

2:1 Mux/DeMux High Bandwidth (> 5 Gbps) HDMI™ 1.3 Compliant Signal Switch

Features

- 4-Differential Channel 2:1 Mux/DeMux
- HDMI™ 1.1, 1.2, and 1.3 compatible
- Allowable Data Rate: > 5.0 Gbps
- Supports both AC coupled and DC coupled signals
- Switching speed: 4ns
- Isolation: -40dB @ 2.0 Gbps
- Crosstalk: -31dB @ 2.0 Gbps
- ESD: Data bits @ 8kV contact, select bit @ 2kV HBM
- Low bit-to-bit skew
- Enable/Disable Time: 9ns
- Bidirectional
- Packaging (Pb-free & Green):
 - 42-pin TQFN (ZH42)
 - 48-pin BQSOP (B48)

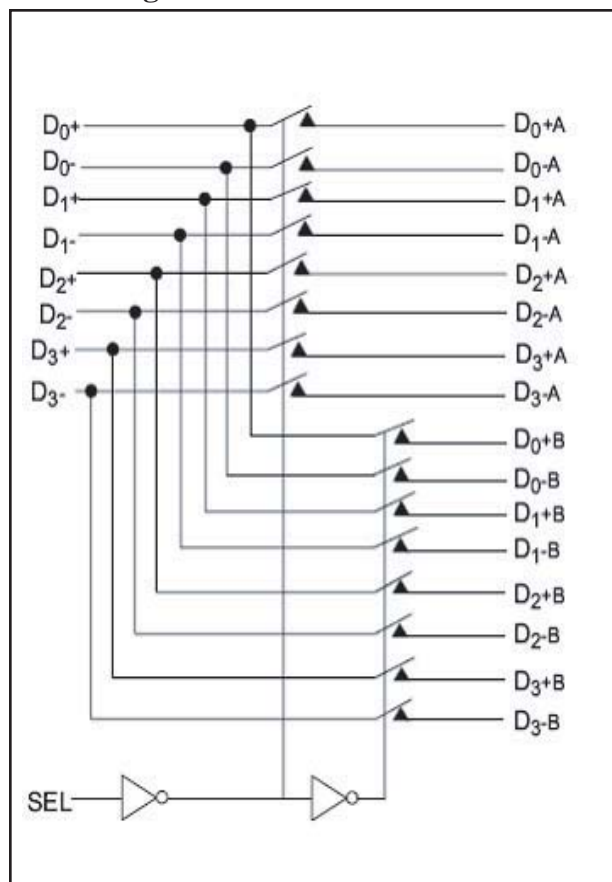
Description

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 PI3HDMI412FT-B is an 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.

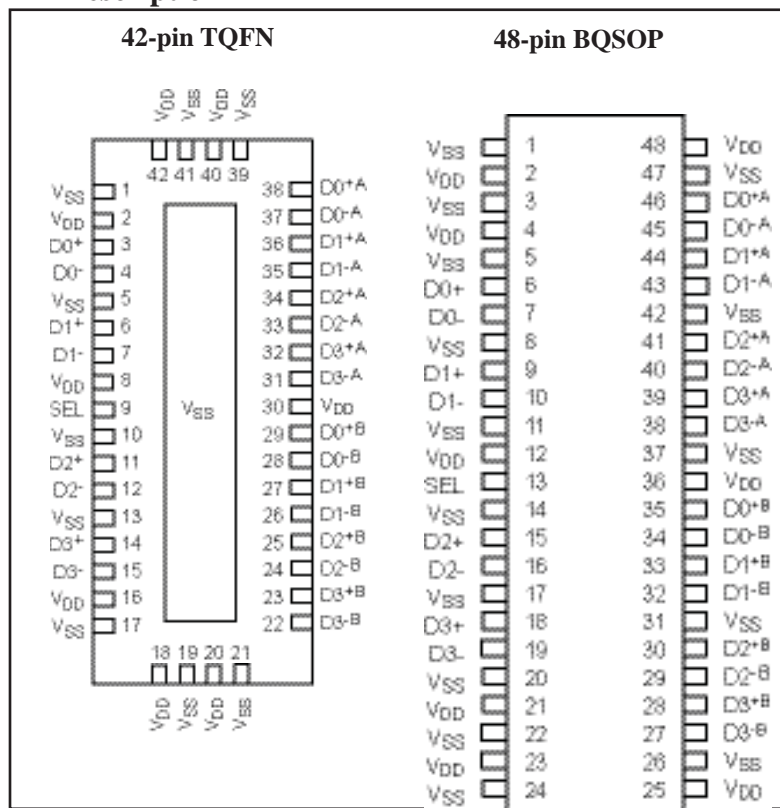
The allowable data rate of 5.0Gbps provides the resolution required by the next generation HDTV and PC graphics. Three differential channels are used for data (video signals for DVI or audio/video signals for HDMI™), and one differential channel is used for Clock for decoding the TMDS signals at the 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 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



Pin Description

Pin # (BQSOP)	Pin # (TQFN)	Pin Name	Description
2, 4, 12, 21, 23, 25, 36, 48	2, 8, 16, 18, 20, 30, 40, 42	V _{DD}	+ Power supply 3.30V
1, 3, 5, 8, 11, 14, 17, 20, 22, 24, 26, 31, 37, 42, 47	1, 5, 10, 13, 17, 19, 21, 39, 41	V _{SS}	- Power supply
13	9	SEL	Select pin, see truth table
6, 7, 9, 10, 15, 16, 18, 19, 27-30, 32-35, 38-41, 43-36	3, 4, 6, 7, 11, 12, 14, 15, 22-29, 31-38	Dx ^{+/-x} + CLK ^{+/-x}	Data + Clk bits for TMDS signal

Truth Table⁽¹⁾

Function	SEL
Dx to Dx ^A	L
Dx to Dx ^B	H

Note:

- x=0,1,2,3

Maximum Ratings

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

Storage Temperature.....	-65°C to +150°C
Supply Voltage to V _{SS} Potential.....	-0.5V to +2.5V
DC Input Voltage	0V to V _{DD} +0.5V
DC Output Current.....	120mA

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 _{DD}	Positive Power Supply	3.0	3.6	V
V _{SS}	Negative Power Supply	1.5	1.6	V

DC Electrical Characteristics for Switching over Operating Range (T_A = -40°C to +85°C)

Parameter	Description	Test Conditions ⁽¹⁾	Min.	Typ. ⁽²⁾	Max.	Units
V _{IH} ⁽³⁾	Input HIGH Voltage	Guaranteed HIGH level	0.65(V _{DD} -V _{SS})+V _{SS}			V
V _{IL} ⁽³⁾	Input LOW Voltage	Guaranteed LOW level	-0.5+V _{SS}		0.35(V _{DD} -V _{SS})+V _{SS}	
V _{IK}	Clamp Diode Voltage	V _{DD} =Max., I _{IN} =-18mA		-0.7+V _{SS}	-1.2+V _{SS}	
I _{IH}	Input HIGH Current	V _{DD} =Max., V _{IN} =V _{DD}			±5	μA
I _{IL}	Input LOW Current	V _{DD} =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°C ambient and maximum loading.
- V_{IH} & V_{IL} are for SEL 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}		300	400	μA

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.

Switching Characteristics (T_A = -40° to +85°C, V_{SS}=0V, V_{DD}=1.8V ±10%)

Parameter	Description	Min.	Max.	Units
t _{PZH} , t _{PZL}	Line Enable Time - SEL to N ^A , N ^B (¹)	0.5	8.0	ns
t _{PHZ} , t _{PLZ}	Line Disable Time - SEL to N ^A , N ^B (¹)	0.5	4.0	

Notes:

1. For measurement setup, please see “Test Circuit For Electrical Characteristic” on page 8, and “Switching waveforms” on page 9

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

Parameter	Description	Test Conditions	Min.	Typ.	Max.	Units
X _{TALK}	Crosstalk	See Fig. 1 for Measurement Setup, @ 2.0 Gbps		-31		dB
O _{IRR}	OFF Isolation	See Fig. 2 for Measurement Setup, @ 2.0 Gbps		-40		
BW	-3dB BW			2.7		GHz
Insertion Loss		@ 1.65 Gbps		-0.87		dB
		@ 2.0 Gbps		-0.95		
		@ 2.5 Gbps		-1.18		
		@ 3.3 Gbps		-1.85		

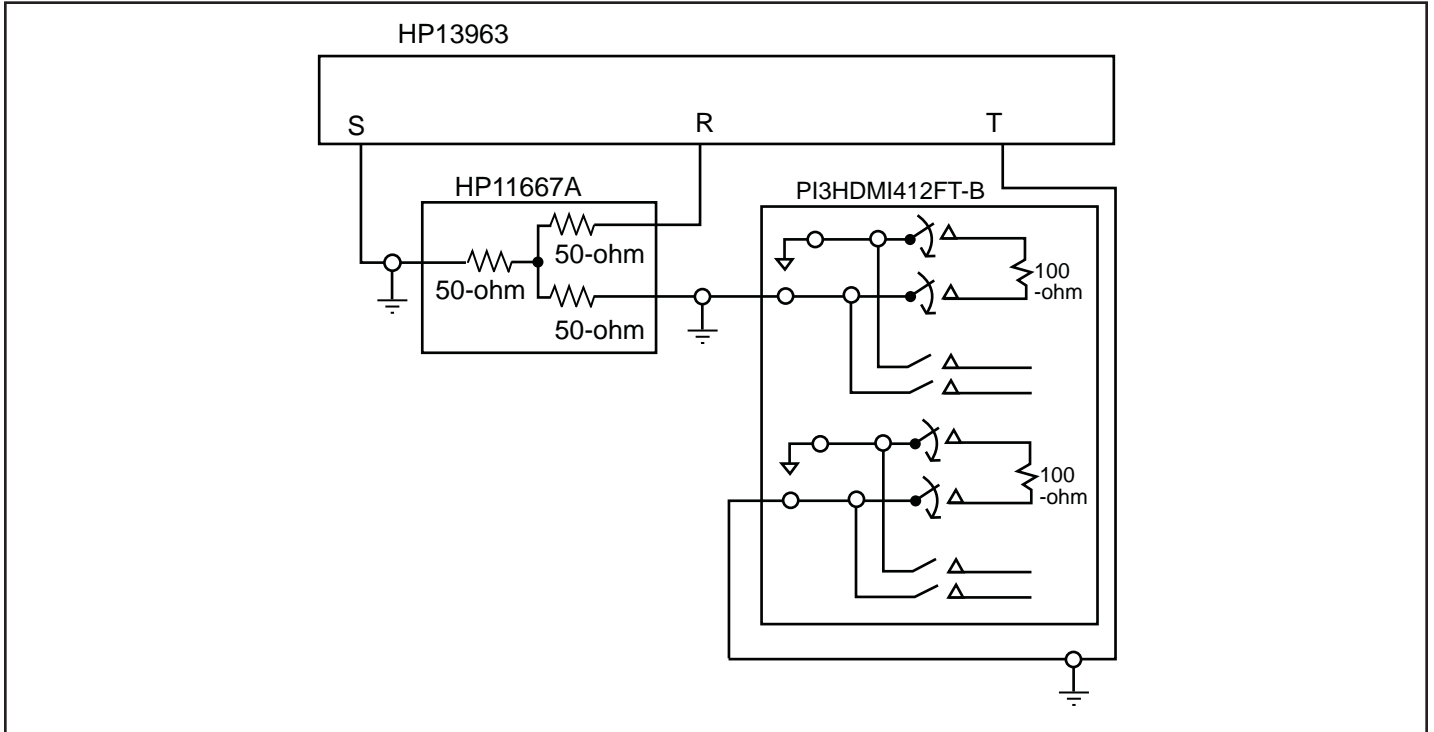


Fig 1. Crosstalk Setup

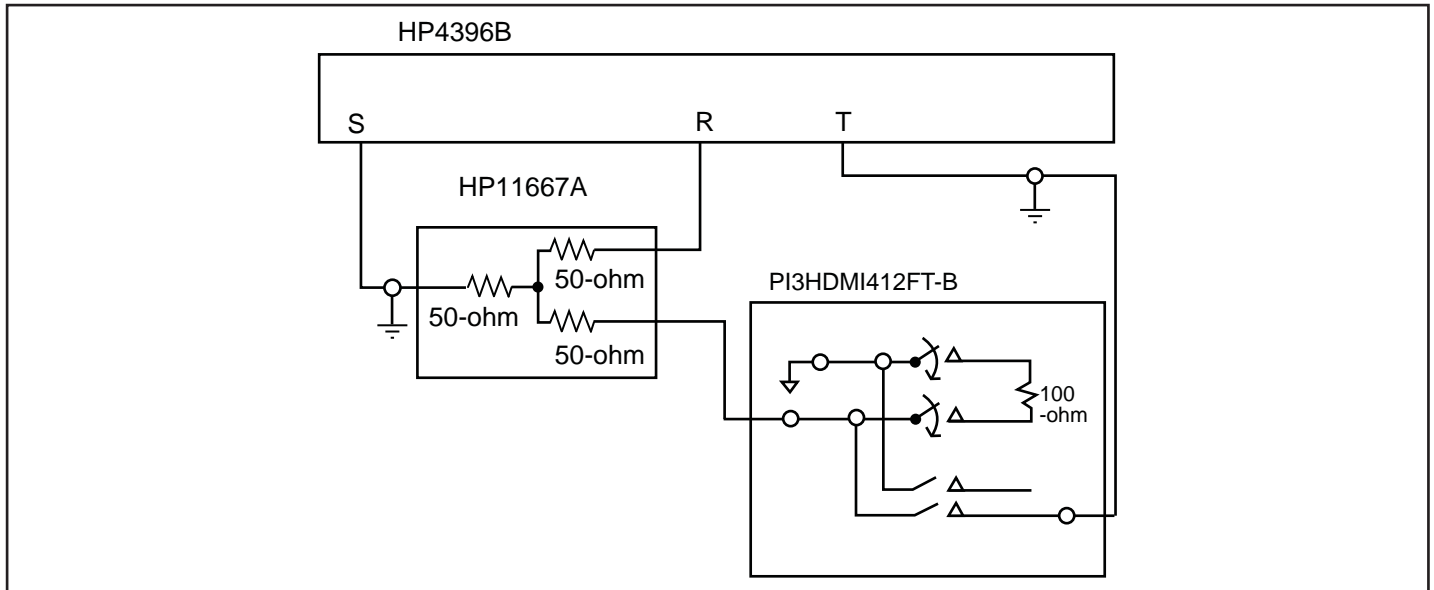


Fig 2. Off-isolation setup

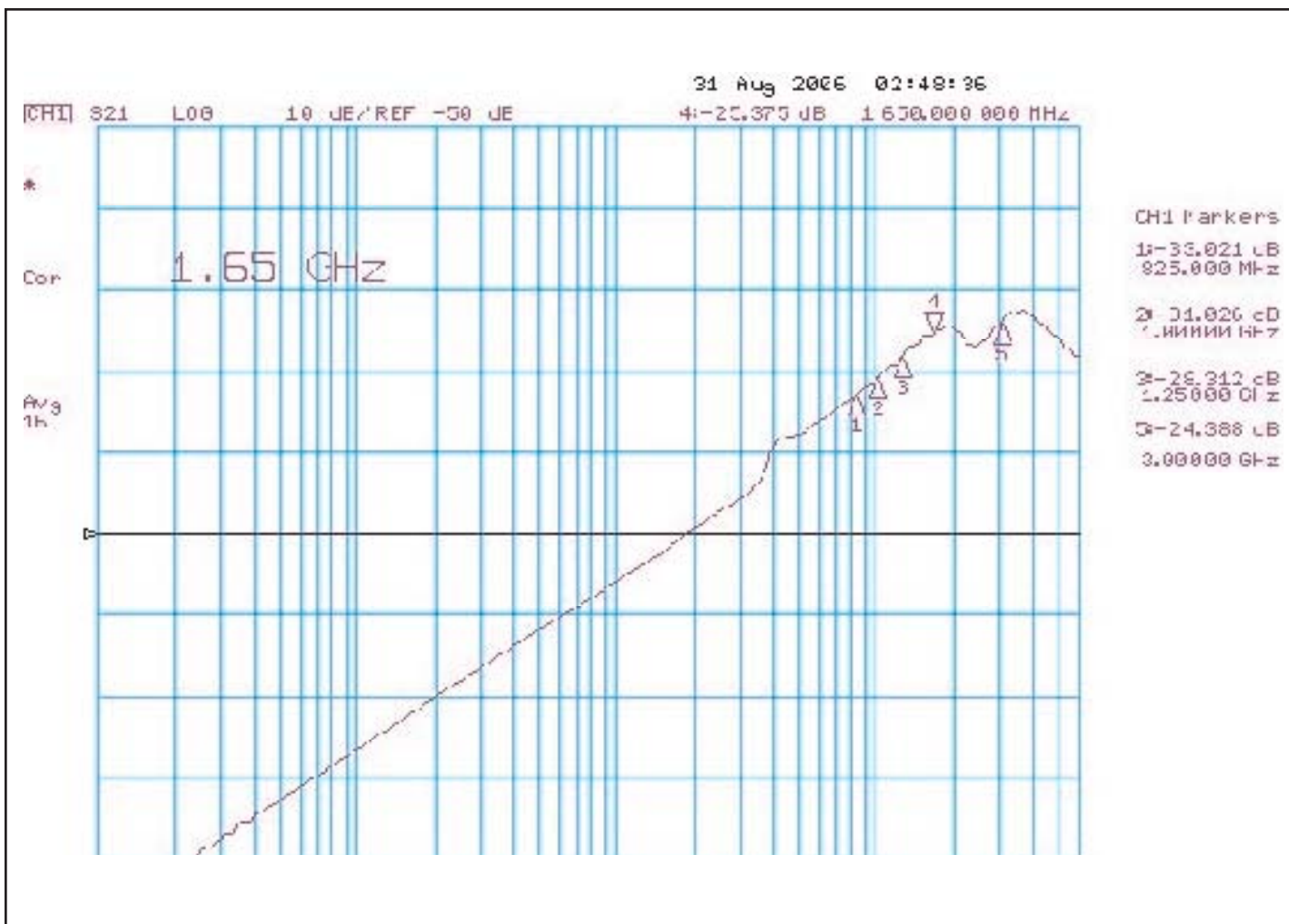


Fig 3. Crosstalk

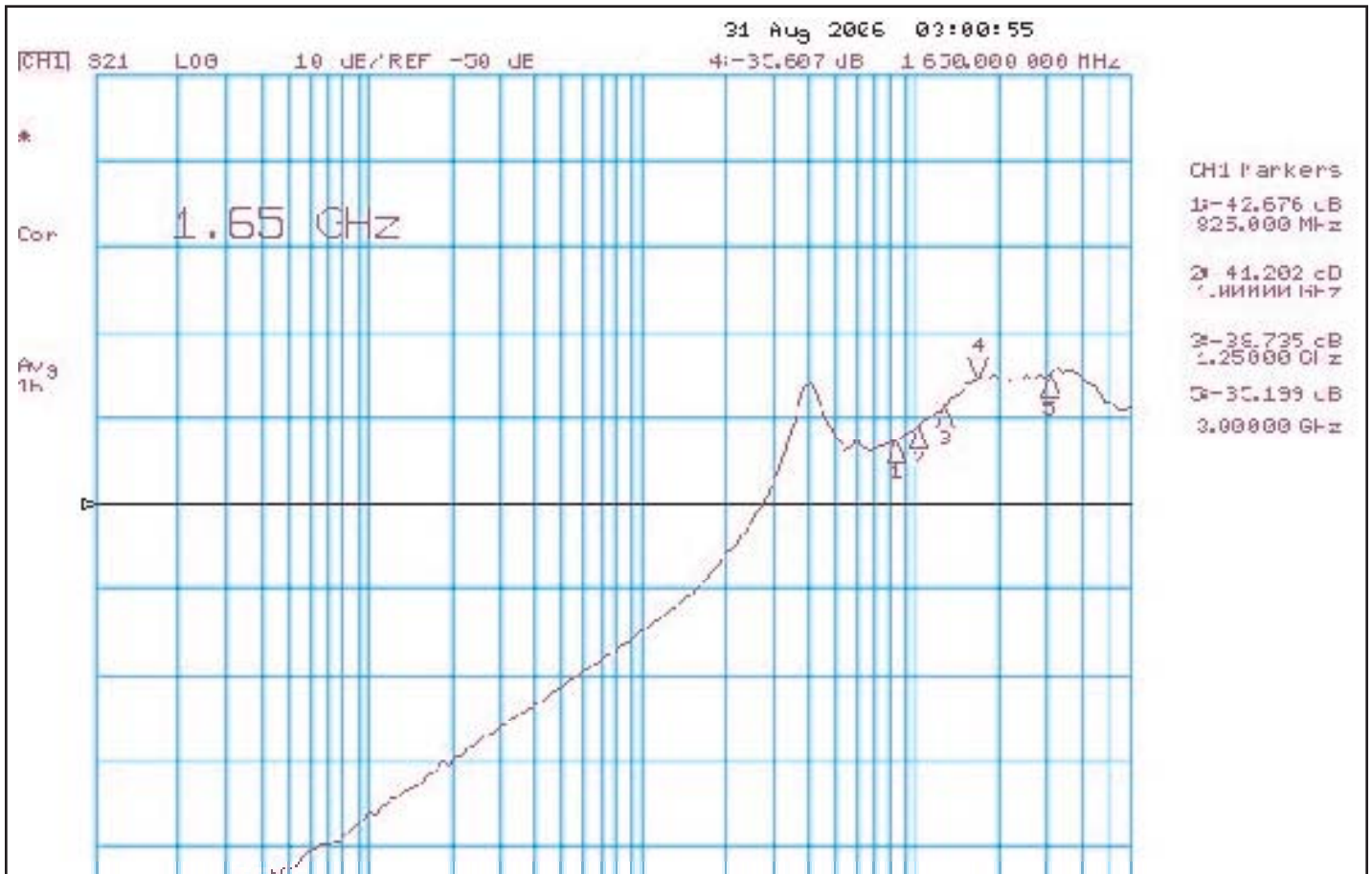


Fig 4. Off Isolation

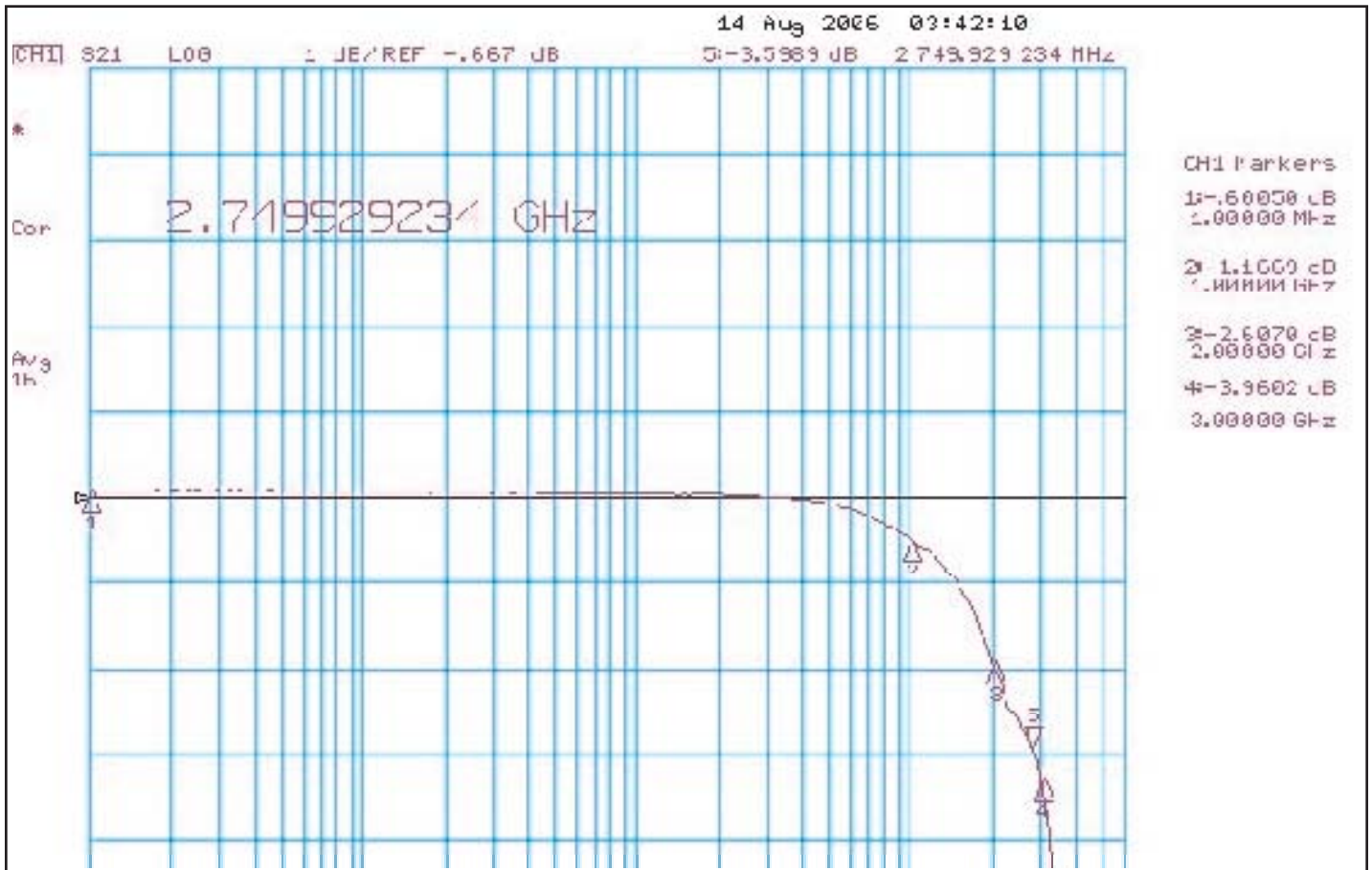


Fig 5. Insertion Loss

Application Measurements

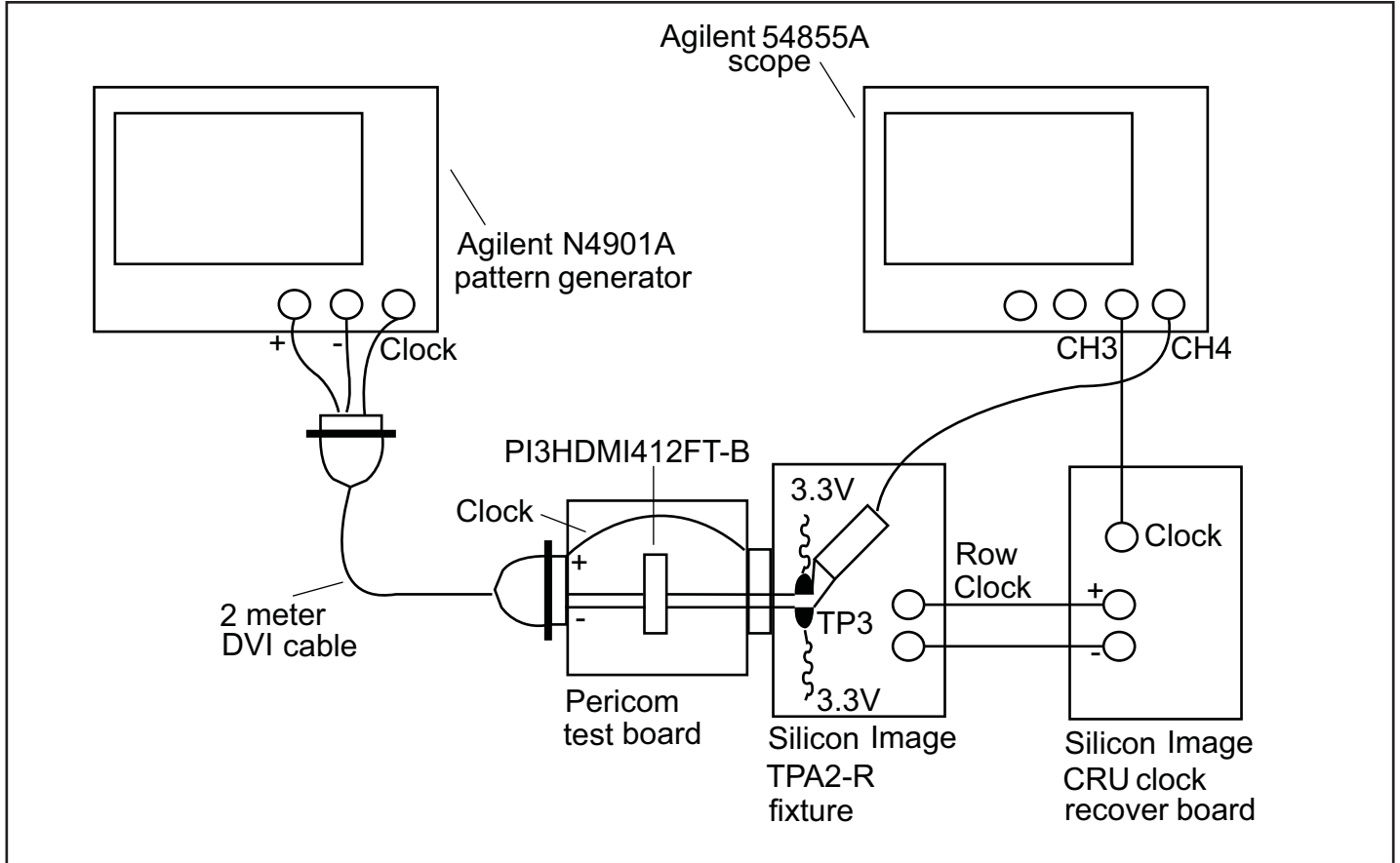


Fig 6. TMDS TP3 Rx eye compliance Test Setup

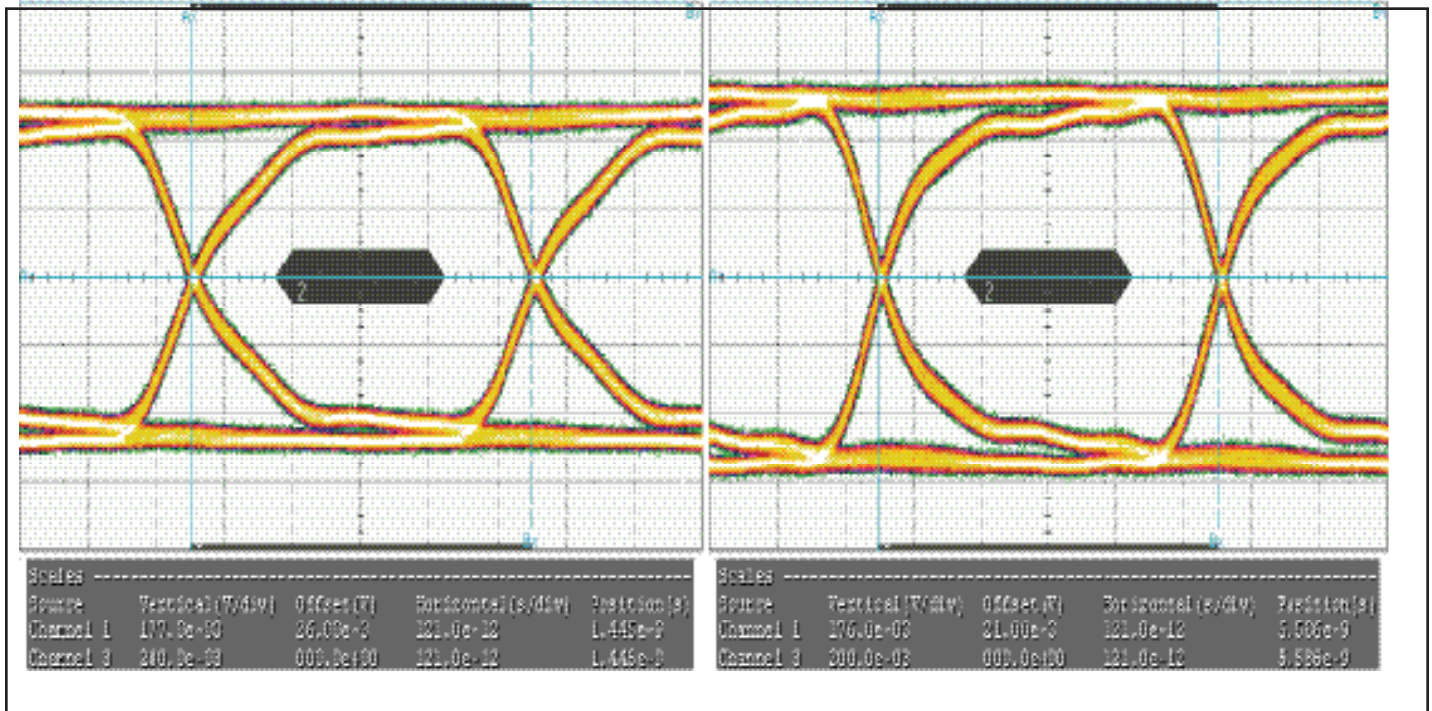
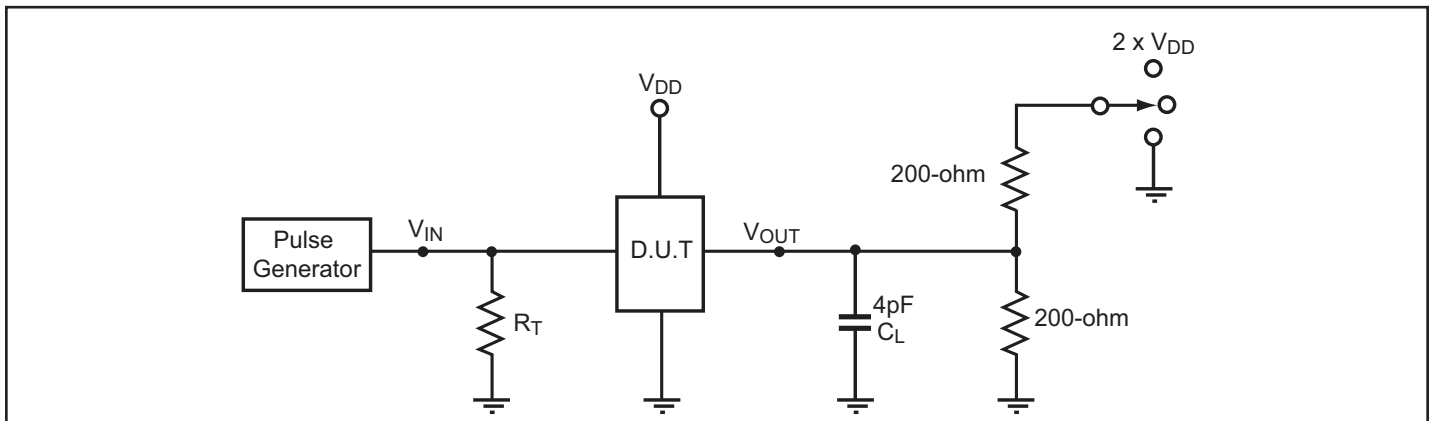


Fig 7. TP3 (Rx) with 2-meter cable eye measurements
(Right eye is with no switch. Left eye is with switch.)

Test Circuit for Electrical Characteristics

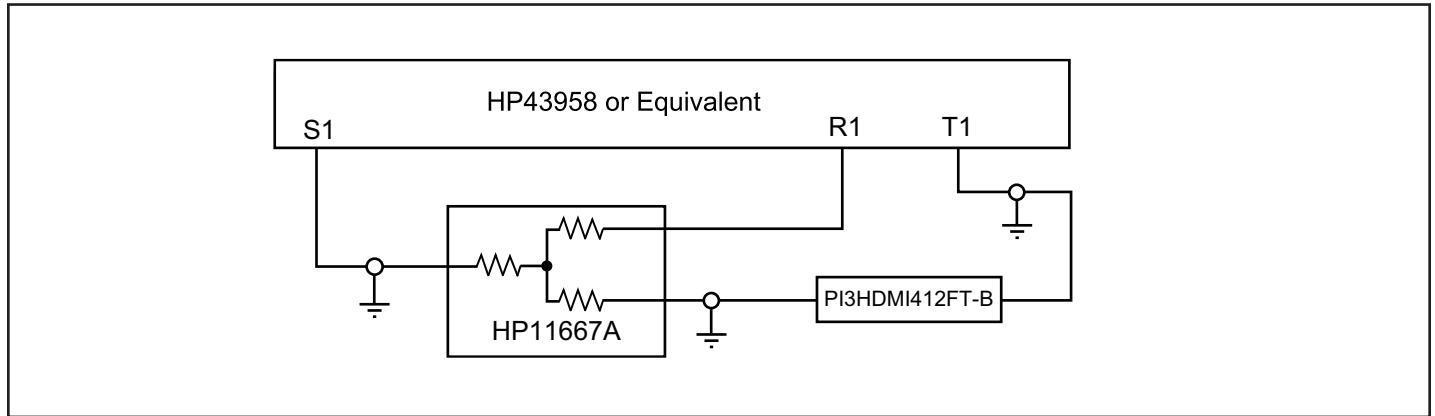
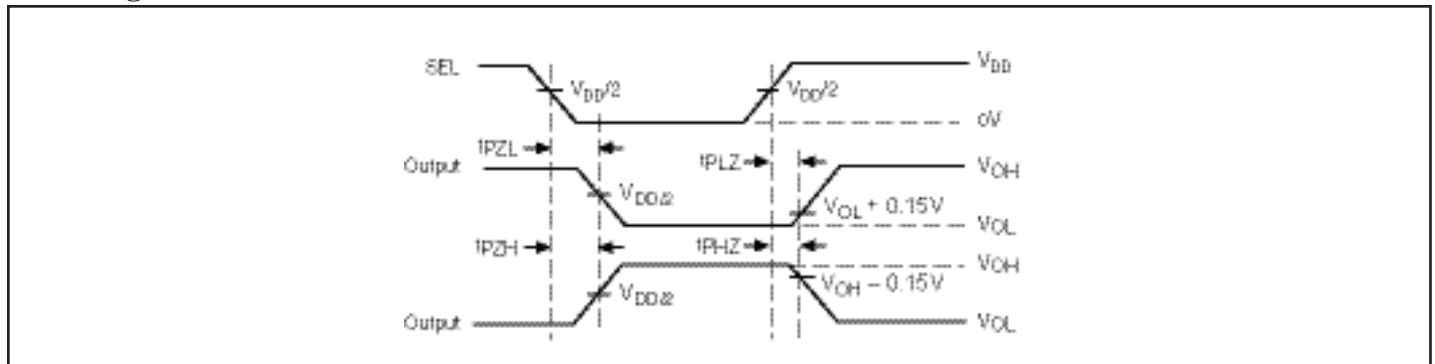
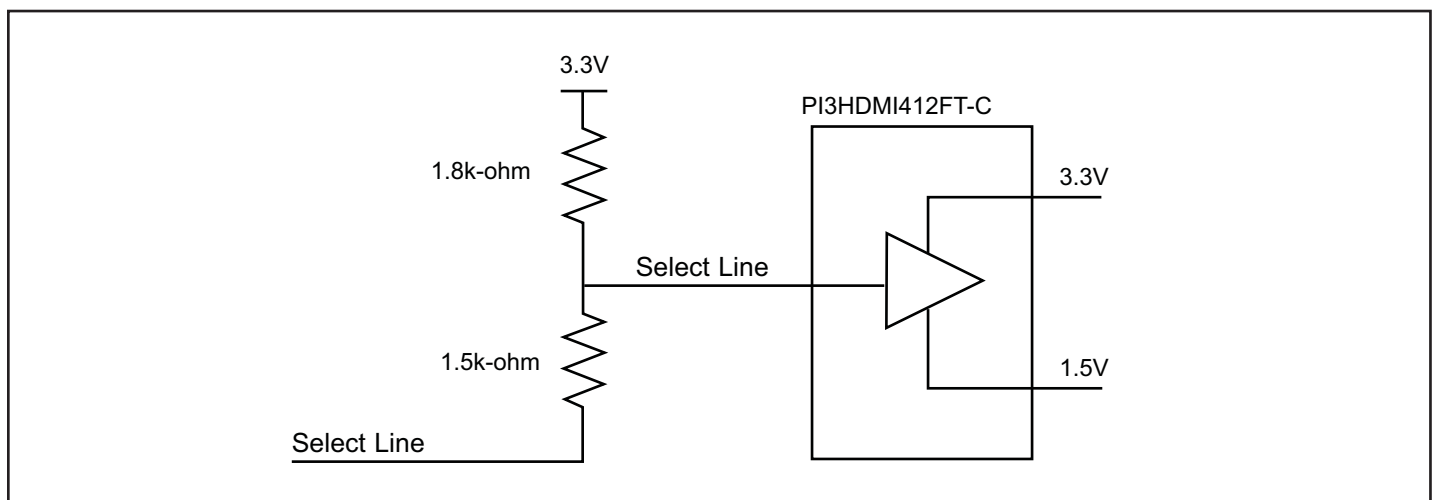


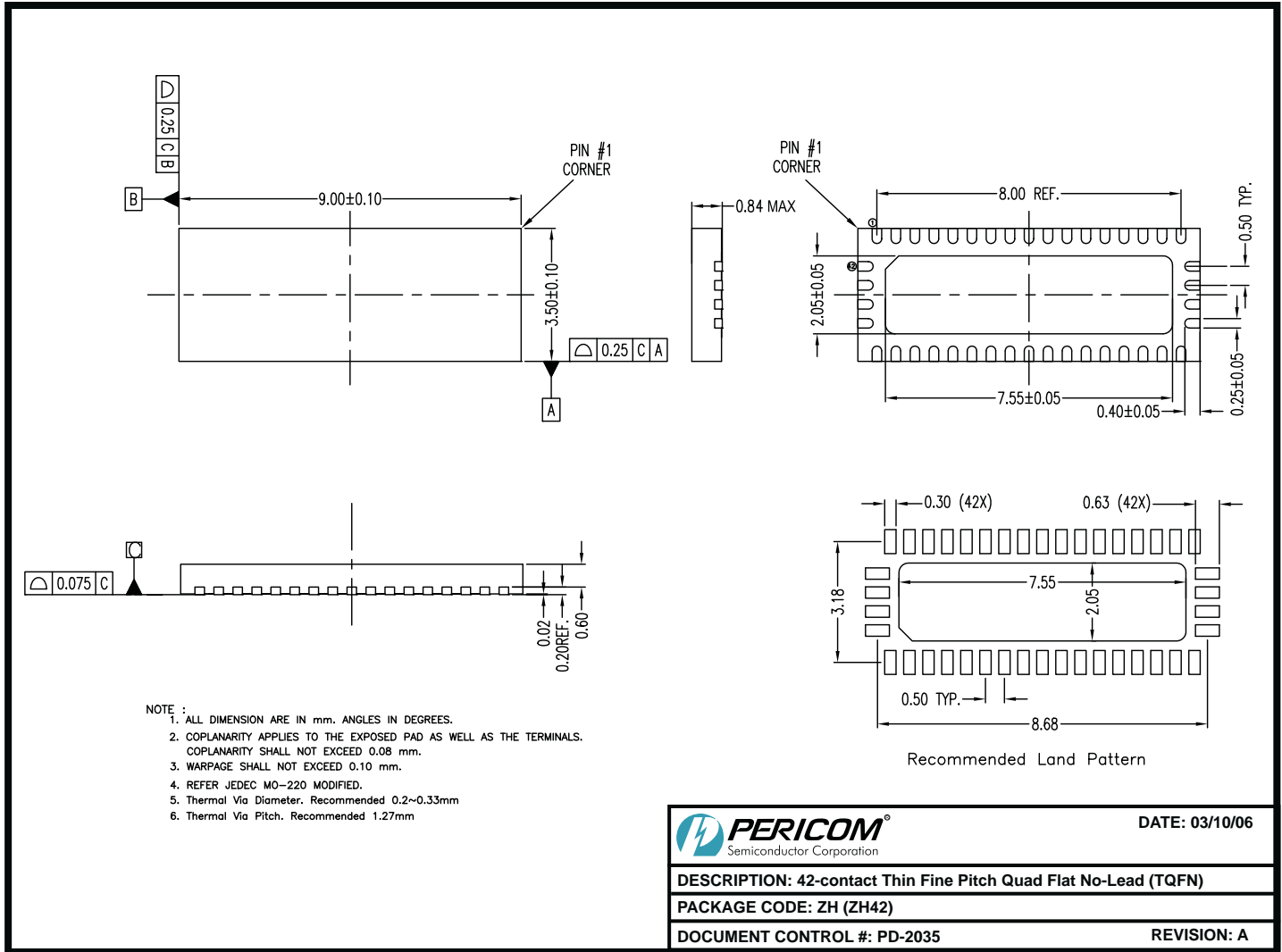
Notes:

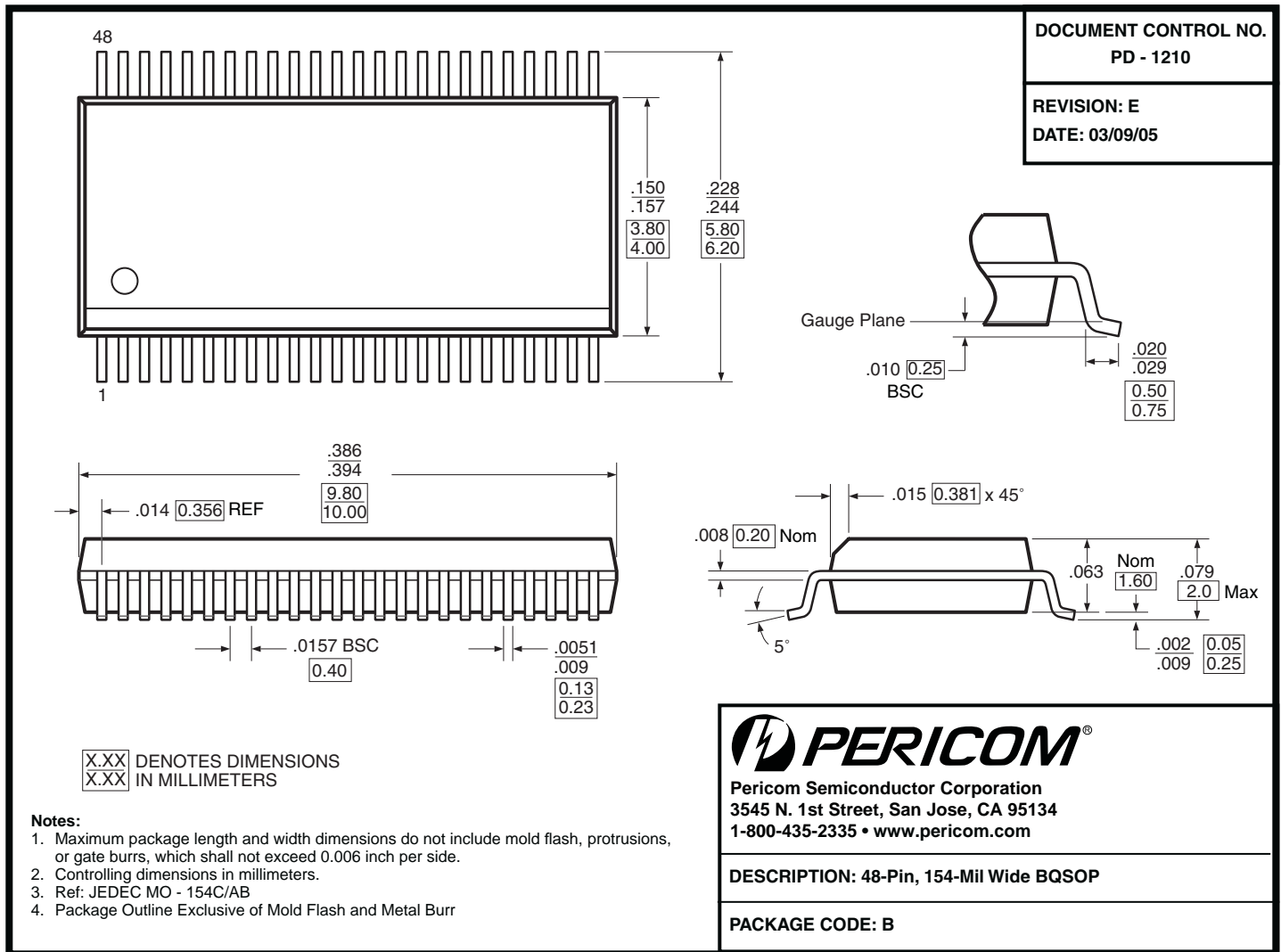
1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output 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}	$2 \times (V_{DD} - V_{SS})$
t_{PHZ} , t_{PZH}	V_{SS}
Prop Delay	Open

Test Circuit for Dynamic Electrical Characteristics

Switching Waveforms

Voltage Waveforms Enable and Disable Times

Example of a circuit that also needs to be connected to the select lines of the PI3HDMI412FT-B





Ordering Information

Ordering Code	Package Code	Package Description
PI3HDMI412FT-BZHE	ZH	Pb-free & Green, 42-pin TQFN
PI3HDMI412FT-BBE	B	Pb-free & Green, 48-pin BQSOP

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free and Green
- Adding X suffix = Tape/Reel
- HDMI & Deep Color are trademarks of Silicon Image



PI3HDMI412FT-B
2:1 Mux/DeMux High BW (> 5 Gbps)
HDMI™ 1.3 Compliant Signal Switch

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