

High-performance HDMI™ 1.3 Compatible Signal Switch w/ Integrated Side-band Signal Support

Features

- 4-Differential Channel 2:1 Mux/DeMux + 4-Channel 2:1 Mux/DeMux
- Deep Color™ Support
- Data Rate: 4.0Gbps for high speed data channels
- Clock rate max support @ 340MHz
- 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 & clock:
 - 12kV HBM per JESD22 standard
 - 8kV contact per IEC61000-4-2 standard
- Side band signal bits: 2kV HBM
- Low bit-to-bit skew
- Enable/Disable time: 9ns
- Targeted for MUX applications only
- Packaging (Pb-free & Green):
 - 80-pin BQSOP (B)

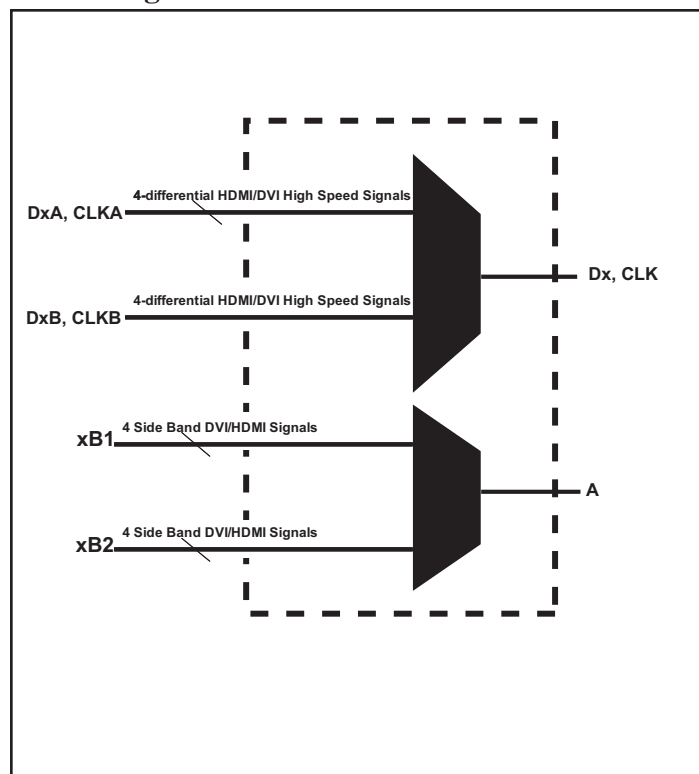
Description

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-A 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.

PI3HDMI1212-A was designed specifically to meet ATC-Sink requirements. Therefore, Pericom recommends locating this switch at the sink to switch between multiple sources.

Block Diagram



Pin Description

CP	1	80	V _{DD} 33
V _{DD} 33	2	79	D0+A
CP	3	78	D0-A
V _{DD} 33	4	77	D1+A
D0+	5	76	D1-A
D0-	6	75	D2+A
CP	7	74	D2-A
D1+	8	73	CLK+A
D1-	9	72	CLK-A
V _{DD} 33	10	71	CP
SEL	11	70	V _{DD} 33
GND	12	69	D0+B
D2+	13	68	D0-B
D2-	14	67	D1+B
CP	15	66	D1-B
CLK+	16	65	D2+B
CLK-	17	64	D2-B
V _{DD} 33	18	63	CLK+B
GND	19	62	CLK-B
V _{DD} 33	20	61	V _{DD} 33
V _{DD} 33	21	60	GND
GND	22	59	NC
NC	23	58	NC
CP	24	57	CP
NC	25	56	NC
V _{DD} 33	26	55	V _{DD} 33
GND	27	54	GND
NC	28	53	0B1
A0	29	52	0B2
V _{DD} 50	30	51	1B1
A1	31	50	1B2
GND	32	49	GND
A2	33	48	2B1
GND	34	47	2B2
A3	35	46	3B1
IN	36	45	3B2
NC	37	44	NC
NC	38	43	NC
V _{DD} 50	39	42	V _{DD} 50
EN	40	41	GND

Truth Table

SEL(pin11)	Function ⁽¹⁾
L	CLK → CLKA
L	D _x → D _x A
H	D _x → D _x B
H	CLK → CLKB

$\overline{\text{EN}}$ (pin40)	IN(pin36)	Function ⁽²⁾
L	L	A _n → _n B ₁
L	H	A _n → _n B ₂
H	X	A _n = _n B ₁ = _n B ₂ =H ₁ -Z

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

Pin Description

Pin Name	Description
V _{DD33}	3.3V Power supply
CP	Tie this pin to GND via 0.1μF capacitor for optimal operation
V _{DD50}	5.0V Power supply
D _x	High Speed TMDS signal I/O
D _x A, D _x B	High Speed TMDS signal I/O
SEL	High Speed Signal Control
IN	Side Band Signal Control
A _x , xB ₁ , xB ₂	Side Band Signal I/O
GND	GND pin
$\overline{\text{EN}}$	Global Enable for Side Band Signals
CLK, CLKA/B	TMDS CLK signal I/O

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 _{DD33}	3.0V to 3.6V
Supply Voltage V _{DD50}	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

Parameter	Description	Min.	Max.	Units
V _{DD33}	3.3V Power Supply	3.0	3.6	V
V _{DD50}	5.0 Power Supply	4.2	5.5	V

DC Electrical Characteristics for Switching over Operating Range

($T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$) for high speed only

Parameter	Description	Test Conditions	Min.	Typ ⁽²⁾	Max.	Units
$V_{IHSEL}^{(3)}$	Input HIGH Voltage	Guaranteed HIGH level	2.8			V
$V_{ILSEL}^{(3)}$	Input LOW Voltage	Guaranteed LOW level			2.0	
$V_{IKHS}^{(4)}$	Clamp Diode Voltage	$V_{DD}=\text{Max.}, I_{IN}=-18\text{mA}$			0.9	

Notes:

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $T_A = 25^{\circ}\text{C}$ ambient and maximum loading.
- $V_{IHSEL} + V_{ILSEL}$ are for SEL input only (pin 11)

DC Electrical Characteristics for Switching over Operating Range

($T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$) for side band signals only

Parameter	Description	Test Conditions	Min.	Typ ⁽²⁾	Max.	Units
$V_{IHIN}^{(3)}$	Input HIGH Voltage	Guaranteed HIGH level	2.1			V
$V_{ILIN}^{(3)}$	Input LOW Voltage	Guaranteed LOW level			0.8	
$V_{IKSB}^{(4)}$	Clamp Diode Voltage	$V_{DD}=\text{Max.}, I_{IN}=-18\text{mA}$			-0.5	
I_{IH}	Input HIGH Current	$V_{DD}=\text{Max.}, V_{IN}=V_{DD}$			± 5	μA
I_{IL}	Input LOW Current	$V_{DD}=\text{Max.}, V_{IN}=V_{SS}$			± 5	

Notes:

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $T_A = 25^{\circ}\text{C}$ ambient and maximum loading.
- $V_{IHIN} + V_{ILIN}$ are for IN input only.

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	15	mA

Notes:

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

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

Parameter	Description	Test Conditions	Min.	Typ. ⁽³⁾	Max.	Units
X _{TALK_{HS}} ⁽¹⁾	Crosstalk	See Fig. 1 for Measurement Setup, f = 1.65Gbps		-30		dB
X _{TALK_{SB}} ⁽²⁾		f = 10MHz		-62		
O _{IRR_{HS}} ⁽¹⁾	OFF Isolation	See Fig. 2 for Measurement Setup, f = 1.65Gbps		-40		
O _{IRR_{SB}} ⁽²⁾		10MHz		-67		
BW _{HS} ⁽¹⁾ Data	-3dB Bandwidth			2.3		GHz
IL _{HS} ⁽¹⁾	Insertion Loss	@1.65 Gbps (8-bit deep color)		-0.5		dB
		@2.0625 Gbps (10-bit deep color)		-0.75		
		@2.25 Gbps (12-bit deep color)		-1.0		
		@3.3 Gbps (16-bit deep color)		-1.84		
BW _{Clock}	-3dB Bandwidth			1.7		GHz

Notes:

- High-speed data path only
- Side-band signal path only
- Typical values are @ T_A = 25°C ambient

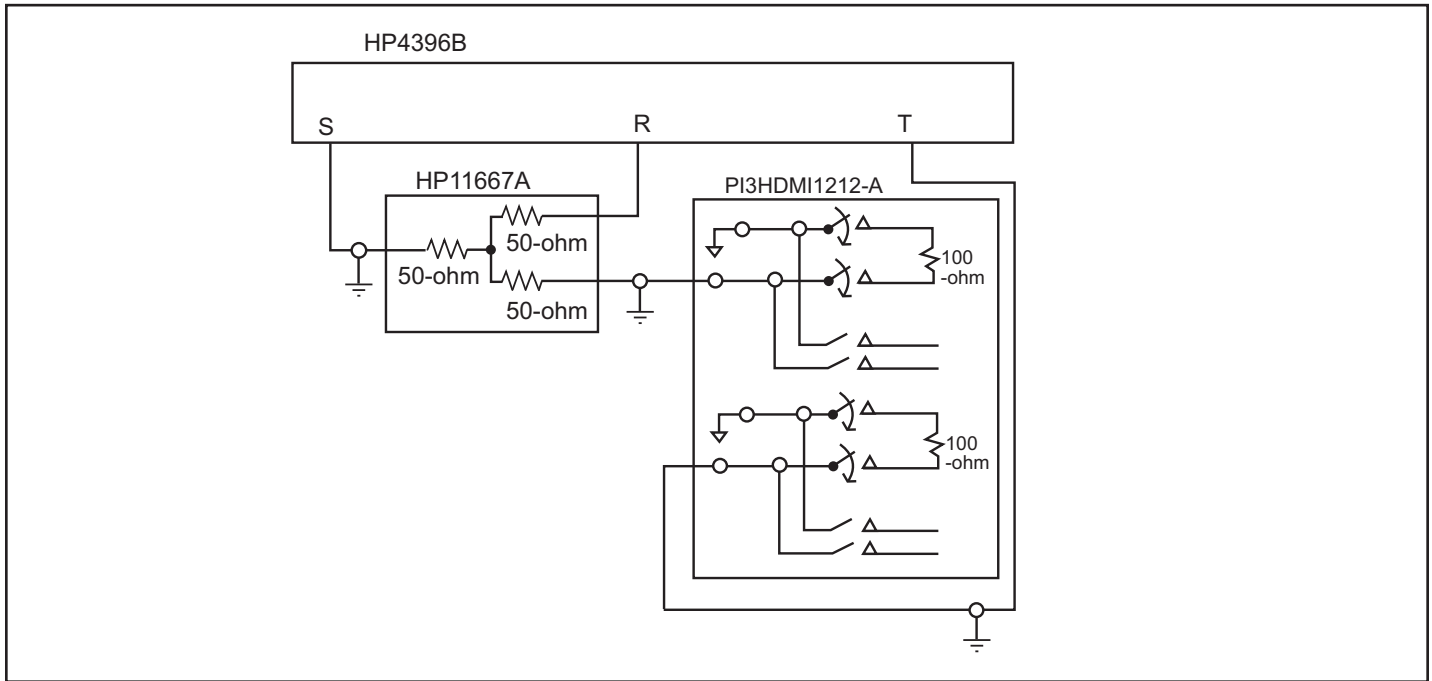


Fig 1. Crosstalk Setup

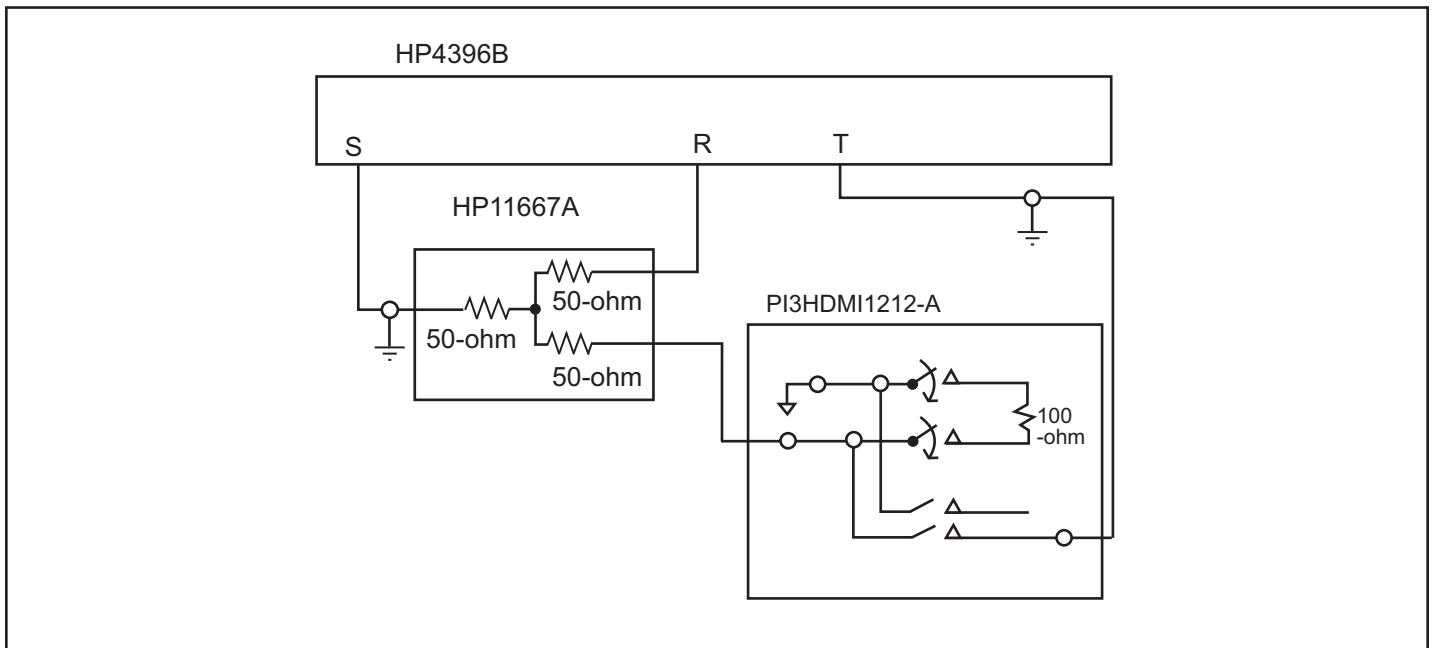


Fig 2. Off-isolation setup

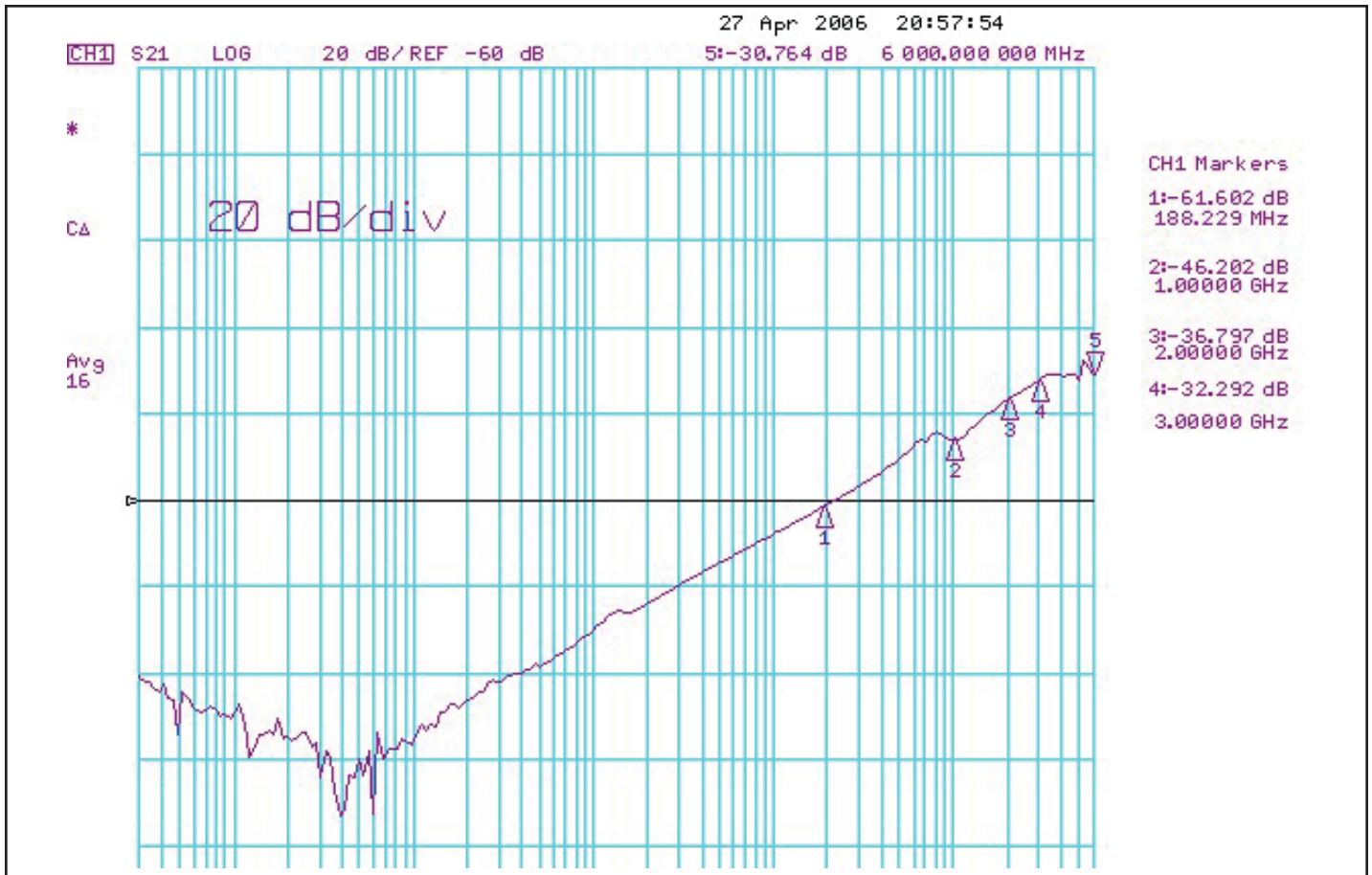


Fig 3. Crosstalk for High-speed data signals only

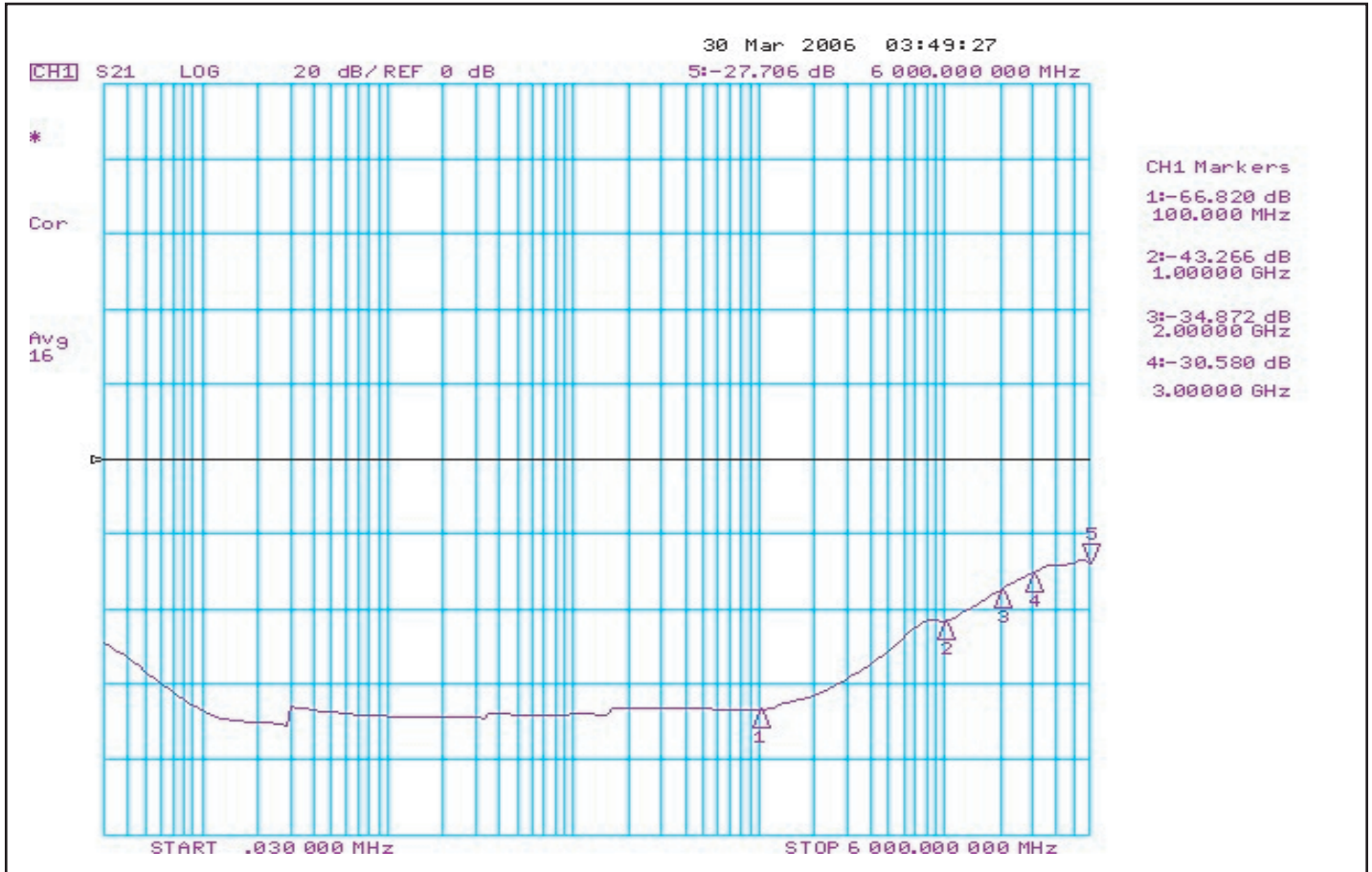


Fig 4. Off Isolation for high-speed data signals only

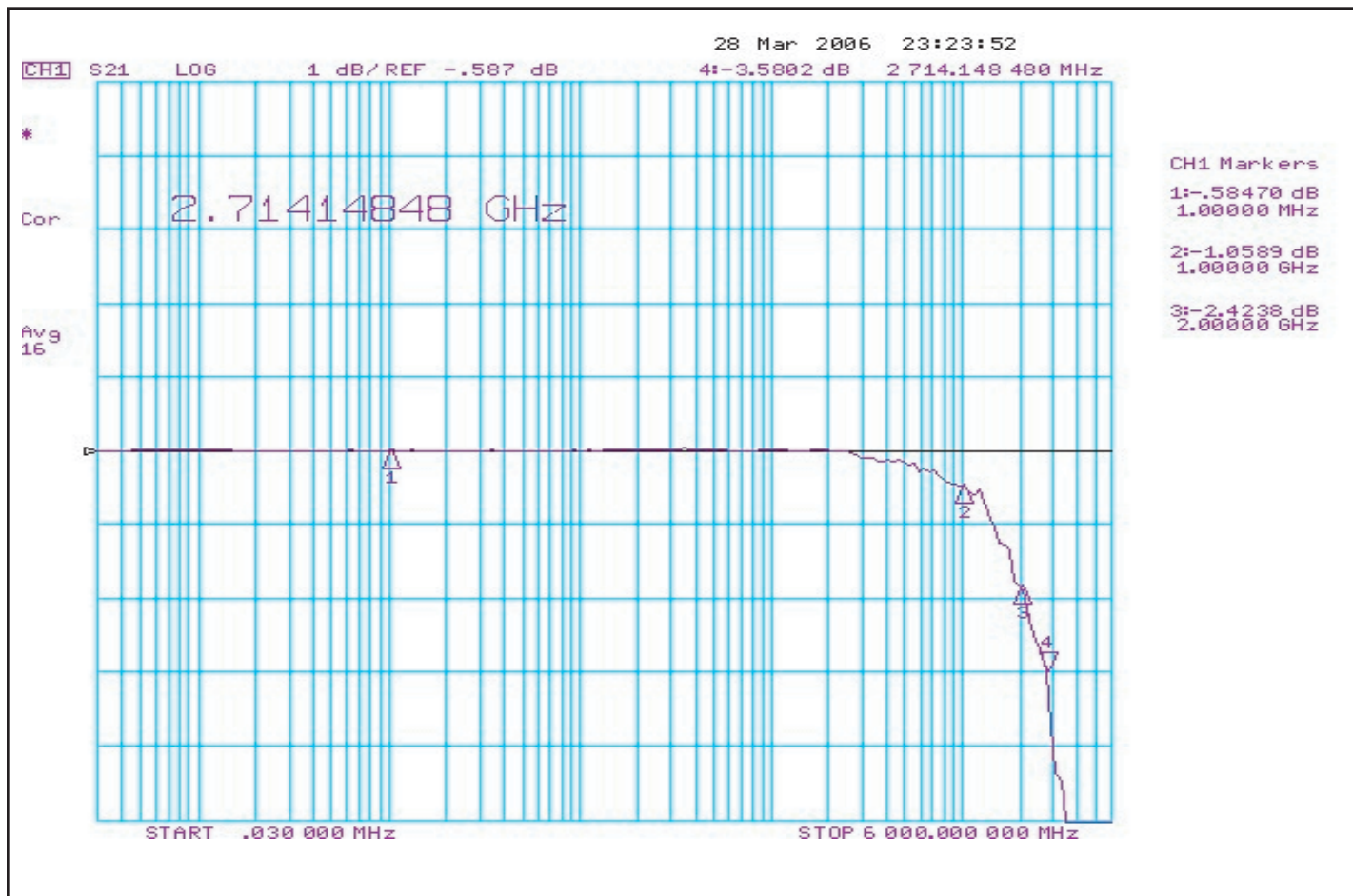


Fig 4. Insertion loss for high-speed data signals only

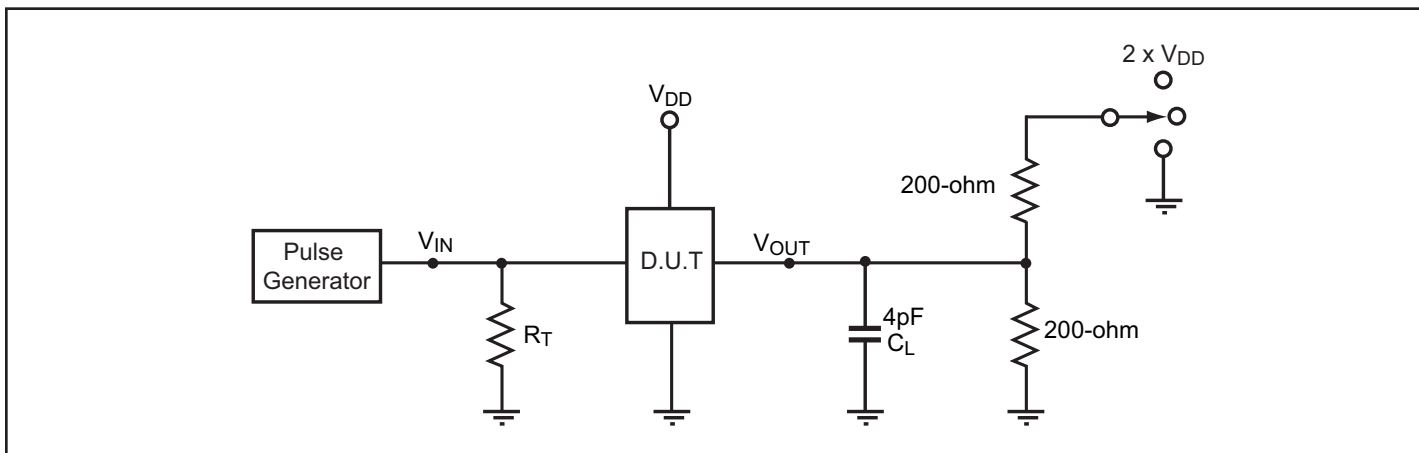
Switching Characteristics ($T_A = -40^\circ$ to $+85^\circ\text{C}$, $V_{DD33} = 3.3\text{V} \pm 10\%$, $V_{DD50} = 5.0\text{V} \pm 10\%$)

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

Test Circuit for Electrical Characteristics⁽¹⁾



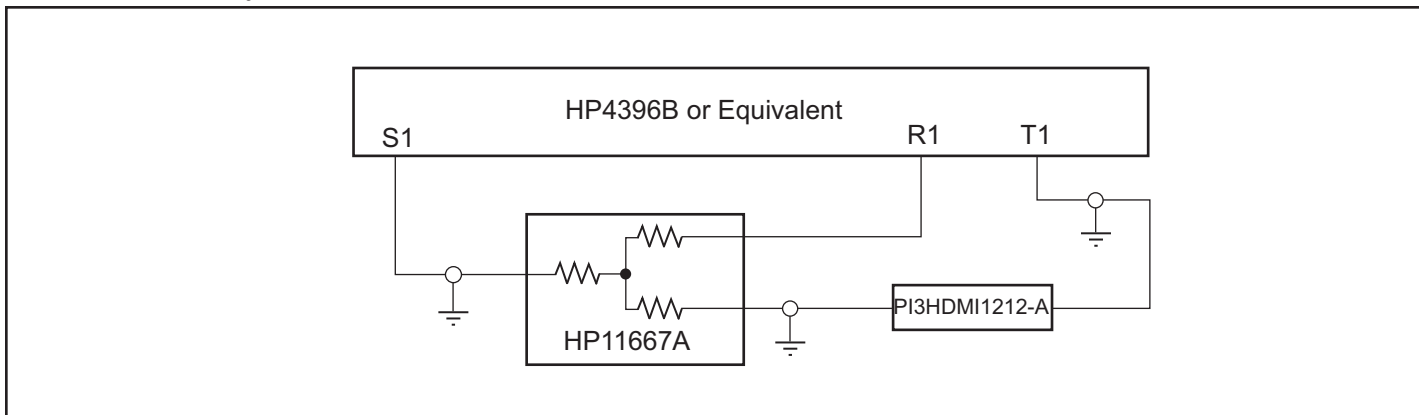
Notes:

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: $PRR \leq \text{MHz}$, $Z_O = 50\Omega$, $t_R \leq 2.5\text{ns}$, $t_F \leq 2.5\text{ns}$.
5. The outputs are measured one at a time with one transition per measurement.

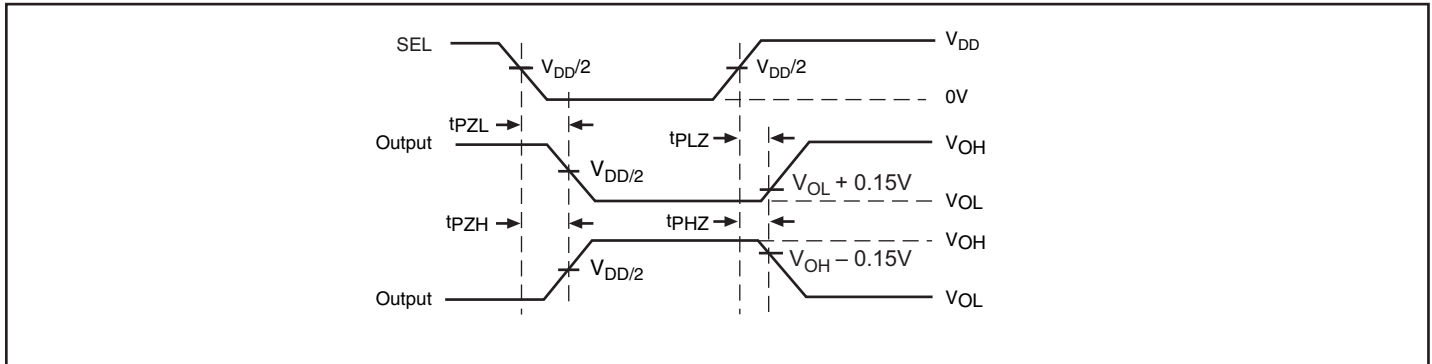
Switch Positions

Test	Switch
t_{PLZ} , t_{PZL} (output on B-side)	$2 \times (V_{DD33})$
t_{PHZ} , t_{PZH} (output on B-side)	GND
Prop Delay	Open

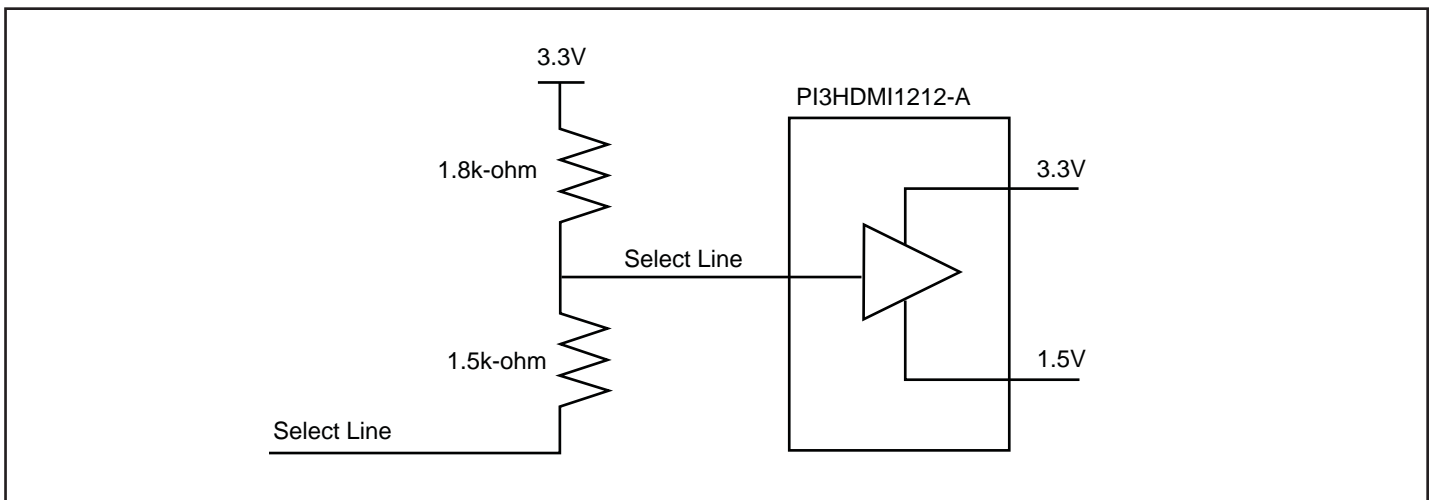
Test Circuit for Dynamic Electrical Characteristics



Switching Waveforms



Voltage Waveforms Enable and Disable Times



Example of a circuit that needs to be connected to the SEL pin (11) of the PI3HDMI1212-A of our device:

Application Test Results

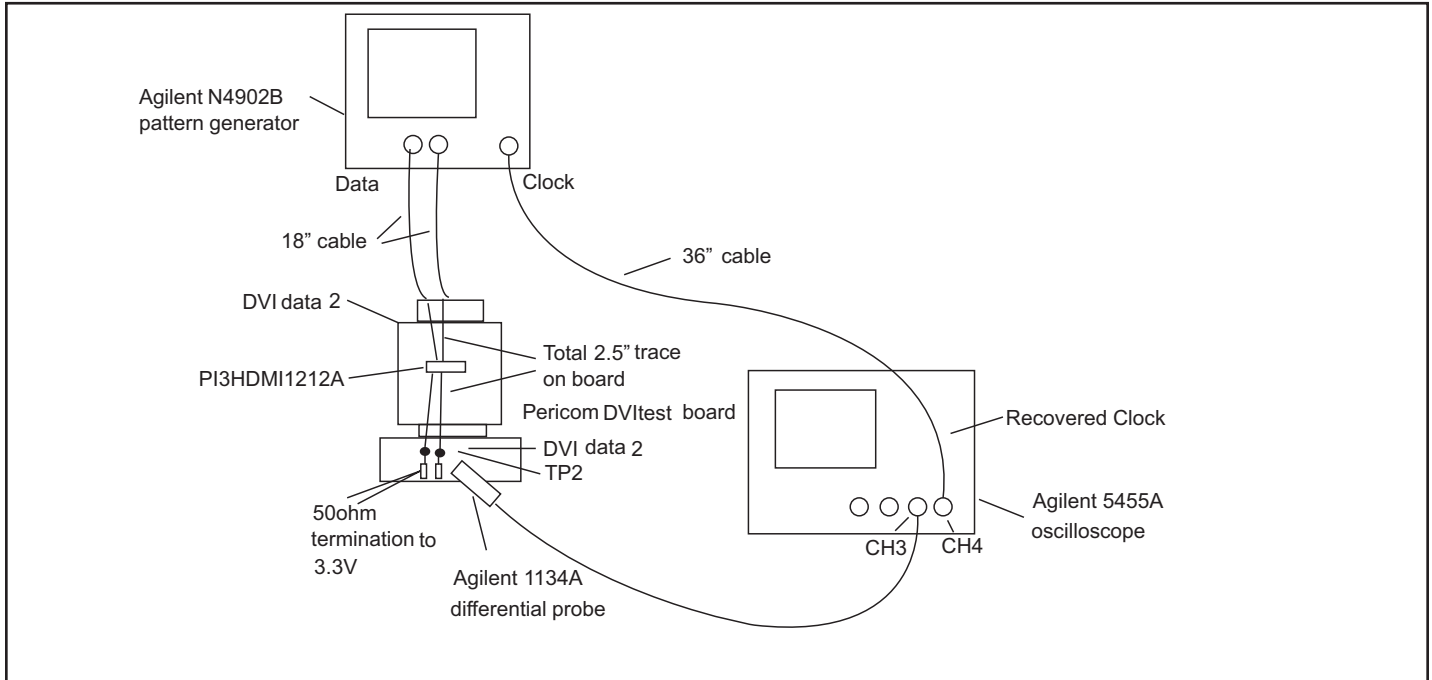


Figure 1. TMDS TP2 Tx eye compliance test setup

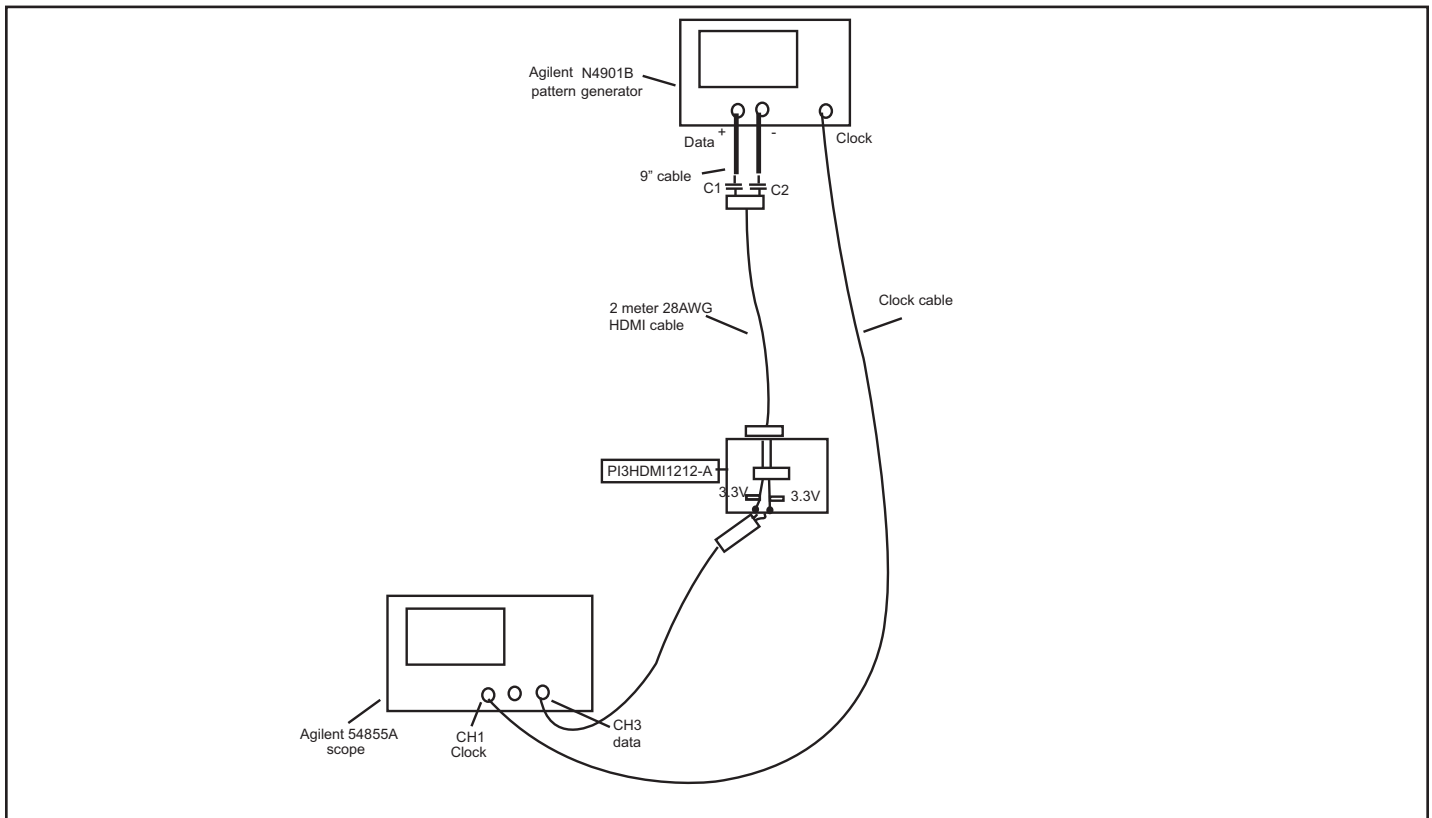


Figure 2. TMDS TP3 Rx "switch at receiver" eye compliance test setup

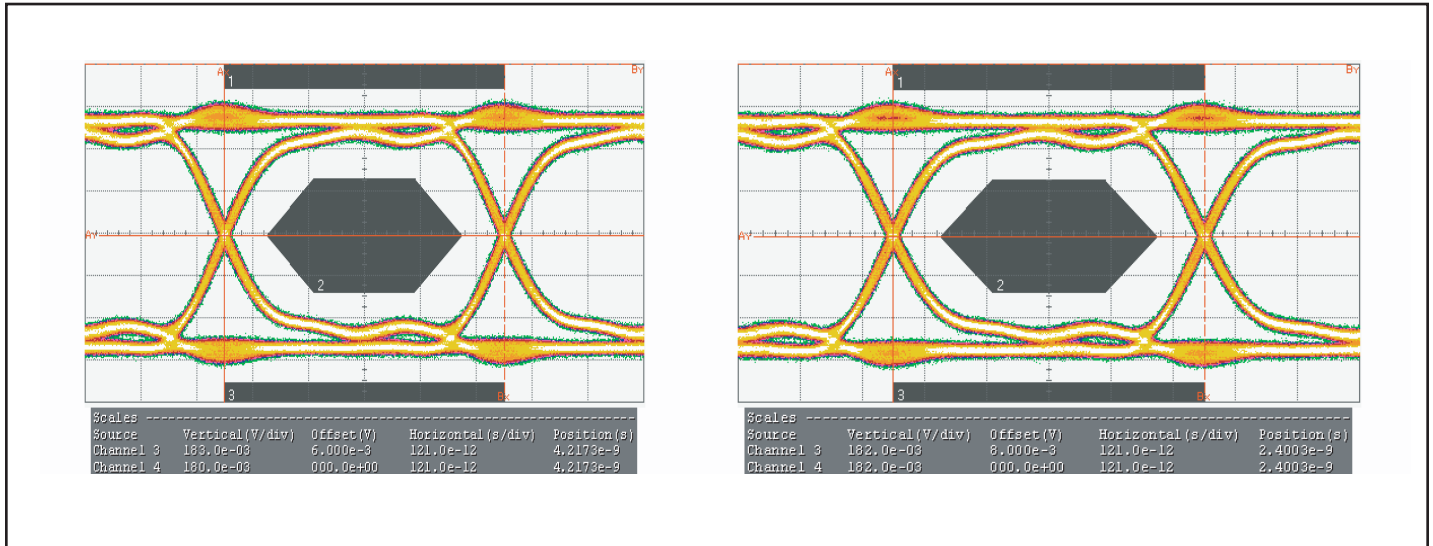


Figure 3. TP2 (Tx) eye-measurements (left is with switch, right is without switch), refer to figure 1 for the test set up

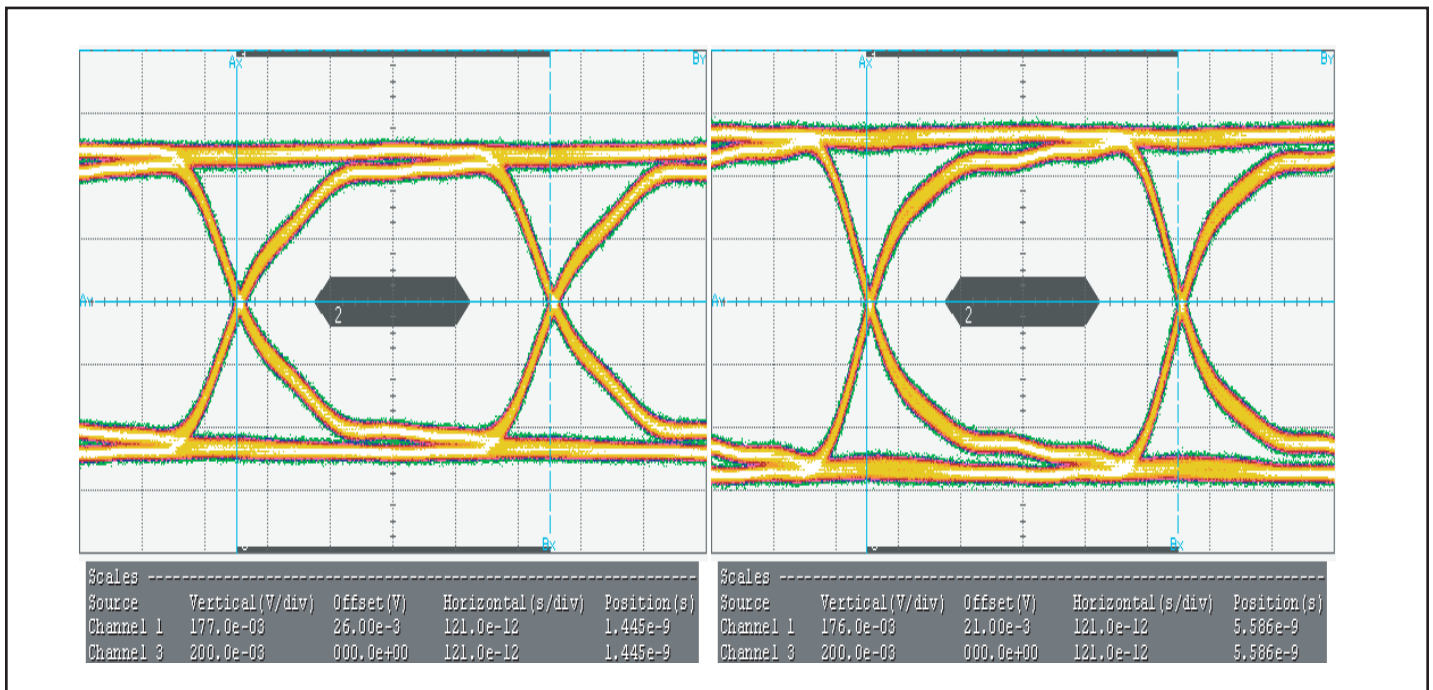
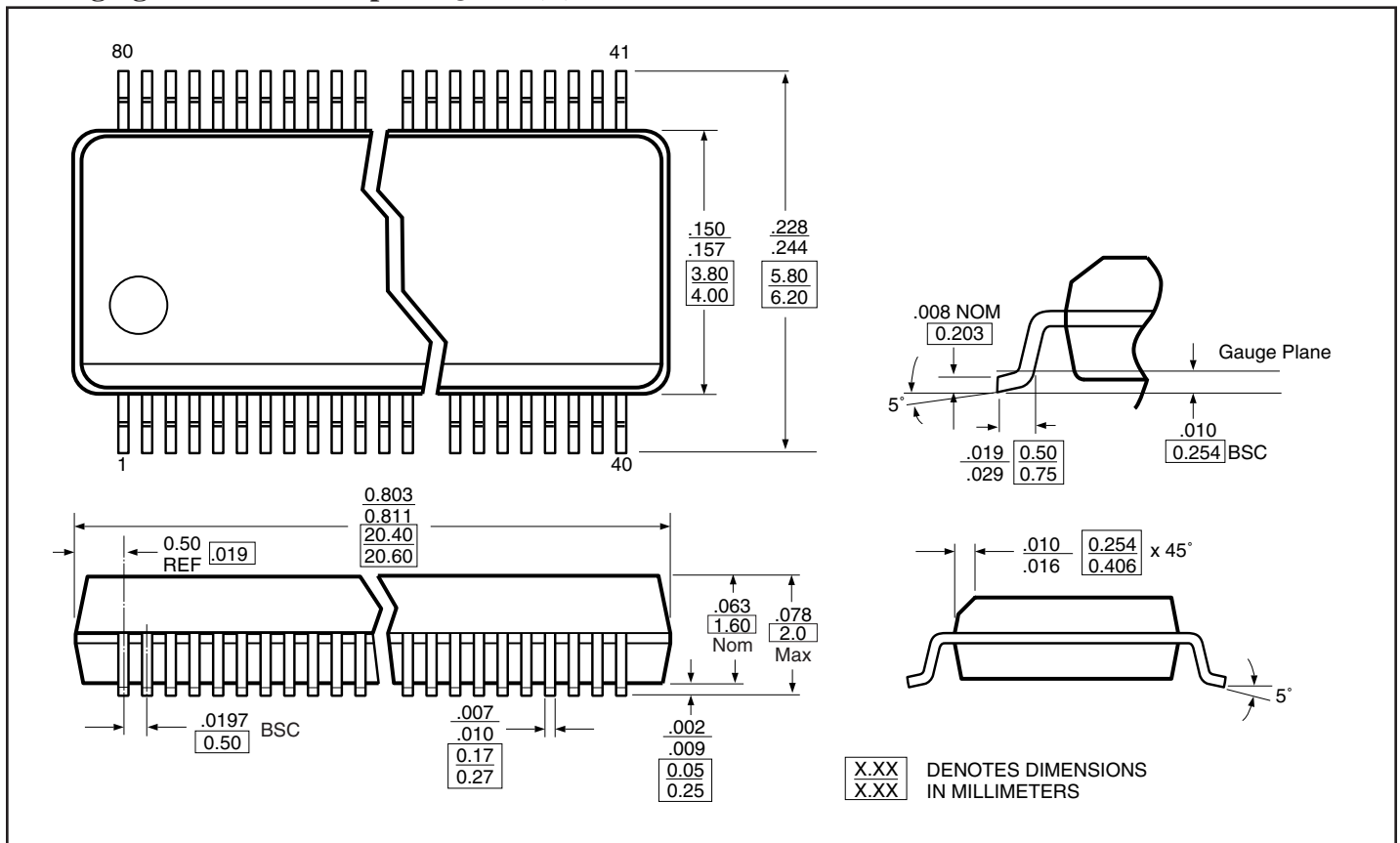


Figure 4. TP3 (Rx) - "Switch at receiver side" with 2-meter cable eye-measurements (left is with switch, right is without switch), refer to figure 2 for the test set up.

Packaging Mechanical: 80-pin BQSOP (B)



Ordering Information

Ordering Code	Package Code	Package Description
PI3HDMI1212-ABE	B	Pb-free & Green, 80-pin BQSOP

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
4. HDMI & Deep Color are trademarks of Silicon Image



HDMI Licensing, LLC, a wholly owned subsidiary of Silicon Image, Inc., is the agent responsible for licensing the HDMI Specification, promoting the HDMI standard and providing education on the benefits of HDMI to retailers and consumers. The HDMI Specification was developed by Sony, Hitachi, Thomson (RCA), Philips, Matsushita (Panasonic), Toshiba and Silicon Image as the digital interface standard for the consumer electronics market. The HDMI specification combines uncompressed high-definition video and multi-channel audio in a single digital interface to provide crystal-clear digital quality over a single cable. For more information about HDMI, please visit www.hdmi.org