PI3HDMI1212

High-performance HDMI 1.1 and 1.2 Compatible Signal Switch w/ Integrated Side-band Signal Support

Features

- 4-Differential Channel 2:1 Mux/DeMux + 4-Channel 2:1 Mux/DeMux
- DVI, HDMI 1.1, 1.2 and 1.3 signal compatible
- Data Rate: 4.0Gbps for high speed channels
- Supports both AC coupled and DC coupled signals
- Switching speed: 4ns
- Isolation: -40dB@1GHz for high-speed channels
- Integrated ESD protection
- High-speed data bits: 12kV HBM
    8kV contact
- Side band signal bits: 2kV HBM
- Low bit-to-bit skew
- Enable/Disable time: 9ns
- Bidirectional
- Packaging (Pb-free & Green):
 —80-pin BQSOP (B)

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 PI3HDMI1212 is a 2-to-1 HDMI Mux/DeMux Switch. The device multiplexes differential signals to one of two corresponding HDMI inputs. 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 4.0Gbps 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

Pin Description

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Truth Table

SEL(pin11)	Function[1]
L	$D_x \rightarrow D_xA$
H	$D_x \rightarrow D_xB$

EN(pin40)	IN(pin36)	Function[2]
L	L	$A_n \rightarrow {_n}B_1$
L	H	$A_n \rightarrow {_n}B_2$
H	X	$A_n = {_n}B_1 = {_n}B_2 = H_1\text{-}Z$

Note:
1) x=0,1,2,3
2) n=0,1,2,3

Pin Description

Pin Name	Description
$V_{DD}33$	3.3V Power supply
CP	Tie this pin to GND via 0.1µF capacitor for optimal operation
$V_{DD}50$	5.0V Power supply
Dx	High Speed TMDS signal I/O
DxA, DxB	High Speed TMDS signal I/O
SEL	High Speed Signal Control
IN	Side Band Signal Control
Ax, xB1, xB2	Side Band Signal I/O
GND	GND pin
EN\	Global Enable for Side Band Signals

Maximum Ratings

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

Storage Temperature..–65°C to +150°C

DC Input Voltage for side band signals.................-0.5V to 5.5V
DC Output Current..20mA
Power Dissipation...0.5W
Supply Voltage $V_{DD}33$..3.0V to 3.6V
Supply Voltage $V_{DD}50$.....................................4.2V to 5.5V

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 Power Supply Characteristics

Paramenter	Description	Min.	Max.	Units
V_{DD}^{33}	3.3V Power Supply	3.0	3.6	V
V_{DD}^{50}	5.0 Power Supply	4.2	5.5	V

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DC Electrical Characteristics for Switching over Operating Range

($T_A = -40°C$ to $+85°C$)

Paramenter	Description	Test Conditions	Min.	Typ[2]	Max.	Units
$V_{IH_{SEL}}$[3]	Input HIGH Voltage	Guaranteed HIGH level	2.8			V
$V_{IL\ SEL}$[3]	Input LOW Voltage	Guaranteed LOW level			2.0	
$V_{IK_{HS}}$[4]	Clamp Diode Voltage	V_{DD}=Max., I_{IN}=−18mA			0.9	

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.

2. Typical values are at $T_A = 25°C$ ambient and maximum loading.

3. $V_{IH_{SEL}} + V_{IL_{SEL}}$ are for SEL input only (pin 11)

4. For High-speed signals only

DC Electrical Characteristics for Switching over Operating Range

($T_A = -40°C$ to $+85°C$) for high speed signals only

Paramenter	Description	Test Conditions	Min.	Typ[2]	Max.	Units
$V_{IH_{IN}}$[3]	Input HIGH Voltage	Guaranteed HIGH level	2.1			V
$V_{IL_{IN}}$[3]	Input LOW Voltage	Guaranteed LOW level			0.8	
$V_{IK_{HS}}$[4]	Clamp Diode Voltage	V_{DD}=Max., I_{IN}=−18mA			-0.9	
IIH	Input HIGH Current	V_{DD}=Max., V_{IN}=V_{DD}			±5	µA
IIL	Input LOW Current	V_{DD}=Max., V_{IN}=V_{SS}			±5	

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.

2. Typical values are at $T_A = 25°C$ ambient and maximum loading.

3. $V_{IH_{IN}} + V_{IL_{IN}}$ are for IN input only.

4. For Side-speed signals only

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Power Supply Characteristics

Parameters	Description	Test Conditions[1]	Min.	Typ.[2]	Max.	Units
I_{CC}	Quiescent Power Supply Current	V_{DD} = Max., V_{IN} = V_{DD} or V_{SS}		11		mA

Notes:
1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at T_A = 25°C ambient and maximum loading.

Dynamic Electrical Characteristics Over the Operating Range (T_A= -40º to +85ºC)

Parameter	Description	Test Conditions	Min.	Typ.[2]	Max.	Units
$X_{TALK_{HS}}$[1]	Crosstalk	See Fig. 1 for Measurement Setup, f = 1.65Gbps		-45		dB
$X_{TALK_{SB}}$[2]		f = 250KHz		-80		
$O_{IRR_{HS}}$[1]	OFF Isolation	See Fig. 2 for Measurement Setup, f = 1.65Gbps		-40		
$O_{IRR_{SB}}$[2]		250KHz		-56		
BW_{HS}[1]	-3dB Bandwith			2.7		GHz
IL_{HS}[1]	Insertion Loss	@1.65 Gbps (8-bit deep color)		-.87		dB
		@2.0625 Gbps (10-bit deep color)		-0.96		
		@2.475 Gbps (12-bit deep color)		-1.18		
		@3.3 Gbps (16-bit deep color)		-1.84		

Notes:
1. High-speed signal path only
2. Side-band signal path only
3. Typical values are @ T_A = 25˚C ambient

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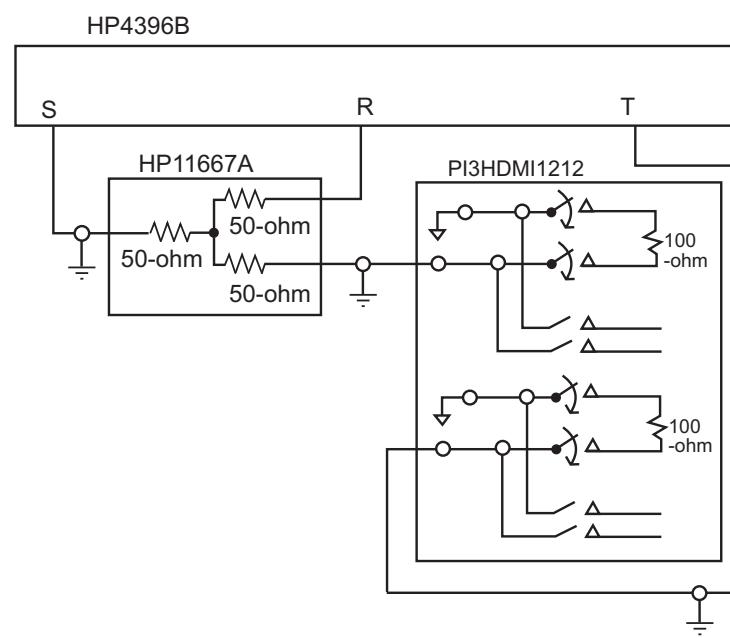
Fig 1. Crosstalk Setup
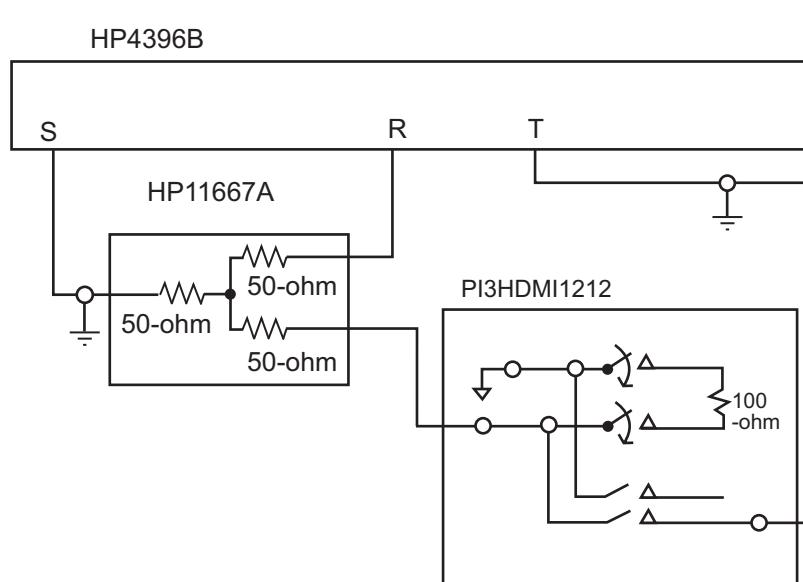
Fig 2. Off-isolation setup

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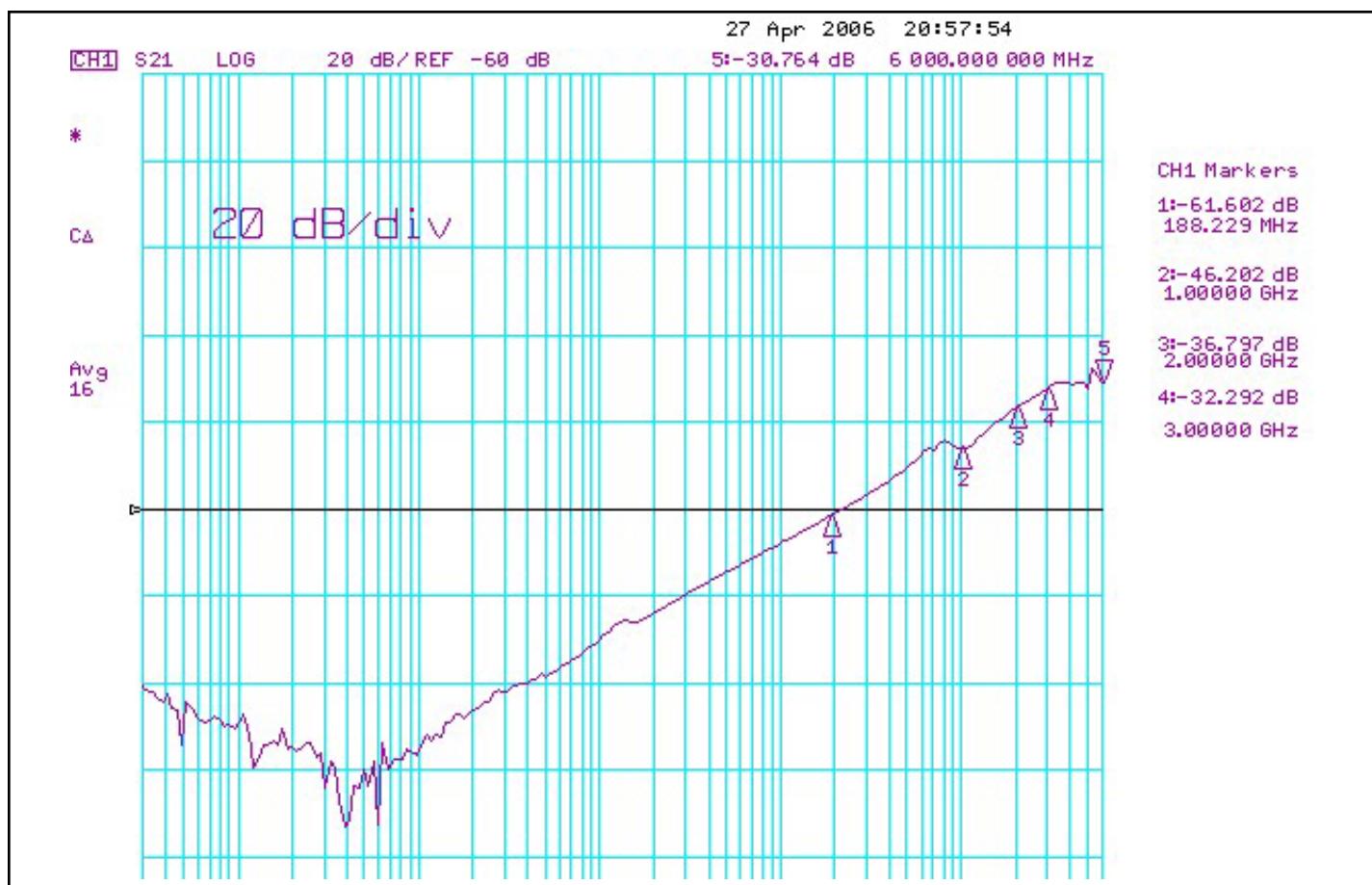
Fig 3. Crosstalk for High-speed signals only

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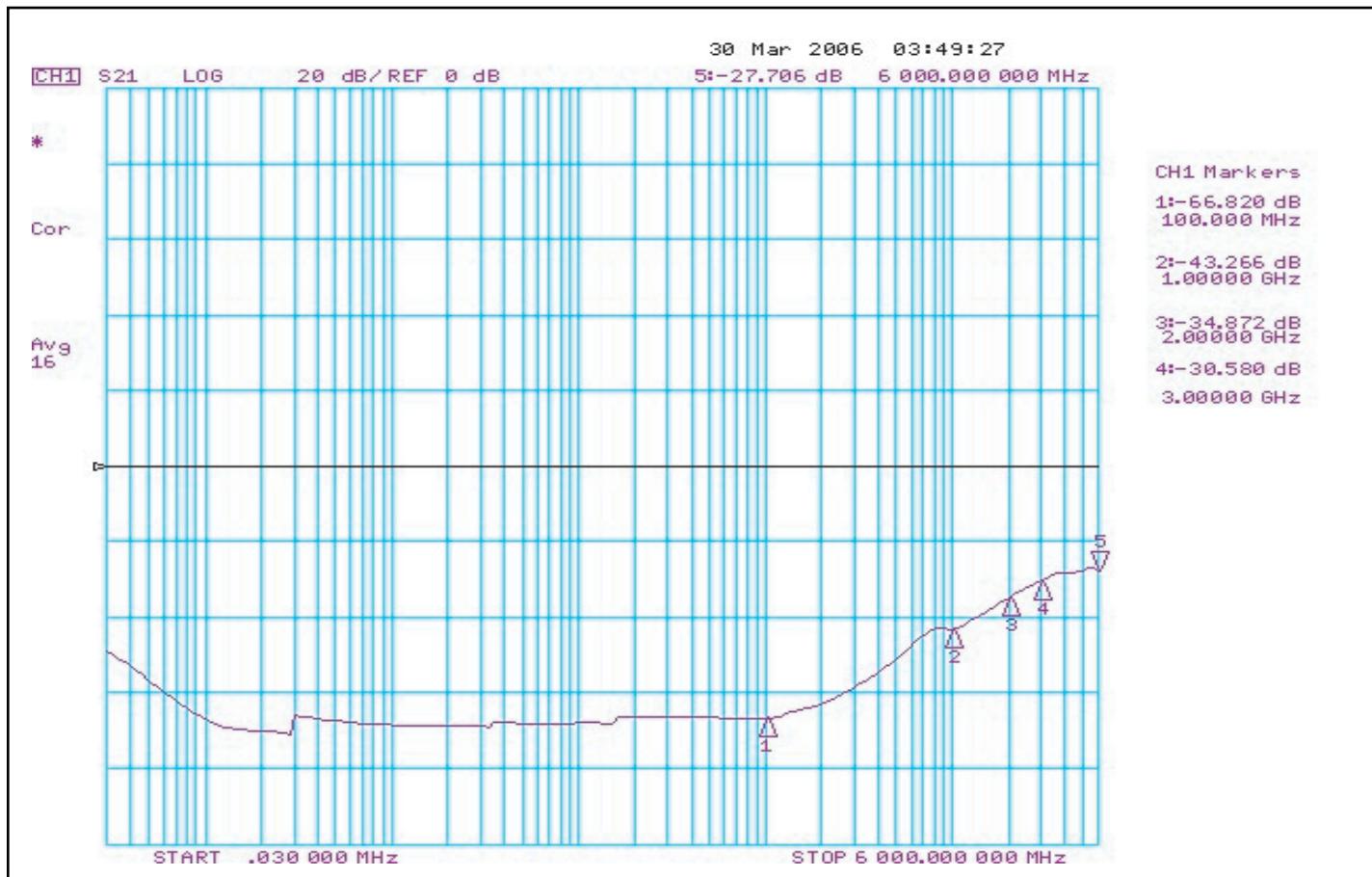
Fig 4. Off Isolation for high-speed signals only

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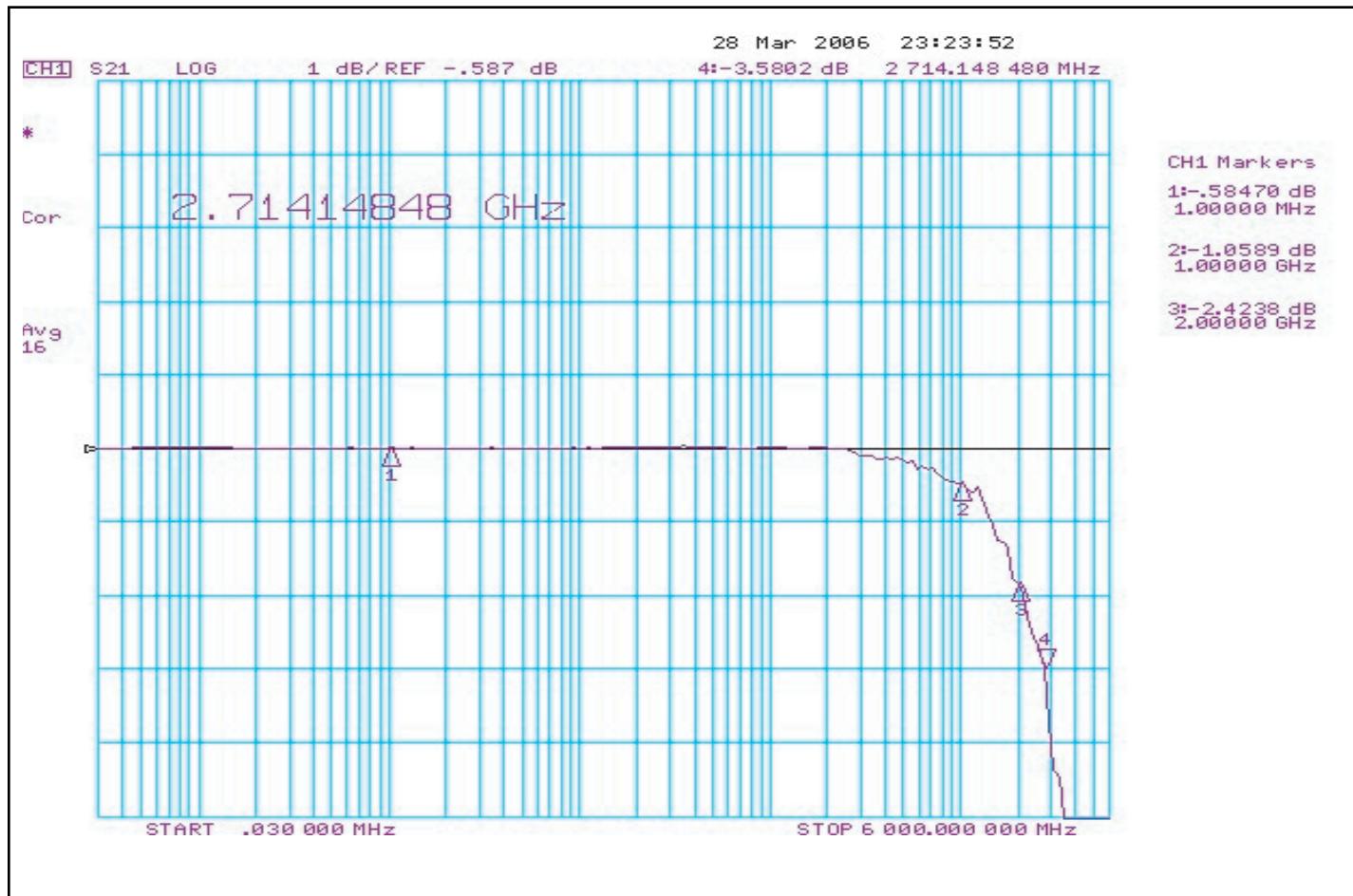
Fig 4. Insertion loss for high-speed signals only

Switching Characteristics (T_A= -40º to +85ºC, $V_{DD}33$= 3.3V±10%, $V_{DD}50$= 5.0V±10%

Parameter	Description	Min.	Typ.[2]	Max.	Units
t_{PZH}, t_{PZL}	Line Enable Time - SEL to A_N, B_N	0.5		8.0	**ns**
t_{PHZ}, t_{PLZ}	Line Disable Time - SEL to A_N, B_N	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

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Test Circuit for Electrical Characteristics[1]
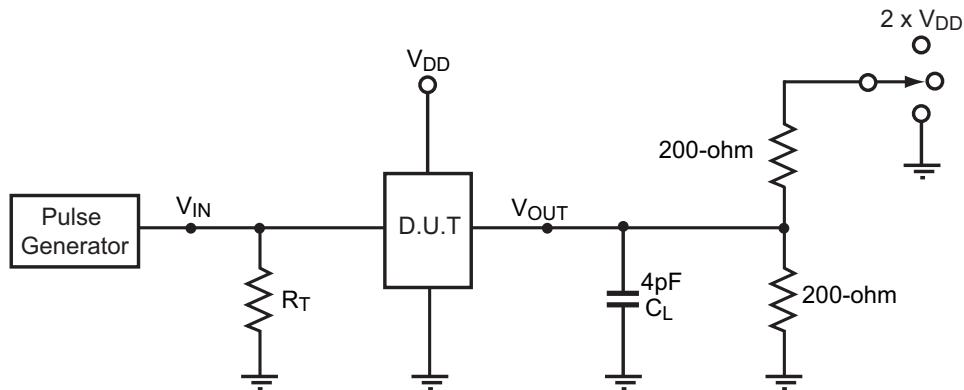
Notes:
1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
    Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
4. All input impulses are supplied by generators having the following characteristics: PRR ≤ MHz, Z_O = 50Ω, t_R ≤ 2.5ns, t_F ≤ 2.5ns.
5. 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 x (V_{DD}33)
t_{PHZ}, t_{PZH} (output on B-side)	GND
Prop Delay	Open

Test Circuit for Dynamic Electrical Characteristics

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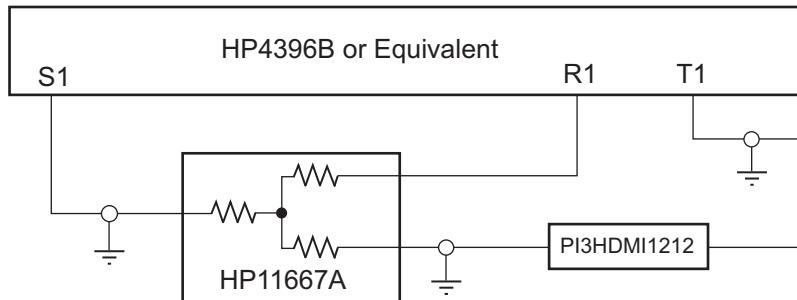
Switching Waveforms
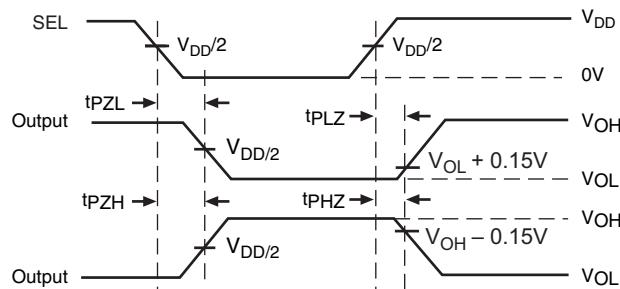
Voltage Waveforms Enable and Disable Times
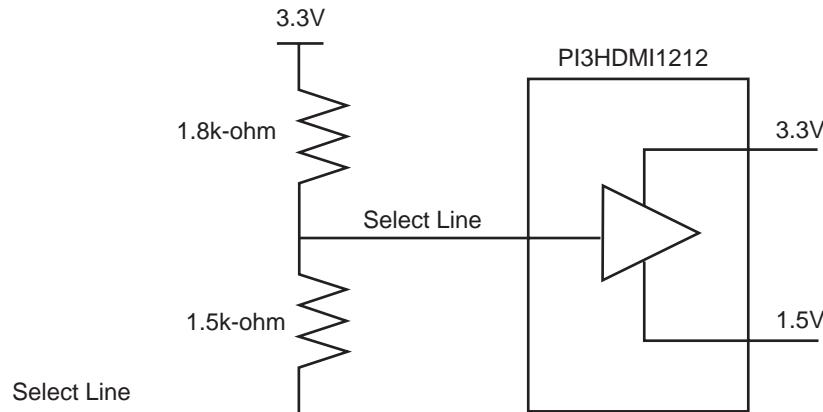
**Example of a circuit that needs to be connected to the SEL pin (11) of the PI3HDMI1212 of our device:**

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Application Test Results
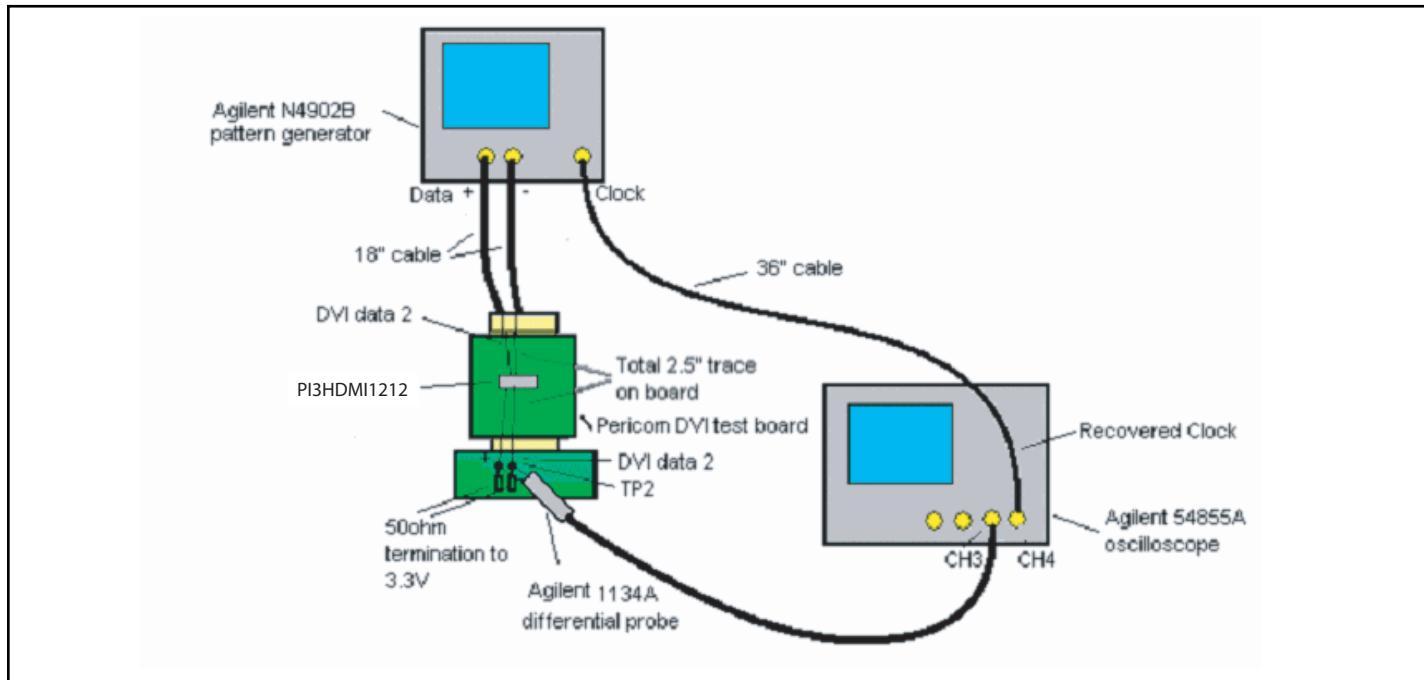
Figure 1. TMDS TP2 Tx eye compliance test setup
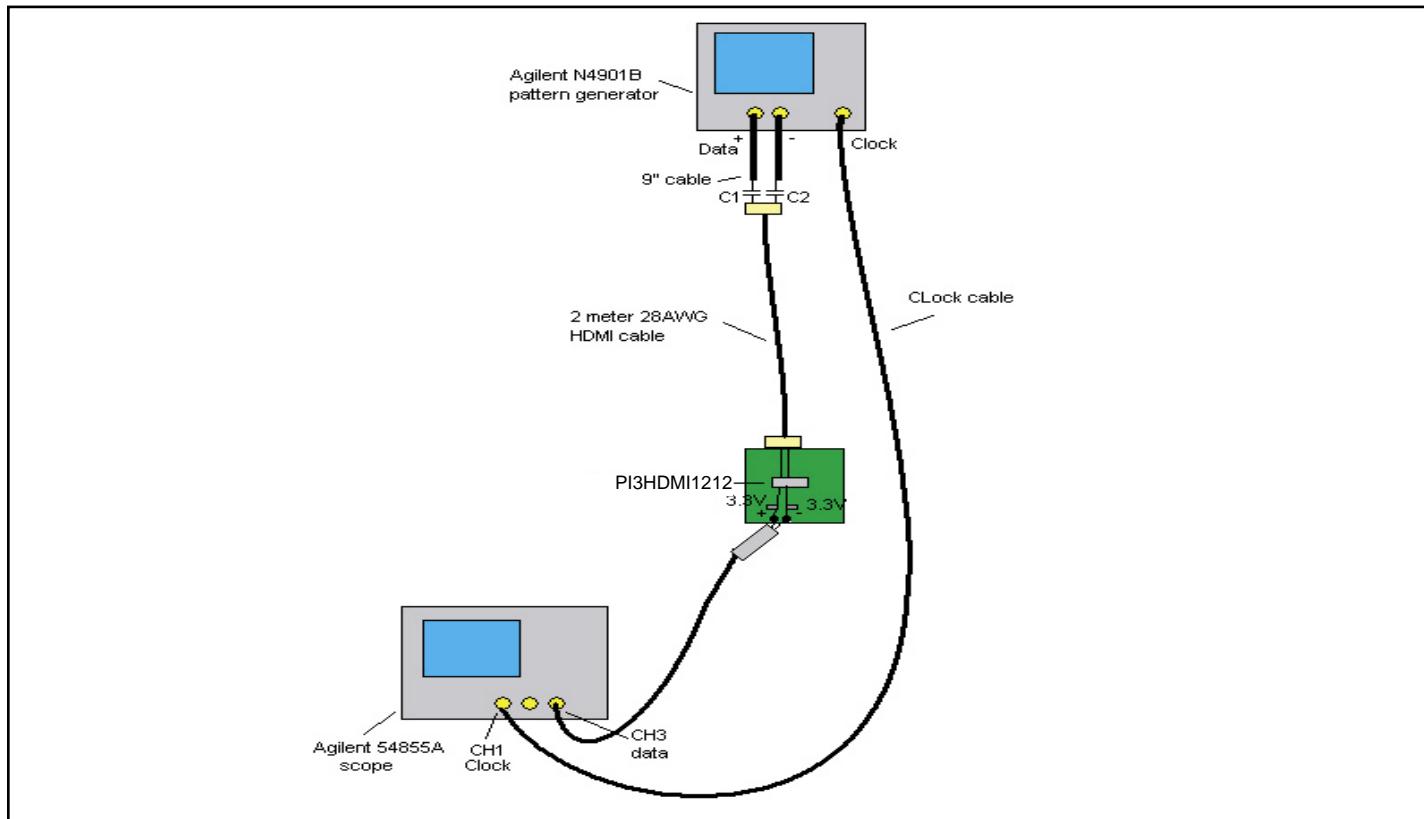
Figure 2. TMDS TP3 Rx "switch at receiver" eye compliance test setup

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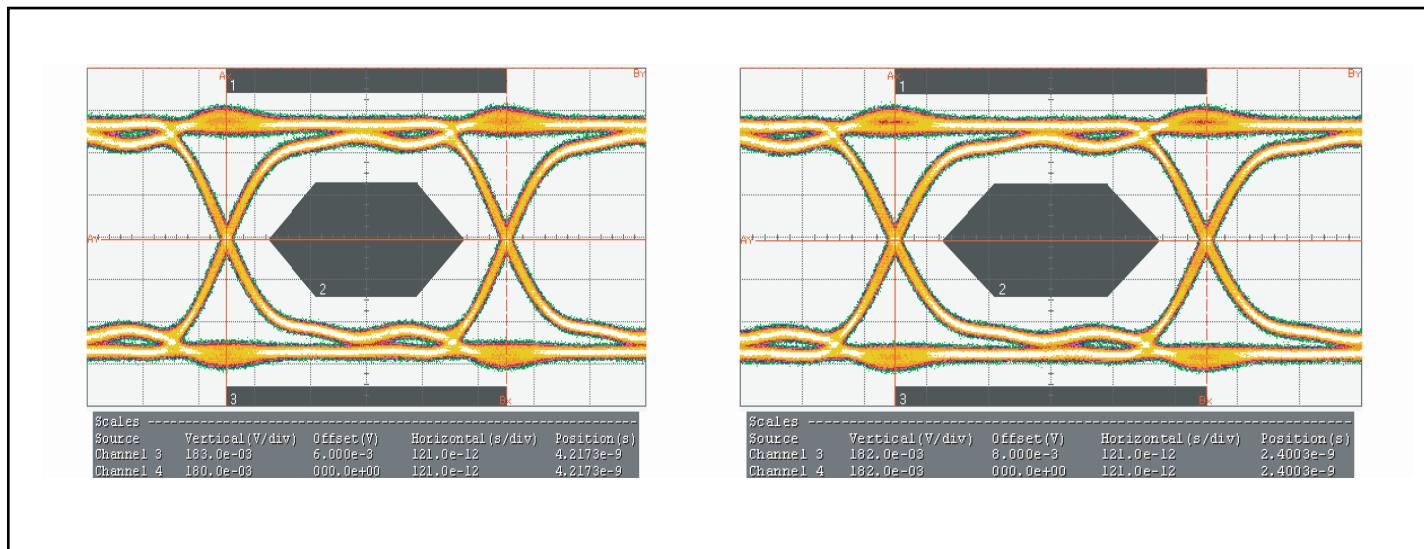
Figure 3. TP2 (Tx) eye-measurements (left is with switch, right is without switch), refer to figure 1 for the test set up
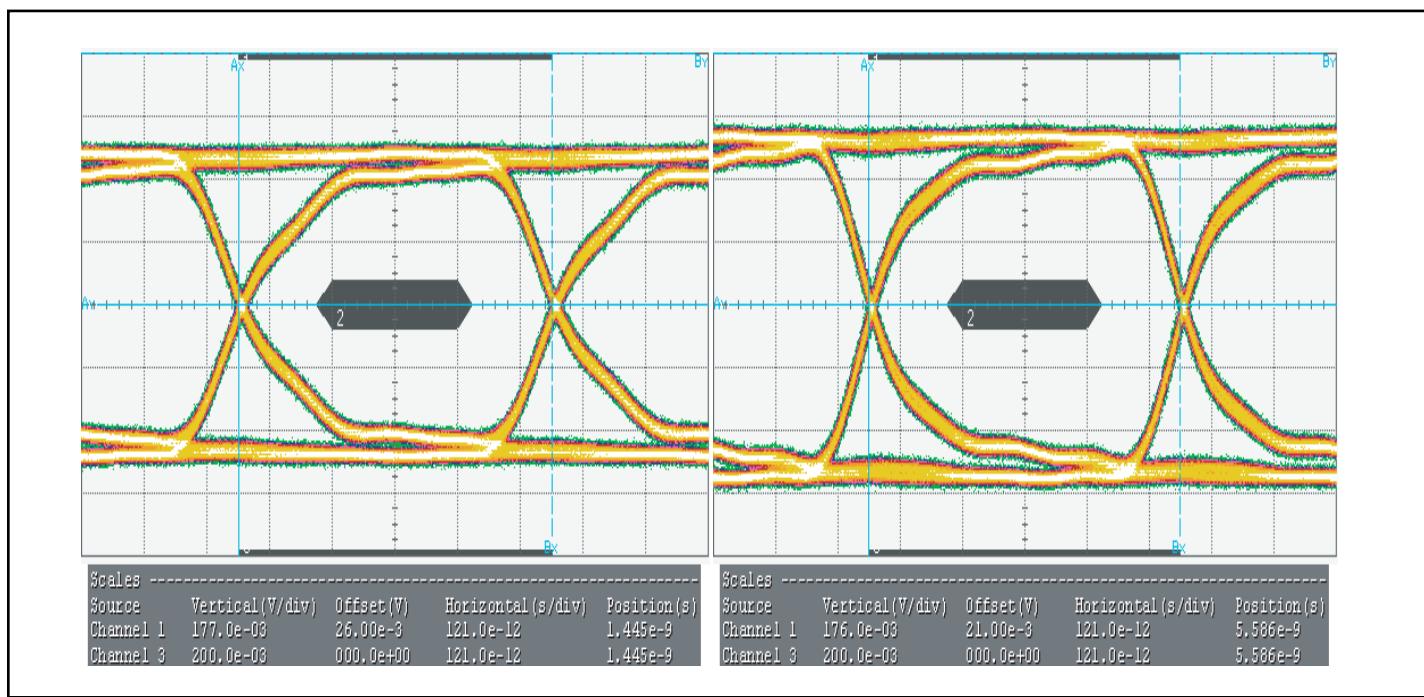
Figure 4. TP3 (Rx) - "Switch at receiver side" with 2-meter cable eye-measurements (left is with switch, right is without switch), refer to figure 2 for the test set up.

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Packaging Mechanical: 80-pin BQSOP (B)
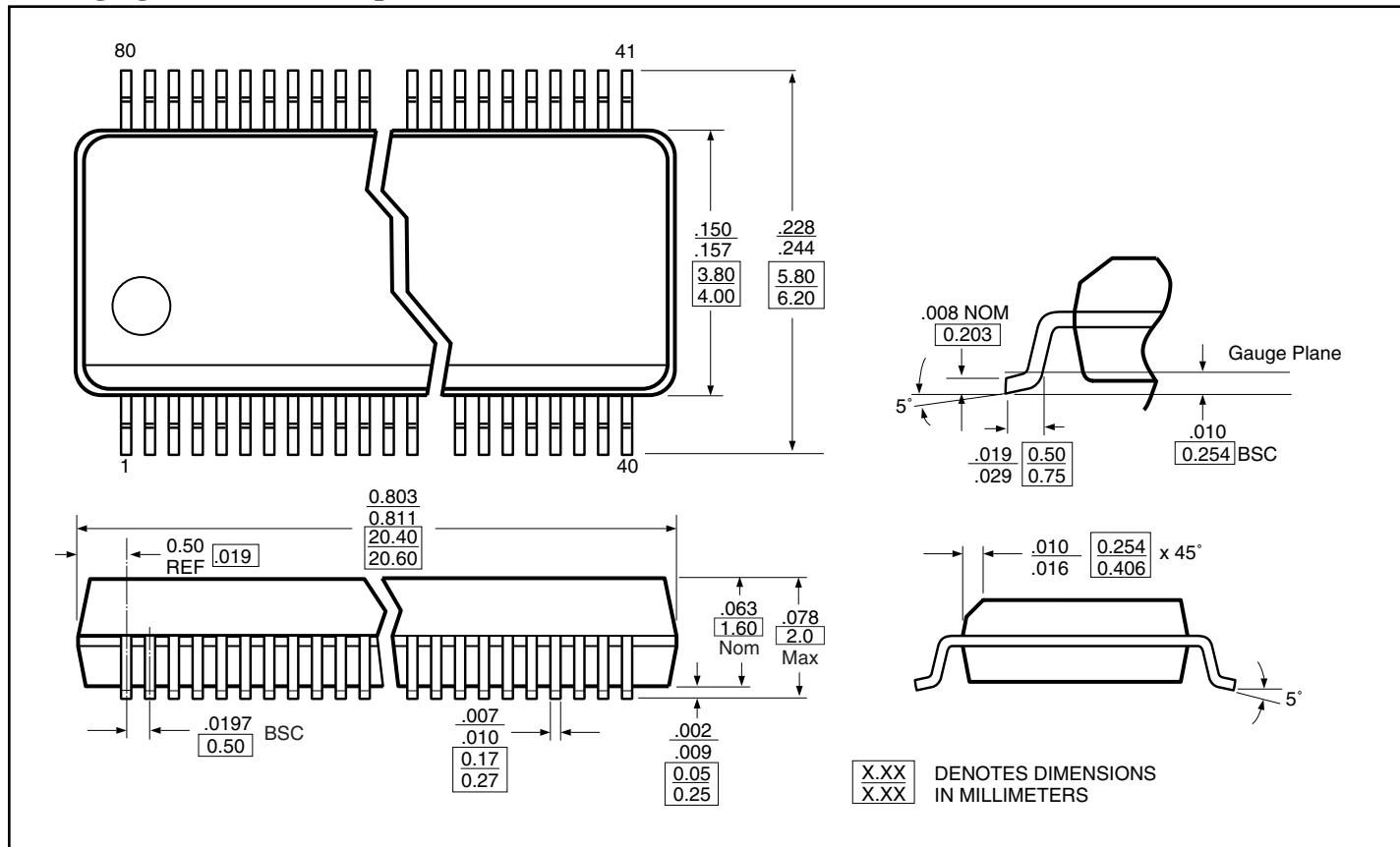
Ordering Information

Ordering Code	Package Code	Package Description
PI3HDMI1212BE	B	Pb-free & Green, 80-pin TSSOP

Notes:

1. Thermal characteristics can be found on the company web site at www.pericom.com/packaging/

2. E = Pb-free and Green

3. X Suffix = Tape/Reel