

PI3WVR12412

HDMI 2.0, DisplayPort 1.2 Video Switch

Features

- 4-lane, 1:2 mux/demux that will support RBR, HBR1, or HBR2
- Data rate: 3.4 Gbps to 6.0 Gbps for high data channels
- Supports DDC with HPD channel mux/demux @ HDMI
- Supports 720 Mbps high-speed DP AUX @ DP
- -1.7 dB Insertion Loss for Dx channels @ 3.0 GHz
- -3 dB Bandwidth for Dx channels: 4.8 GHz
- Return loss for Dx channels @ 3.0 GHz: -16 dB
- Low Crosstalk for high speed channels: -25 dB@6.0 Gbps
- Low Off Isolation for high speed channels: -22dB@6.0 Gbps
- Low channel-to-channel skew, 35ps max
- Low Bit-to-Bit Skew, 5ps typ (between '+' and '-' bits)
- V_{DD} Operating Range: 3.3V +/-10%
- ESD Tolerance: 2kV HBM
- Packaging (Pb-free & Green): 42 TQFN (ZHE)

Description

The PI3WVR12412 is a multi-standard video switch with wide voltage range capability. It supports HDMI 2.0, DisplayPort 1.2, and emerging and proprietary standard.

PI3WVR12412 can pass high-speed signals up to 1.2 V peak-to-peak differential with a common-mode voltage from 0 to 3.4V for TMDS signal.

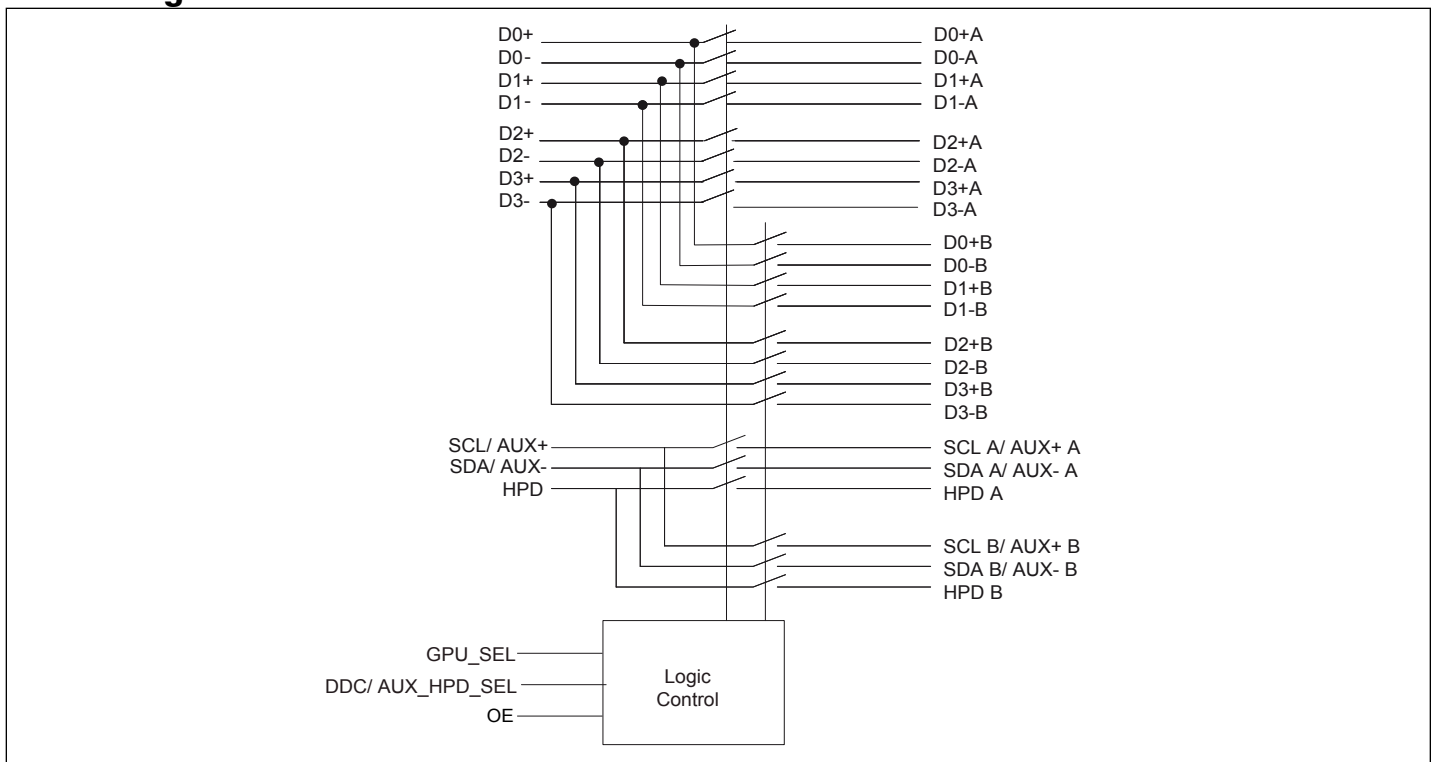
The wide voltage range allow DC-coupled multi-standard operation. Eliminating AC coupling capacitors saves board space and improves signal integrity for dense PCB design. The high speed channels can also pass 0V-3.3V CMOS signals up to 1MHz.

In addition to four high-speed lanes, PI3WVR12412 also switches the DDC and HPD signals or AUX and HPD signals using the DDC/ AUX and HPD channel mux/demux.

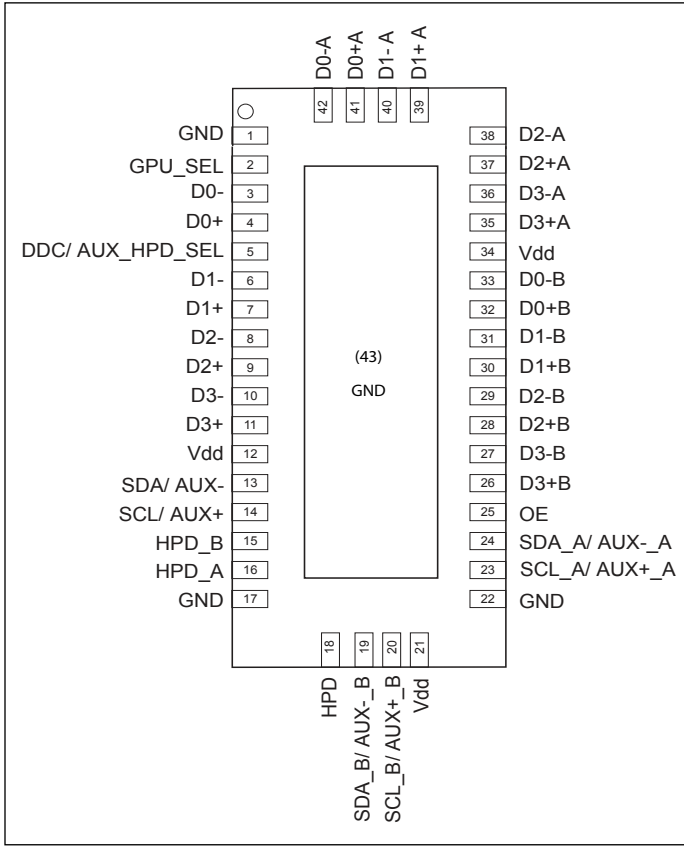
Application

- Routing of HDMI 2.0 video signals with low signal attenuation between source and sink for 4K2K ultra high definition video display and broadcast video equipment.
- Routing of DisplayPort video signals with low signal attenuation between source and sink for PC and monitor.

Block Diagram



Pin Assignment (TQFN-42, ZH)



Truth Table

| Control | | | Switch Function | | |
|---------|---------|------------------|-----------------|--------------|-------|
| OE | GPU_SEL | DDC/ AUX_HPD_SEL | D0-D3 | DDC/ AUX | HPD |
| High | Low | Low | A | DDC A/ AUX A | HPD A |
| High | Low | High | A | DDC B/ AUX B | HPD B |
| High | High | Low | B | DDC A/AUX A | HPD A |
| High | High | High | B | DDC B/ AUX B | HPD B |
| Low | x | x | Hi-Z | Hi-Z | Hi-Z |

Pin Description

| Pin# | Pin Name | Signal Type | Description |
|------|------------------|-------------|---|
| 1 | GND | Ground | Ground |
| 2 | GPU_SEL | I | switch logic control |
| 3 | D0- | I/O | negative differential signal 0 for COM port |
| 4 | D0+ | I/O | positive differential signal 0 for COM port |
| 5 | DDC/ AUX_HPD_SEL | I | Switch logic control for DDC/ AUX and HPD |
| 6 | D1- | I/O | negative differential signal 1 for COM port |
| 7 | D1+ | I/O | positive differential signal 1 for COM port |
| 8 | D2- | I/O | negative differential signal 2 for COM port |
| 9 | D2+ | I/O | positive differential signal 2 for COM port |
| 10 | D3- | I/O | negative differential signal 3 for COM port |
| 11 | D3+ | I/O | positive differential signal 3 for COM port |
| 12 | VDD | Power | 3.3V +/-10% power supply |
| 13 | SDA/ AUX- | I/O | SDA signal for DDC COM port, or negative differential signal for AUX COM port |
| 14 | SCL/ AUX+ | I/O | SCL signal for DDC COM port, or positive differential signal for AUX COM port |
| 15 | HPD_B | I/O | HPD for port B |
| 16 | HPD_A | I/O | HPD for port A |
| 17 | GND | Ground | Ground |
| 18 | HPD | I/O | HPD for COM port |
| 19 | SDA_B/ AUX-_B | I/O | SDA signal for DDC, port B, or negative differential signal for AUX COM port |
| 20 | SCL_B/ AUX+_B | I/O | SCL signal for DDC, port B, or positive differential signal for AUX COM port |
| 21 | VDD | Power | 3.3V +/-10% power supply |
| 22 | GND | Ground | Ground |
| 23 | SCL_A/ AUX+_A | I/O | SCL signal for DDC, port A, or positive differential signal for AUX COM port |
| 24 | SDA_A/ AUX-_A | I/O | SDA signal for DDC, port A, or negative differential signal for AUX COM port |
| 25 | OE | I | output enable. if OE is high, IC is enabled. if OE is low, IC is power down and all I/Os are Hi-Z |
| 26 | D3+B | I/O | positive differential signal 3 for portB |
| 27 | D3-B | I/O | negative differential signal 3 for portB |
| 28 | D2+B | I/O | positive differential signal 2 for portB |
| 29 | D2-B | I/O | negative differential signal 2 for portB |
| 30 | D1+B | I/O | positive differential signal 1 for portB |
| 31 | D1-B | I/O | negative differential signal 1 for portB |

PI3WVR12412

| Pin# | Pin Name | Signal Type | Description |
|------|------------|-------------|---|
| 32 | D0+B | I/O | positive differential signal 0 for portB |
| 33 | D0-B | I/O | negative differential signal 0 for portB |
| 34 | VDD | Power | 3.3V +/-10% power supply |
| 35 | D3+A | I/O | positive differential signal 3 for port A |
| 36 | D3-A | I/O | negative differential signal 3 for port A |
| 37 | D2+A | I/O | positive differential signal 2 for port A |
| 38 | D2-A | I/O | negative differential signal 2 for port A |
| 39 | D1+A | I/O | positive differential signal 1 for port A |
| 40 | D1-A | I/O | negative differential signal 1 for port A |
| 41 | D0+A | I/O | positive differential signal 0 for port A |
| 42 | D0-A | I/O | negative differential signal 0 for port A |
| 43 | Center pad | Ground | Ground |

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 +4.2V |
| High Speed Data Channel | -0.5V to 3.8V |
| HPD_x, SDA_x, SCL_x | -0.5V to 5.5V |
| DC Input Voltage | -0.5V to V _{DD} |
| 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.

DC Electrical Characteristics for Switching over Operating Range

(T_A = -40°C to +105°C, V_{DD} = 3.3V ±10%)

| Parameter | Description | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽²⁾ | Max. | Units |
|--------------------------|---|--|------|---------------------|------|-------|
| V _{IH} | Input HIGH Voltage (SEL & OE) | Guaranteed HIGH level | 1.5 | | | V |
| V _{IL} | Input LOW Voltage (SEL & OE) | Guaranteed LOW level | | | 0.75 | |
| V _{IK} | Clamp Diode Voltage (HS Channel) | V _{DD} = Max., I _{IN} = -18mA | | -1.6V | -1.8 | |
| V _{IK} | Clamp Diode Voltage (DDC/ AUX, Cntrl) | V _{DD} = Max., I _{IN} = -18mA | | -0.7 | -1.5 | μA |
| I _{IH} | Input HIGH Current | V _{DD} = Max., V _{IN} = V _{DD} | | | ±5 | |
| I _{IL} | Input LOW Current | V _{DD} = Max., V _{IN} = GND | | | ±5 | |
| I _{OFF_SB} | I/O leakage when part is off for side-band signals only (DDC/ AUX, HPD) | V _{DD} = 0V, V _{INPUT} = 0V to 3.6V | | | 20 | |
| R _{ON_HS} | On resistance between input to output for high speed signals | V _{INPUT,cm} = 0V to 3.4V, V _{INPUT,diff} < 1.2V _{p-p,diff} V _{DD} = 3.0V, I _{INPUT} = 20mA | | 11 | | Ohm |
| R _{ON_DDC/ AUX} | On resistance between input to output for side-band signals (DDC/ AUX) | V _{DD} = 3.0V, V _{input} = 0 to 3.3V, I _{INPUT} = 20mA | | 7 | | Ohm |
| R _{ON_HPDP} | On resistance between input to output for HPD channel | V _{DD} = 3.0V, V _{input} = 0 to 3.0V, I _{INPUT} = 20mA | | 7 | | Ohm |
| V _{DDC/ AUX_SS} | Signal Swing Tolerance in DDC/ AUX path | V _{DD} = 3.0V | -0.5 | | 5.5 | V |
| V _{HPD_I} | Input voltage on HPD path | | | | 5.5 | V |
| V _{HPD_O} | Output voltage tolerance on HPD path | HPD input from 3.3V to 5.25V | | 3.3 | 3.6 | V |

Power Supply Characteristics

($T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$)

| Parameter | Description | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽²⁾ | Max. | Units |
|--------------|--------------------------------|---|------|---------------------|------|---------------|
| I_{DD} | Power Supply Current | $V_{DD} = 3.3\text{V}$, $V_{IN} = \text{GND}$ or V_{DD} | | 1 | 3 | mA |
| $I_{DD,Off}$ | Power Supply Current, Disabled | $V_{DD} = 3.3\text{V}$, $V_{IN} = \text{GND}$ or V_{DD} , $V_{OE} < V_{IL}$ | | 1 | 50 | μA |

Note:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{DD} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$ ambient and maximum loading.

Dynamic Electrical Characteristics over Operating Range

($T_A = -40^\circ$ to $+105^\circ\text{C}$, $V_{DD} = 3.3\text{V} \pm 10\%$)

| Parameter | Description | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽²⁾ | Max. | Units | |
|--------------------|---|----------------------------------|-----------------------|---------------------|-------|-------|----|
| X_{TALK} | Crosstalk on High Speed Channels | See Fig. 1 for Measurement Setup | $f = 3.0\text{ GHz}$ | | -25 | -22 | dB |
| | | | $f = 2.7\text{ GHz}$ | | -28 | -25 | |
| | | | $f = 1.7\text{ GHz}$ | | -31 | -28 | |
| | | | $f = 1.35\text{ GHz}$ | | -32 | -28 | |
| O_{IRR} | OFF Isolation on High Speed Channels | See Fig. 2 for Measurement Setup | $f = 3.0\text{ GHz}$ | | -22 | -20 | dB |
| | | | $f = 2.7\text{ GHz}$ | | -22 | -20 | |
| | | | $f = 1.7\text{ GHz}$ | | -29 | -26 | |
| | | | $f = 1.35\text{ GHz}$ | | -30 | -27 | |
| I_{LOSS} | Differential Insertion Loss on High Speed Channels | @3.0 GHz (see figure 3) | -2.0 | -1.7 | | dB | |
| | | @5.4 Gbps (see figure 3) | -2.0 | -1.7 | | | |
| R_{loss} | Differential Return Loss on high speed channels | @ 3.0 GHz (6.0Gbps) | | -16.0 | -14 | dB | |
| | | @ 2.7 GHz (5.4Gbps) | | -14.0 | -12.5 | | |
| $BW_{Dx\pm}$ | Bandwidth -3dB for Main high speed path ($Dx\pm$) | See figure 3 | 3.7 | 4.8 | | GHz | |
| $BW_{DDC/AUX/HPD}$ | -3dB BW for DDC/ AUX and HPD signals | See figure 3 | 1.35 | 1.5 | | GHz | |

Note:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{DD} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$ ambient and maximum loading.

Switching Characteristics

($T_A = -40^\circ$ to $+105^\circ\text{C}$, $V_{DD} = 3.3\text{V} \pm 10\%$)

| Parameter | Description | Min. | Typ. | Max. | Units |
|---------------|---|------|------|------|-------|
| T_{pd} | Propagation delay (input pin to output pin) on all channels | | 80 | | ps |
| t_{b-b} | Bit-to-bit skew within the same differential pair of $Dx\pm$ channels | | 5 | 7 | ps |
| t_{ch-ch} | Channel-to-channel skew of $Dx\pm$ channels | | | 35 | ps |
| $T_{sw\ a-b}$ | time it takes to switch from port A to port B | | | 0.1 | us |
| $T_{sw\ b-a}$ | time it takes to switch from port B to port A | | | 0.1 | us |
| $T_{startup}$ | V_{DD} valid to channel enable | | | 10 | us |
| T_{wakep} | Enabling output by changing OE from low to High | | | 10 | us |

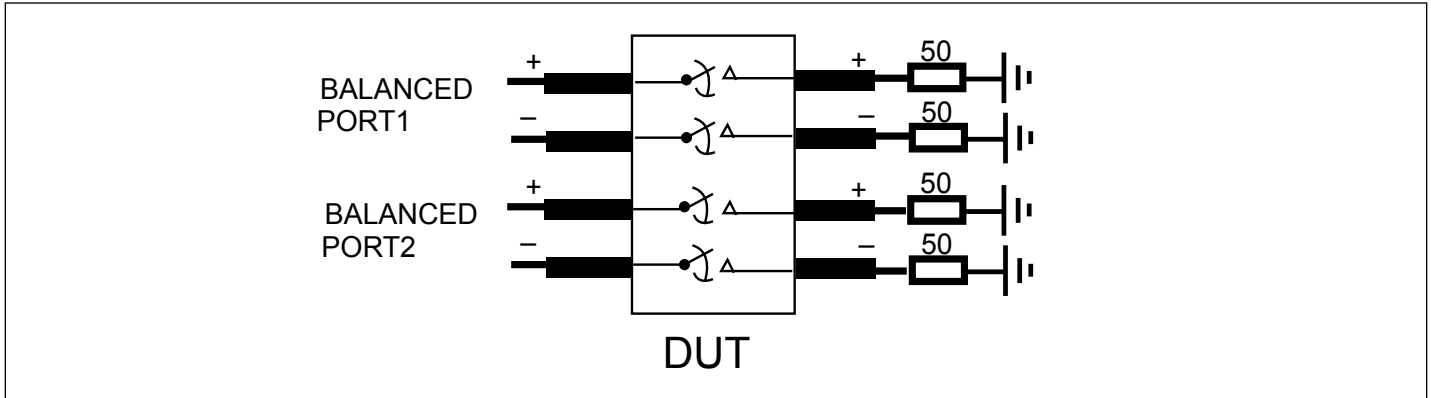


Fig 1. Crosstalk Setup

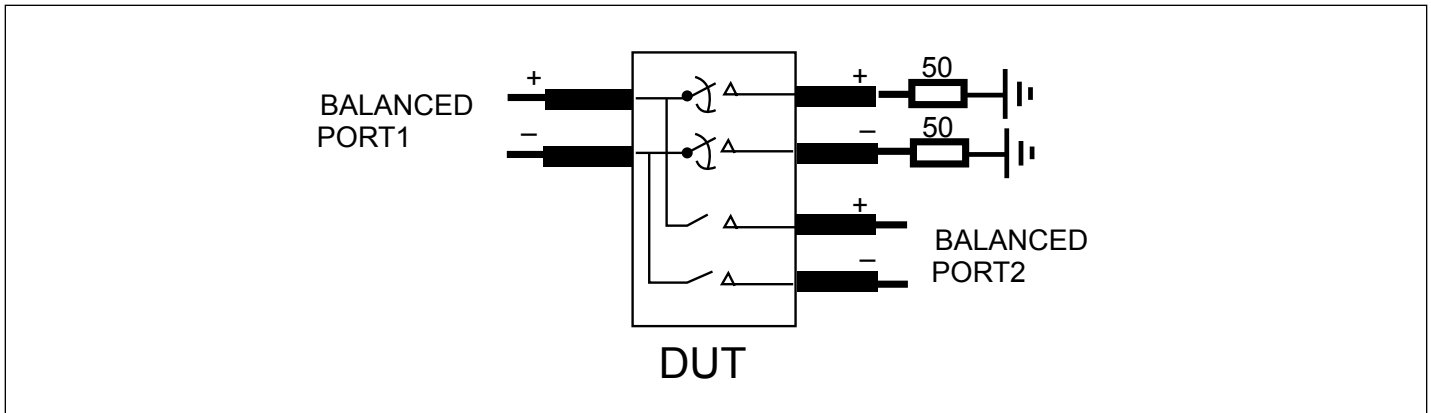


Fig 2. Off-isolation setup

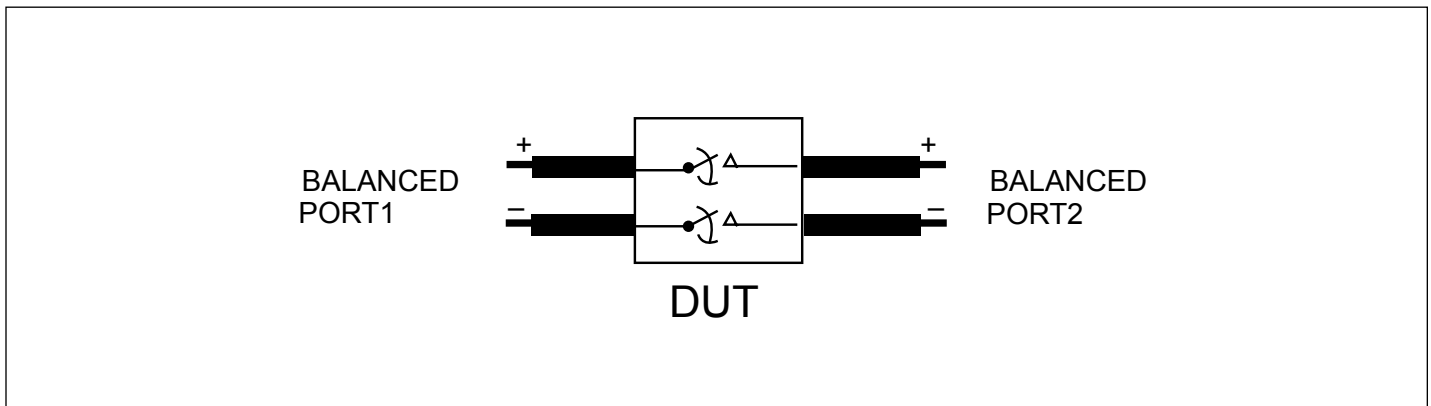


Fig 3. Differential Insertion Loss

Test Circuit for Dynamic Electrical Characteristics

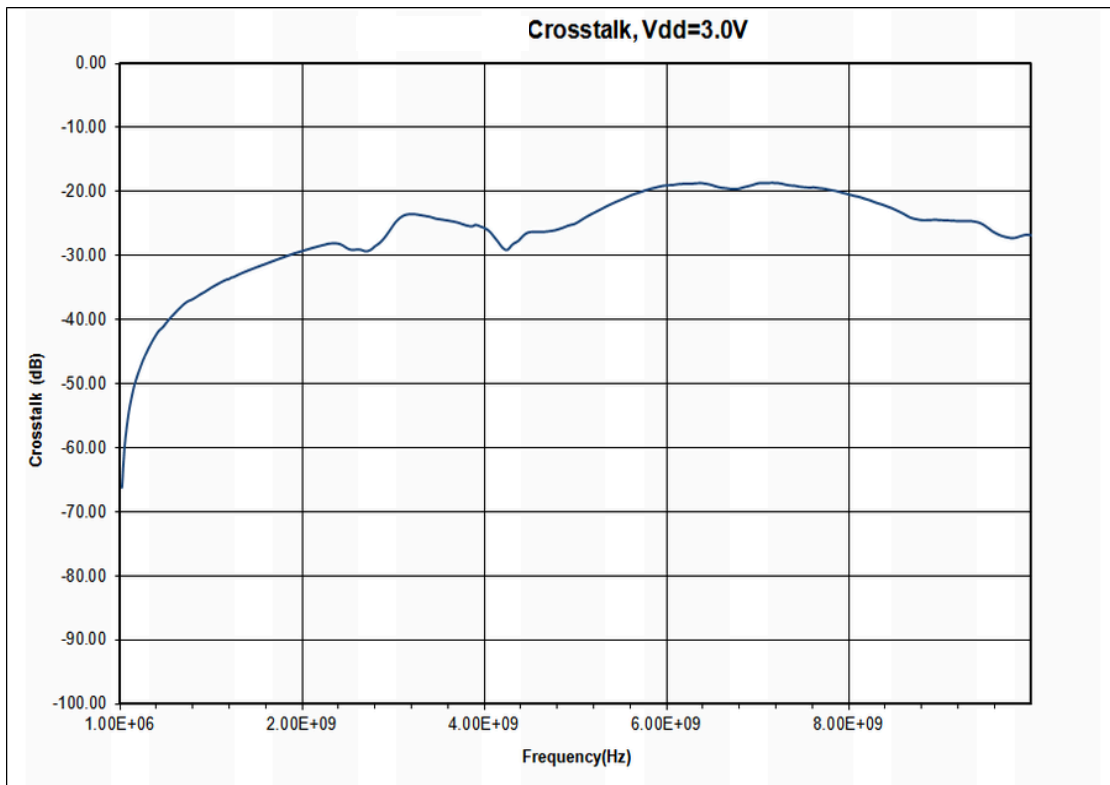
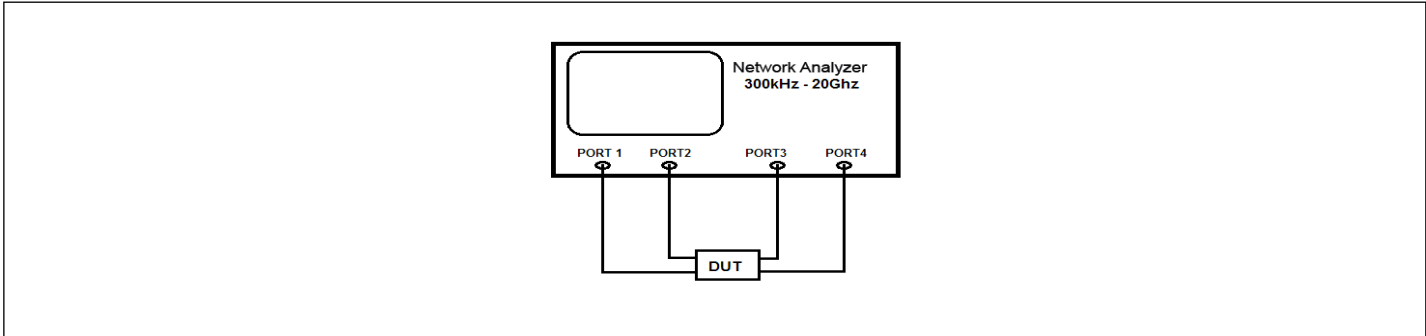


Fig 4. Crosstalk

PI3WVR12412

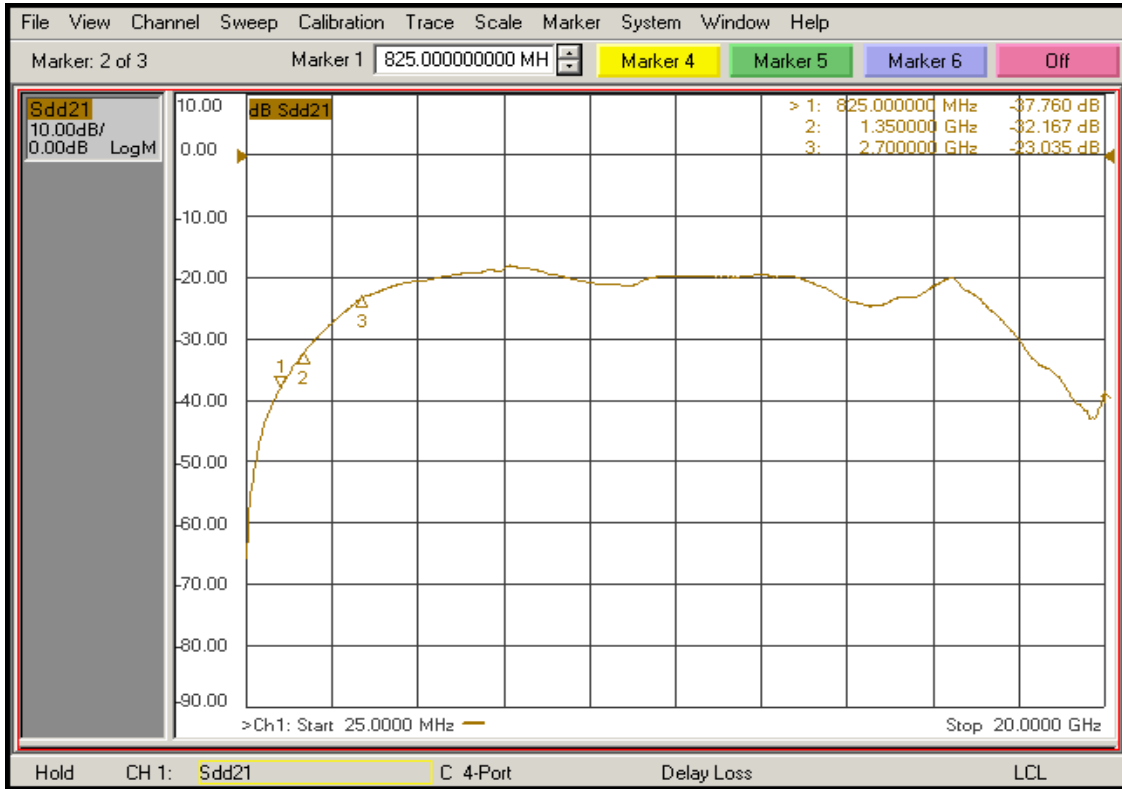


Fig 5. Off Isolation

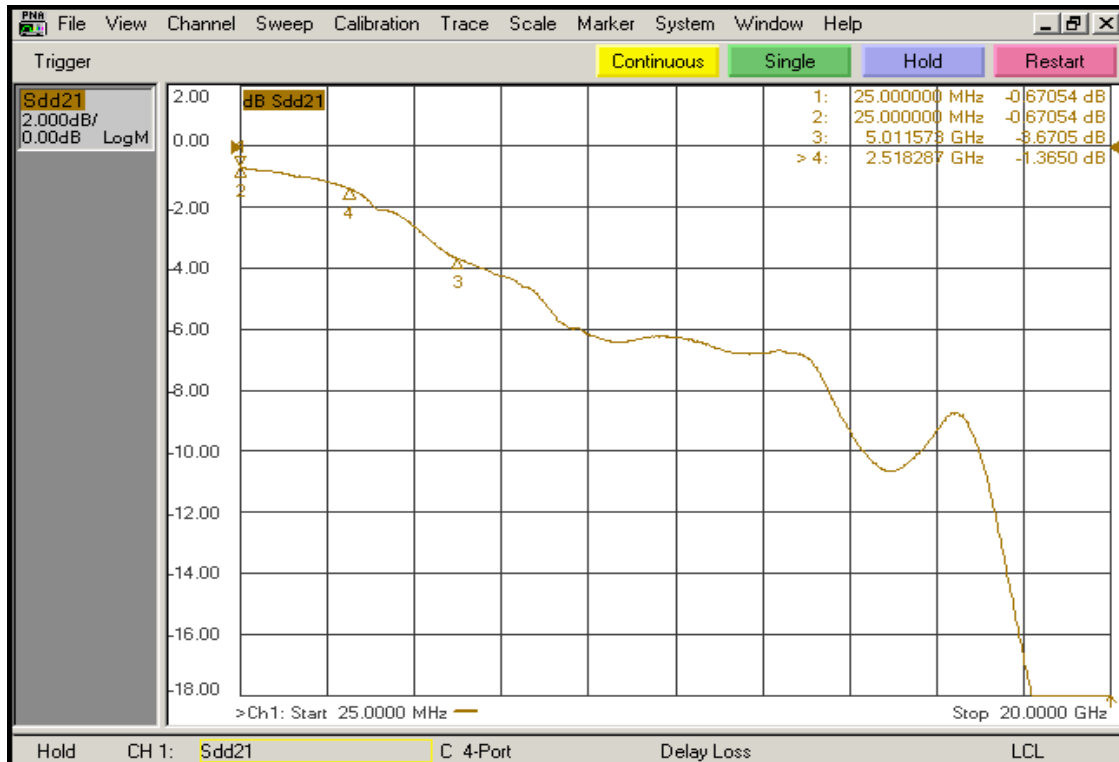


Fig 6. Insertion Loss

PI3WVR12412

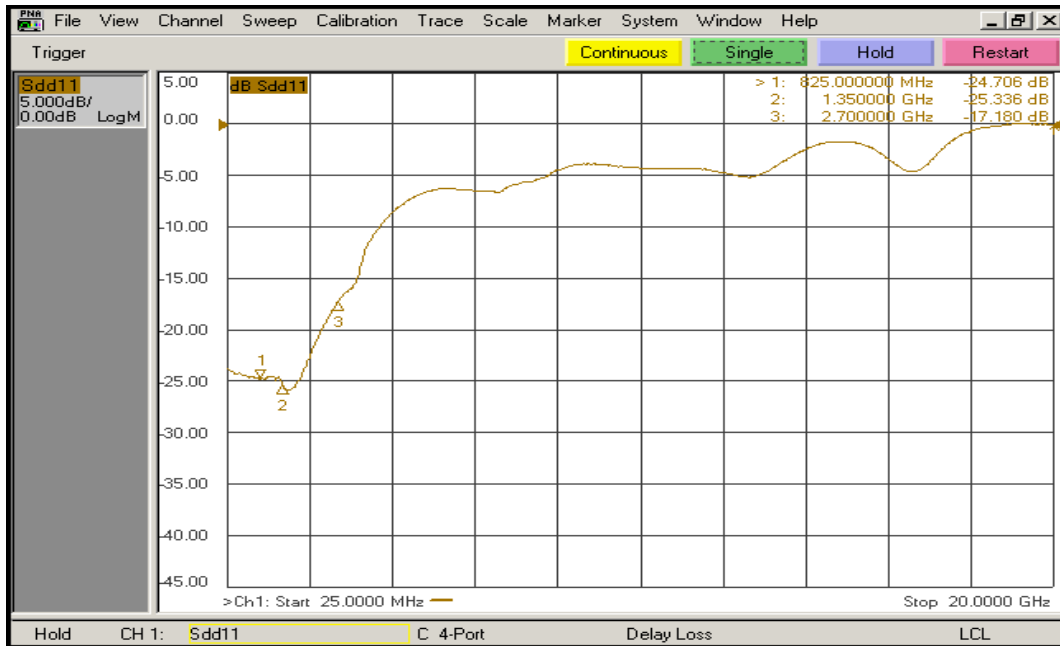


Fig 7. Return Loss

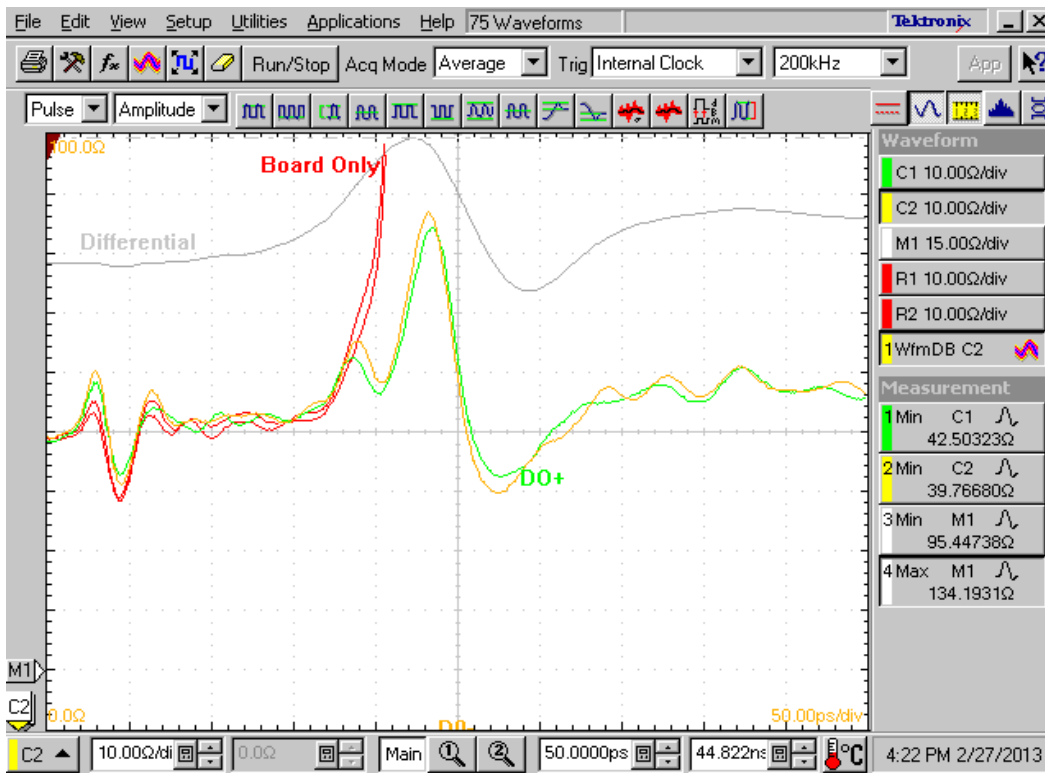
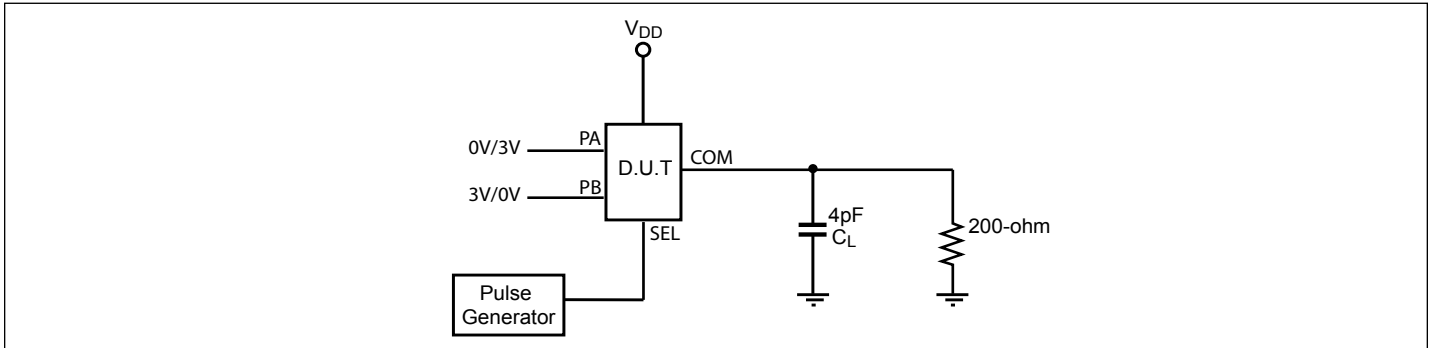


Fig 8. TDR Channel D0, VDD=3.0V, 25C

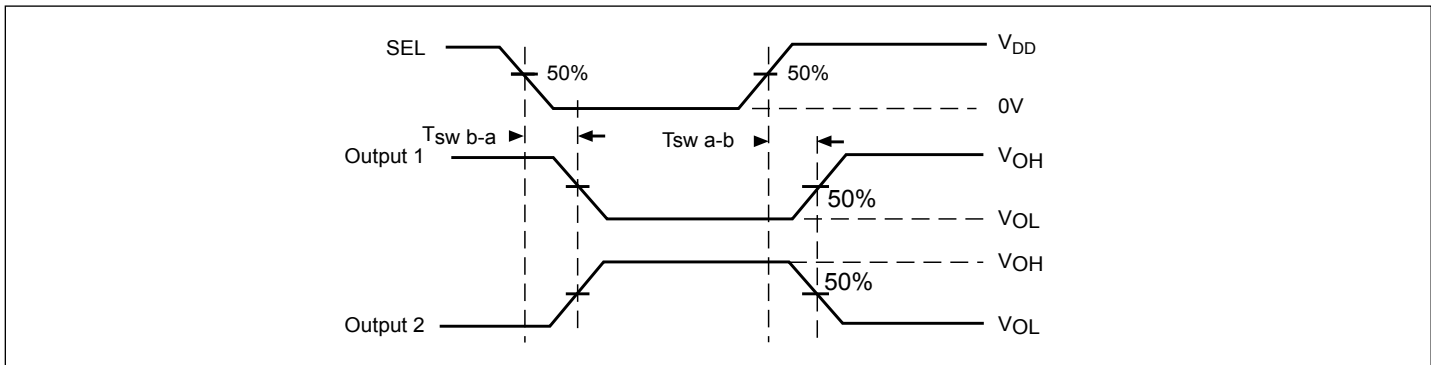
Test Circuit for Electrical Characteristics(1-4)



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. All input impulses are supplied by generators having the following characteristics: $PRR \leq \text{MHz}$, $Z_O = 50\Omega$, $t_R \leq 2.5\text{ns}$, $t_F \leq 2.5\text{ns}$.
4. The outputs are measured one at a time with one transition per measurement.

Switching Waveforms

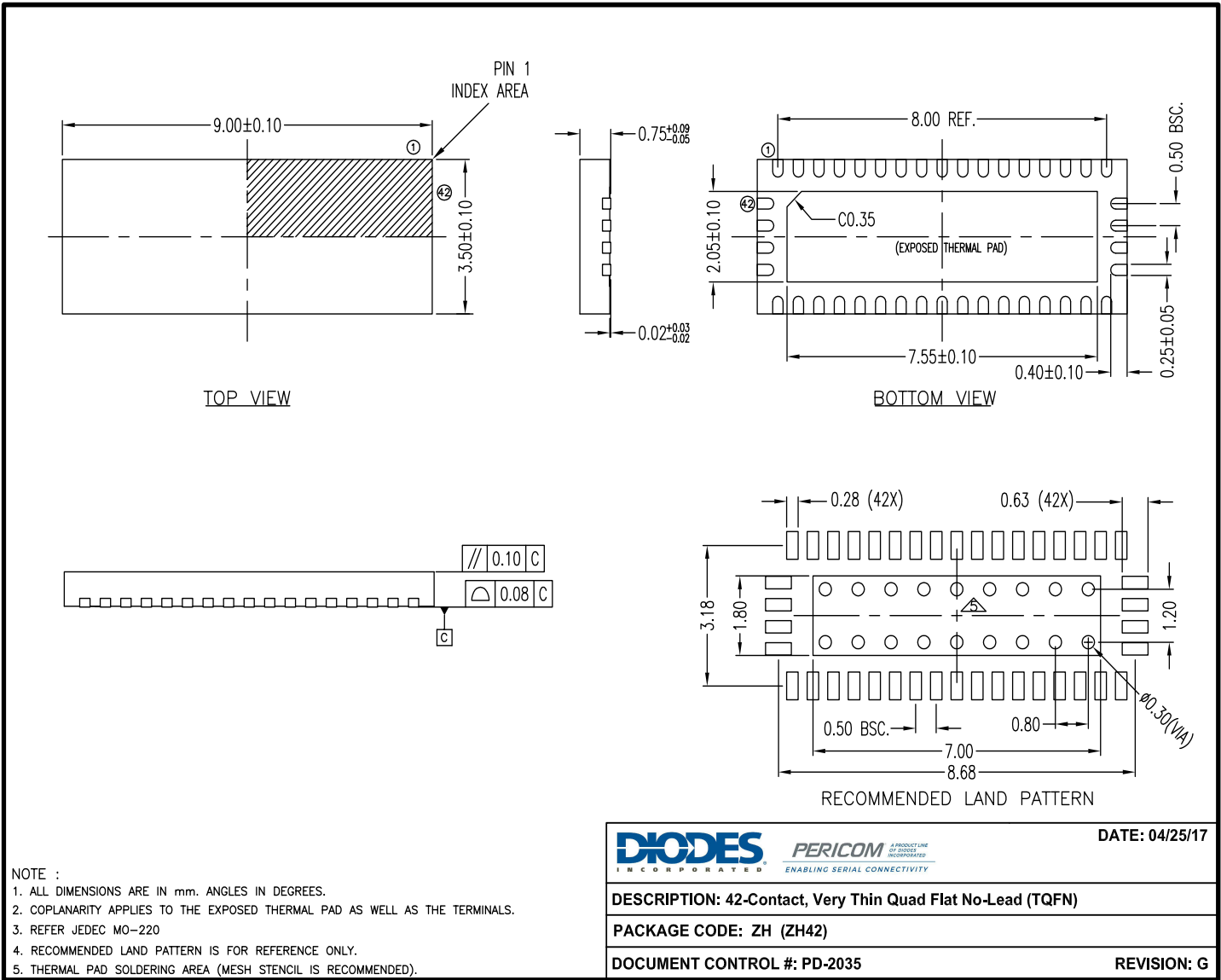


Voltage Waveforms for Select Timing

Test Condition

| Output 1 Test Condition | Output 2 Test Condition |
|-------------------------|-------------------------|
| PA = Low | PA = High |
| PB = High | PB = Low |

Packaging Mechanical: 42ZH



| | | |
|--|---|-----------------------|
| DIODES INCORPORATED | PERICOM A PRODUCT LINE OF DIODES INCORPORATED ENABLING SERIAL CONNECTIVITY | DATE: 04/25/17 |
| DESCRIPTION: 42-Contact, Very Thin Quad Flat No-Lead (TQFN) | | |
| PACKAGE CODE: ZH (ZH42) | | |
| DOCUMENT CONTROL #: PD-2035 | | REVISION: G |

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 |
|--------------------|--------------|--|
| PI3WVR12412ZHEX | ZH | 42-contact, Very Thin Quad Flat No-Lead (TQFN) (W24) |
| PI3WVR12412ZHE+DRX | ZH | 42-contact, Very Thin Quad Flat No-Lead (TQFN) (W16) |

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

IMPORTANT NOTICE

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and definitive format released by Diodes Incorporated.

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.

Copyright © 2016, Diodes Incorporated

www.diodes.com

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Diodes Incorporated:](#)

[PI3WVR12412ZHEX](#) [PI3WVR12412ZHE](#) [PI3WVR12412ZHE+DRX](#)