

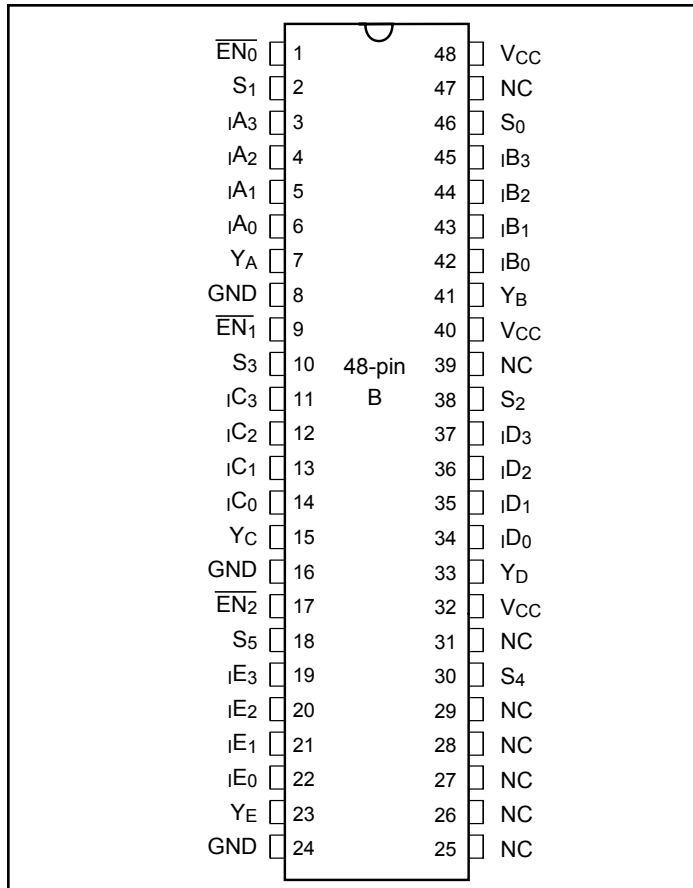


Low On-Resistance, 3.3V High-Bandwidth 5-port, 4:1 Mux/DeMux VideoSwitch

Features

- Near-Zero propagation delay
- 5Ω switches connect inputs to outputs
- High signal passing bandwidth (400 MHz)
- Beyond Rail-to-Rail switching
- 5V I/O tolerant with 3.3V supply
- 2.5V and 3.3V supply voltage operation
- Low Crosstalk ($X_{TALK} = -60\text{dB Typ.}$)
- Low Off-Isolation ($O_{IRR} = -60\text{dB Typ.}$)
- Hot-insertion capable
- Industrial operating temperature: -40°C to $+85^{\circ}\text{C}$
- 2KV ESD Protection (human body model)
- Latch-up performance $>250\text{mA}$ per JESD17
- Packaging (Pb-free & Green available):
– 48-pin 150-mil wide plastic BQSOP (B)

Pin Configuration



Notes:

1. N.C. = No internal connection

Description

The PI3V514 is a true bi-directional 5-Port 4:1 multiplexer/demultiplexer with Hi-Z outputs that is recommended for both RGB and composite video switching applications. With the additional 2 ports, vertical and horizontal synchronous signals can be switched in addition to switching the RGB and composite signals between different components, such as DVD, VCR, PCs and etc. With the increased 4:1 channels, multiple components, such as VCR, DVD, PC1, PC2 and etc. can be put on the video networks. The Video switch can be driven from a current output RAMDAC or voltage output composite video source.

Low On-Resistance, Low Crosstalk, Low OFF Isolation and wide bandwidth features make it ideal for video and other applications. Industry leading advantages include a near-zero propagation delay, resulting from its low channel resistance and I/O capacitance. The switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. The device also has exceptional high current capability which is far greater than most analog switches offered today. The PI3V514 offers a high-performance (400 MHz), low-cost solution to switch between video sources.

Applications

- Projection TV and LCD TV
- Video consumer applications
- Analog video signal processing

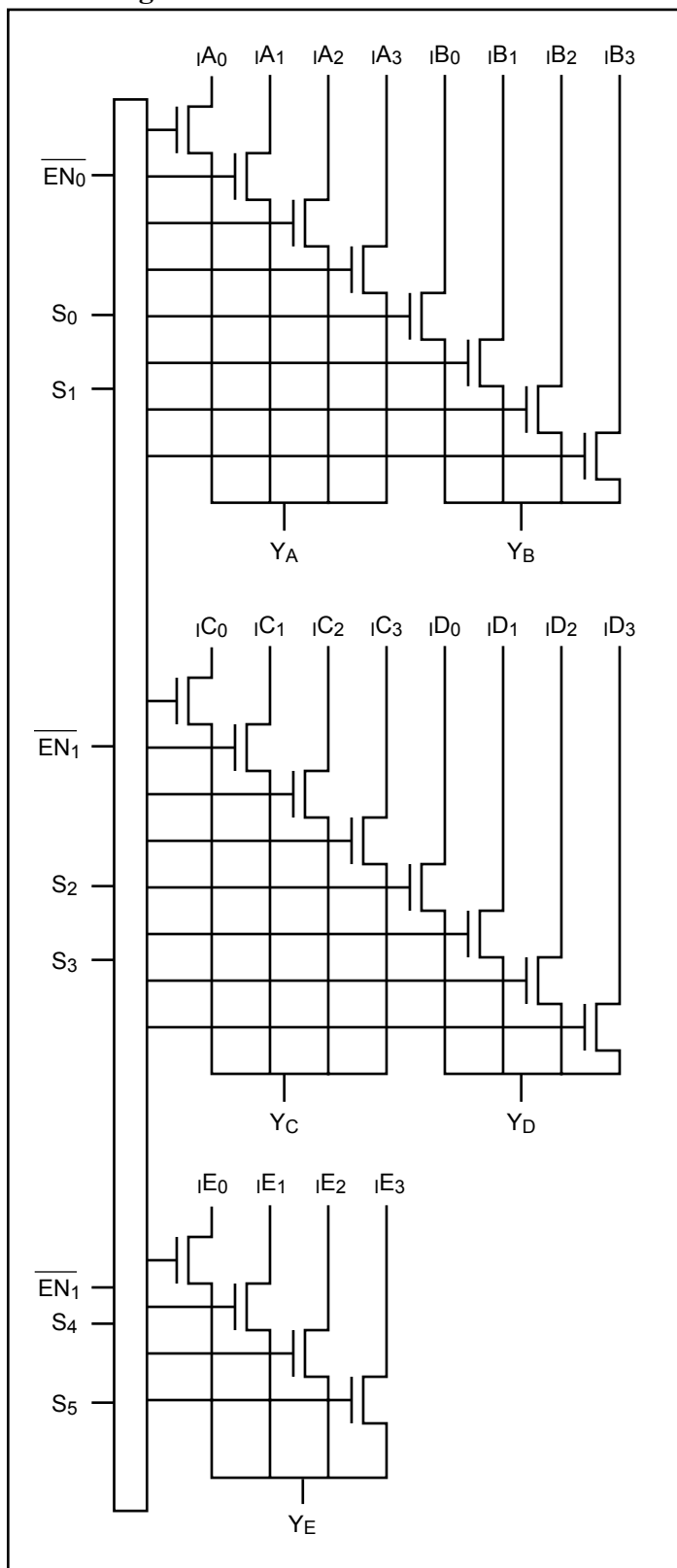
Pin Description

| Pin Name | Description |
|------------------|---------------|
| I_{AN}, I_{BN} | Data Inputs |
| S_{0-1} | Select Inputs |
| \overline{EN} | Enable |
| Y_A to Y_B | Data Outputs |
| GND | Ground |
| V_{CC} | Power |

Notes:

1. For video applications: In order to control Muxing and DeMuxing of all the 20 to 5 channels with the same control plane, the following connectoins need to be made on the board:
 - a. $\overline{EN1}$, $\overline{EN2}$ and $\overline{EN3}$ need to be tied together
 - b. $S1$, $S3$ and $S5$ need to be tied together
 - c. $S0$, $S2$, and $S4$ need to be tied together

Block Diagram



Truth Table 1⁽¹⁾

| Enable | Select | | | |
|-------------------|----------------|----------------|--------------------------------|-----------|
| $\overline{EN_0}$ | S ₁ | S ₀ | Y _A /Y _B | Function |
| H | X | X | Hi-Z | Disable |
| L | L | L | I0 | S1-S0 = 0 |
| L | L | H | I1 | S1-S0 = 1 |
| L | H | L | I2 | S1-S0 = 2 |
| L | H | H | I3 | S1-S0 = 3 |

Truth Table 2⁽¹⁾

| Enable | Select | | | |
|-------------------|----------------|----------------|--------------------------------|-----------|
| $\overline{EN_1}$ | S ₃ | S ₂ | Y _C /Y _D | Function |
| H | X | X | Hi-Z | Disable |
| L | L | L | I0 | S3-S2 = 0 |
| L | L | H | I1 | S3-S2 = 1 |
| L | H | L | I2 | S3-S2 = 2 |
| L | H | H | I3 | S3-S2 = 3 |

Truth Table 3⁽¹⁾

| Enable | Select | | | |
|-------------------|----------------|----------------|----------------|-----------|
| $\overline{EN_2}$ | S ₅ | S ₄ | Y _E | Function |
| H | X | X | Hi-Z | Disable |
| L | L | L | I0 | S5-S4 = 0 |
| L | L | H | I1 | S5-S4 = 1 |
| L | H | L | I2 | S5-S4 = 2 |
| L | H | H | I3 | S5-S4 = 3 |

Notes:

1. H = High Voltage Level; L = Low Voltage Level

Maximum Ratings

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

| | |
|--|-----------------|
| Storage Temperature | -65°C to +150°C |
| Ambient Temperature with Power Applied | -40°C to +85°C |
| Supply Voltage to Ground Potential | -0.5V to +4.6V |
| DC Input Voltage | -0.5V to +6.0V |
| 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, 3.3V Supply (Over the Operating Range, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 3.3\text{V} \pm 10\%$)

| Parameters | Description | Test Conditions ⁽¹⁾ | Min. | Typ ⁽²⁾ | Max. | Units |
|------------|-------------------------------------|--|------|--------------------|---------|---------------|
| V_{IH} | Input HIGH Voltage | Guaranteed Logic HIGH Level | 2.0 | | | V |
| V_{IL} | Input LOW Voltage | Guaranteed Logic LOW Level | -0.5 | | 0.8 | |
| V_{IK} | Clamp Diode Voltage | $V_{CC} = \text{Min.}, I_{IN} = -18 \text{ mA}$ | | -1.3 | -1.8 | |
| I_{IH} | Input HIGH Current | $V_{CC} = \text{Max.}, V_{IN} = V_{CC}$ | | | ± 1 | μA |
| I_{IL} | Input LOW Current | $V_{CC} = \text{Max.}, V_{IN} = \text{GND}$ | | | ± 1 | |
| I_{OZH} | High Impedance Output Current | $0 \leq Y, I_n \leq V_{CC}$ | | | ± 1 | |
| R_{ON} | Switch On-Resistance ⁽⁴⁾ | $V_{CC} = \text{Min.}, V_{IN} = 0\text{V},$ $I_{ON} = 48 \text{ mA or } -64\text{mA}$ | | 4 | 6 | Ω |
| | | $V_{CC} = \text{Min.}, V_{IN} = 3.6\text{V}, I_{ON} = -15 \text{ mA}$ | | 5 | 8 | |

DC Electrical Characteristics, 2.5V Supply (Over Operating Range, $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 2.5\text{V} \pm 10\%$)

| Parameters ⁽⁵⁾ | Description | Test Conditions | Min. | Typ. | Max. | Units |
|---------------------------|---------------------------------------|---|------|------|----------------|---------------|
| V_{IH} | Input HIGH Voltage | Guaranteed Logic HIGH Level | 1.8 | — | $V_{CC} + 0.3$ | V |
| V_{IL} | Input LOW Voltage | Guaranteed Logic LOW Level | -0.3 | — | 0.8 | |
| V_{IK} | Clamp Diode Voltage | $V_{CC} = \text{Max.}, I_{IN} = -6\text{mA}$ | — | -0.7 | -1.8 | |
| I_{IH} | Input HIGH Current | $V_{CC} = \text{Max.}, V_{IN} = V_{CC}$ | — | — | ± 1 | μA |
| I_{IL} | Input LOW Current | $V_{CC} = \text{Max.}, V_{IN} = \text{GND}$ | — | — | ± 1 | |
| I_{OZH} | High Impedance Current ⁽³⁾ | $0 \leq Y, I_n \leq V_{CC}$ | — | — | ± 1 | |
| R_{ON} | Switch On-Resistance ⁽⁴⁾ | $V_{CC} = \text{Min.}, V_{IN} = 0\text{V},$ $I_{ON} = -48\text{mA}$ | — | 6 | 8 | Ω |
| | | $V_{CC} = \text{Min.}, V_{IN} = 2.25\text{V},$ $I_{ON} = -15\text{mA}$ | — | 7 | 14 | |

Capacitance ($T_A = 25^\circ\text{C}$ $f = 1\text{ MHz}$)

| Parameters ⁽⁵⁾ | Description | Test Conditions | Typ. | Units |
|---------------------------|-----------------------------|----------------------|------|-------|
| C_{IN} | Input Capacitance | $V_{IN} = 0\text{V}$ | 3.0 | pF |
| $C_{OFF(IN)}$ | In Capacitance, Switch Off | | 3.5 | |
| $C_{OFF(Y)}$ | Y Capacitance, Switch Off | | 12 | |
| C_{ON} | Y/In Capacitance, Switch On | | 15.0 | |

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{CC} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$ ambient and maximum loading.
3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
4. Measured by the voltage drop between Y and In pin at indicated current through the switch. On-Resistance is determined by the lower of the voltages on the two (Y, In) pins.
5. This parameter is determined by device characterization but is not production tested.

Power Supply Characteristics

| Parameters | Description | Test Conditions ⁽¹⁾ | Min. | Typ. ⁽²⁾ | Max. | Units |
|------------|--------------------------------|--|------|---------------------|------|-------|
| I_{CC} | Quiescent Power Supply Current | $V_{CC} = 3.6\text{V}$, $V_{IN} = \text{GND}$ or V_{CC} | | | 2.4 | mA |

Notes:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
2. Typical values are at $V_{CC} = 3.3\text{V}$, $+25^\circ\text{C}$ ambient.

Dynamic Electrical Characteristics Over the Operating Range ($T_A = -40^\circ$ to $+85^\circ$, $V_{CC} = 3.3\text{V} \pm 10\%$)

| Parameter | Description | Test Condition | Min. | Typ. | Max. | Units |
|------------|----------------|---|------|------|------|-------|
| X_{TALK} | Crosstalk | See Test Diagram (10 MHz) | | -60 | | dB |
| O_{IRR} | Off-Isolation | See Test Diagram (10 MHz) | | -60 | | |
| BW | -3dB Bandwidth | See Test Diagram ($C_L = 0\text{pF}$) | 100 | 400 | | MHz |

Switching Characteristics over 3.3V Operating Range

| Parameters | Description | Conditions ⁽¹⁾ | Com. | | | Units |
|--------------------------------------|---|---------------------------|------|------|------|-------|
| | | | Min. | Typ. | Max. | |
| t _{PLH} t _{PHL} | Propagation Delay ^(2,3) Y to In, In to Y | See Test Diagram | | | 0.3 | ns |
| t _{PZH} t _{PZL} | Enable Time S or \overline{EN} to Y or In | See Test Diagram | 1.5 | | 9.0 | |
| t _{PHZ} t _{PLZ} | Disable Time S or \overline{EN} to Y or In | | 1.5 | | 9.0 | |

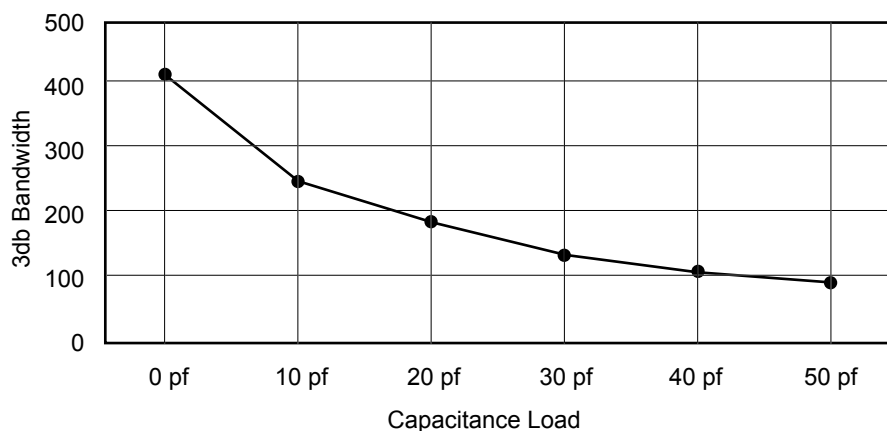
Switching Characteristics over 2.5V Operating Range

| Parameters | Description | Conditions ⁽¹⁾ | Com. | | Units |
|--------------------------------------|---|---------------------------|------|------|-------|
| | | | Min. | Max. | |
| t _{PLH} t _{PHL} | Propagation Delay ^(2,3) Y to In, In to Y | See Test Diagram | | 0.3 | ns |
| t _{PZH} t _{PZL} | Enable Time S or \overline{EN} to Y or In | See Test Diagram | 1.5 | 15.0 | |
| t _{PHZ} t _{PLZ} | Disable Time S or \overline{EN} to Y or In | | 1.5 | 12.0 | |

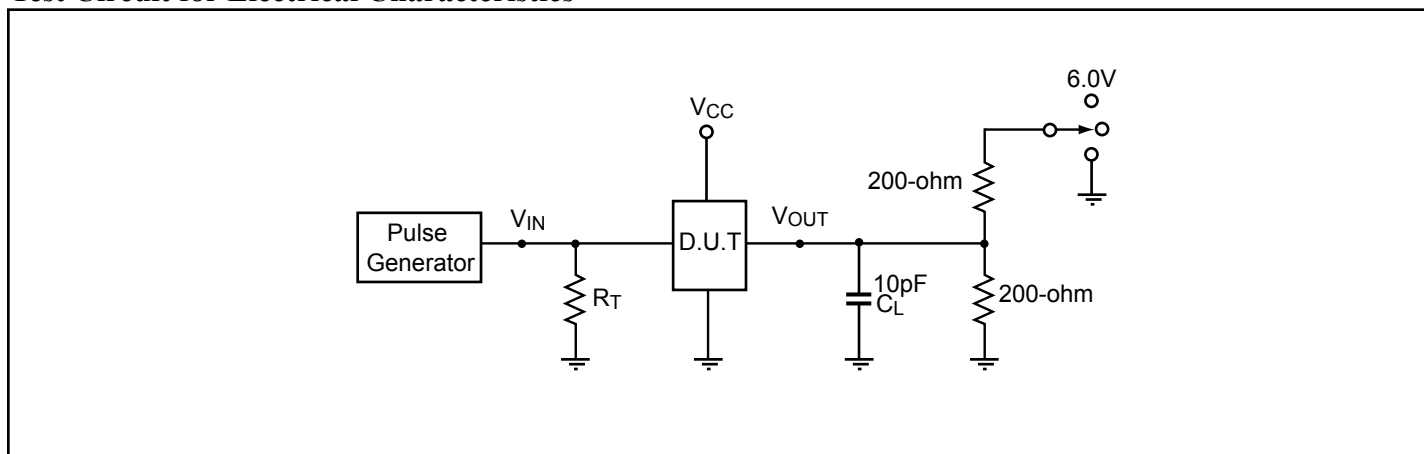
Notes:

1. See test circuit and waveforms.
2. This parameter is guaranteed but not tested on Propagation Delays.
3. The switch contributes no propagational delay other than the RC delay of the On-Resistance of the switch and the load capacitance. The time constant for the switch alone is of the order of 0.30ns for 10pF load. Since this time constant is much smaller than the rise/fall times of typical driving signals, it adds very little propagational delay to the system. Propagational delay of the switch when used in a system is determined by the driving circuit on the driving side of the switch and its interaction with the load on the driven side.

Bandwidth vs Capacitance



Test Circuit for Electrical Characteristics⁽¹⁾



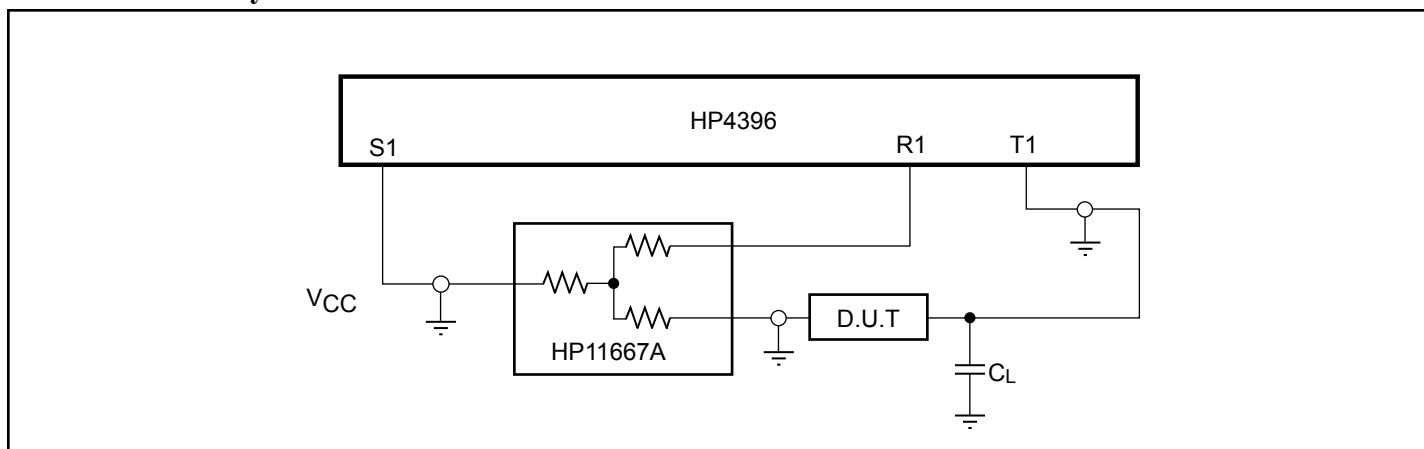
Notes:

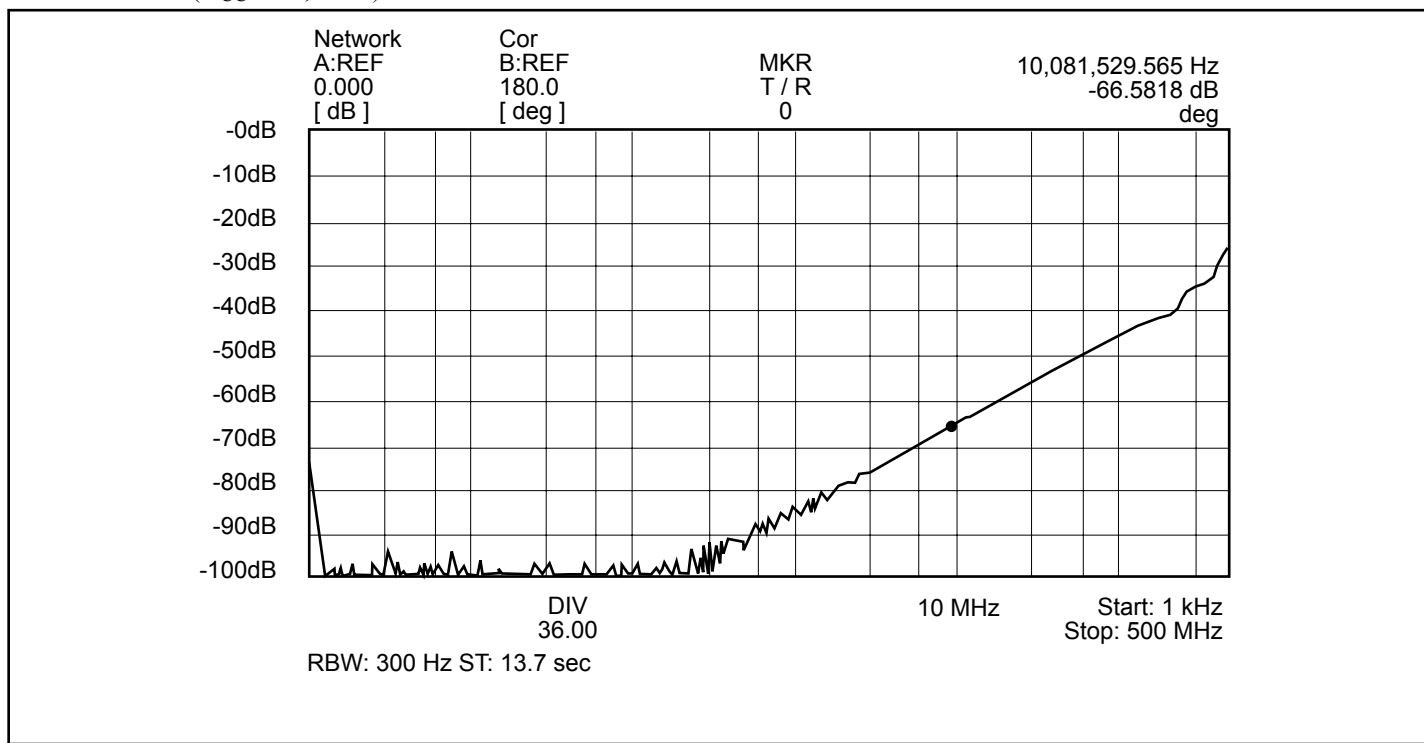
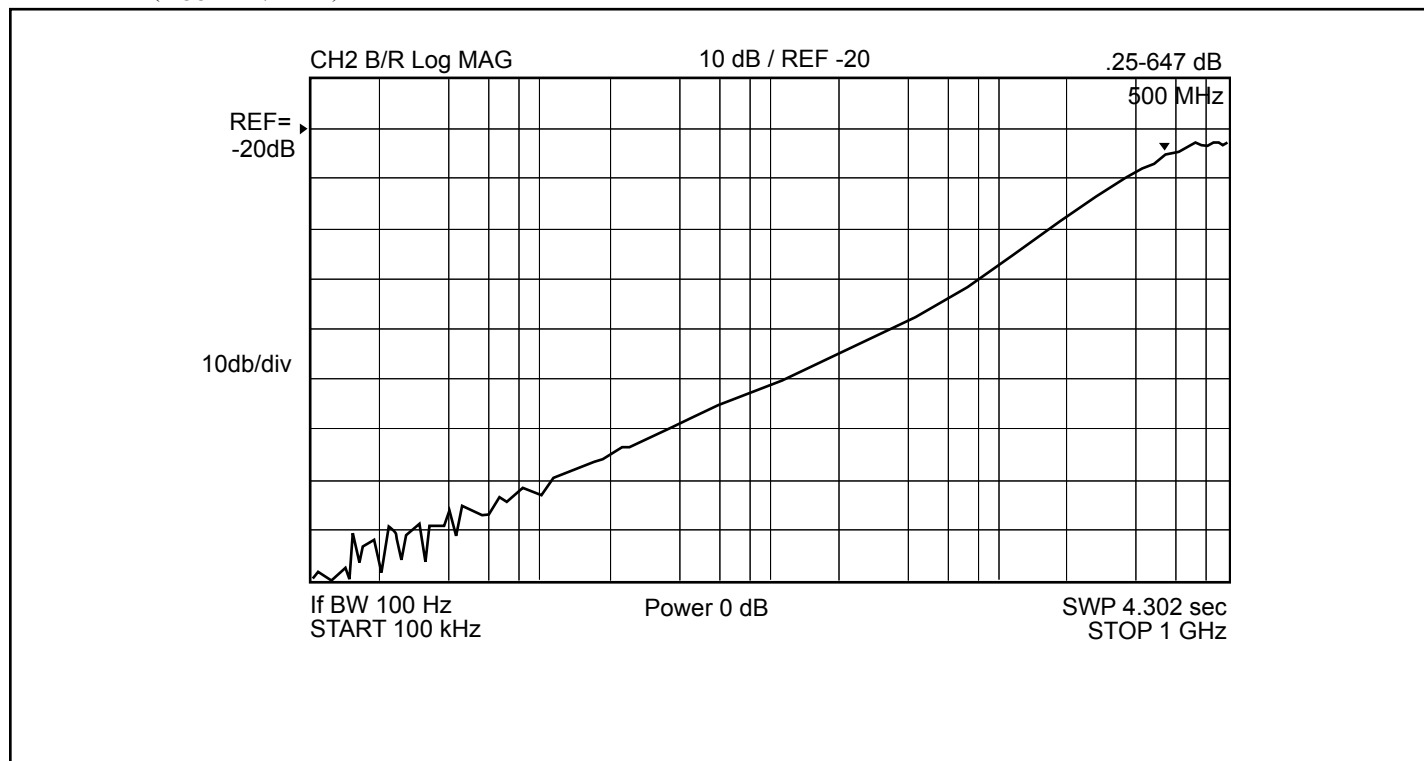
1. C_L = Load capacitance: includes jig and probe capacitance.
2. R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator
3. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output 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

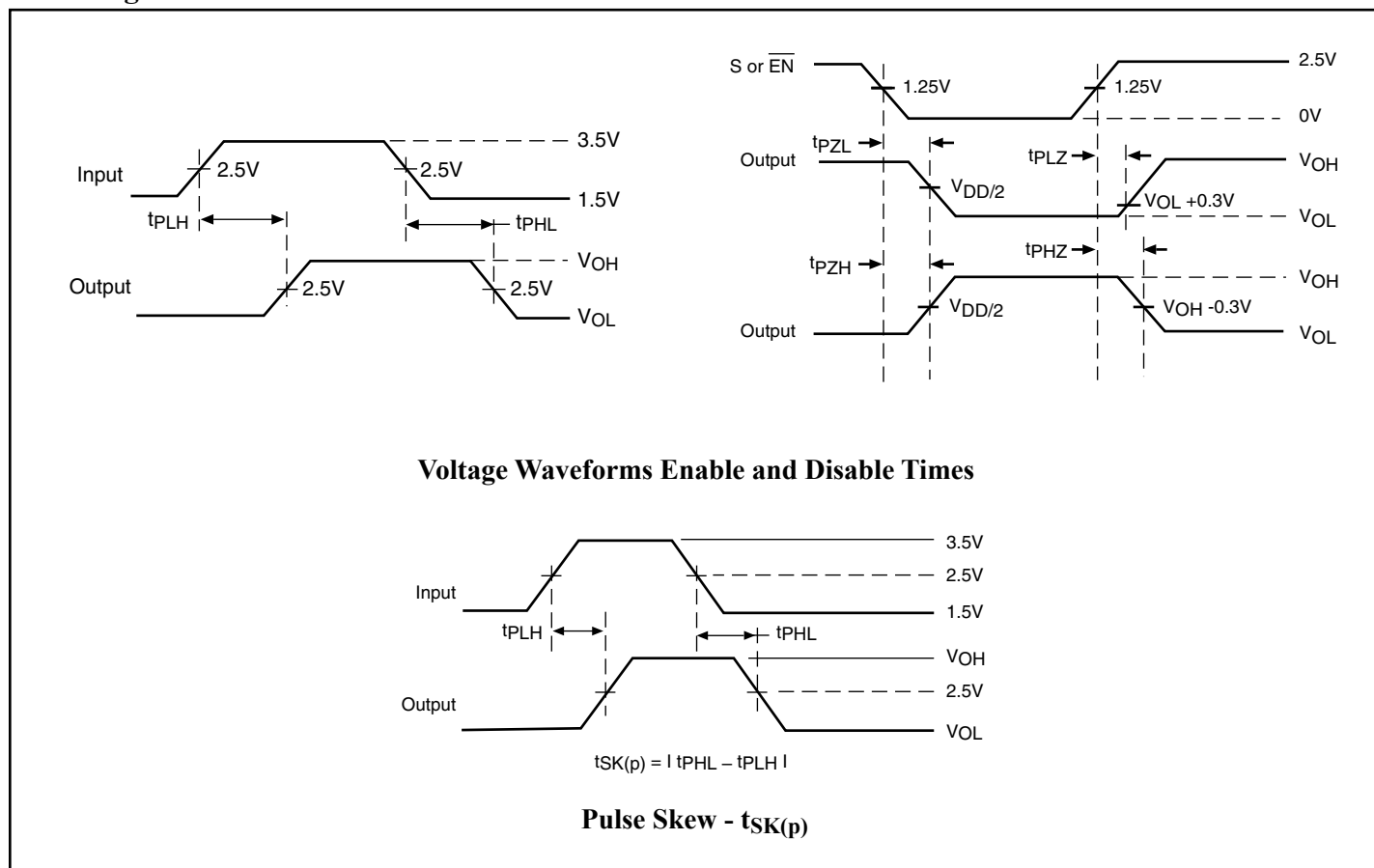
| Test | Switch |
|-----------------------|--------|
| t_{PLZ} , t_{PZL} | 6.0V |
| t_{PHZ} , t_{PZH} | GND |
| Prop Delay | Open |

Test Circuit for Dynamic Electrical Characteristics



Off Isolation (V_{CC} 3.3V, 25°C)

Crosstalk (V_{CC} 3.3V, 25°C)


Switching Waveforms



Applications Information

Logic Inputs

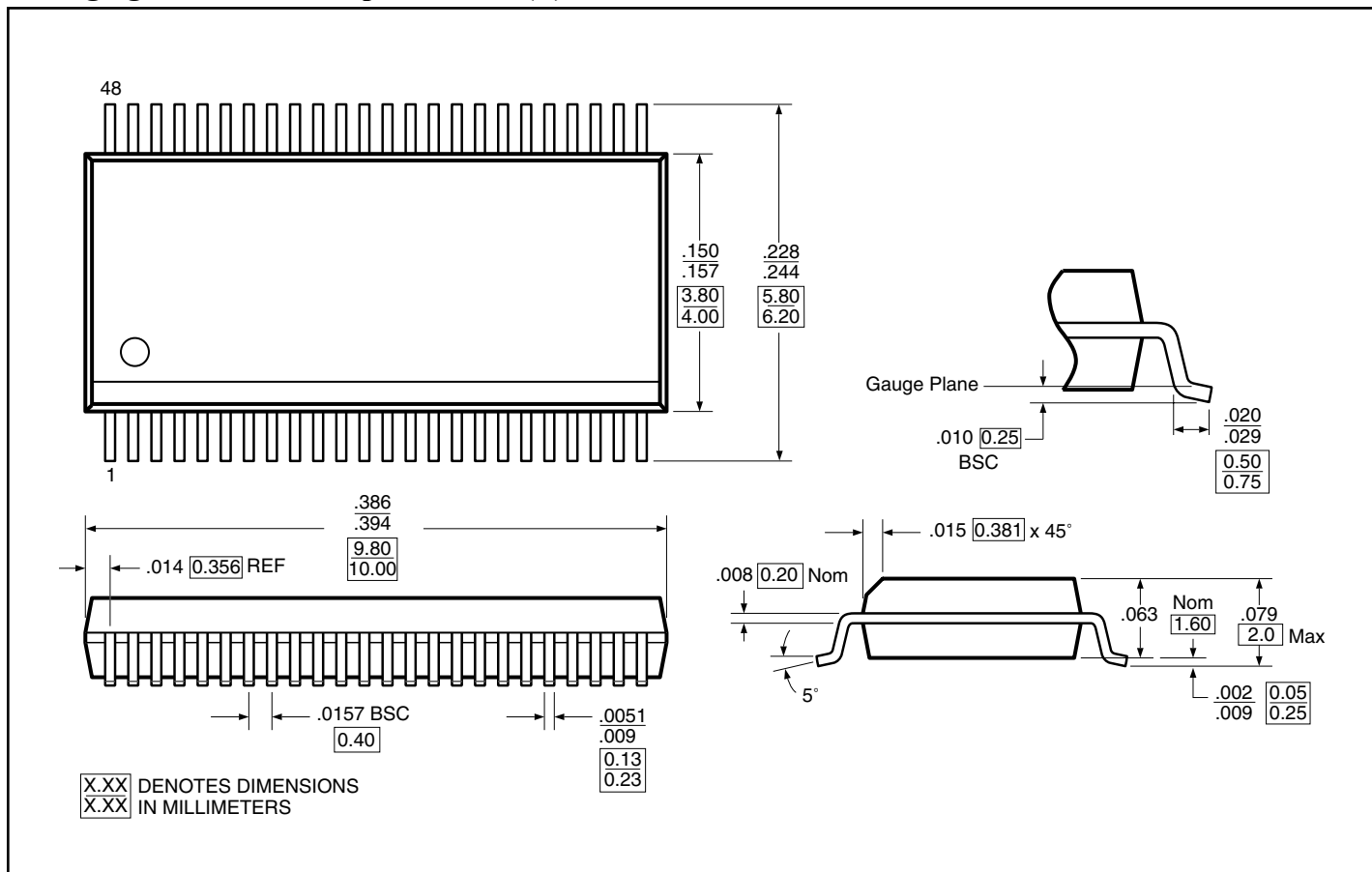
The logic control inputs can be driven up to 3.6V regardless of the supply voltage. For example, given a +3.3V supply, \overline{EN} maybe driven LOW to 0V and HIGH to 3.6V. Driving \overline{EN} Rail-to-Rail® minimizes power consumption.

Power Supply-Sequencing

Proper power supply sequencing is recommended for all CMOS devices. Always apply V_{CC} before applying signals to the input/output or control pins.

Hot Insertion

For Datacom and Telecom applications that have ten or more volts passing through the backplane, a high voltage from the power supply may be seen at the device input pins during hot insertion. The PI3Vxxx devices have maximum limits of 6V and 120mA for 20ns. If the power is higher or applied for a longer time or repeatedly reaches the maximum limits, the devices can be damaged.

Packaging Mechanical: 48-pin BQSOP (B)

Ordering Information

| Ordering Code | Package Code | Package Description |
|---------------|--------------|--|
| PI3V514B | B | 48-Pin 150-mil, BQSOP |
| PI3V514BE | B | Pb-free & Green, 48-Pin 150-mil, BQSOP |

Notes:

- Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
- Number of Transistors = TBD