

3.3V PCI Express® 3.0 2-Lane Exchange Switch

Features

- 8 Differential Channel (2-lane) Exchange
- PCI Express® 3.0 performance, 8.0 Gbps
- Bi-directional operation
- Low Bit-to-Bit Skew: 10ps (between ± signals)
- Low Crosstalk: -29dB @ 2.5GHz (5Gbps)
-20dB @ 4.0GHz (8Gbps)
- Low Insertion Loss: -1.1dB @ 2.5GHz (5Gbps)
-1.45dB @ 4.0GHz (8Gbps)
- V_{DD} Operating Range: 3.3V ±10%
- Industrial Temperature Range: -40°C to 85°C
- ESD Tolerance: 2kV HBM
- Packaging (Pb-free & Green):
 - 42-contact, TQFN (ZH42), 3.5x9mm.
 - 40-contact, TQFN (ZL40), 3x6mm.

Description

Diodes' PI3PCIE3442A is a differential exchange switch featuring pass-through pinout. It supports two full PCI Express® lanes operating at 8.0Gbps PCIe® 3.0 performance.

With the select control input low, Port A connects to Port B, and Port C connects to port D for an 8-channel differential pass-through. When the select control input is high Port A connects to Port D, and Port B connects to Port C.

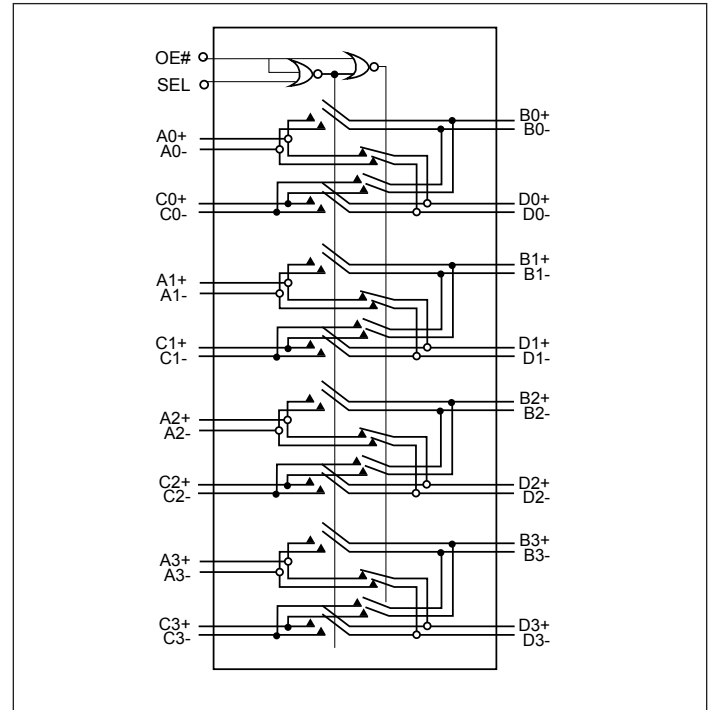
Application

Switching 4 lanes of DP1.2 from PC/Notebook/Tablet to Display monitor

Truth Table

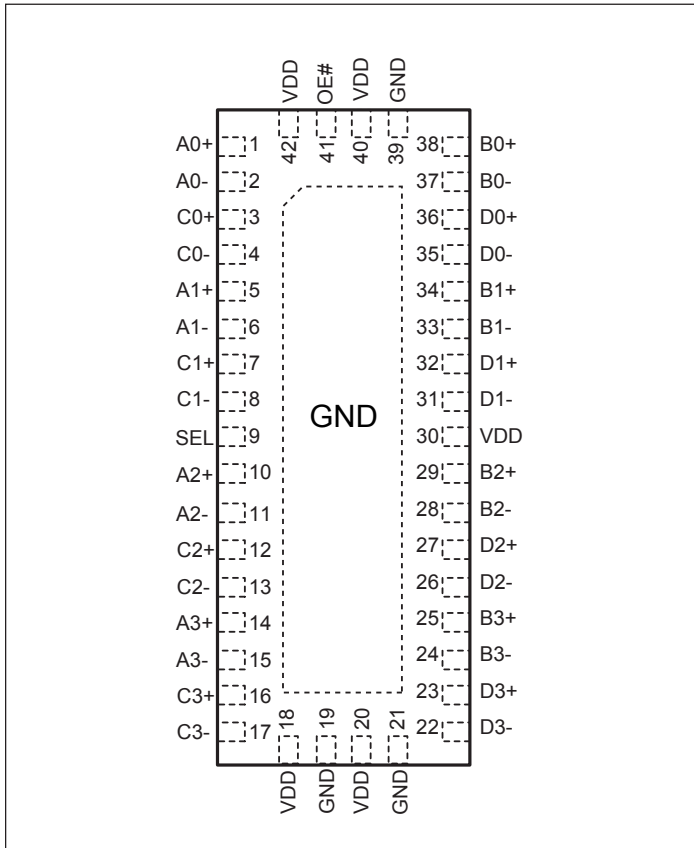
| Function | SEL | OE# |
|------------------------------------|-----|-----|
| Ax = Bx Cx = Dx | 0 | 0 |
| Ax = Dx Cx = Bx | 1 | 0 |
| Ax, Bx, Cx, Dx = Hi-Z (disconnect) | x | 1 |

Block Diagram

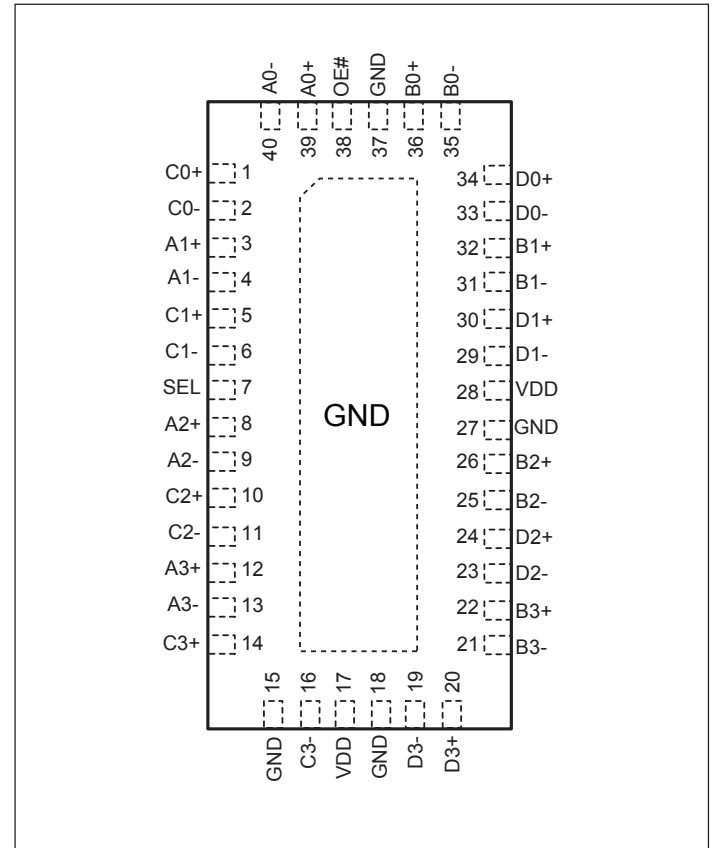


PI3PCIE3442A

Pin Diagram 42-TQFN

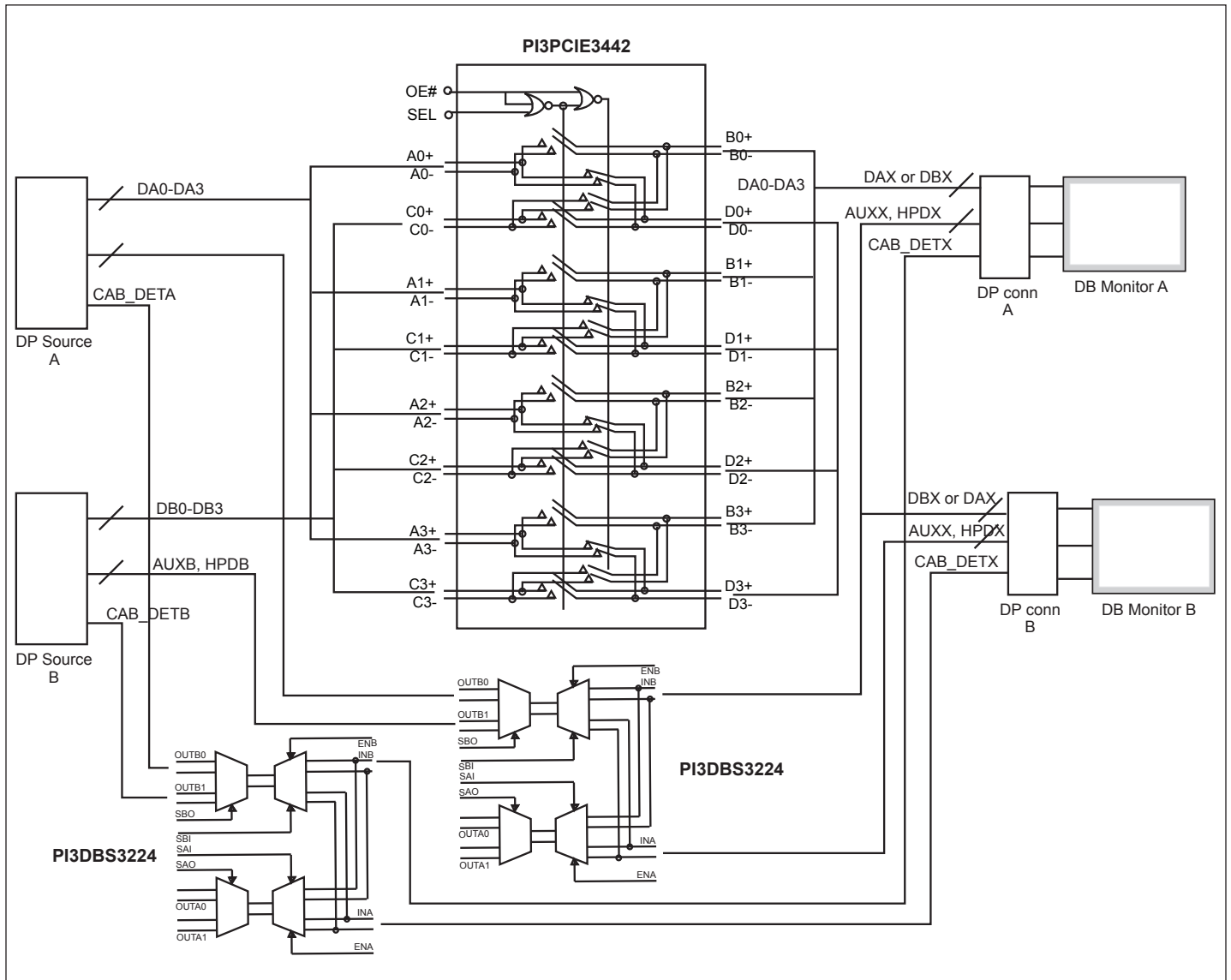


Pin Diagram 40-TQFN



PI3PCIE3442A

Application Diagram



Generic 2 x 2 DP1.2 Switching Using PI3PCIE3442A (3x6mm 40 pad QFN)

Pin Description (42-TQFN)

| Pin # | Pin Name | I/O | Description |
|------------------------|-----------------|-----|-----------------------------------------------------------------------------------------------------------|
| 1 | A0+ | I/O | Signal I/O, Channel 0, Port A |
| 2 | A0- | | |
| 5 | A1+ | I/O | Signal I/O, Channel 1, Port A |
| 6 | A1- | | |
| 10 | A2+ | I/O | Signal I/O, Channel 2, Port A |
| 11 | A2- | | |
| 14 | A3+ | I/O | Signal I/O, Channel 3, Port A |
| 15 | A3- | | |
| 38 | B0+ | I/O | Signal I/O, Channel 0, Port B |
| 37 | B0- | | |
| 34 | B1+ | I/O | Signal I/O, Channel 1, Port B |
| 33 | B1- | | |
| 29 | B2+ | I/O | Signal I/O, Channel 2, Port B |
| 28 | B2- | | |
| 25 | B3+ | I/O | Signal I/O, Channel 3, Port B |
| 24 | B3- | | |
| 3 | C0+ | I/O | Signal I/O, Channel 0, Port C |
| 4 | C0- | | |
| 7 | C1+ | I/O | Signal I/O, Channel 1, Port C |
| 8 | C1- | | |
| 12 | C2+ | I/O | Signal I/O, Channel 2, Port C |
| 13 | C2- | | |
| 16 | C3+ | I/O | Signal I/O, Channel 3, Port C |
| 17 | C3- | | |
| 36 | D0+ | I/O | Signal I/O, Channel 0, Port D |
| 35 | D0- | | |
| 32 | D1+ | I/O | Signal I/O, Channel 1, Port D |
| 31 | D1- | | |
| 27 | D2+ | I/O | Signal I/O, Channel 2, Port D |
| 26 | D2- | | |
| 23 | D3+ | I/O | Signal I/O, Channel 3, Port D |
| 22 | D3- | | |
| 41 | OE# | I | Output Enable, active low. When OE# = 0 the device I/O is enabled. When OE#=1, all I/O are high impedance |
| 9 | SEL | I | Operation mode Select (when SEL=0: A→B, C→D, when SEL=1: A→D, C→B) |
| 18, 20, 30, 40, 42 | V _{DD} | Pwr | 3.3V ±10% Positive Supply Voltage |
| 19, 21, 39, Center Pad | GND | Pwr | Power ground |

Pin Description (40-TQFN)

| Pin # | Pin Name | I/O | Description |
|----------------------------|-----------------|-----|-----------------------------------------------------------------------------------------------------------|
| 39 | A0+ | I/O | Signal I/O, Channel 0, Port A |
| 40 | A0- | | |
| 3 | A1+ | I/O | Signal I/O, Channel 1, Port A |
| 4 | A1- | | |
| 8 | A2+ | I/O | Signal I/O, Channel 2, Port A |
| 9 | A2- | | |
| 12 | A3+ | I/O | Signal I/O, Channel 3, Port A |
| 13 | A3- | | |
| 36 | B0+ | I/O | Signal I/O, Channel 0, Port B |
| 35 | B0- | | |
| 32 | B1+ | I/O | Signal I/O, Channel 1, Port B |
| 31 | B1- | | |
| 26 | B2+ | I/O | Signal I/O, Channel 2, Port B |
| 25 | B2- | | |
| 22 | B3+ | I/O | Signal I/O, Channel 3, Port B |
| 21 | B3- | | |
| 1 | C0+ | I/O | Signal I/O, Channel 0, Port C |
| 2 | C0- | | |
| 5 | C1+ | I/O | Signal I/O, Channel 1, Port C |
| 6 | C1- | | |
| 10 | C2+ | I/O | Signal I/O, Channel 2, Port C |
| 11 | C2- | | |
| 14 | C3+ | I/O | Signal I/O, Channel 3, Port C |
| 16 | C3- | | |
| 34 | D0+ | I/O | Signal I/O, Channel 0, Port D |
| 33 | D0- | | |
| 30 | D1+ | I/O | Signal I/O, Channel 1, Port D |
| 29 | D1- | | |
| 24 | D2+ | I/O | Signal I/O, Channel 2, Port D |
| 23 | D2- | | |
| 20 | D3+ | I/O | Signal I/O, Channel 3, Port D |
| 19 | D3- | | |
| 38 | OE# | I | Output Enable, active low. When OE# = 0 the device I/O is enabled. When OE#=1, all I/O are high impedance |
| 7 | SEL | I | Operation mode Select (when SEL=0: A→B, C→D, when SEL=1: A→D, C→B) |
| 17, 28 | V _{DD} | Pwr | 3.3V ±10% Positive Supply Voltage |
| 15, 18, 27, 37, 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 |
| DC Input Voltage | -0.5V to V _{DD} |
| DC Output Current | 120mA |
| Power Dissipation | 0.5W |
| 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 | SEL and OE# at OV or V _{DD} | | | 300 | μA |
| 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} | Input HIGH Voltage | Guaranteed HIGH level | 0.65 x V _{DD} | | | V |
| V _{IL} | Input LOW Voltage | Guaranteed LOW level | -0.5 | | 0.35 x V _{DD} | |
| 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} | -10 | | +10 | μA |
| I _{IL} | Input LOW Current, SEL | V _{DD} = Max., V _{IN} = GND | -10 | | +10 | |
| I _{IH} | Input HIGH Current, A _X , B _X , C _X , D _X | V _{DD} = Max., V _{IN} = 1.8V | -10 | | +10 | μA |
| I _{IL} | Input LOW Current, A _X , B _X , C _X , D _X | V _{DD} = Max., V _{IN} = 0V | -10 | | +10 | |

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 | | 45 | ns |
| t _{PHZ} , t _{PLZ} | Line Disable Time - SEL to A _N , B _N , C _N , D _N | | 0.5 | | 25 | |
| t _{b-b} | Bit-to-bit skew within the same differential pair | | | | 10 | ps |
| t _{ch-ch} | Channel-to-channel skew | | | | 20 | |

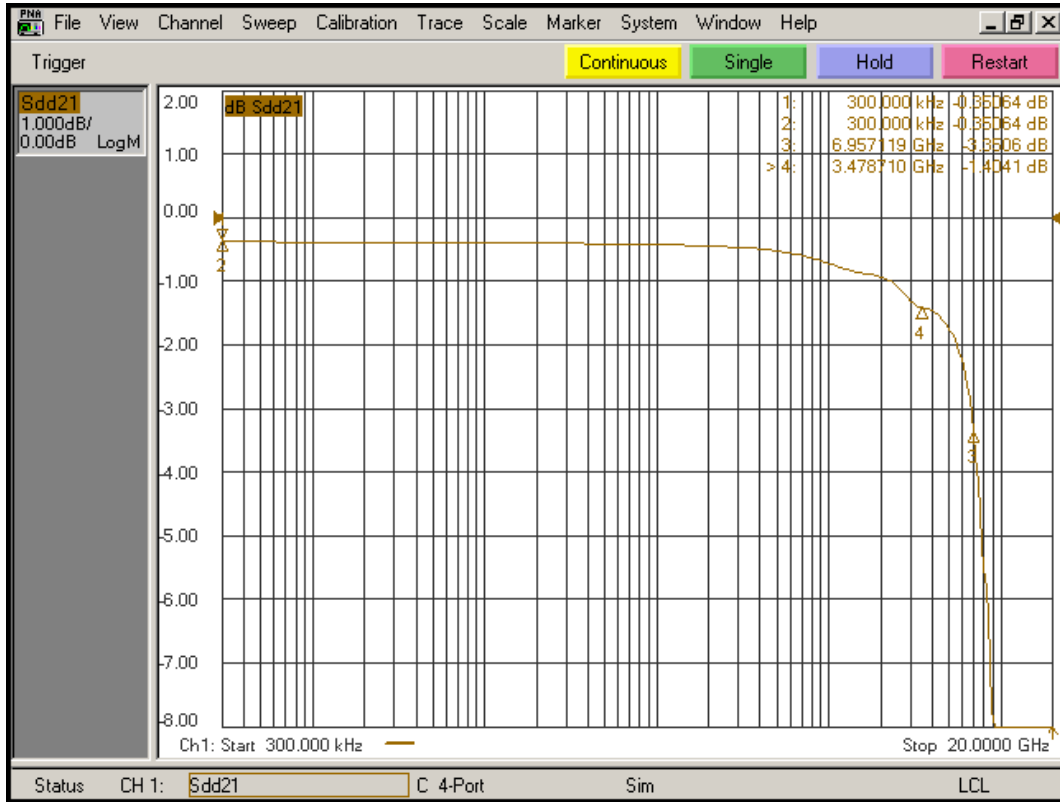
Dynamic Electrical Characteristics

| Parameter | Description | Test Conditions | Min. | Typ. ⁽¹⁾ | Max. | Units |
|---------------------|----------------------------------------------------------------------|-------------------------------------------------------------|------|--------------------------------------|--------------------------------------|-------|
| DDIL | Differential Insertion Loss ($V_{IN} = -10\text{dBm}$, DC = 0V) | f=1.2GHz f=2.5GHz f=4.0GHz f=5.0GHz f=7.5GHz | | -0.8 -1.0 -1.3 -1.8 -4.5 | -1.0 -1.2 -1.9 -2.6 -5.6 | dB |
| DDIL _{OFF} | Differential Off Isolation | f= 4.0GHz | | -19 | | dB |
| DDRL | Differential Return Loss | f= 0 to 2.8GHz f= 2.8 to 5.0GHz f= 5.0 to 8.0GHz | | -26 -14 -7.5 | | dB |
| DDNEXT | Near End Crosstalk | f= 0 to 2.8GHz f= 2.8 to 5.0GHz f= 5.0 to 8.0GHz | | -26 -20 -16 | | dB |
| V _{IF} | Max Signal Frequency Range | Insertion loss 1.5dB, $V_{IN}=0.623\text{Vpp}$, DC=0V | | 4.0 | | GHz |
| | | Insertion loss 1.5dB, $V_{IN}=0.623\text{Vpp}$, DC=0.9V | | 4.0 | | |
| | | Insertion loss 3dB, $V_{IN}=0.623\text{Vpp}$, DC=0V | | 8.0 | | |
| | | Insertion loss 3dB, $V_{IN}=0.623\text{Vpp}$, DC=0.9V | | 8.0 | | |
| BW | -3dB Bandwidth | | | 6.5 | | GHz |

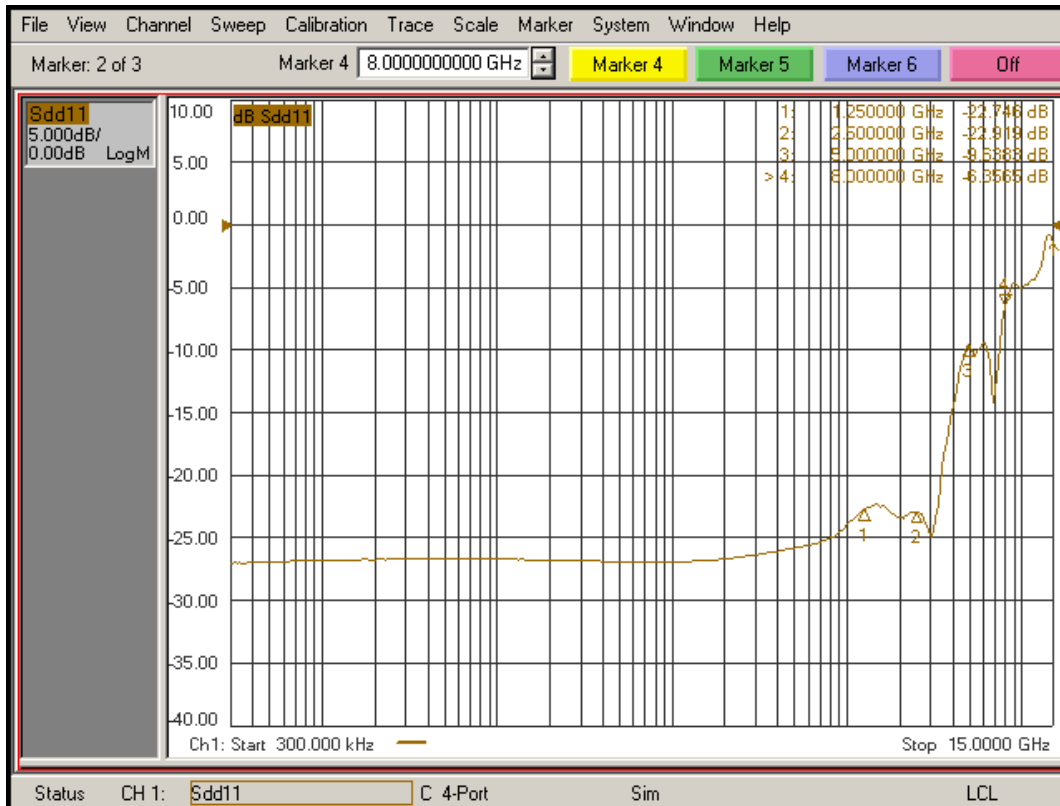
Notes:

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

PI3PCIE3442A

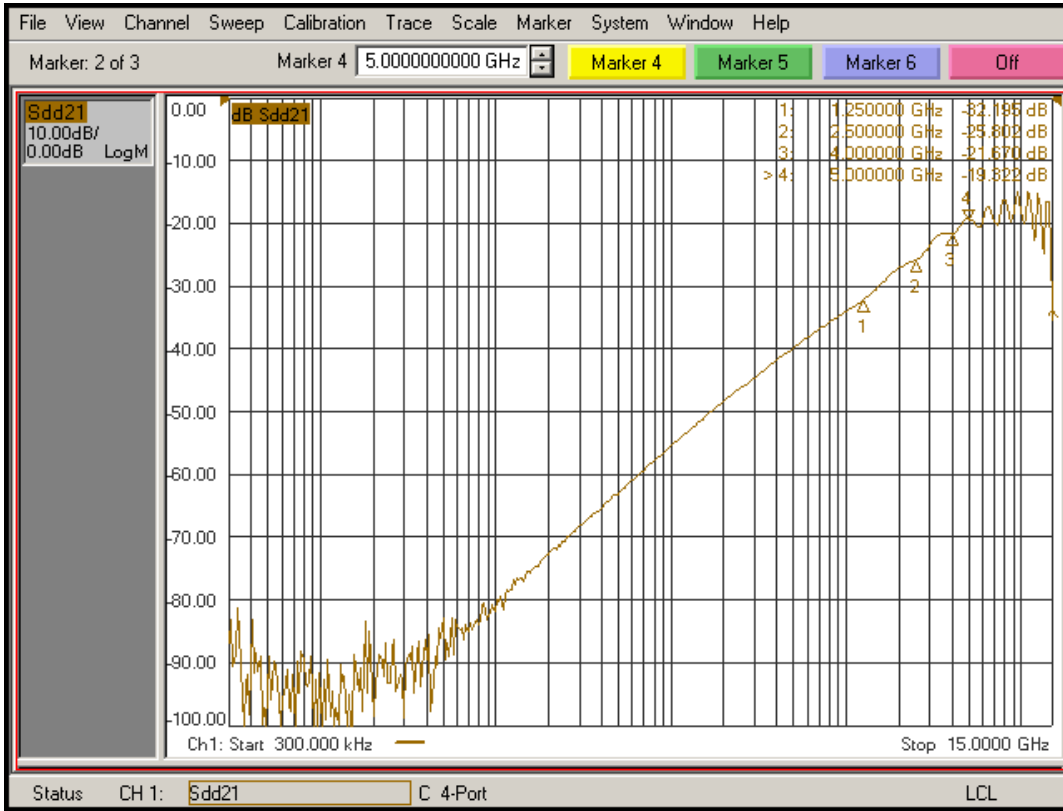


Differential Insertion Loss

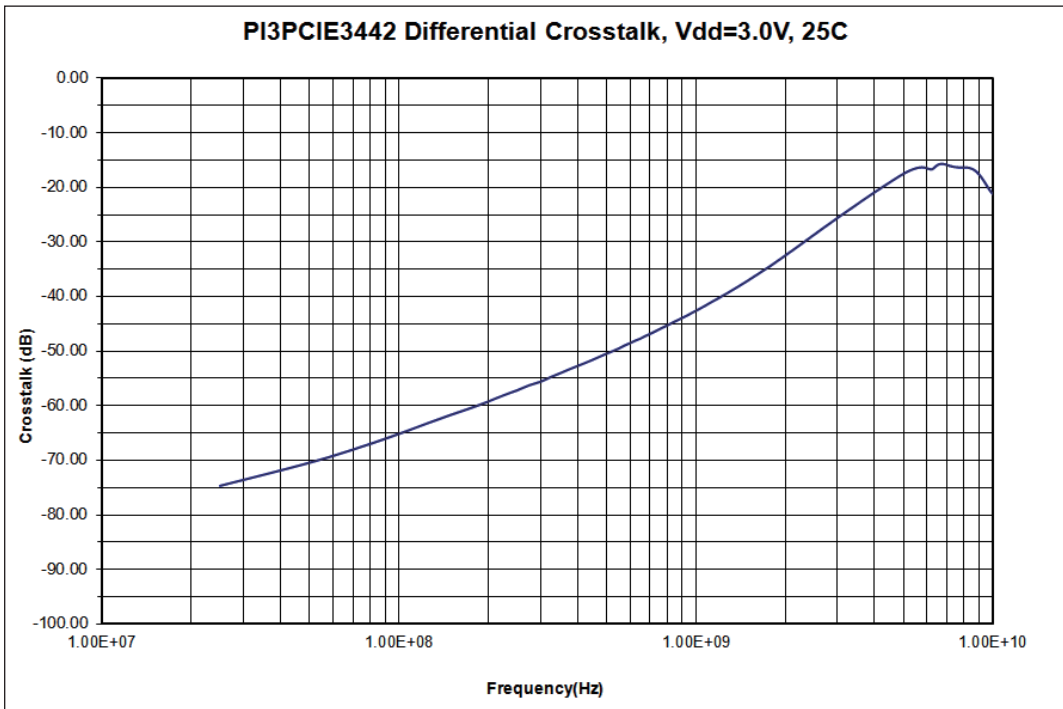


Differential Return Loss

PI3PCIE3442A

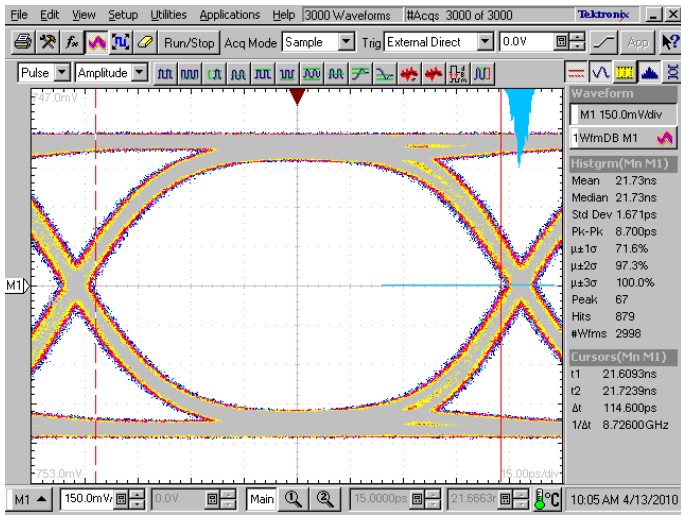


Differential Off Isolation

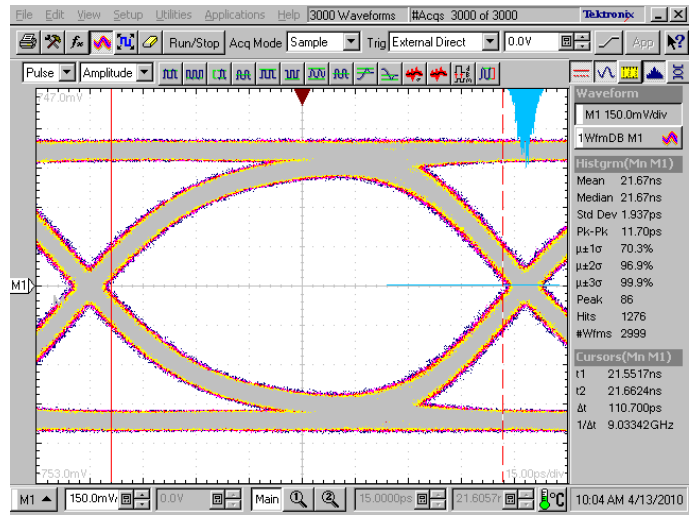


Differential Crosstalk

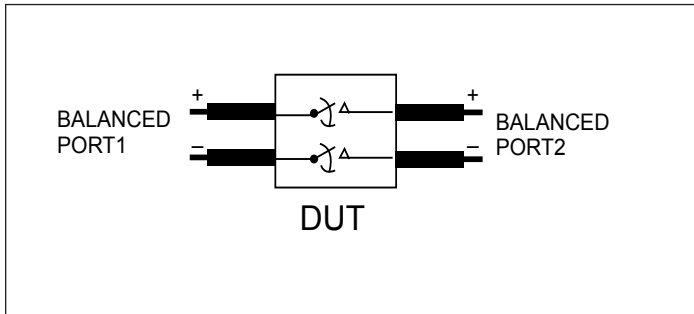
PI3PCIE3442A



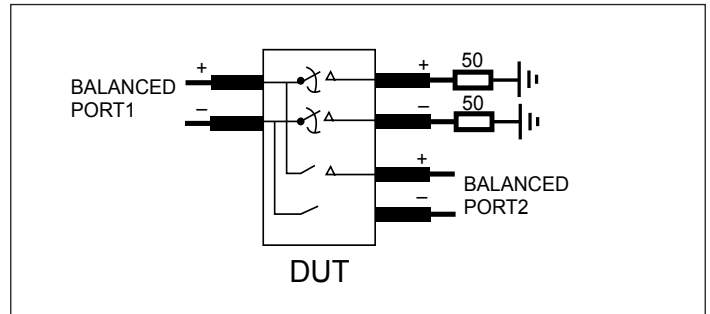
8.0 Gbps RX signal eye without PI3PCIE3442A



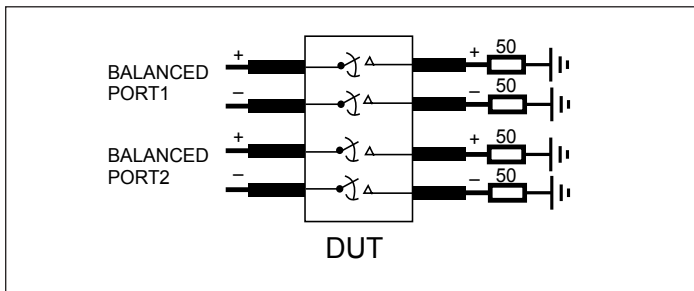
8.0 Gbps RX signal eye with PI3PCIE3442A



Differential Insertion Loss and Return Test Circuit

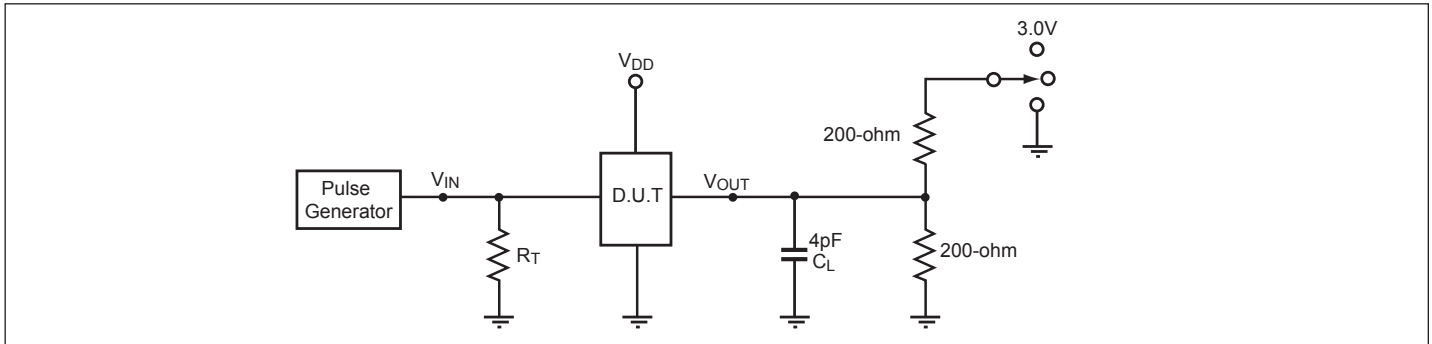


Differential Off Isolation Test Circuit



Differential Near End Xtalk Test Circuit

Test Circuit for Electrical Characteristics(1-5)



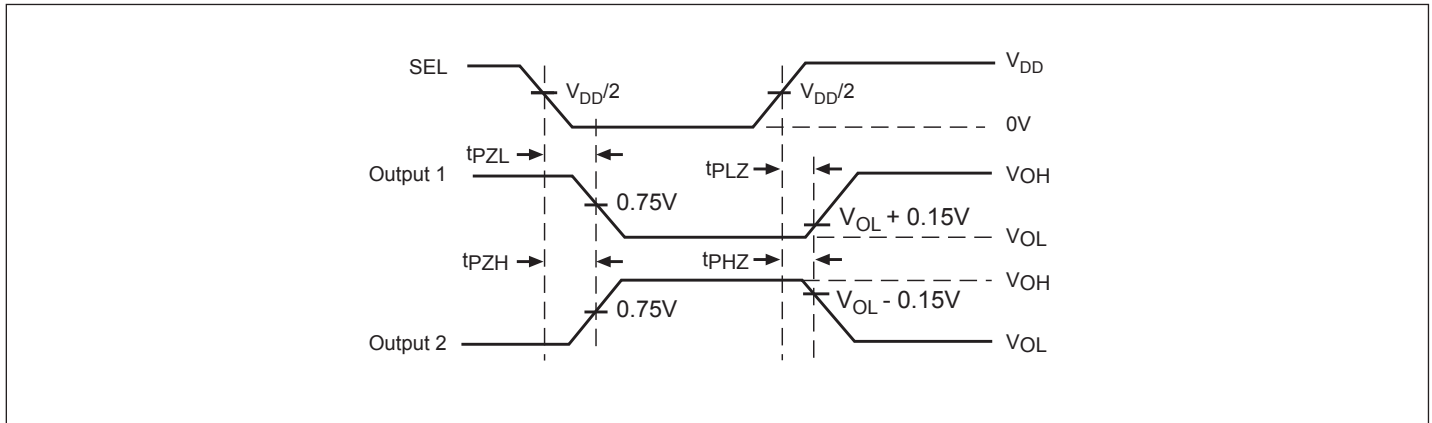
Notes:

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: $PRR \leq \text{MHz}$, $Z_O = 50\Omega$, $t_R \leq 2.5\text{ns}$, $t_F \leq 2.5\text{ns}$.
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

PI3PCIE3442A

Part Marking Information

ZH Package

PI3PCIE
3442AZHE
○ YYWWXX

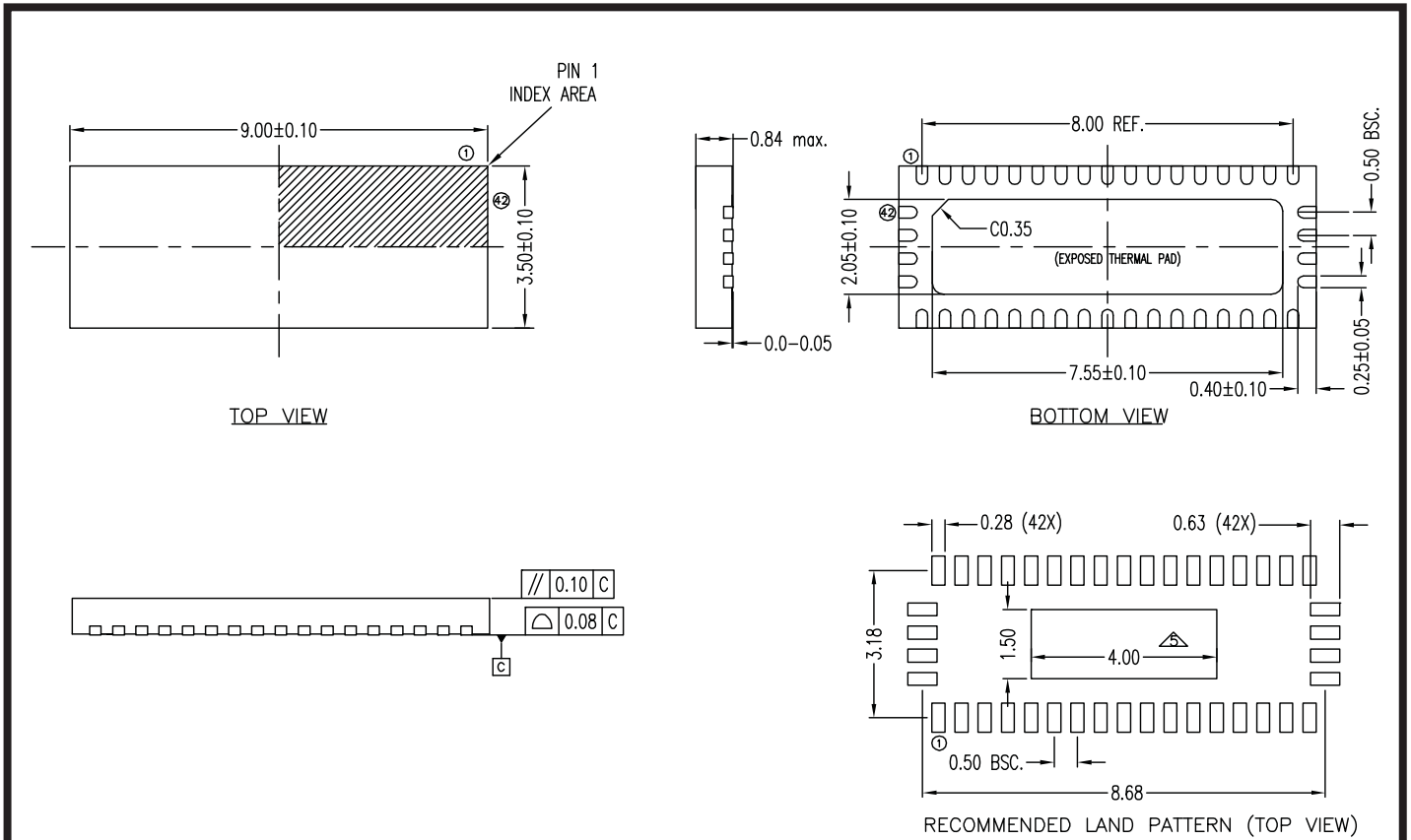
YY : Year
WW : Workweek
1st X: Assembly Code
2nd X: Fab Code

ZL Package

PI3PCIE
3442AZLE
○ YYWWXX

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

Packaging Mechanical: 42-Contact TQFN (3.5x9mm)



Notes:

- All dimensions are in millimeters, angles in degrees.
- Coplanarity applies to the exposed thermal pad as well as the terminals.
- Refer JEDEC MO-220
- Recommended Land Pattern is for reference only.
- Thermal Pad Soldering Area



DATE: 02/17/09

DESCRIPTION: 42-contact Thin Fine Pitch Quad Flat No-Lead (TQFN)

PACKAGE CODE: ZH (ZH42)

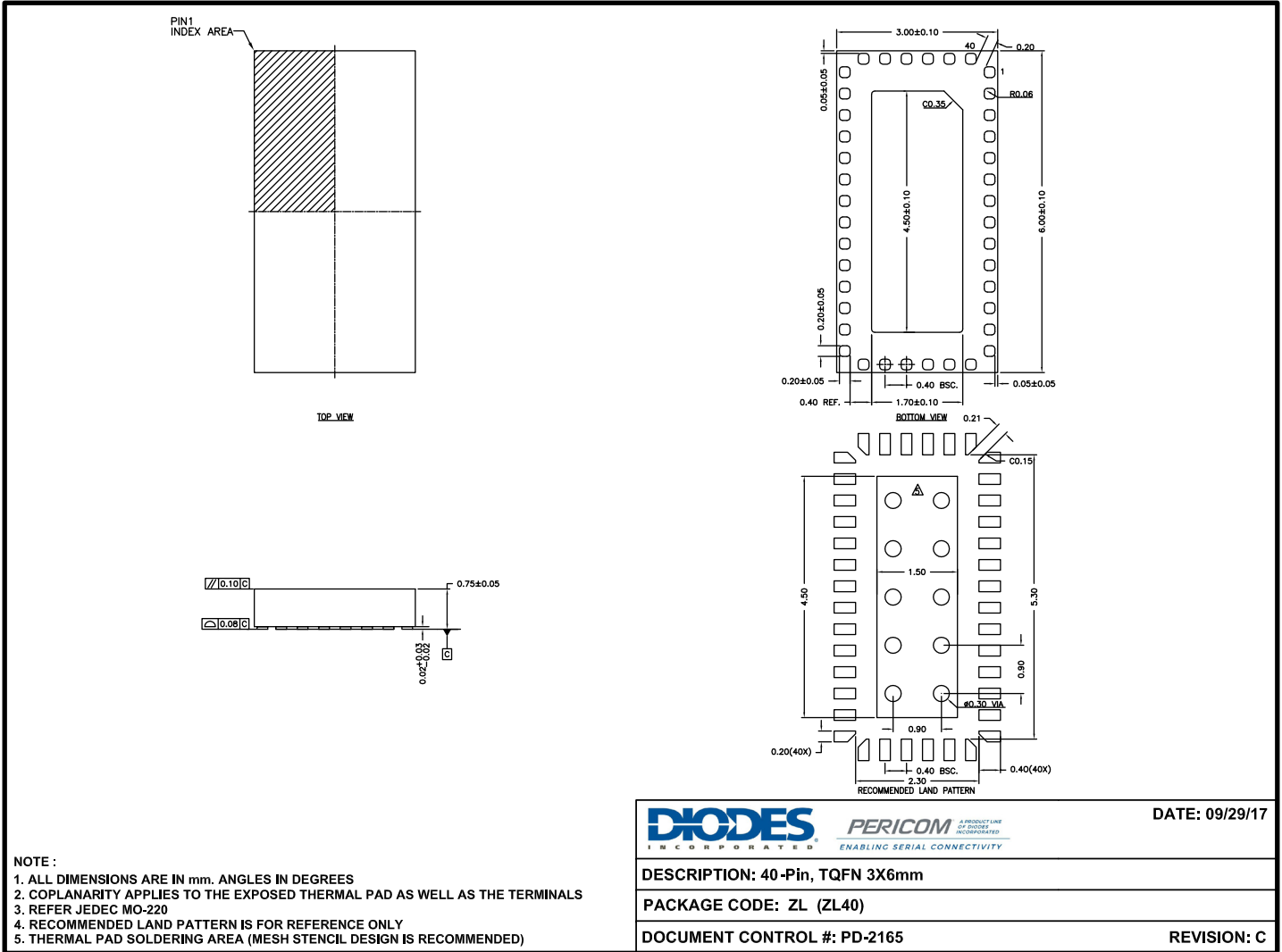
DOCUMENT CONTROL #: PD-2035

REVISION: C

09-0116

PI3PCIE3442A

Packaging Mechanical: 40-Contact TQFN (3x6mm)



17-0681

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 |
|------------------|--------------|------------------------------------------------------|
| PI3PCIE3442AZHEX | ZH | 42-contact, Thin Fine Pitch Quad Flat No-Lead (TQFN) |
| PI3PCIE3442AZLEX | ZL | 40-contact, 3 x 6mm (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