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A product Line of
Diodes Incorporated

PI3PCIE3413A

3.3V, PCI Express® 3.0 2-Lane, 3:1 Mux/DeMux Switch, with Power Down Feature

Features

- 4 Differential Channel, 3:1 Mux/DeMux
- PCI Express® 3.0 Performance, 8.0Gbps
- Bi-directional operation
- -3dB Bandwidth: 6.8GHz
- Low Bit-to-Bit Skew, 10ps max
- Low Crosstalk: -40dB@4 GHz
- Low Insertion Loss: -1.4dB@4 GHz (8.0Gbps)
- Low Return Loss:-15dB@4GHz (8.0Gbps)
- Low Off Isolation:-19dB @4GHz (8Gbps)
- ESD:1.5KV HBM
- Power Down option
- Supply Voltage 3.3V
- Packaging (Pb-free & Green):
  - 42-contact, TQFN (ZH42)

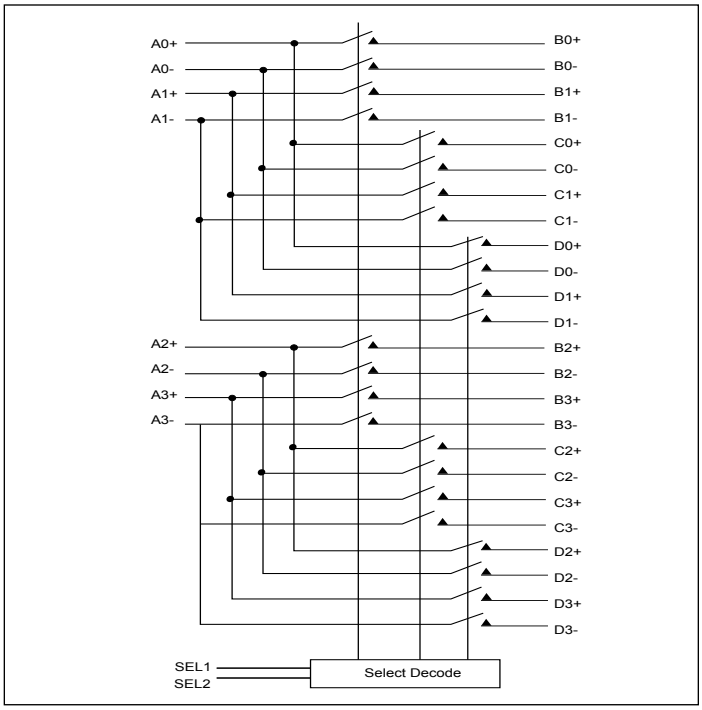
Description

The PI3PCIE3413A is an 12 to 4 differential channel multiplexer/demultiplexer switch. This solution can switch 2 full PCI Express® 3.0, lanes to one of three locations. Using a unique design technique, Diodes Incorporated has been able to minimize the impedance of the switch such that the attenuation observed through the switch is mininal. The unique design technique also offers a layout targeted for PCI Express signals, which minimizes the channel to channel skew as well as channel to channel crosstalk as required by the PCI Express specification.

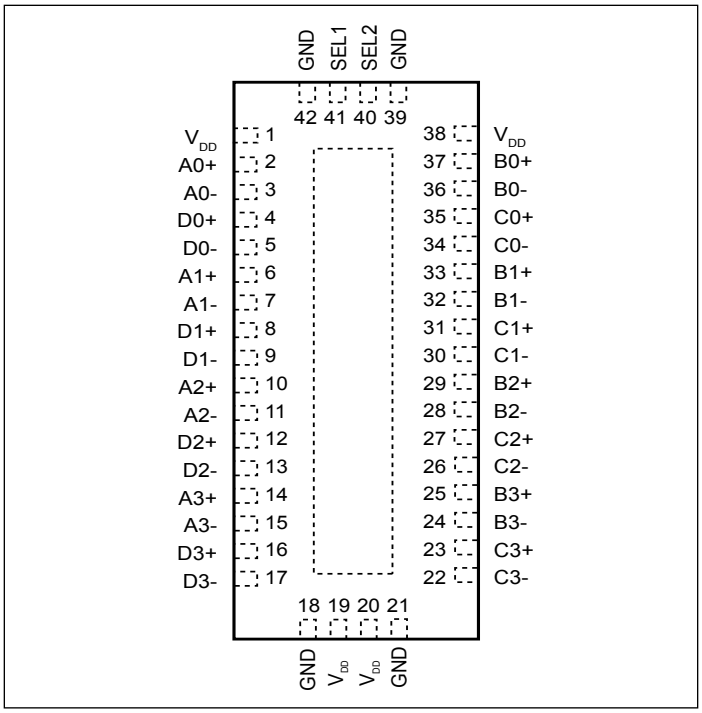
Application

Routing of PCI Express 3.0, signals with low signal attenuation.

Block Diagram



Pin Description (Top-side view)



Truth Table

SEL1	SEL2	Function
0	0	Power down all switch hi-z
0	1	A→B
1	0	A→C
1	1	A→D

Pin Description

Pin #	Pin Name	I/O	Description
2 3	A0+ A0–	I/O	Signal I/O, Channel 0, Port A
6 7	A1+ A1–	I/O	Signal I/O, Channel 1, Port A
10 11	A2+ A2–	I/O	Signal I/O, Channel 2, Port A
14 15	A3+ A3–	I/O	Signal I/O, Channel 3, Port A
37 36	B0+ B0–	I/O	Signal I/O, Channel 0, Port B
33 32	B1+ B1–	I/O	Signal I/O, Channel 1, Port B
29 28	B2+ B2–	I/O	Signal I/O, Channel 2, Port B
25 24	B3+ B3–	I/O	Signal I/O, Channel 3, Port B
35 34	C0+ C0–	I/O	Signal I/O, Channel 0, Port C
31 30	C1+ C1–	I/O	Signal I/O, Channel 1, Port C
27 26	C2+ C2–	I/O	Signal I/O, Channel 2, Port C
23 22	C3+ C3–	I/O	Signal I/O, Channel 3, Port C
4 5	D0+ D0–	I/O	Signal I/O, Channel 0, Port D
8 9	D1+ D1–	I/O	Signal I/O, Channel 1, Port D
12 13	D2+ D2–	I/O	Signal I/O, Channel 2, Port D
16 17	D3+ D3–	I/O	Signal I/O, Channel 3, Port D
40, 41	SEL2, SEL1	I	Operation mode Select. Please see Truth Table on Page 1
1, 19, 20, 38	V_{DD}	Pwr	3.3V ±10% Positive Supply Voltage
18, 21, 39, 42, 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 +3.7V
Channel DC Input Voltage .....–0.5V to 1.5V
DC Output Current 120mA
Power Dissipation 0.5W
SEL DC Input Voltage .....–0.5V to 3.7V
Junction Temperature..... 125°C

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	SEL1,2 = 01, 10 or 11		0.15	1	mA
I_{DDQ}	Standby I_{DD}	SEL1,2 = 00		0.1		
T_{CASE}	Case temperature range for operation within spec.		-40		85	Celsius

DC Electrical Characteristics for Switching over Operating Range

Parameters	Description	Test Conditions(1)	Min.	Typ.(1)	Max.	Units
V_{IH} - SEL	Input HIGH Voltage, SEL Input		2		3.6	V
V_{IL} - SEL	Input LOW Voltage, SEL 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	V_{DD} = Max., V_{IN} = V_{DD}			±5	µA
I_{IL}	Input LOW Current, SEL	V_{DD} = Max., V_{IN} = 0V			±5	
I_{IH}	Input HIGH Current, A_X, B_X, C_X, D_x	V_{DD} = Max., V_{IN} = 1.5V	–10		+10	µA
I_{IL}	Input LOW Current, A_X, B_X, C_X, D_x	V_{DD} = Max., V_{IN} = 0V	–10		+10	
I_{OZH}	HighZ HIGH Current, B_X, C_X, D_x	V_{DD} = Max., V_{IN} = 1.5V	–10		+10	µA
I_{OZL}	HighZ LOW Current, B_X, C_X, D_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, D_N		0.5	41	55	ns
t_{PHZ}, t_{PLZ}	Line Disable Time - SEL to A_N, B_N, C_N, D_N		0.5	5	25	
t_{b-b}	Bit-to-bit skew within the same differential pair			5	10	ps

Notes:

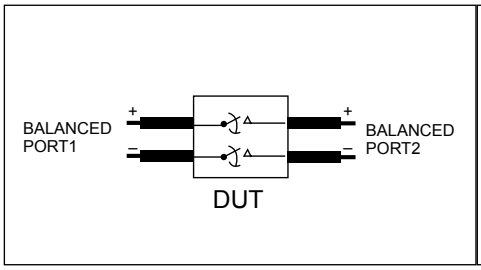
1. Guaranteed by design. Typical values are at V^{DD} = 3.3V , T^A = 25°C ambient and maximum loading.

Dynamic Electrical Characteristics

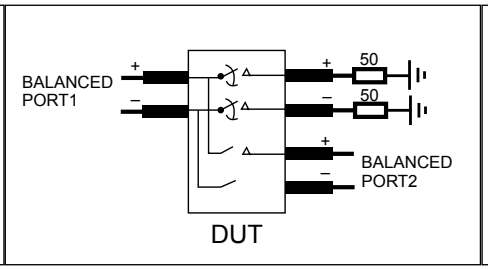
Parameter	Description	Test Conditions	Min.	Typ.(1)	Max.	Units
DDIL	Differential Insertion Loss (V_{IN} = -10dBm, DC = 0V)	f= 50MHz - 1.25GHz	-0.8	-0.6		dB
		f= 1.25GHz - 2.5GHz	-1.2	-1.0		
		f= 2.5GHz - 4.0GHz	-1.7	-1.4		
		f= 5.0GHz	-2.3	-1.9		
$DDIL_{RL}$	Differential Return Loss	f= 50MHz - 1.25GHz		-24	-21	dB
		f= 1.25GHz - 2.5GHz		-21	-18.5	
		f= 2.5GHz - 4.0GHz		-15	-13.4	
		f= 5.0GHz		-11	-9.8	
$DDIL_{OFF}$	Differential Off Isolation	f= 50MHz - 1.25GHz		-34.8	-27.8	dB
		f= 1.25GHz - 2.5GHz		-25.2	-20.2	
		f= 2.5GHz - 4.0GHz		-19.5	-15.6	
		f= 5.0GHz		-18.5	-14.8	
DDNEXT	Near End Crosstalk	f= 50MHz - 1.25GHz		-48.5	-38.8	dB
		f= 1.25GHz - 2.5GHz		-43.4	-34.7	
		f= 2.5GHz - 4.0GHz		-42.7	-34.2	
		f= 5.0GHz		-42.7	-34.2	
BW	-3dB Bandwidth			6.8		GHz

Notes:

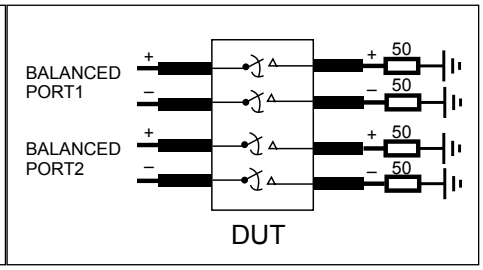
1. Guaranteed by design. Typical values are at V_{DD} = 3.3V , T_A = 25°C ambient and maximum loading.



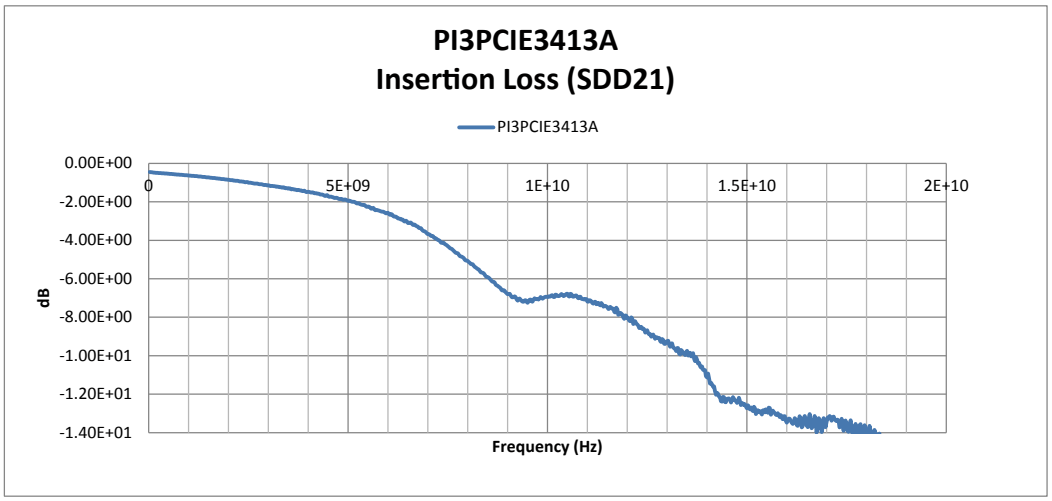
Diff. Insertion Loss and Return Test Circuit



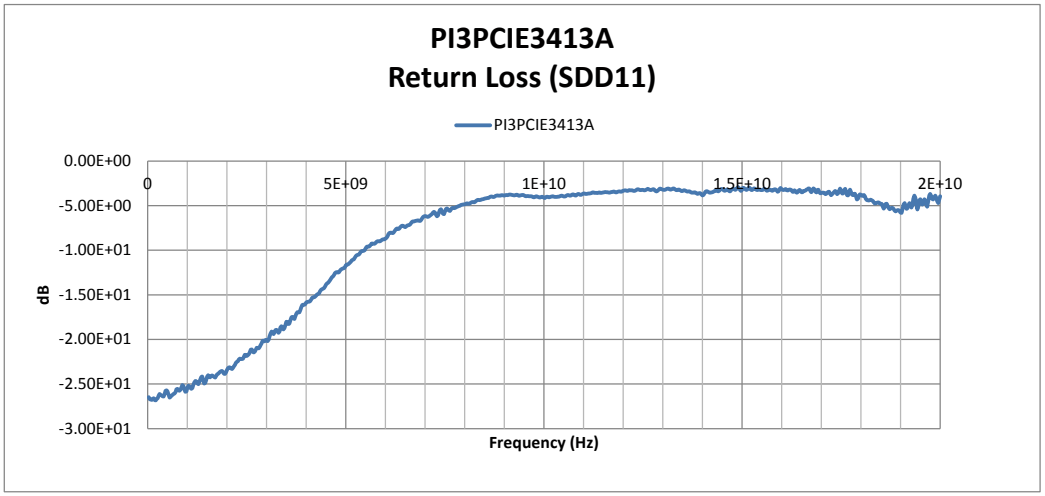
Diff. Off Isolation Test Circuit



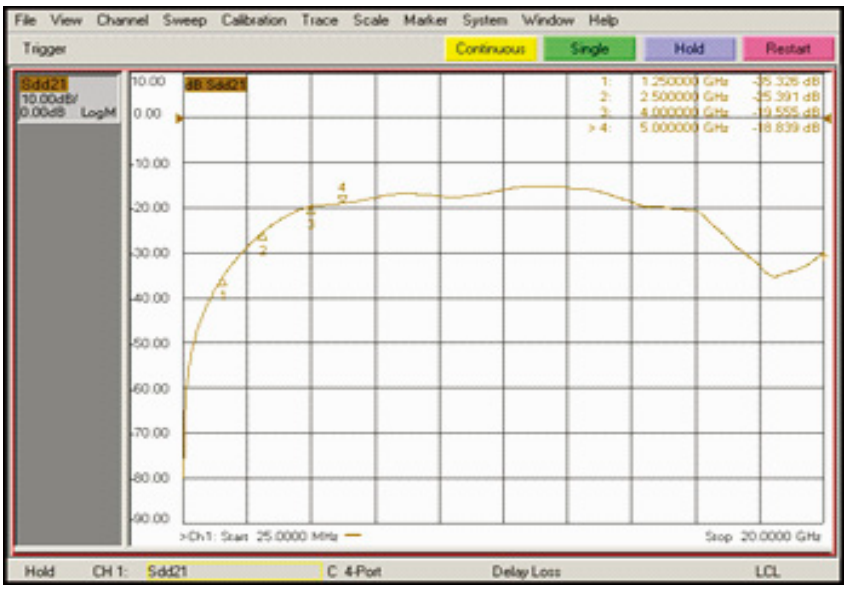
Diff. Near End Xtalk Test Circuit



Differential Insertion Loss

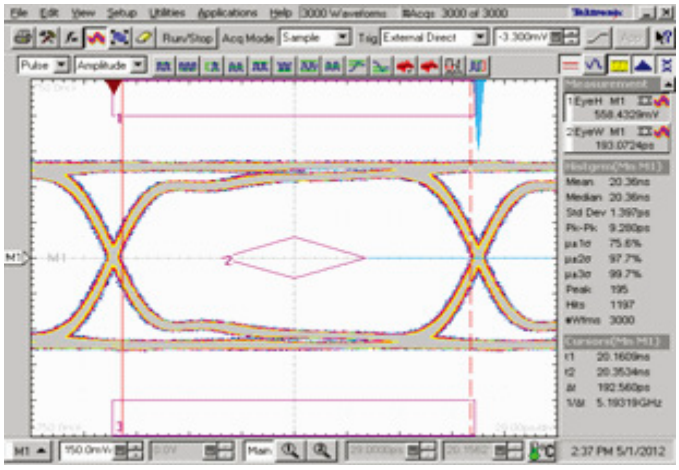


Differential Return Loss

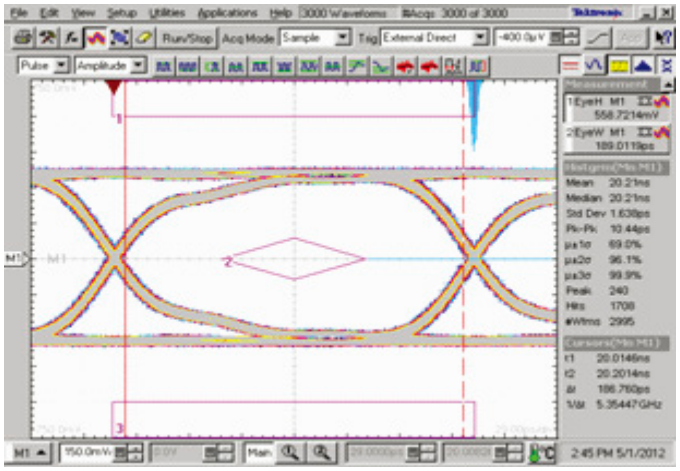


Differential Off Isolation

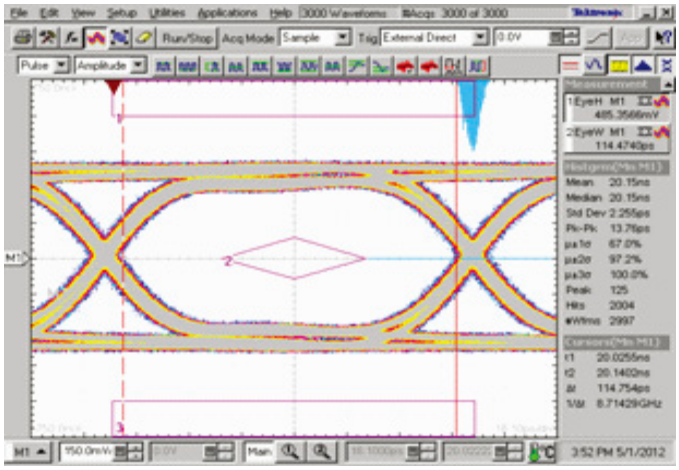
Differential Crosstalk



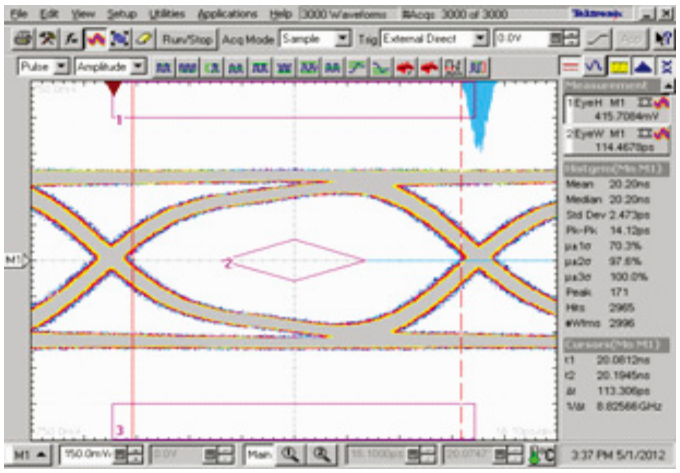
5.0 Gbps RX signal eye without PI3PCIE3413A



5.0 Gbps RX signal eye with PI3PCIE3413A

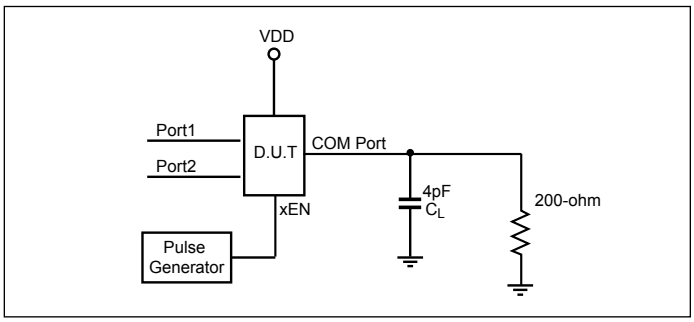


8.0 Gbps RX signal eye without PI3PCIE3413A



8.0 Gbps RX signal eye with PI3PCIE3413A

Test Circuit for Electrical Characteristics(1-5)



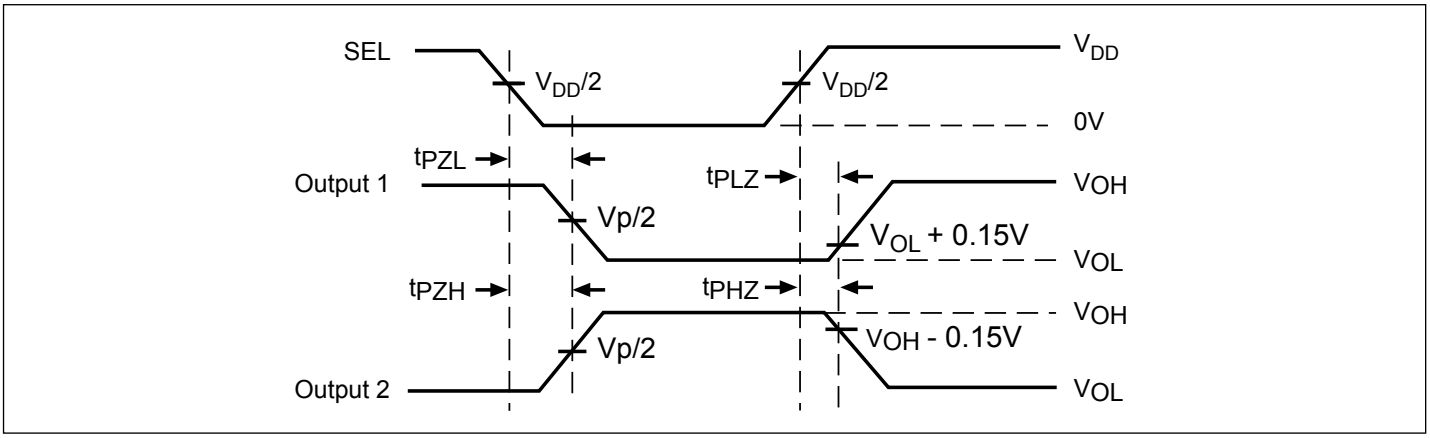
Notes:

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

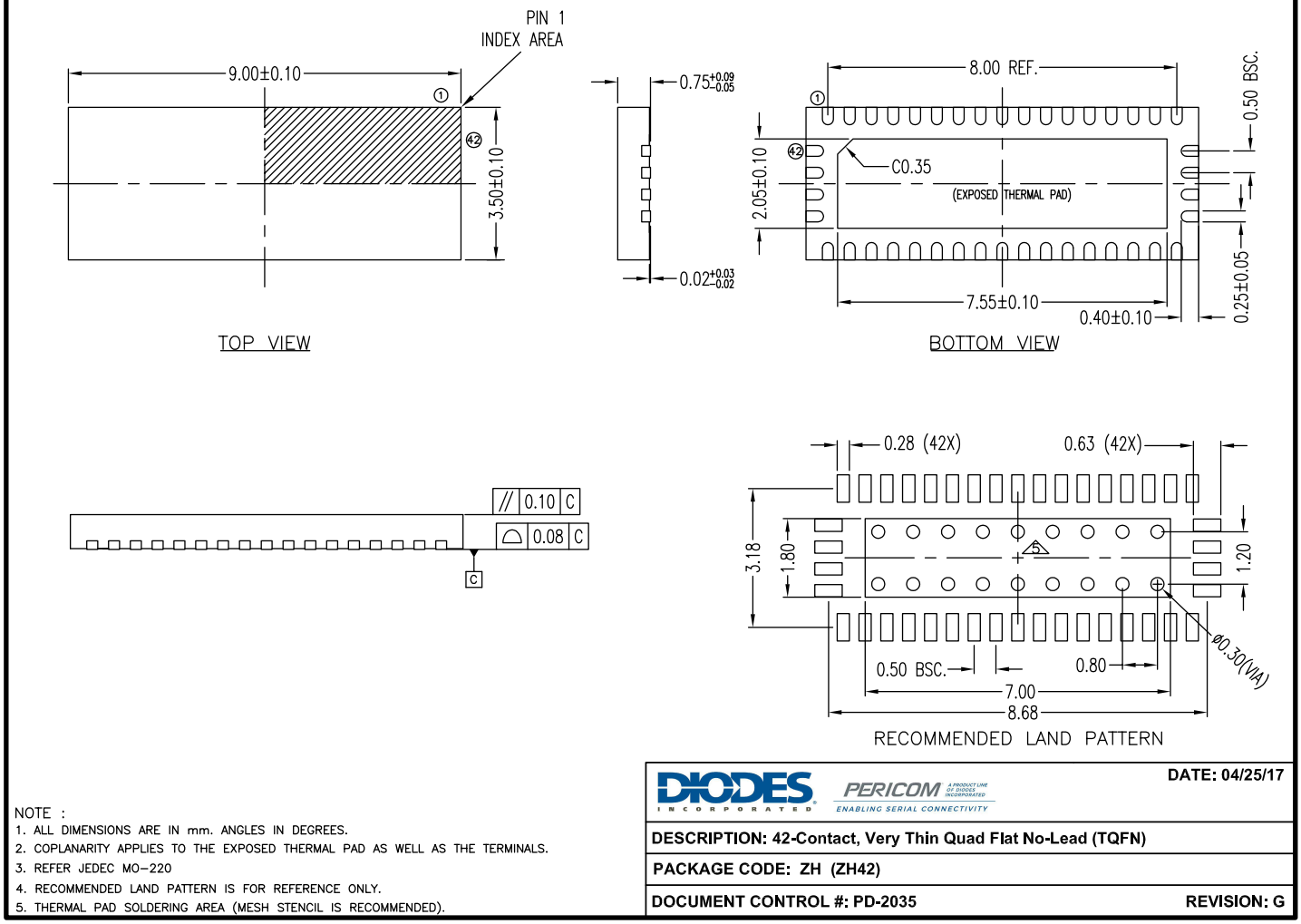
Test	Switch
t_{PLZ}, t_{PZL}	3.0V
t_{PHZ}, t_{PZH}	GND
Prop Delay	Open

Switching Waveforms



Voltage Waveforms Enable and Disable Times

Packaging Information: 42-contact (TQFN)



17-0266

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
PI3PCIE3413AZHEX	ZH	42-contact, Thin Fine Pitch Quad Flat No-Lead (TQFN)

Notes:

- Thermal characteristics can be found on the company web site at www.diodes.com/design/support/packaging/
- E = Pb-free and Green
- X suffix = Tape/Reel

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