SAS3.0, SAS4.0 and CXL1.0
- Bi-directional Operation
- Low Bit-to-Bit Skew, 3 ps typ
- Low Channel-to-Channel Skew, 10 ps typ
- Low Insertion Loss: -0.9 dB@5 GHz, -1 dB@8 GHz, -2.7 dB@16 GHz
- Return Loss: -21.4 dB@5 GHz, -21 dB@8 GHz, -10.8 dB@16 GHz
- Low Power Consumption - 200 µA typ
- Supply Voltage: 1.8 V
- Industrial Temperature Range: -40 °C to 105 °C
- 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-Q100/101/104/200, 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):
  - 24-contact, X1QFN (XEB), 2.5x2.5mm

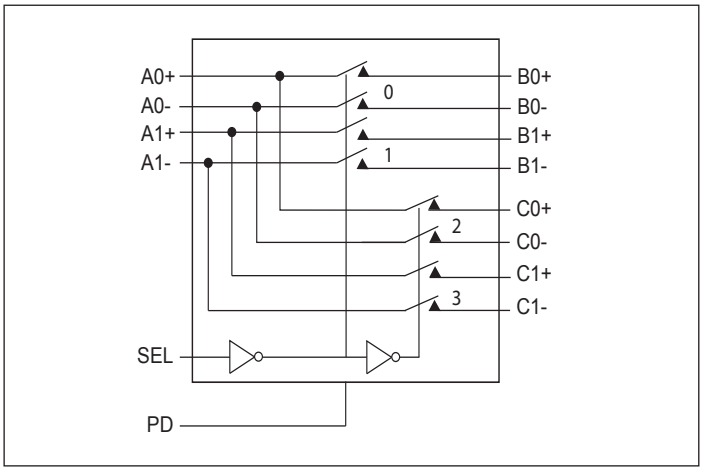
Application

Routing high speed differential signals including PCIe 5.0, USB 3.0/3.1, USB 3.2 Gen 1x1/Gen 2x1, USB4 Gen 2x1/Gen 3x1, 10GE, Thunderbolt 3, SAS3.0, SAS4.0 and CXL1.0 signals.

Description

The DIODES™ PI2DBS32212 is a generic analog high speed passive mux/demux. The configuration is 4-to-2 differential-channel, and data rate is up to 32 Gbps. Based on an unique design technique, Diodes has been able to optimize dynamic electrical characteristics of the device, including low insertion loss, crosstalk and return loss. The device allows high-speed switching with minimum attenuation to the signal and suitable for multiple signal types including PCIe 5.0, USB 3.0/3.1, USB 3.2 Gen 1x1/Gen 2x1, USB4 Gen 2x1/Gen 3x1, 10GE, Thunderbolt 3, SAS3.0, SAS4.0 and CXL1.0 signals.

Block Diagram



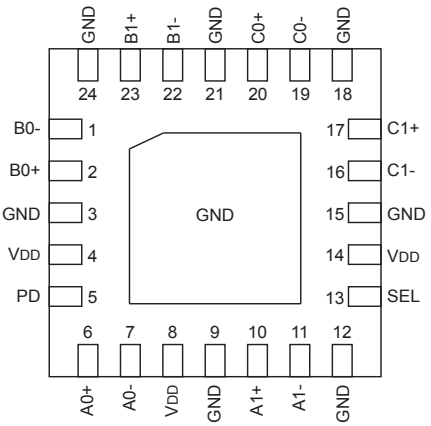
Truth Table

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

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



Pin Description

Pin#	Pin Name	I/O	Description
6 7	A0+ A0-	I/O	Signal I/O, Channel 0, Port A, 100K pull-down
10 11	A1+ A1-	I/O	Signal I/O, Channel 1, Port A, 100K pull-down
2 1	B0+ B0-	I/O	Signal I/O, Channel 0, Port B
23 22	B1+ B1-	I/O	Signal I/O, Channel 1, Port B
20 19	C0+ C0-	I/O	Signal I/O, Channel 0, Port C
17 16	C1+ C1-	I/O	Signal I/O, Channel 1, Port C
13	SEL	I	Operation mode Select (when SEL=0: A→B, when SEL=1: A→C)
5	PD	I	PD = 1, Power down is enabled. Please see Truth Table
4, 8, 14	V_{DD}	Pwr	1.8V ±10% Positive Supply Voltage
3, 9, 12, 15, 18, 21, 24, 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 +2.1V
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 +2.1V
Maximum Stress Voltage (MSV)	3.8V
ESD (HBM)	850V

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}	1.8V Power Supply		1.6	1.8	2.0	V
I_{DD}	Current consumption in normal operation	SEL = GND or V_{DD}, PD = Low		0.2	0.4	mA
I_{DDQ}	Current consumption when all switches are disabled	V_{DD} = 1.8V, PD = High		0.05		mA
P_{DD}	Total Power from VDD 1.8V supply	Control pins = GND or V_{DD}		0.5		mW
P_{DDQ}	Power consumption when all switches are disabled	V_{DD} = 1.8V, PD = High		0.1		mW
T_A	Operating temperature range		-40		105	°C

DC Electrical Characteristics for Switching over Operating Range

Parameters	Description	Test Conditions(1)	Min.	Typ.(1)	Max.	Units
V_{IH} - cntrl signals	Input HIGH Voltage for SEL and PD	V_{DD} = 1.8V	1.4		2.0	V
V_{IL} - cntrl signals	Input LOW Voltage for SEL and PD	V_{DD} = 1.8V	-0.5		0.4	
V_{IK}	Clamp Diode Voltage	V_{DD} = Max., I_{input} = –18mA		–0.7	–1.2	
I_{IH}	Input HIGH Current for SEL and PD	V_{DD} = Max., $V_{input = VDD}$	-80		+80	µA
I_{IL}	Input LOW Current for SEL and PD	V_{DD} = Max., V_{input} = 0V	-10		+10	
I_{OZH}	HighZ HIGH Current, switch I/O pins	V_{DD} = 1.8V., V_{input} = 1.2V	–20		+20	µA
I_{OZL}	HighZ LOW Current, switch I/O pins	V_{DD} = Max., V_{input} = 0V	–10		+10	µA
Vp	Max voltage pass through tolerance analog switches (See Test Circuit)	V_{DD} = 1.8V, I_{PASS} = 10mA		1		V
V_{IN}	Analog Signal to input of switch			1.1	1.2	V

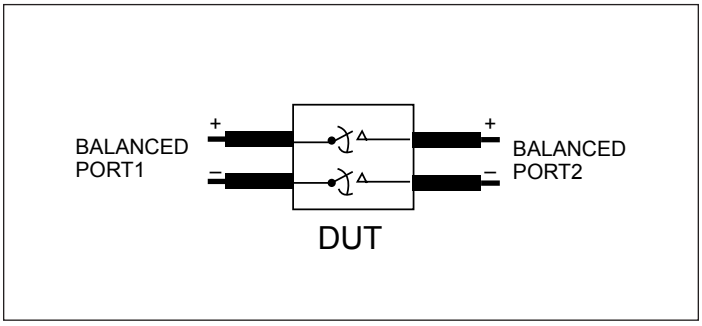
Note:
1. Typical values are at V_{DD} = 1.8V, T_A = 25°C ambient and maximum loading.

Dynamic Electrical Characteristics

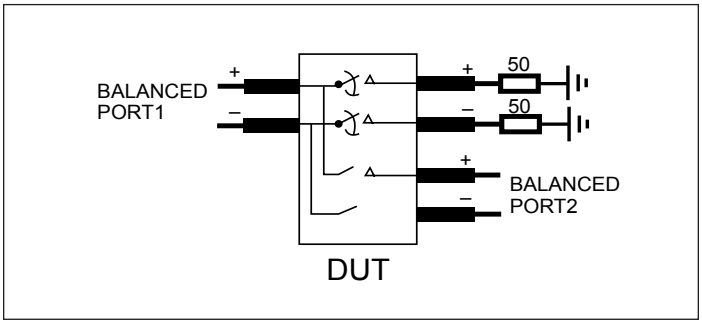
Parameter	Description	Test Conditions	Min.	Typ.(1)	Max.	Units
DDIL	Differential Insertion Loss	f=2.5GHz f=4.0GHz f=5.0GHz f=8.0GHz f=10.0GHz f=16.0GHz		-0.9 -0.9 -0.9 -1.0 -1.0 -2.7		dB
DDRL	Differential Return Loss	f= 2.5GHz f= 4.0GHz f= 5.0GHz f= 8.0GHz f=10.0GHz f=16.0GHz		-22.0 -21.9 -21.4 -21.0 -20.5 -10.8		dB
DDOI	Differential OFF Isolation	f= 2.5GHz f= 4.0GHz f= 5.0GHz f= 8.0GHz f=10.0GHz f=16.0GHz		-29.0 -23.0 -23.0 -19.0 -17.0 -15.0		dB
DDXT	Differential Crosstalk	f= 2.5GHz f= 4.0GHz f= 5.0GHz f=8.0GHz f=10.0GHz f=16.0GHz		-44.7 -41.4 -40.0 -40.0 -36.8 -30.0		dB

Switching Characteristics

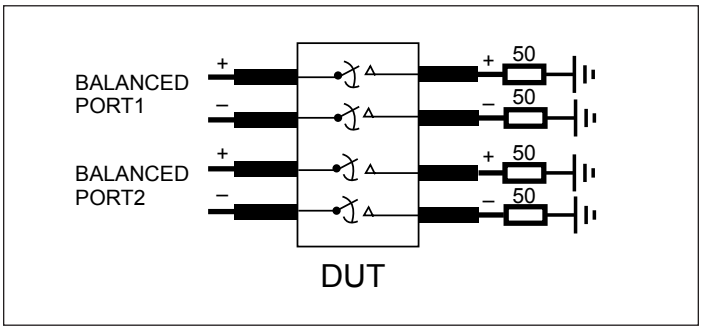
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
t_{PZH}, t_{PZL}	Line Enable Time - SEL to A_N, B_N, C_N			200	350	ns
t_{PHZ}, t_{PLZ}	Line Disable Time - SEL to A_N, B_N, C_N			200	350	ns
t_{PLH}	Propagation Delay, LOW to HIGH				50	ps
t_{PHL}	Propagation Delay, HIGH to LOW				50	ps
$t_{b\text{-}b}$	Bit-to-bit skew within the same differential pair			3	10	ps
$t_{ch\text{-}ch}$	Channel-to-channel skew			10	20	ps



Diff. Insertion Loss and Return Loss Test Circuit

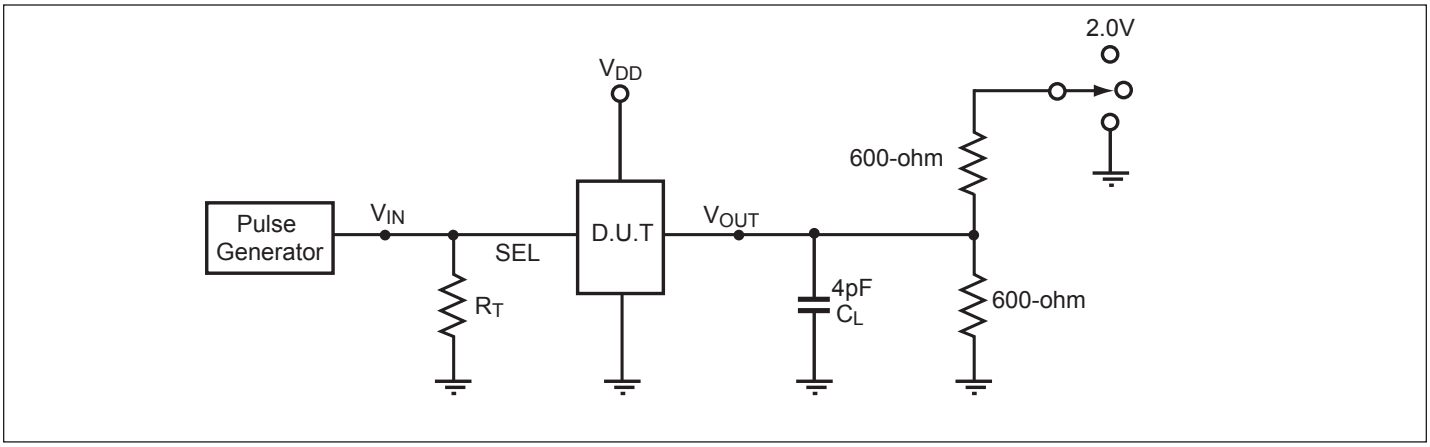


Diff. Off Isolation Test Circuit



Diff. Near End Xtalk Test Circuit

Test Circuit for Electrical Characteristics(1-5)



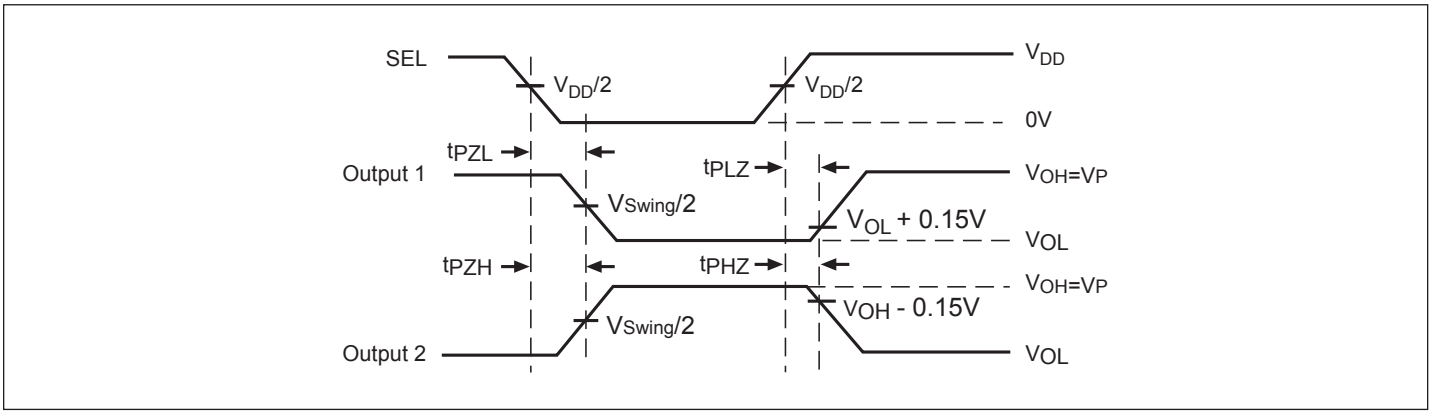
Notes:

1. CL = Load capacitance: includes jig and probe capacitance.
2. RT = Termination resistance: should be equal to ZOUT 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, ZO = 50Ω, tR ≤ 2.5ns, tF ≤ 2.5ns.
5. The outputs are measured one at a time with one transition per measurement.

Switch Position

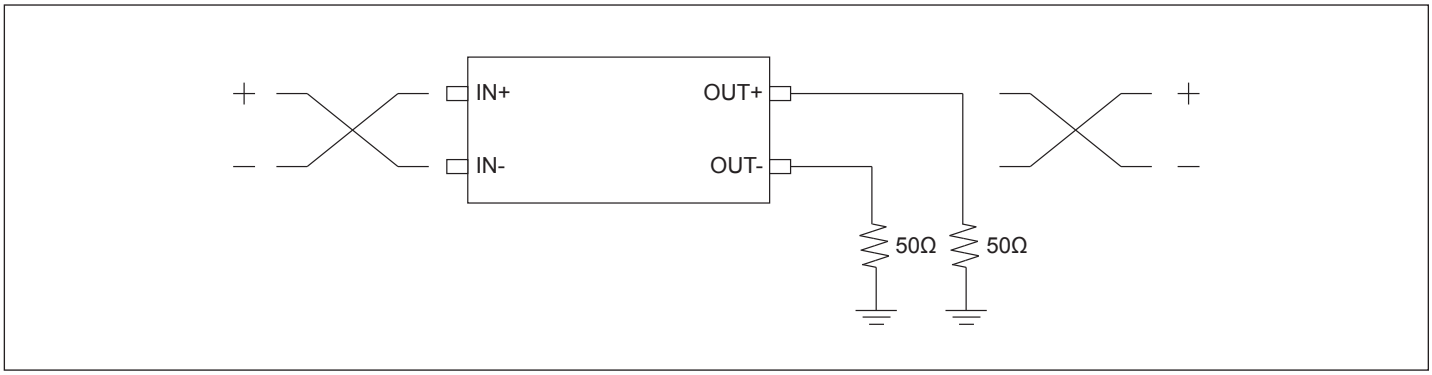
Test	Switch
$t_{PLZ, tPZL}$	2.0V
$t_{PHZ, tPZH}$	GND

Switching Waveforms

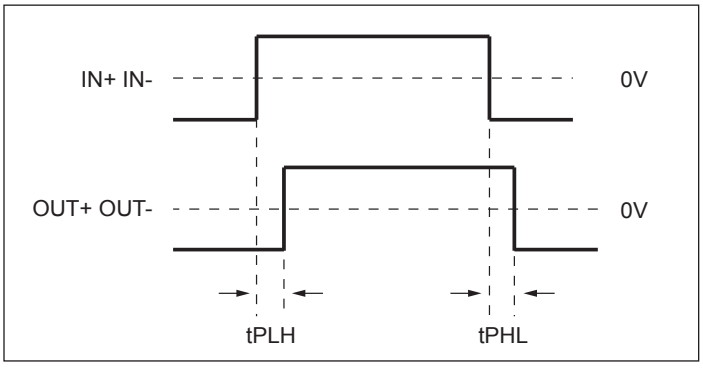


Voltage Waveforms Enable and Disable Times

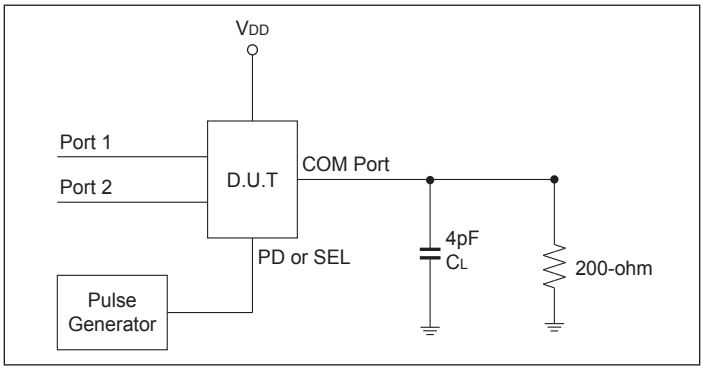
Test Circuit for Propagation Delay



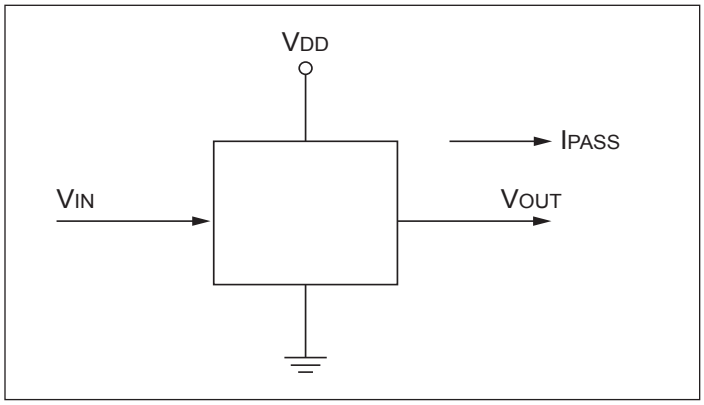
Differential Input/Output Signal Waveform



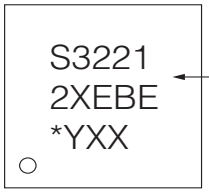
Test Circuit for SEL Switching Time



Test Circuit for Max Voltage Pass through



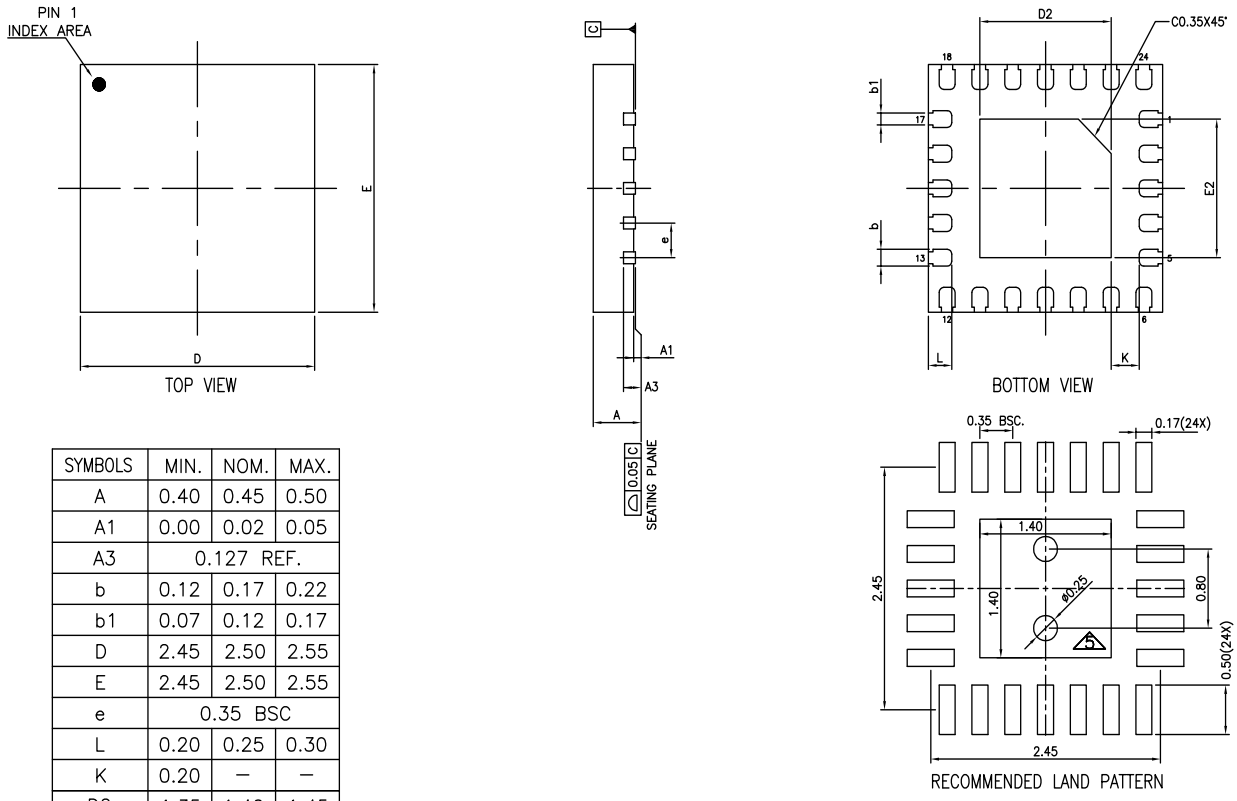
Part Marking



Pericom Product Family
Device/Pkg Type

*: Option Code for Top Mark
Y: One Character Shortened Date Code
1st X: Assembly Code
2nd X: Fab Code
Note: Date Code per MA-1251

Packaging Mechanical: 24-X1QFN (XEB)



SYMBOLS	MIN.	NOM.	MAX.
A	0.40	0.45	0.50
A1	0.00	0.02	0.05
A3		0.127 REF.	
b	0.12	0.17	0.22
b1	0.07	0.12	0.17
D	2.45	2.50	2.55
E	2.45	2.50	2.55
e		0.35 BSC	
L	0.20	0.25	0.30
K	0.20	–	–
D2	1.35	1.40	1.45
E2	1.35	1.40	1.45

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-288
4. RECOMMENDED LAND PATTERN IS FOR REFERENCE ONLY.
5. THERMAL PAD SOLDERING AREA

DATE: 06/26/19

DESCRIPTION: 24-Contact, Extra Thin Fine Pitch QFN, X1QFN

PACKAGE CODE: XEB (XEB24)

DOCUMENT CONTROL #: PD-2243 REVISION: --

20-0457

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
PI2DBS32212XEBEX	XEB	24-Contact, Extra Thin Fine Pitch QFN (X1QFN)

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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