



# THE DATASHEET OF PI3HDMI412-BAEX



## 4-Differential Channel, 2:1 Mux/DeMux, DVI/HDMI Compliant Signal Switch based on TMDS Signaling Standard

### Features

- 3.3V V<sub>DD</sub>
- 4-Differential Channel 2:1 Mux/DeMux
- DVI, HDMI, 1.2 +1.2 signal compatible
- Data Rate: 1.65Gbps
- Supports both AC coupled and DC coupled signals
- Crosstalk: -35dB@825MHz
- Switching speed: 4ns
- Isolation: -30dB@825MHz
- Near-Zero Prop Delay: 250ps max.
- Low bit-to-bit skew
- Enable/Disable Time: 9ns
- Bidirectional
- Enhanced ESD Protection:
  - Switch pins: 1.1kV (machine model)  
12kV (humanbody model)  
8kV (contact)<sup>(1)</sup>
- Packaging (Pb-free & Green):
  - 48-pin TSSOP (A)

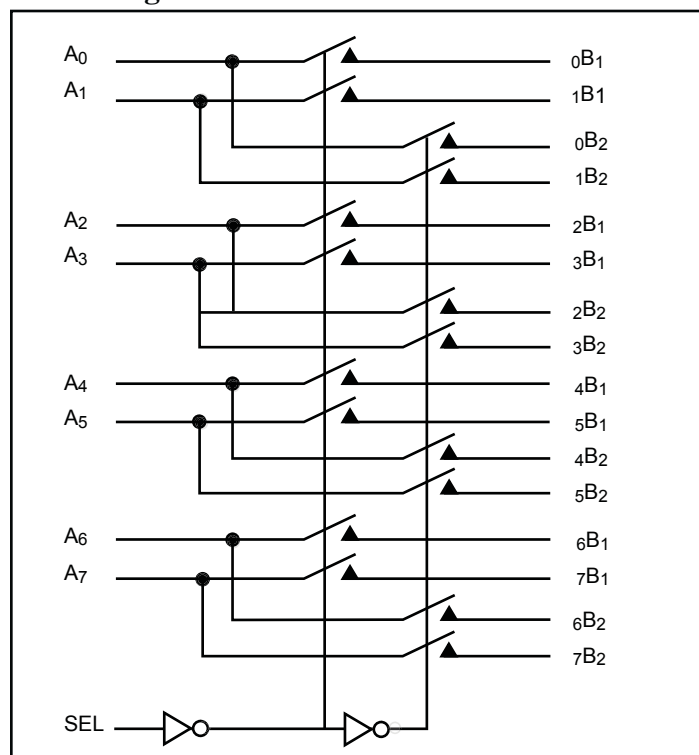
### Description

Pericom Semiconductor's PI3HDMI series of switch circuits are targeted for high-resolution video networks that are based on DVI/HDMI standards, and TMDS signal processing. The PI3HDMI412-B is a 8- to 4-Channel Mux/DeMux Switch. The device multiplexes differential signals to one of two corresponding outputs. The switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. It is designed for low bit-to-bit skew and high channel-to-channel noise isolation.

The maximum DVI/HDMI data rate of 1.65Gbps provides the resolution required by the next generation HDTV and PC graphics. Three differential channels are used for data (video signals for DVI or audio/video signals for HDMI), and one differential channel is used for Clock for decoding the TMDS signals at the outputs.

Because of its passive bidirectional feature, this switch can be used either at the video drivers side or at the receiver side. For PC graphics applications, the device sits at the drivers side to switch between multiple display units such as PC LCD monitor, projector, TV, etc. For consumer video applications, the device sits at the receiver end to switch between the source components such as DVD, D-VHS, STB, etc.

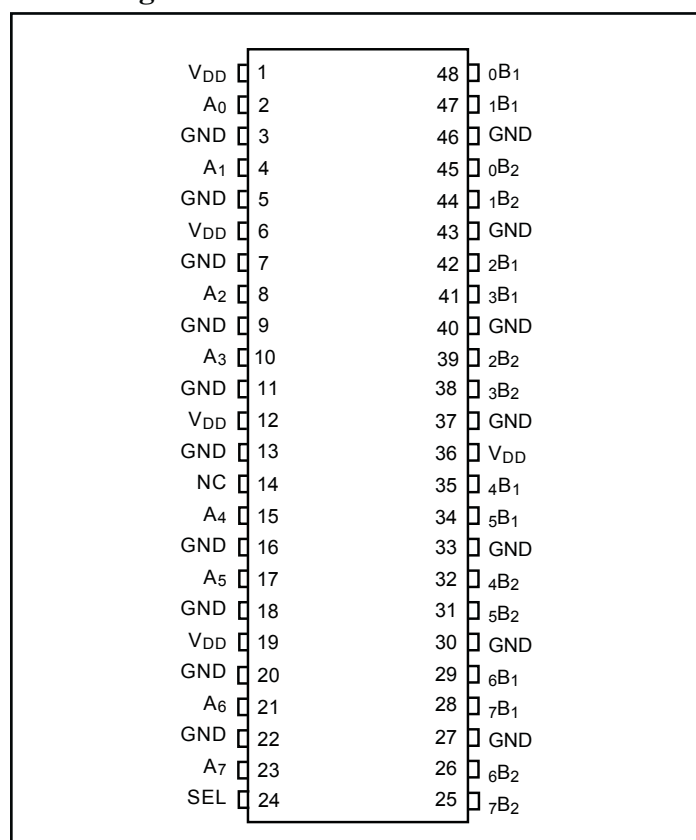
### Block Diagram



#### Note:

1. IEC 61000-4-2

### Pin Configuration



**Truth Table**

| Function <sup>(1)</sup> | SEL |
|-------------------------|-----|
| Ax to xB <sub>1</sub>   | L   |
| Ax to xB <sub>2</sub>   | H   |

**Note:**  
 1 x=0 through 7

**Pin Description**

| Pin #  | Pin Name | Type  | Description                    |
|--|----------|-------|--------------------------------|
| 3,5,7,9,11,13,16,18,20,22,27,30,33,37,40,43,46 | GND      | Power | Ground                         |
| 1,6,12,19,36                                   | VDD      | Power | Supply Voltage (3.3V ± 10%)    |
| 14   | NC       |       | No Connection                  |
| 2  | A0       | I/O   | TMDS Data 0-                   |
| 4  | A1       | I/O   | TMDS Data 0+                   |
| 8  | A2       | I/O   | TMDS Data 1-                   |
| 10   | A3       | I/O   | TMDS Data 1+                   |
| 15   | A4       | I/O   | TMDS Data 2-                   |
| 17   | A5       | I/O   | TMDS Data 2+                   |
| 21   | A6       | I/O   | TMDS Data 3-                   |
| 23   | A7       | I/O   | TMDS Data 3+                   |
| 24   | SEL      | Input | Selection for Port 1 or Port 2 |
| 25   | 7B2      | I/O   | TMDS Data 3+ for Port 2        |
| 26   | 6B2      | I/O   | TMDS Data 3- for Port 2        |
| 28   | 7B1      | I/O   | TMDS Data 3+ for Port 1        |
| 29   | 6B1      | I/O   | TMDS Data 3- for Port 1        |
| 31   | 5B2      | I/O   | TMDS Data 2+ for Port 2        |
| 32   | 4B2      | I/O   | TMDS Data 2- for Port 2        |
| 34   | 5B1      | I/O   | TMDS Data 2+ for Port 1        |
| 35   | 4B1      | I/O   | TMDS Data 2- for Port 1        |
| 38   | 3B2      | I/O   | TMDS Data 1+ for Port 2        |
| 39   | 2B2      | I/O   | TMDS Data 1- for Port 2        |
| 41   | 3B1      | I/O   | TMDS Data 1+ for Port 1        |
| 42   | 2B1      | I/O   | TMDS Data 1- for Port 1        |
| 44   | 1B2      | I/O   | TMDS Data 0+ for Port 2        |
| 45   | 0B2      | I/O   | TMDS Data 0- for Port 2        |
| 47   | 1B1      | I/O   | TMDS Data 0+ for Port 1        |
| 48   | 0B1      | I/O   | TMDS Data 0- for Port 1        |

### Maximum Ratings

(Above which useful life may be impaired. For user guidelines, not tested.)

|                          |                       |
|--------------------------|-----------------------|
| Storage Temperature..... | -65°C to +150°C       |
| Supply Voltage.....      | -0.5V to 3.6V         |
| DC Input Voltage .....   | 0V to V <sub>DD</sub> |
| 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<sub>A</sub> = -40°C to +85°C, V<sub>DD</sub> = 3.3V ±10%)

| Parameter                      | Description         | Test Conditions <sup>(1)</sup>                          | Min.                    | Typ. <sup>(2)</sup> | Max.                    | Units |
|--------------------------------|---------------------|---|-------------------------|---------------------|-------------------------|-------|
| V <sub>IH</sub> <sup>(3)</sup> | Input HIGH Voltage  | Guaranteed HIGH level                                   | 0.65 (V <sub>DD</sub> ) |                     |                         | V     |
| V <sub>IL</sub> <sup>(3)</sup> | Input LOW Voltage   | Guaranteed LOW level                                    | -0.5                    |                     | 0.35 (V <sub>DD</sub> ) |       |
| V <sub>IK</sub>                | Clamp Diode Voltage | V <sub>DD</sub> =Max., I <sub>IN</sub> =-18mA           |                         | -0.7                | -1.2                    |       |
| I <sub>IH</sub>                | Input HIGH Current  | V <sub>DD</sub> =Max., V <sub>IN</sub> =V <sub>DD</sub> |                         |                     | ±5                      | μA    |
| I <sub>IL</sub>                | Input LOW Current   | V <sub>DD</sub> =Max., V <sub>IN</sub> =0V              |                         |                     | ±5                      |       |

**Notes:**

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at T<sub>A</sub> = 25°C ambient and maximum loading.
- V<sub>IH</sub> + V<sub>IL</sub> are for SEL input only.

### Power Supply Characteristics

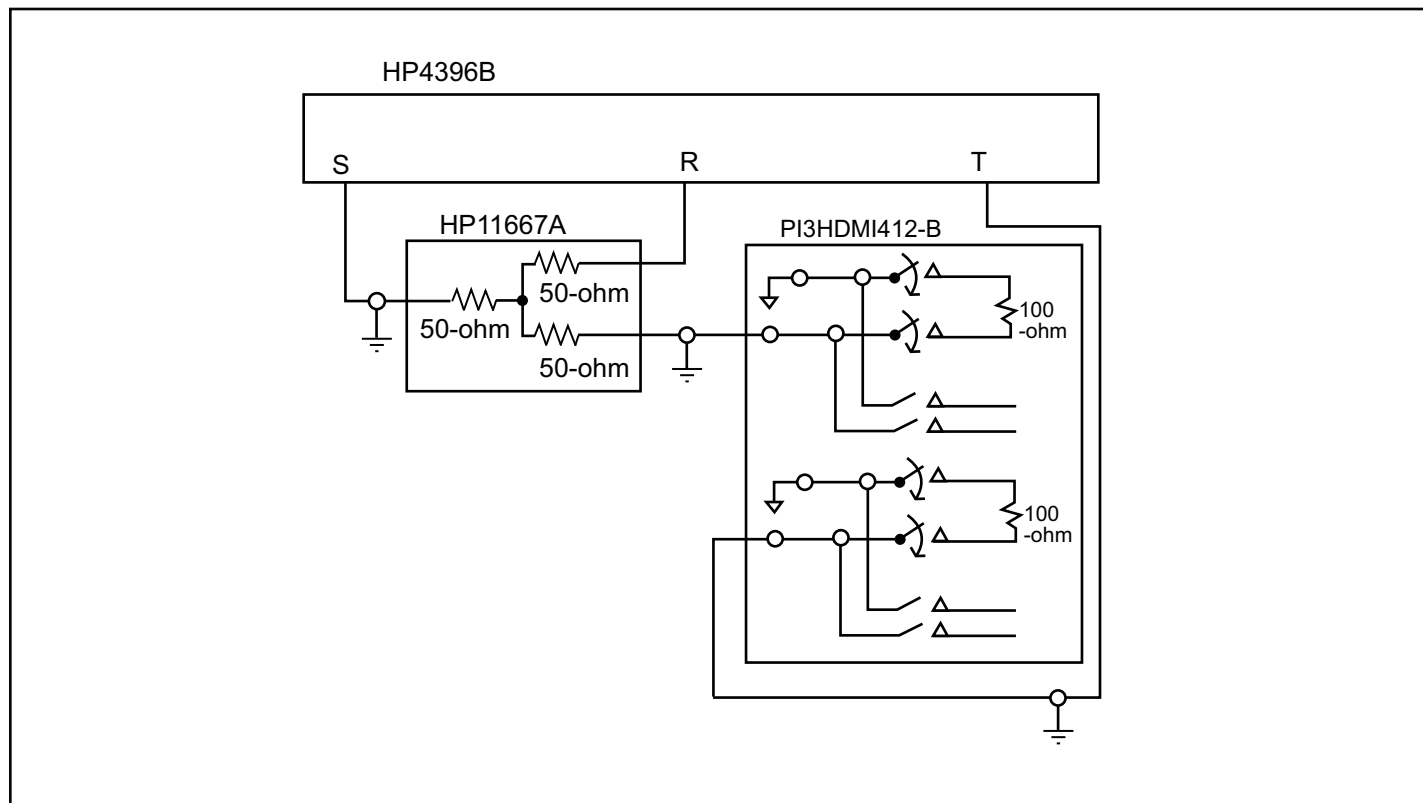
| Parameters      | Description                    | Test Conditions <sup>(1)</sup>                                  | Min. | Typ. <sup>(2)</sup> | Max. | Units |
|-----------------|--------------------------------|---|------|---------------------|------|-------|
| I <sub>CC</sub> | Quiescent Power Supply Current | V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>DD</sub> or 0V |      | 500                 |      | μA    |

### Dynamic Electrical Characteristics Over the Operating Range (T<sub>A</sub> = -40° to +85°C, V<sub>DD</sub> = 3.3V ±10%)

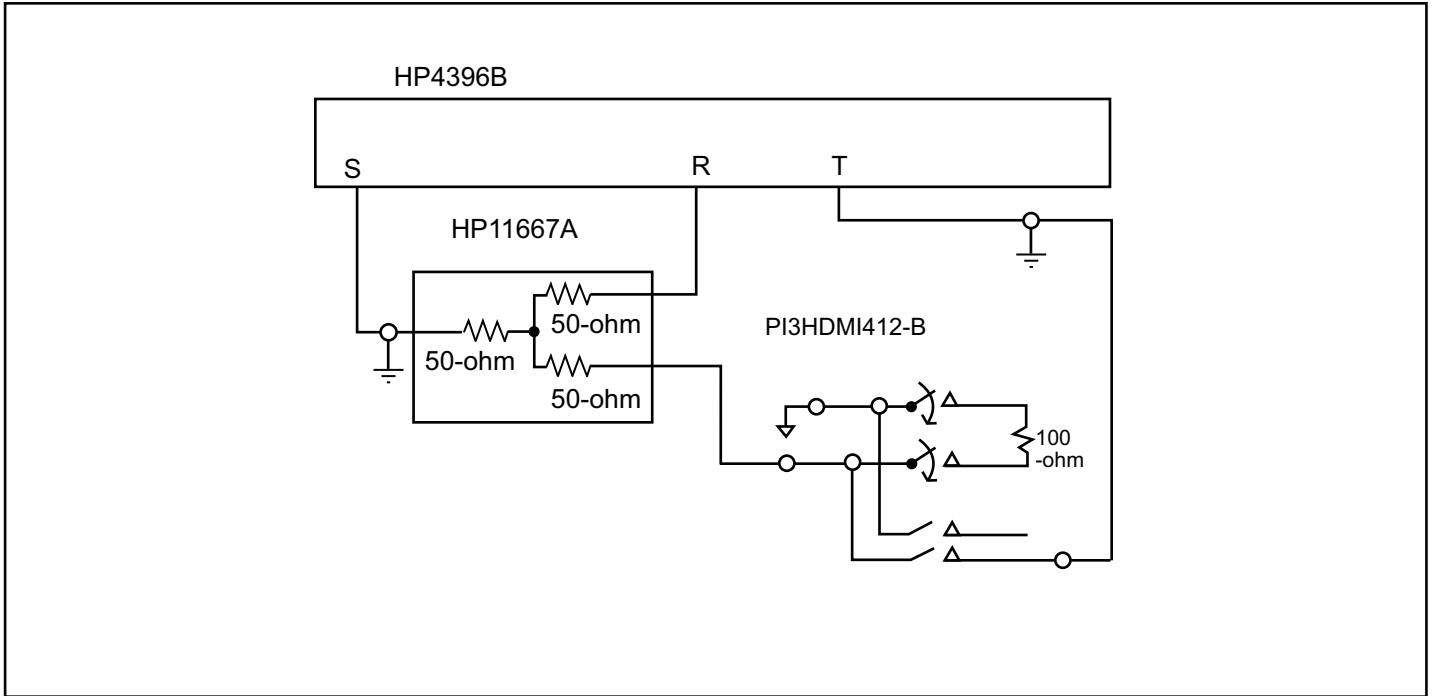
| Parameter         | Description   | Test Conditions                                  | Min. | Typ. <sup>(2)</sup> | Max. | Units |
|-------------------|---------------|--|------|---------------------|------|-------|
| X <sub>TALK</sub> | Crosstalk     | See Fig. 1 for Measurement Setup,<br>f = 825 MHz |      | -35                 |      | dB    |
| O <sub>IRR</sub>  | OFF Isolation | See Fig. 2 for Measurement Setup,<br>f = 825 MHz |      | -30                 |      |       |
| DR                | Data Rate     |  |      | 1.65                |      | Gbps  |

**Notes:**

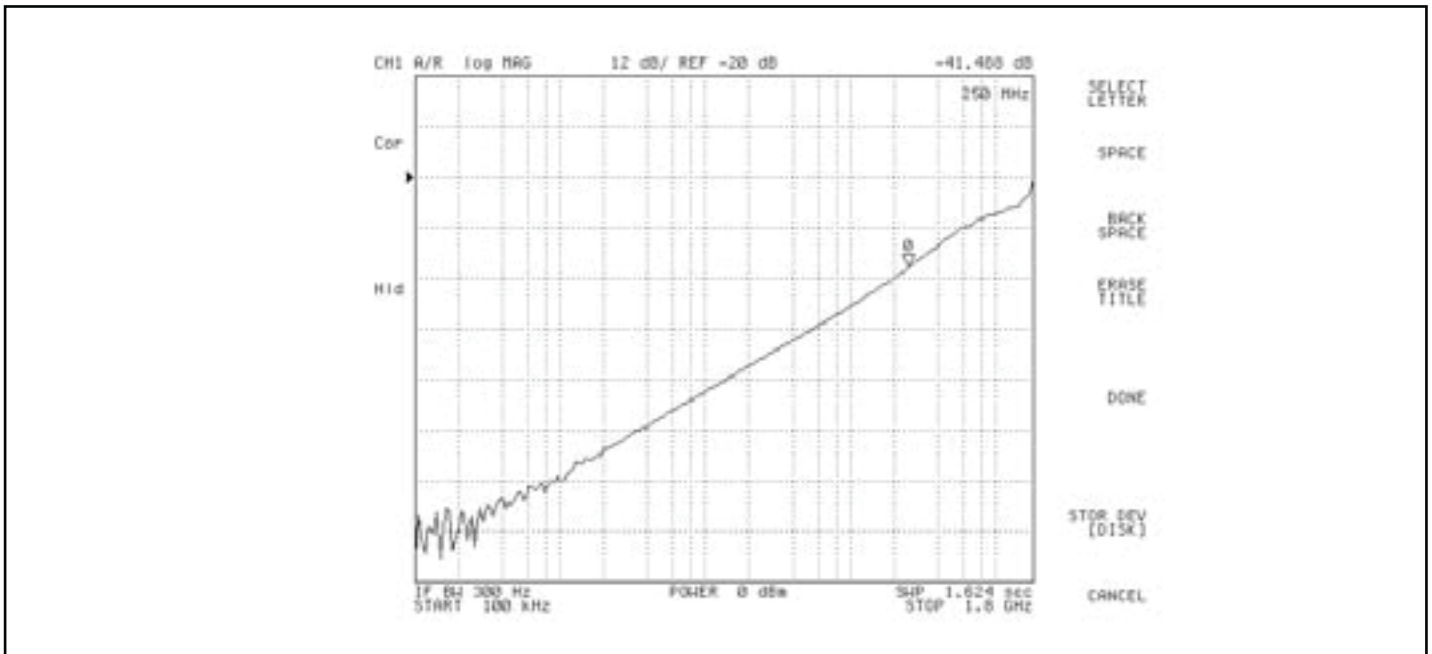
- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at T<sub>A</sub> = 25°C ambient and maximum loading.



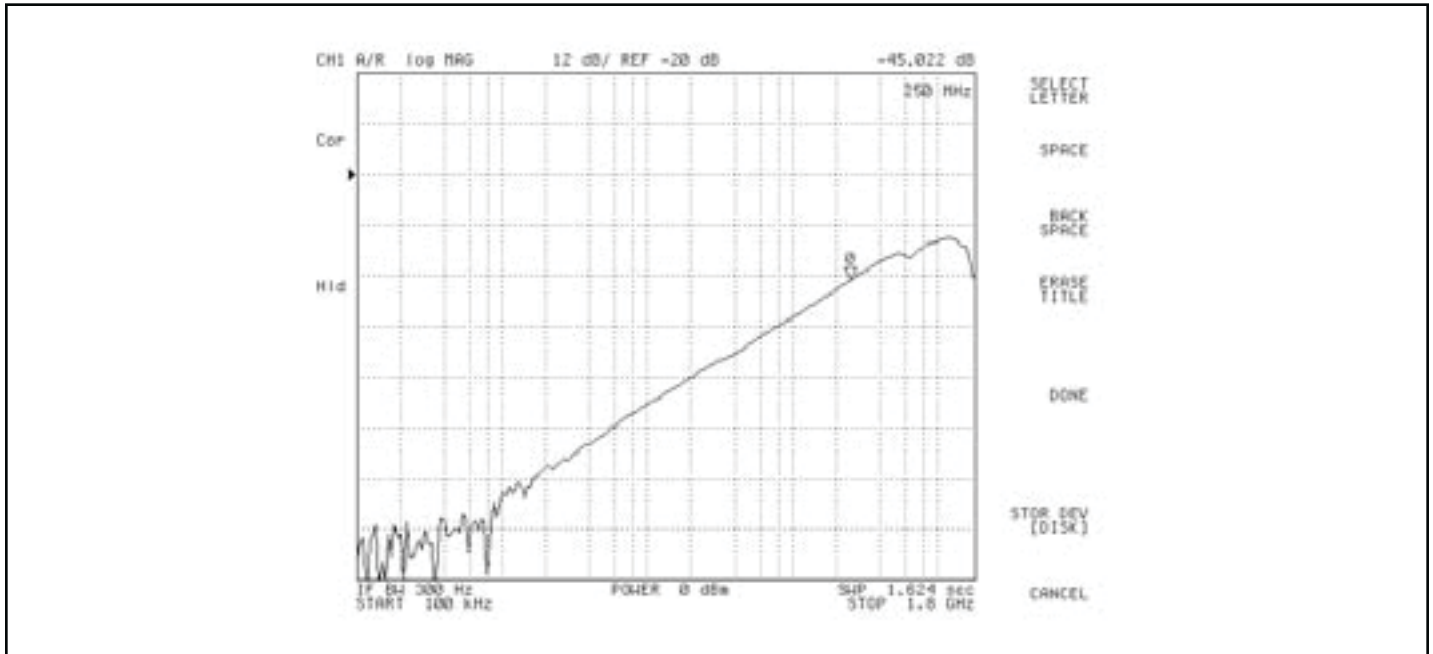
**Fig 1. Crosstalk Setup**



**Fig 2. Off-isolation setup**



**Fig 3. Crosstalk**



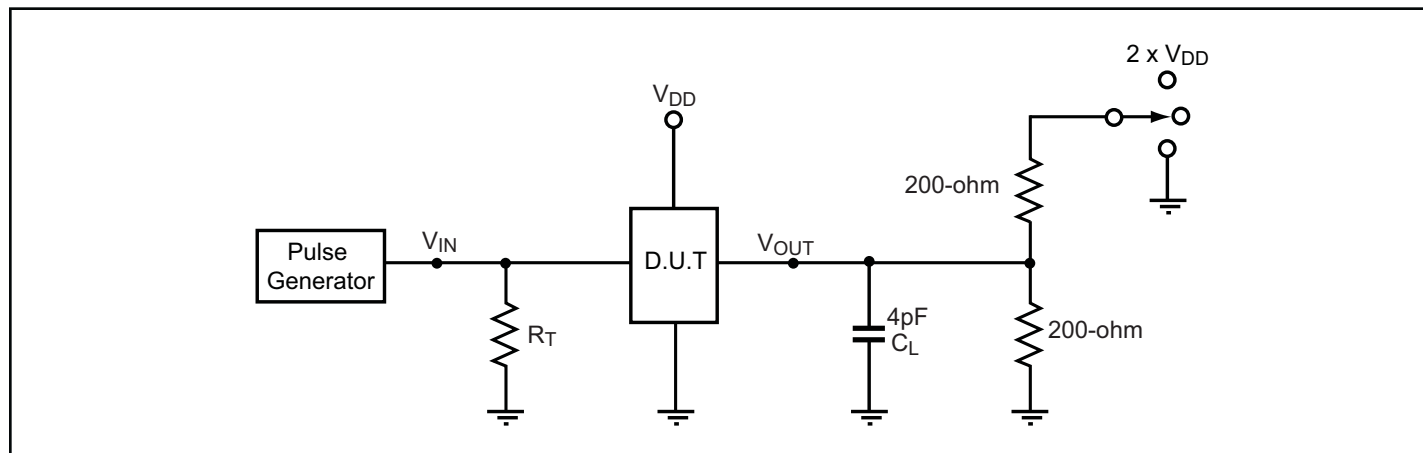
**Fig 4. Off Isolation**

**Switching Characteristics** ( $T_A = -40^\circ$  to  $+85^\circ\text{C}$ ,  $GND=0V$ ,  $V_{DD}=3.3V \pm 10\%$ )

| Parameter                           | Description <sup>(1)</sup>                                 | Min. | Typ. | Max. | Units |
|-------------------------------------|--|------|------|------|-------|
| t <sub>PZH</sub> , t <sub>PZL</sub> | Line Enable Time - SEL to A <sub>N</sub> , B <sub>N</sub>  | 0.5  | -    | 8.0  |       |
| t <sub>PHZ</sub> , t <sub>PLZ</sub> | Line Disable Time - SEL to A <sub>N</sub> , B <sub>N</sub> | 0.5  | -    | 4.0  |       |

**Notes:**

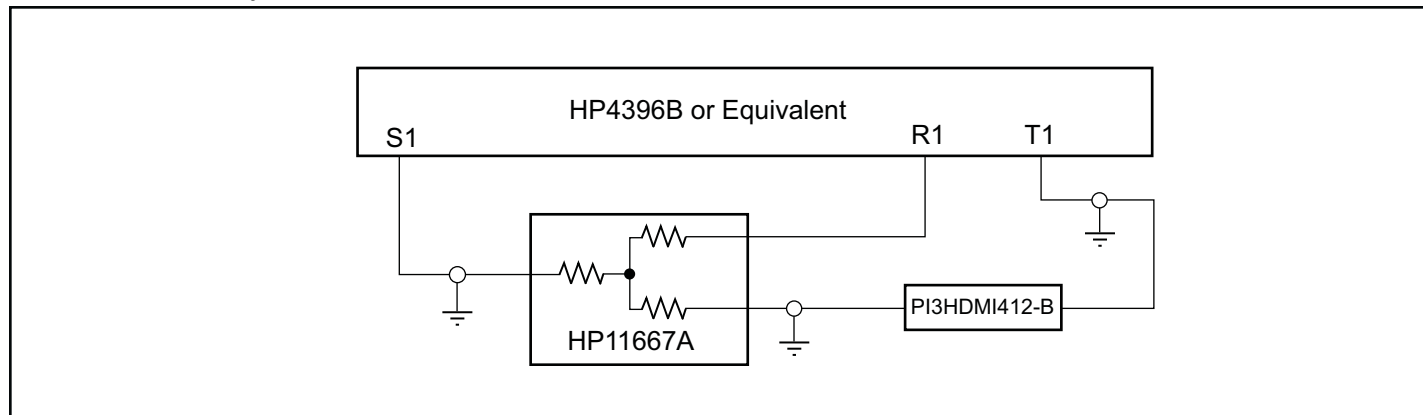
1. For measurement setup, please see “Test Circuit For Electrical Characteristic” on page 6, and “Switching waveforms” on page 7

**Test Circuit for Electrical Characteristics**

**Notes:**

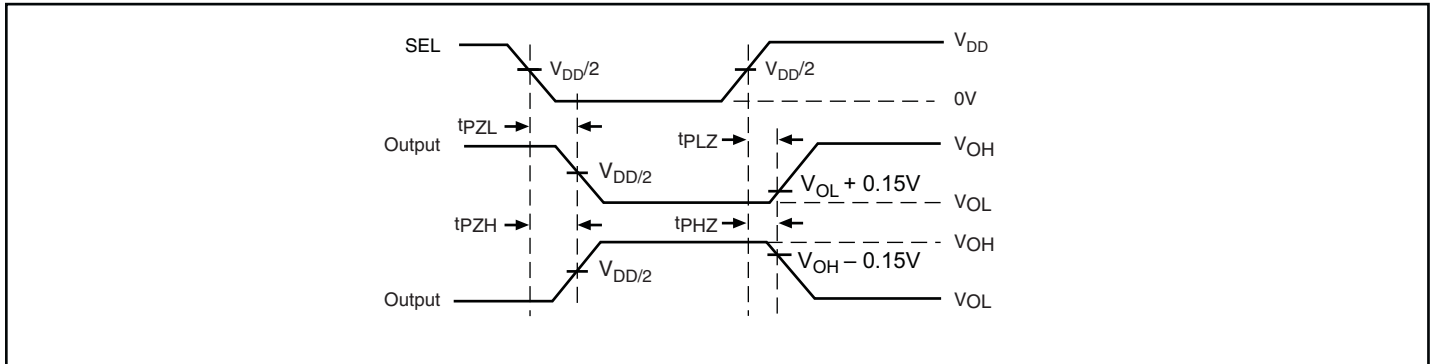
- $C_L$  = Load capacitance: includes jig and probe capacitance.
- $R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input impulses are supplied by generators having the following characteristics:  $PRR \leq \text{MHz}$ ,  $Z_O = 50\Omega$ ,  $t_R \leq 2.5\text{ns}$ ,  $t_F \leq 2.5\text{ns}$ .
- The outputs are measured one at a time with one transition per measurement.

**Switch Positions**

| Test                                     | Switch              |
|--|---------------------|
| $t_{PLZ}$ , $t_{PZL}$ (output on B-side) | $2 \times (V_{DD})$ |
| $t_{PHZ}$ , $t_{PZH}$ (output on B-side) | Gnd                 |
| Prop Delay                               | Open                |

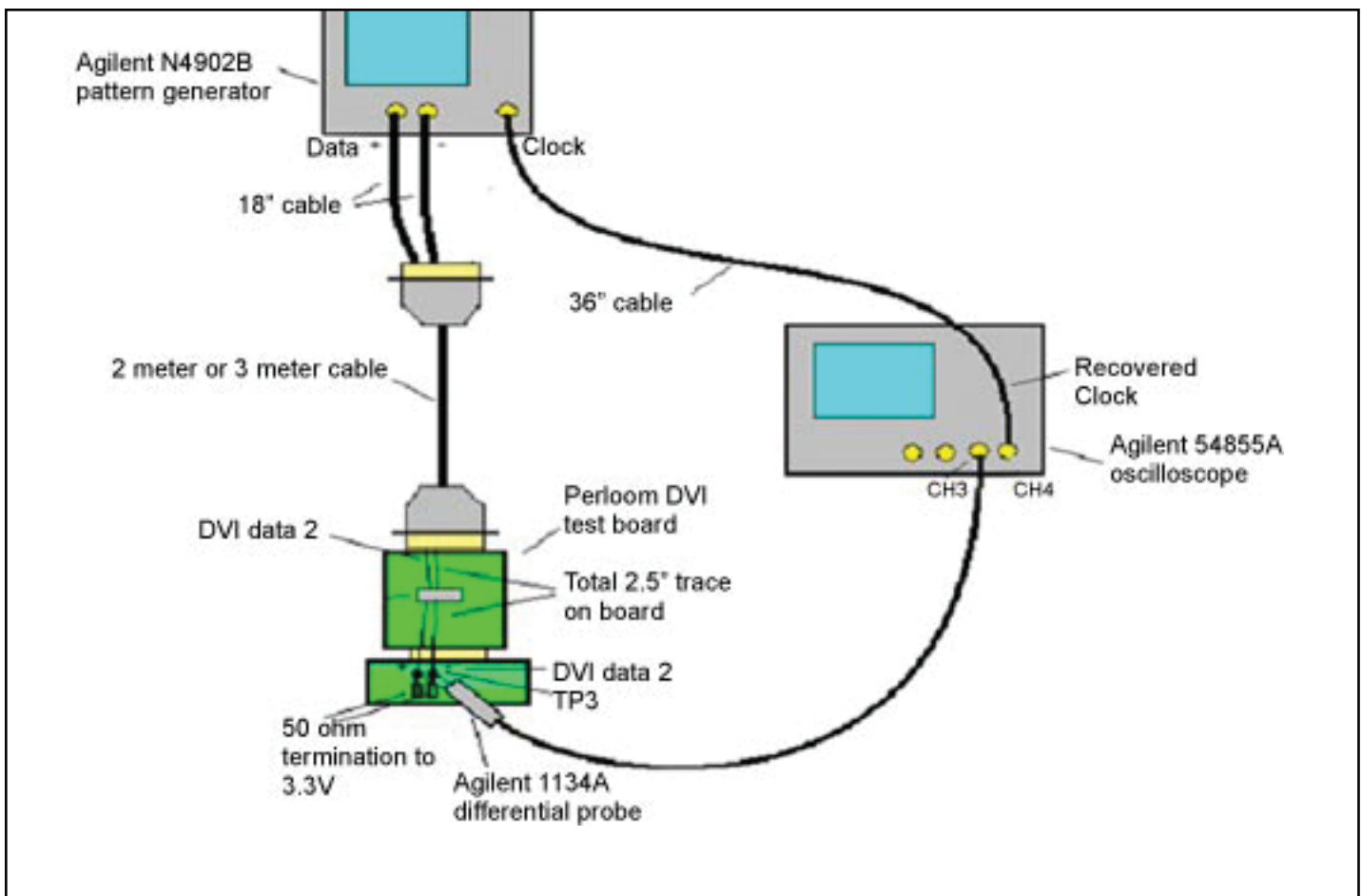
**Test Circuit for Dynamic Electrical Characteristics**


### Switching Waveforms

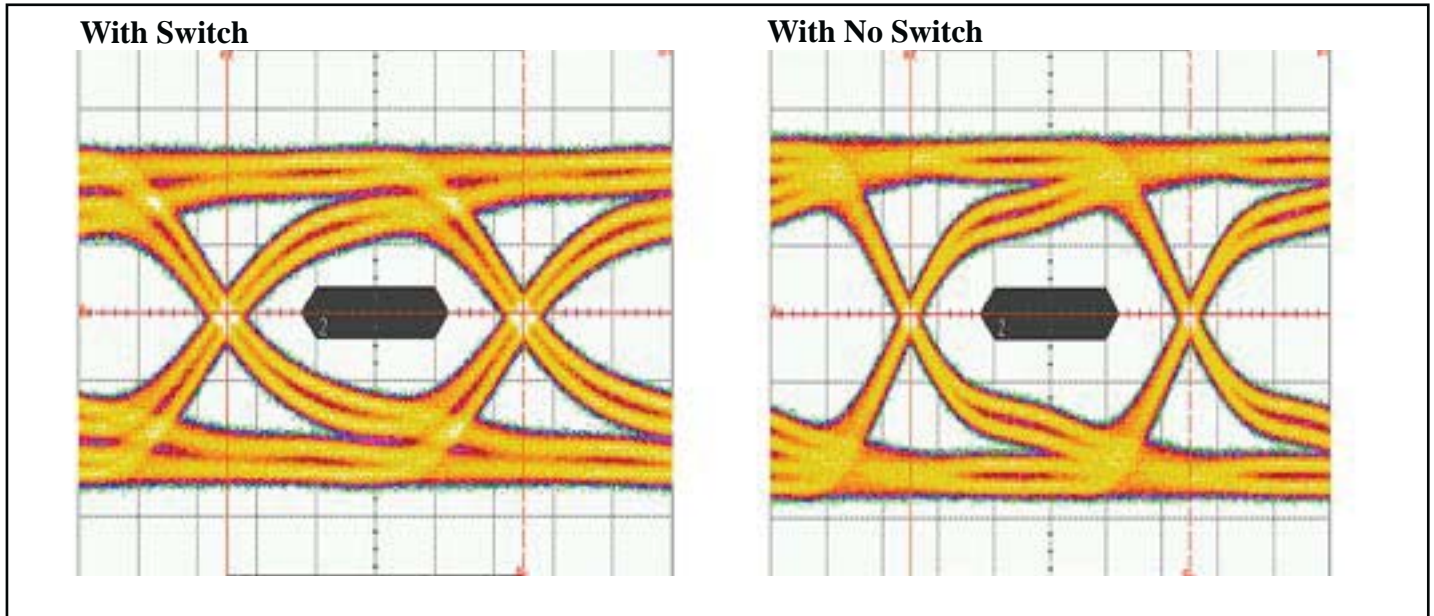


**Voltage Waveforms Enable and Disable Times**

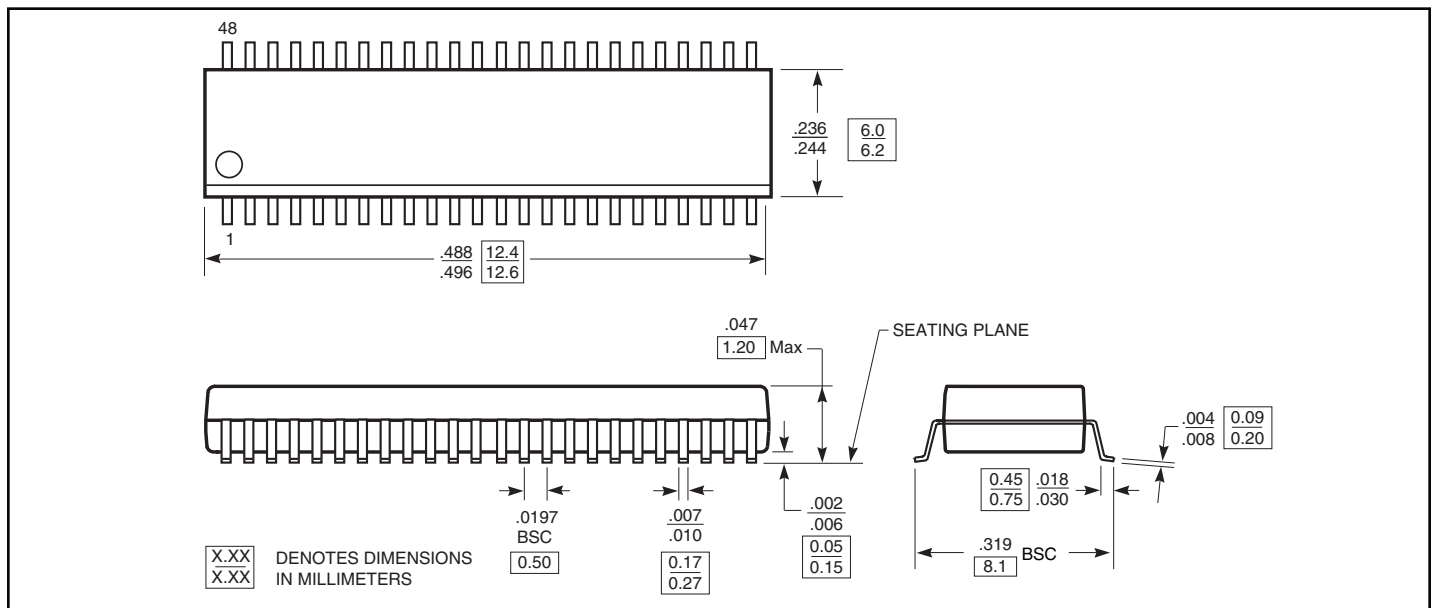
### TP3 Rx Test Setup



**TP3 eye diagrams with 3 meter cables**



**Packaging Mechanical: 48-pin TSSOP (A)**



**Ordering Information**



| Ordering Code  | Package Code | Package Description           |
|----------------|--------------|-------------------------------|
| PI3HDMI412-BAE | A            | Pb-free & Green, 48-pin TSSOP |

**Notes:**

- Thermal characteristics can be found on the company web site at [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
- E = Pb-free and Green

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