

4-Differential Channel, 3:1 Mux/DeMux, DVI/HDMI Compliant Signal Switch based on TMDS Signaling Standard

Features

- 4-Differential Channel 3:1 Mux/DeMux
- HDMI 1.1, 1.2, and 1.3 compatible
- Supports both AC coupled & DC coupled signals
- Max Data Rate: 4.0 Gbps
- Crosstalk: -30dB @ 1.65 Gbps
- Switching speed: 4ns
- Isolation: -40dB @ 1.65 Gbps
- ESD: Data bits @ 8kV contact (Typ)
- Near-Zero Prop Delay: 250ps max.
- Low bit-to-bit skew
- Enable/Disable Time: 9ns
- Bidirectional
- Packaging (Pb-free & Green):
 - 64-pin TSSOP (A64)
 - 80-pin BQSOP (B80)

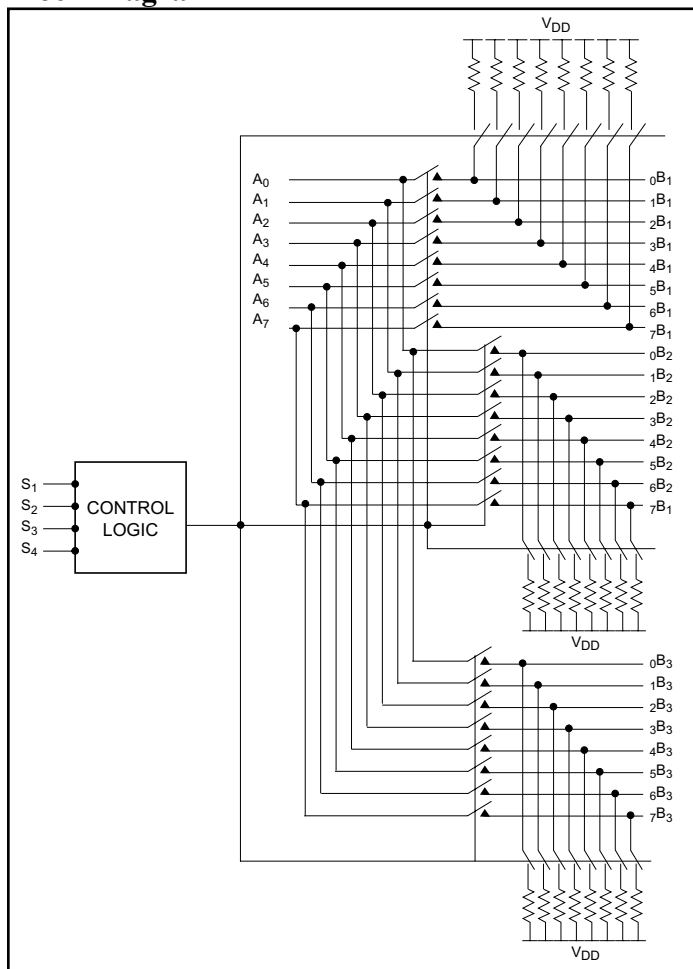
Description

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 PI3HDMI413-A is a 12- to 4-Differential Channel Mux/DeMux Switch. The device multiplexes differential signals to one of three 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 4.5Gbps provides the resolution required by the next generation HDTV and PC graphics.

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 (A64)

| | | | |
|-----|----|----|-----|
| VSS | 1 | 64 | VDD |
| VDD | 2 | 63 | VSS |
| VSS | 3 | 62 | 0B1 |
| VSS | 4 | 61 | 1B1 |
| VSS | 5 | 60 | 2B1 |
| S1 | 6 | 59 | 3B1 |
| S2 | 7 | 58 | 0B2 |
| VDD | 8 | 57 | 1B2 |
| A0 | 9 | 56 | 2B2 |
| A1 | 10 | 55 | 3B2 |
| A2 | 11 | 54 | VSS |
| A3 | 12 | 53 | VDD |
| VDD | 13 | 52 | 0B3 |
| VSS | 14 | 51 | 1B3 |
| VDD | 15 | 50 | 2B3 |
| VDD | 16 | 49 | 3B3 |
| VSS | 17 | 48 | 4B1 |
| VDD | 18 | 47 | 5B1 |
| S3 | 19 | 46 | 6B1 |
| S4 | 20 | 45 | 7B1 |
| VDD | 21 | 44 | 4B2 |
| A4 | 22 | 43 | 5B2 |
| A5 | 23 | 42 | 6B2 |
| A6 | 24 | 41 | 7B2 |
| A7 | 25 | 40 | VDD |
| VDD | 26 | 39 | 4B3 |
| VSS | 27 | 38 | 5B3 |
| VSS | 28 | 37 | 6B3 |
| VSS | 29 | 36 | 7B3 |
| VSS | 30 | 35 | VSS |
| VDD | 31 | 34 | VSS |
| VSS | 32 | 33 | VDD |

Pin Description (B80)

| | | | |
|-----|----|----|-----|
| VDD | 1 | 80 | VDD |
| VSS | 2 | 79 | 0B1 |
| VSS | 3 | 78 | 1B1 |
| S1 | 4 | 77 | 2B1 |
| S2 | 5 | 76 | 3B1 |
| VSS | 6 | 75 | 0B2 |
| VDD | 7 | 74 | 1B2 |
| A0 | 8 | 73 | 2B2 |
| A1 | 9 | 72 | 3B2 |
| VSS | 10 | 71 | VSS |
| A2 | 11 | 70 | VDD |
| A3 | 12 | 69 | 0B3 |
| VDD | 13 | 68 | 1B3 |
| VSS | 14 | 67 | 2B3 |
| VSS | 15 | 66 | 3B3 |
| VDD | 16 | 65 | VSS |
| VSS | 17 | 64 | VSS |
| VSS | 18 | 63 | VSS |
| VSS | 19 | 62 | VSS |
| VDD | 20 | 61 | VDD |
| VDD | 21 | 60 | VDD |
| VSS | 22 | 59 | 4B1 |
| VSS | 23 | 58 | 5B1 |
| S3 | 24 | 57 | 6B1 |
| S4 | 25 | 56 | 7B1 |
| VSS | 26 | 55 | 4B2 |
| VDD | 27 | 54 | 5B2 |
| A4 | 28 | 53 | 6B2 |
| A5 | 29 | 52 | 7B2 |
| VSS | 30 | 51 | VSS |
| A6 | 31 | 50 | VDD |
| A7 | 32 | 49 | 4B3 |
| VDD | 33 | 48 | 5B3 |
| VSS | 34 | 47 | 6B3 |
| VSS | 35 | 46 | 7B3 |
| VDD | 36 | 45 | VSS |
| VSS | 37 | 44 | VSS |
| VSS | 38 | 43 | VSS |
| VSS | 39 | 42 | VSS |
| VDD | 40 | 41 | VDD |

Pin Description (A64)

| Pin # | Pin Name | Description |
|--|-----------------|-----------------------------|
| 2,8,13,15,16,18,21,26,31,33,40,53,64 | V _{DD} | + Power supply 3.30 |
| 1,3,4,5,14,17,27,28,29,30,32,34,35,54,63 | V _{SS} | - Power supply |
| 6,7,19,20 | S _x | Select pin, see truth table |
| 9,10,11,12,22-25,36-39,41-52,55-62 | xBy & Ax | Differential data signals |

Pin Description (B80)

| Pin # | Pin Name | Description |
|--|-----------------|-----------------------------|
| 1,7,13,16,20,21,27,33,36,40,41,50,60,61,70,80 | V _{DD} | + Power supply 3.30 |
| 2,3,6,10,14,15,17,18,19,22,23,26,30,34,35,37,38,39,42-45,51,62-65,71 | V _{SS} | - Power supply |
| 4,5,24,25 | S _x | Select pin, see truth table |
| 8,9,11,12,28,29,31,32,46-49, 52-59, 66-69, 72-79 | xBy & Ax | Differential data signals |

Truth Table for X=[0,3]

| S2 | S1 | Function |
|----|----|----------------------------------|
| 0 | 0 | A _x = xB ₁ |
| 0 | 1 | A _x = xB ₂ |
| 1 | 0 | A _x = xB ₃ |
| 1 | 1 | A _x = Hi-Z |

Truth Table for X=[4,7]

| S4 | S3 | Function |
|----|----|----------------------------------|
| 0 | 0 | A _x = xB ₁ |
| 0 | 1 | A _x = xB ₂ |
| 1 | 0 | A _x = xB ₃ |
| 1 | 1 | A _x = Hi-Z |

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 | V _{SS} 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 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 ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$)

| 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 | $V_{DD}=\text{Max.}, I_{IN}=-18\text{mA}$ | | $-0.7+V_{SS}$ | $-1.2+V_{SS}$ | μA |
| I_{IH} | Input HIGH Current | $V_{DD}=\text{Max.}, V_{IN}=V_{DD}$ | | | ± 5 | |
| 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.
- $V_{IH} + V_{IL}$ are for SEL input only.

Power Supply Characteristics

| Parameters | Description | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽²⁾ | Max. | Units |
|------------|--------------------------------|---|------|---------------------|------|---------------|
| I_{CC} | Quiescent Power Supply Current | $V_{DD} = \text{Max.}, V_{IN} = V_{DD}$ or V_{SS} | | 500 | 600 | μA |

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.

Dynamic Electrical Characteristics Over the Operating Range ($T_A = -40^\circ$ to $+85^\circ\text{C}$)

| Parameter ⁽¹⁾ | Description | Test Conditions | Min. | Typ. ⁽²⁾ | Max. | Units |
|--------------------------|----------------|---|------|---------------------|------|-------|
| X_{TALK} | Crosstalk | See Fig. 1 for Measurement Setup, @ 1.65Gbps | | -30 | | dB |
| O_{IRR} | OFF Isolation | See Fig. 2 for Measurement Setup, @ 1.65 Gbps | | -40 | | |
| -3dB BW | -3dB bandwidth | | | 2 | | GHz |
| Insertion Loss | | @ 1.65 Gbps 8-bits color/channel | | -0.90 | | dB |
| | | @ 2.0 Gbps 10-bits color/channel | | -1.05 | | |
| | | @ 2.5 Gbps 12-bits color/channel | | -1.35 | | |
| | | @ 3.3 Gbps 16-bits color/channel | | -2.20 | | |

Notes:

- Guaranteed by design.
- Typical values are at $T_A = 25^\circ\text{C}$ ambient and maximum loading.

Switching Characteristics ($T_A = -40^\circ$ to $+85^\circ\text{C}$, $V_{SS}=0\text{V}$, $V_{DD}=1.8\text{V} \pm 10\%$)

| Parameter | Description ⁽¹⁾ | Min. | 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 | |

Note:

- For measurement setup, please see "Test Circuit For Electrical Characteristic" on page 6, and "Switching waveforms" on page 7

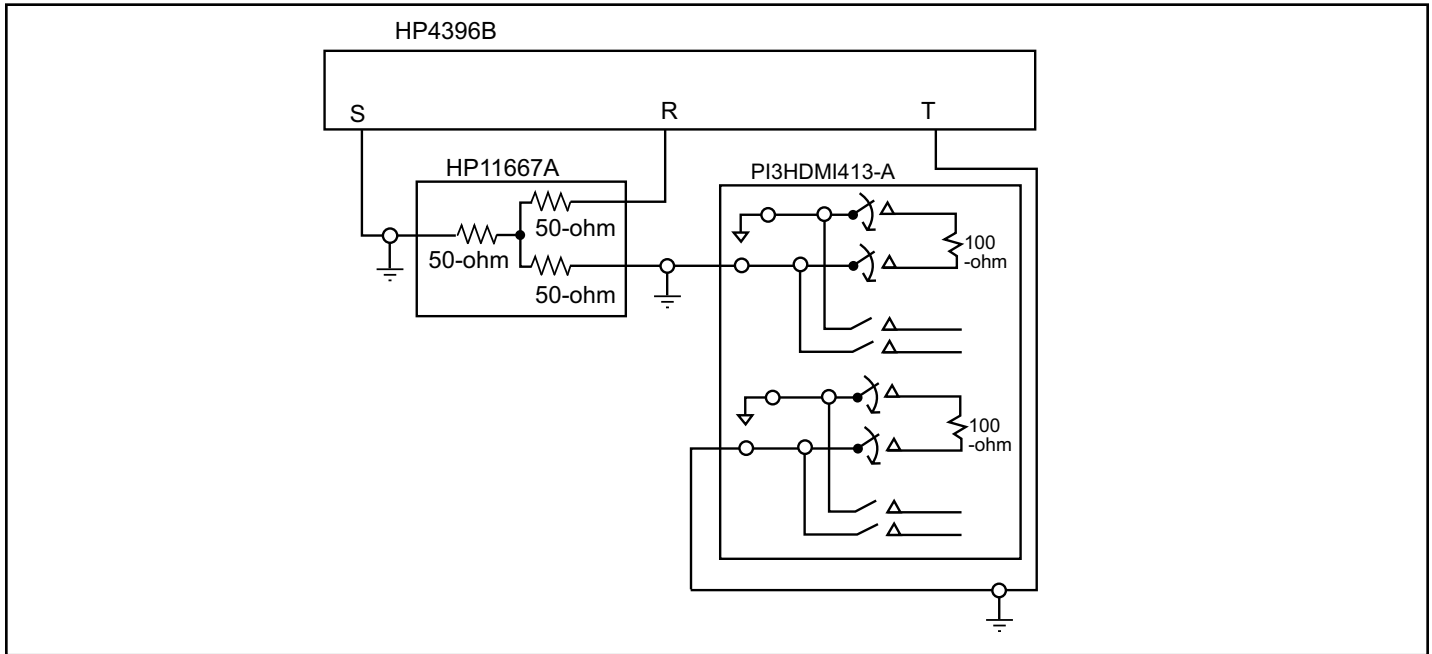


Fig 1. Crosstalk Setup

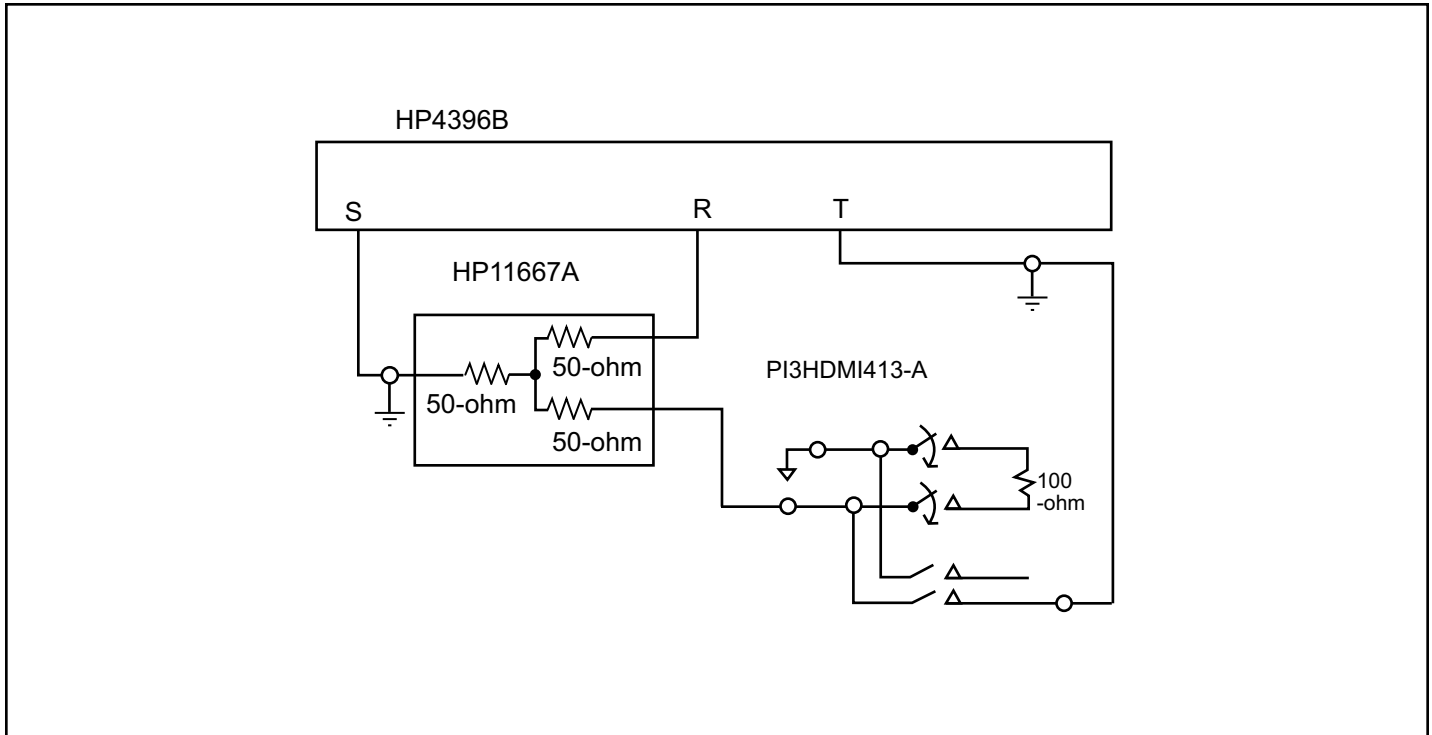


Fig 2. Off-isolation setup

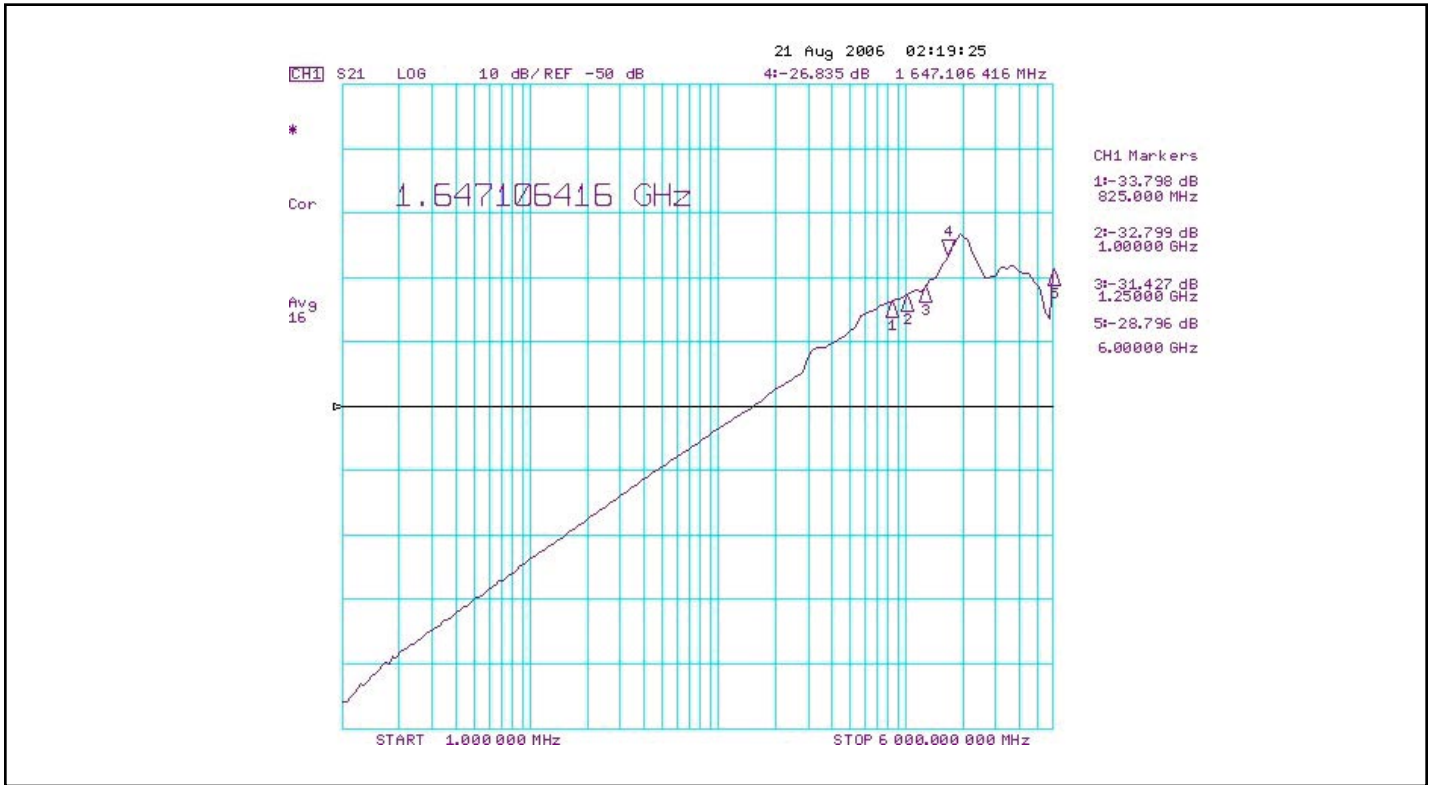


Fig 3. Crosstalk

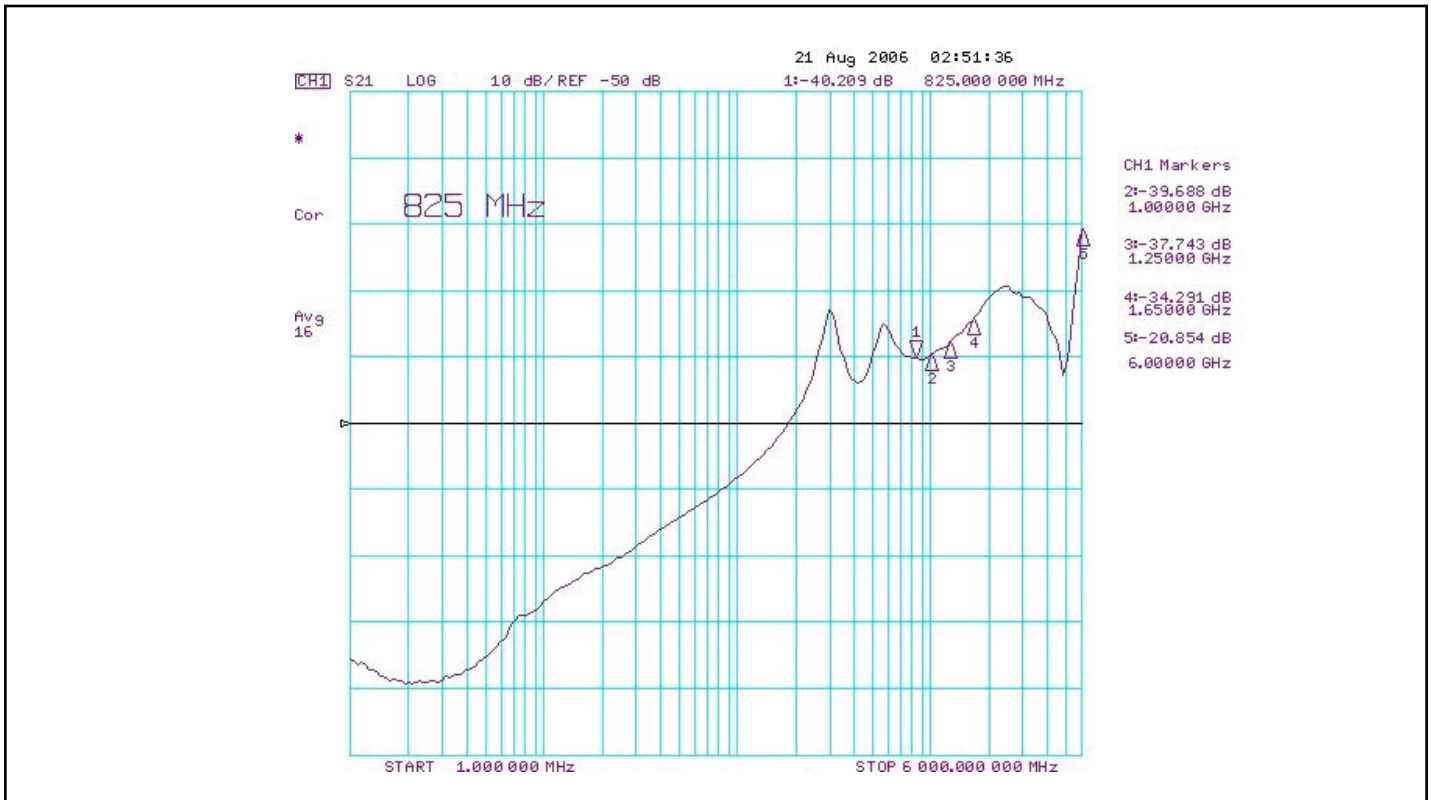


Fig 4. Off Isolation

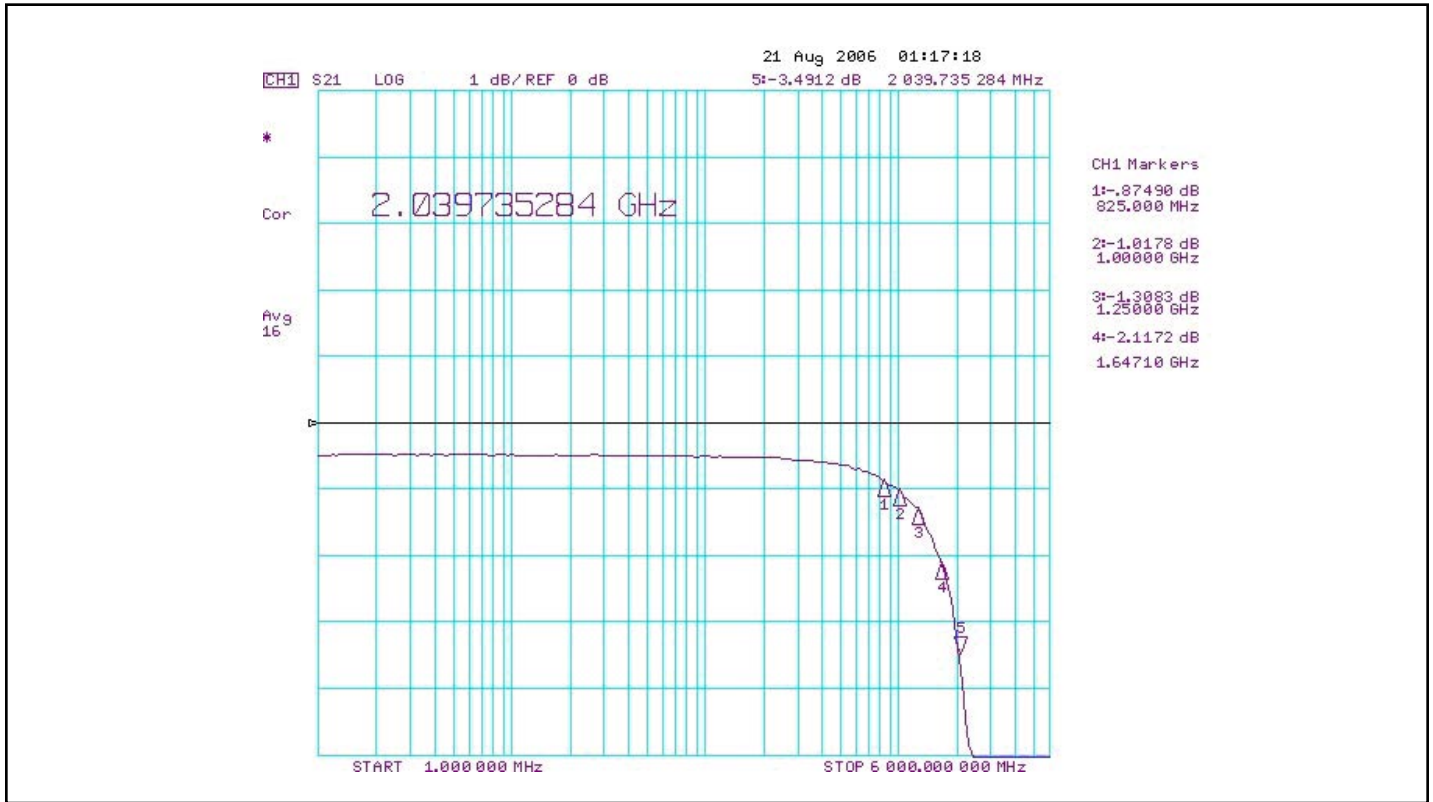
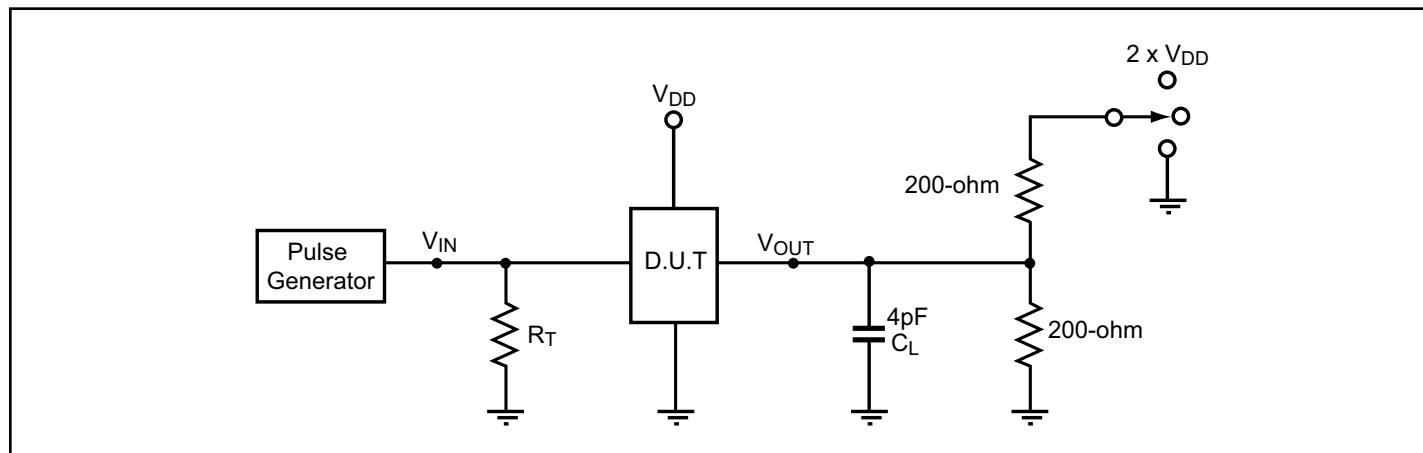


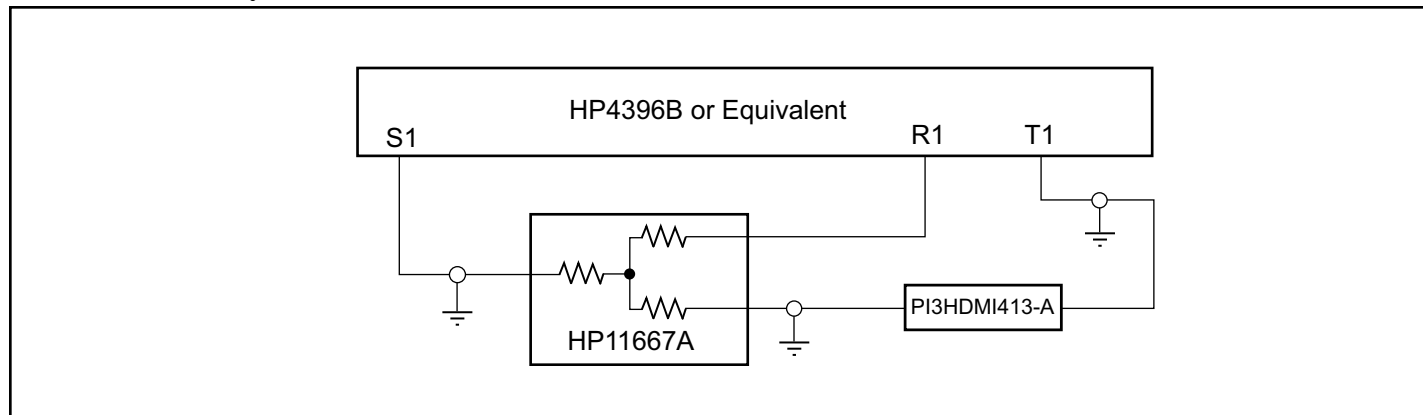
Fig 5. Bandwidth Plot

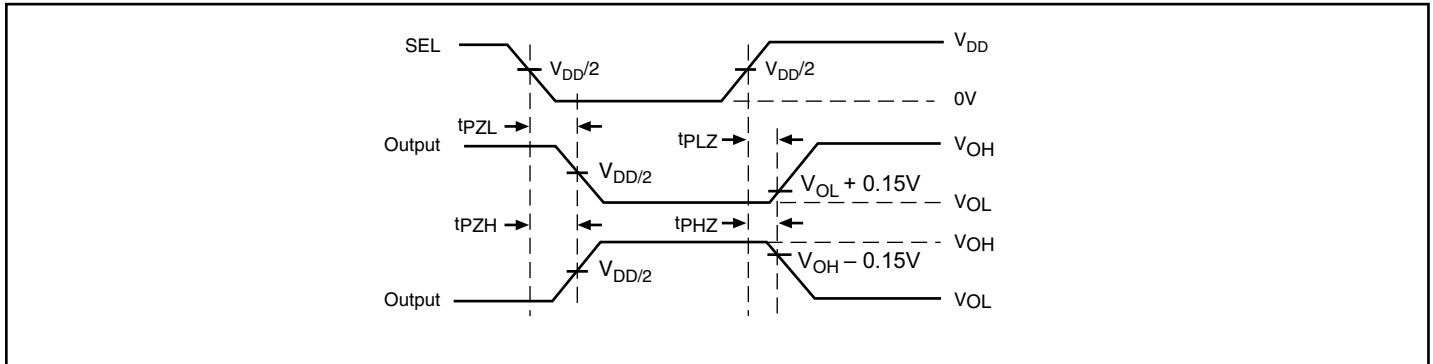
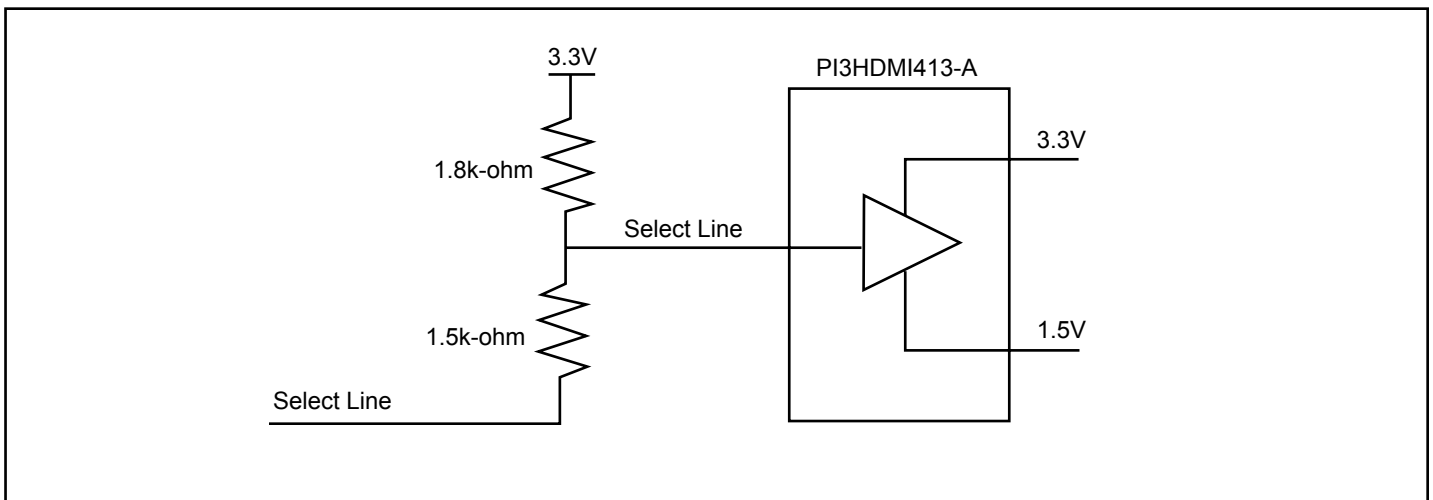
Test Circuit for Electrical Characteristics⁽¹⁾

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

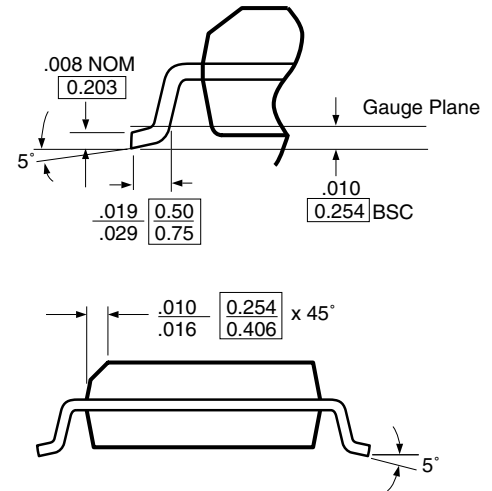
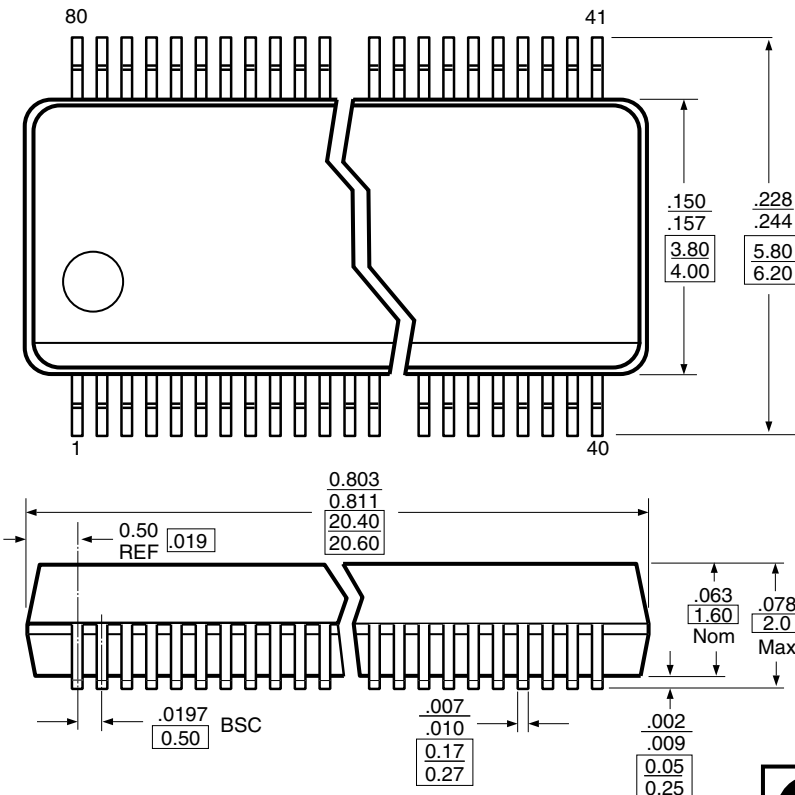
| Test | Switch |
|--|------------------------------|
| t_{PLZ} , t_{PZL} (output on B-side) | $2 \times (V_{DD} - V_{SS})$ |
| t_{PHZ} , t_{PZH} (output on B-side) | V_{SS} |
| Prop Delay | Open |

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 select lines of our device:

DOCUMENT CONTROL NO.
 PD - 1211

REVISION: D
DATE: 03/09/05



X.XX DENOTES DIMENSIONS
 X.XX IN MILLIMETERS

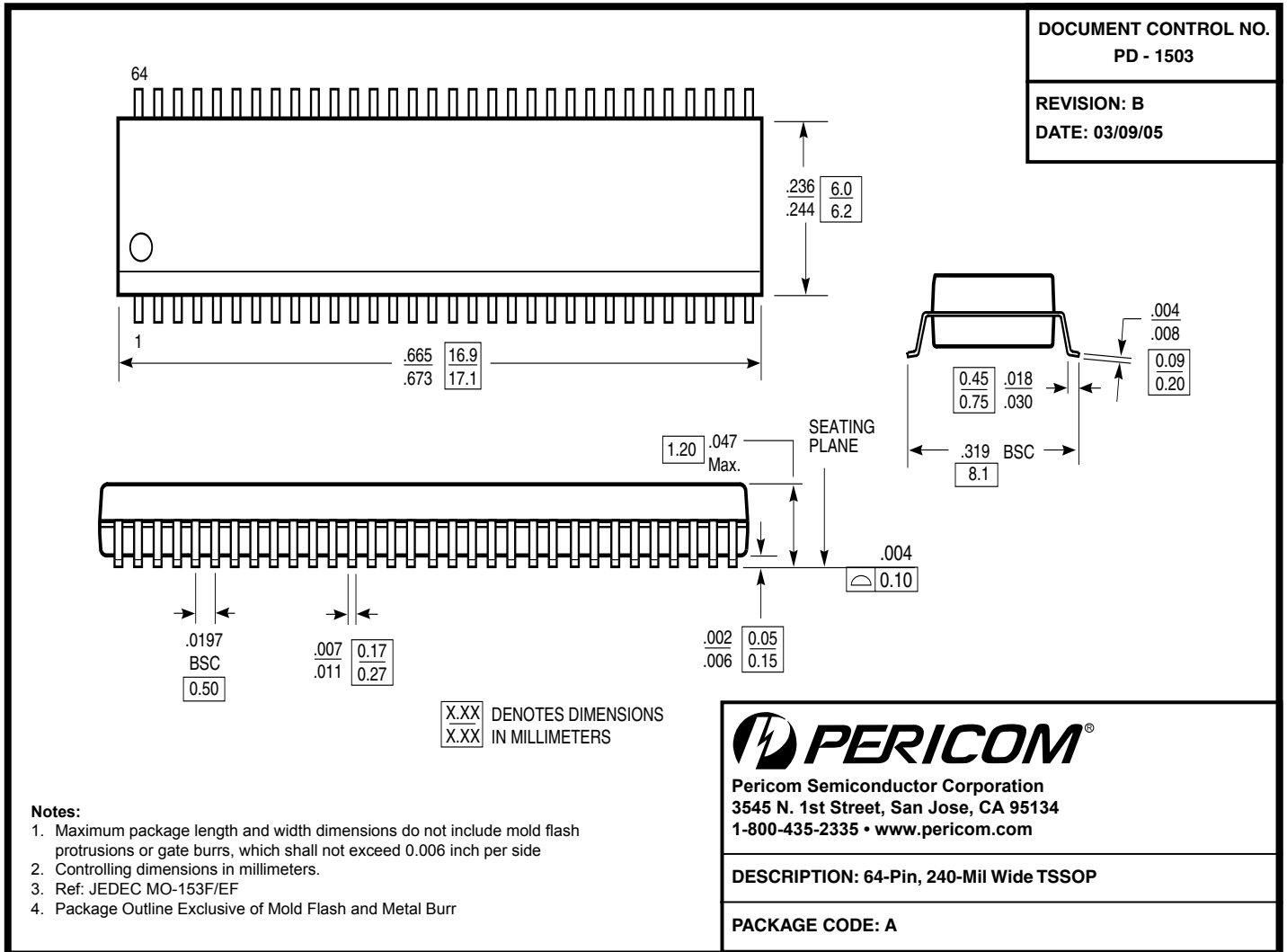
- Note:**
1. Controlling dimensions in millimeters.
 3. Package Outline Exclusive of Mold Flash and Metal Burr
 3. Ref. JEDEC MO-154C/BC



Pericom Semiconductor Corporation
 3545 N. 1st Street, San Jose, CA 95134
 1-800-435-2335 • www.pericom.com

DESCRIPTION: 80-Pin, 150-Mil Wide BQSOP

PACKAGE CODE: B



Ordering Information

| Ordering Code | Package Code | Package Description |
|----------------|--------------|-------------------------------|
| PI3HDMI413-AAE | A | Pb-free & Green, 64-pin TSSOP |
| PI3HDMI413-ABE | B | Pb-free & Green, 80-pin BQSOP |

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- E = Pb-free & Green
- Adding X suffix = Tape/Reel