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Low Voltage, High Bandwidth, Video, 4:1 Mux/DeMux, NanoSwitch™ with Single Enable

Features

- Near-Zero propagation delay
- 5Ω switches connect inputs to outputs
- High signal passing bandwidth (300MHz)
- Beyond Rail-to-Rail switching
- 5V I/O tolerant with 3.3V supply
- 2.5V and 3.3V supply voltage operation
- Hot insertion capable
- Industrial operating temperature: -40°C to +85°C
- 2KV ESD Protection (human body model)
- Latch-up performance >250mA per JESD17
- Packaging (Pb-free & Green available):
 - 16-pin 150 mil wide plastic QSOP (Q)
 - 16-pin 173 mil wide plastic TSSOP (L)
 - 20-contact TQFN (ZH)

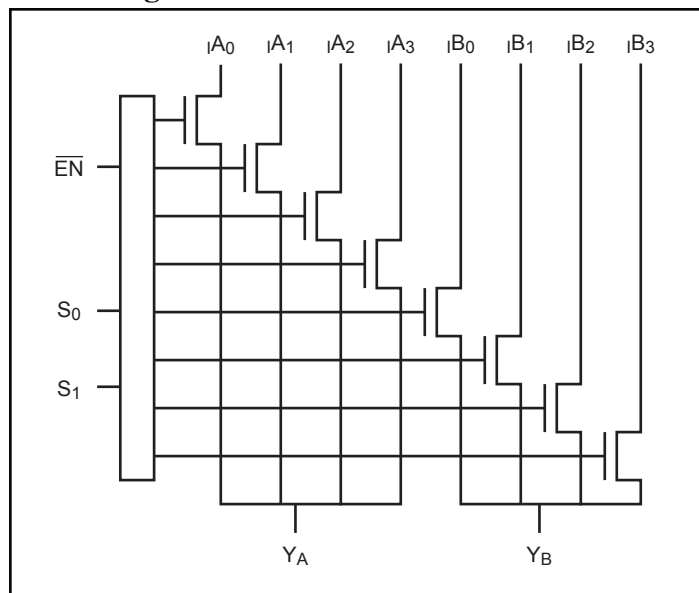
Description

Pericom Semiconductor’s PI3DBV series of switch circuits are produced using the Company’s advanced sub-micron CMOS technology, achieving industry leading performance.

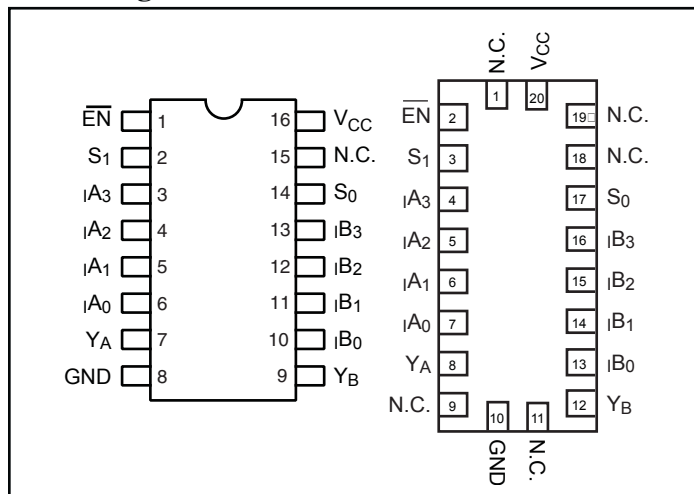
The PI3DBV14 is a 2-channel, 4:1 Multiplexer/Demultiplexer with 3-state outputs. The switch introduces no additional ground bounce noise or propagation delay.

The PI3DBV1 device is very useful in switching differential video signals and others that have high bandwidth (300MHz).

Block Diagram



Pin Configuration



Notes:

1. N.C. = No internal connection

Truth Table⁽¹⁾

| Enable | Select | | Y | Function |
|-----------------|----------------|----------------|------|----------|
| \overline{EN} | S ₁ | S ₀ | Y | Function |
| H | X | X | Hi-Z | Disable |
| L | L | L | I0 | S1-0 = 0 |
| L | L | H | I1 | S1-0 = 1 |
| L | H | L | I2 | S1-0 = 2 |
| L | H | H | I3 | S1-0 = 3 |

Notes:

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

Pin Description

| Pin Name | Description |
|------------------------------------|---------------|
| I _A N, I _B N | Data Inputs |
| S ₀₋₁ | Select Inputs |
| \overline{EN} | Enable |
| Y _A to Y _B | Data Outputs |
| GND | Ground |
| V _{CC} | Power |



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°C to +85°C, V_{CC} = 3.3V ±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} = Min., I _{IN} = -18 mA | | -1.3 | -1.8 | |
| I _{IH} | Input HIGH Current | V _{CC} = Max., V _{IN} = V _{CC} | | | ±1 | µA |
| I _{IL} | Input LOW Current | V _{CC} = Max., V _{IN} = GND | | | ±1 | |
| I _{OZH} | High Impedance Output Current | 0 ≤ Y, I _n ≤ V _{CC} | | | ±1 | |
| R _{ON} | Switch On Resistance ⁽⁴⁾ | V _{CC} = Min., V _{IN} = 0.0V, I _{ON} = 48 mA or -64mA | | 4 | 6 | Ω |
| | | V _{CC} = Min., V _{IN} = 3.6V, I _{ON} = -15 mA | | 5 | 8 | |

DC Electrical Characteristics, 2.5V Supply (Over Operating Range, T_A = -40°C to +85°C, V_{CC} = 2.5V ± 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} = Max., I _{IN} = -6mA | - | -0.7 | -1.8 | |
| I _{IH} | Input HIGH Current | V _{CC} = Max., V _{IN} = V _{CC} | - | - | ±1 | µA |
| I _{IL} | Input LOW Current | V _{CC} = Max., V _{IN} = GND | - | - | ±1 | |
| I _{OZH} | High Impedance Current ⁽³⁾ | 0 ≤ Y, I _n ≤ V _{CC} | - | - | ±1 | |
| R _{ON} | Switch On Resistance ⁽⁴⁾ | V _{CC} = Min., V _{IN} = 0.0V, I _{ON} = -48mA | - | 6 | 8 | Ω |
| | | V _{CC} = Min., V _{IN} = 2.25V, I _{ON} = -15mA | - | 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:

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at $V_{CC} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$ ambient and maximum loading.
- Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
- 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.
- 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} | | | 0.8 | mA |

Notes:

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
- Typical values are at $V_{CC} = 3.3\text{V}$, $+25^\circ\text{C}$ ambient.
- Per LVTTTL driven input (control inputs only); Y and In pins do not contribute to I_{CC} . This parameter is guaranteed, but not production tested.


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

| Parameter | Description | Test Condition | Min. | Typ. | Max. | Units |
|-------------------|----------------|------------------|------|------|------|-------|
| X _{TALK} | Crosstalk | See Test Diagram | | -60 | | dB |
| O _{IRR} | Off-Isolation | See Test Diagram | | -60 | | |
| BW | -3dB Bandwidth | See Test Diagram | 200 | 300 | | MHz |

Switching Characteristics over 3.3V Operating Range

| Parameters | Description | Conditions ⁽¹⁾ | Com. | | | Units |
|--------------------------------------|---|---------------------------|------|------|------|-------|
| | | | Min. | Typ. | Max. | |
| t _{PLH} t _{PHL} | Propogation 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 | |

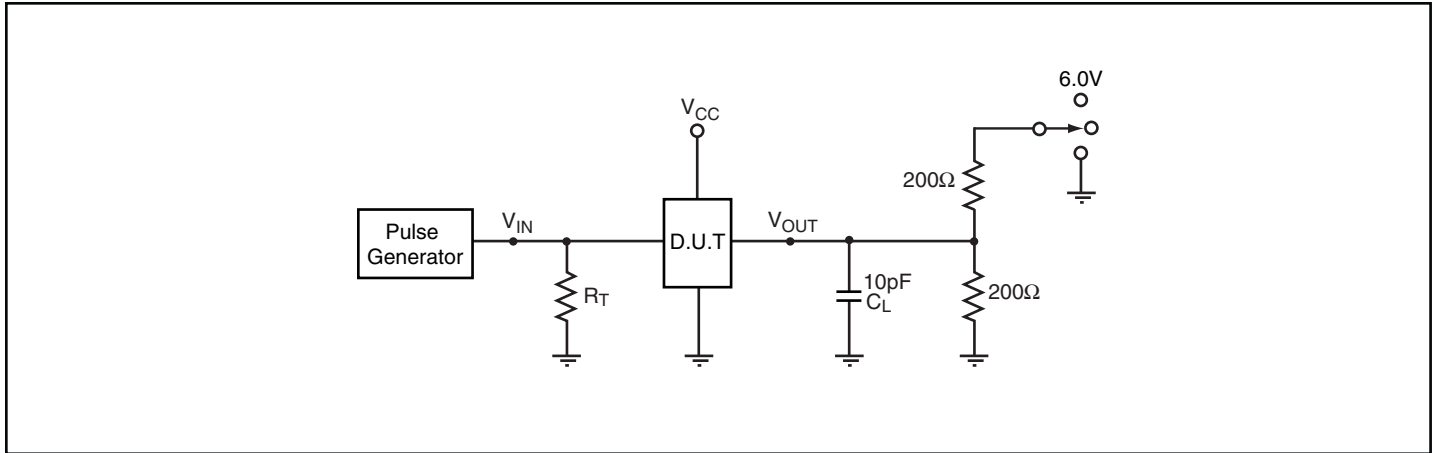
Switching Characteristics over 2.5V Operating Range

| Parameters | Description | Conditions ⁽¹⁾ | Com. | | Units |
|--------------------------------------|---|---------------------------|------|------|-------|
| | | | Min. | Max. | |
| t _{PLH} t _{PHL} | Propogation 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:

- See test circuit and waveforms.
- This parameter is guaranteed but not tested on Propagation Delays.
- 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.

Test Circuit for Electrical Characteristics⁽¹⁾



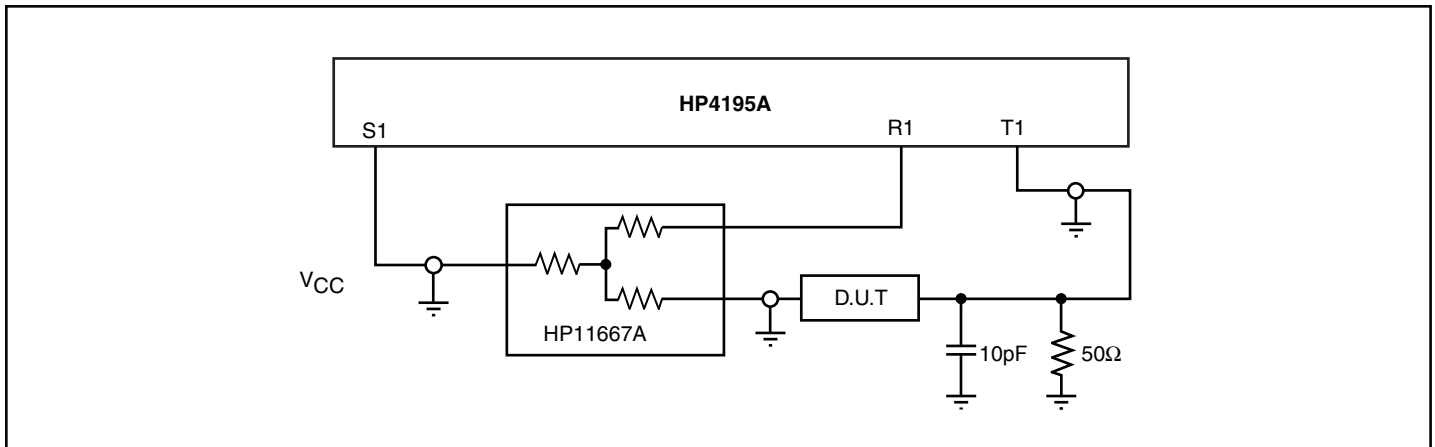
Notes:

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.

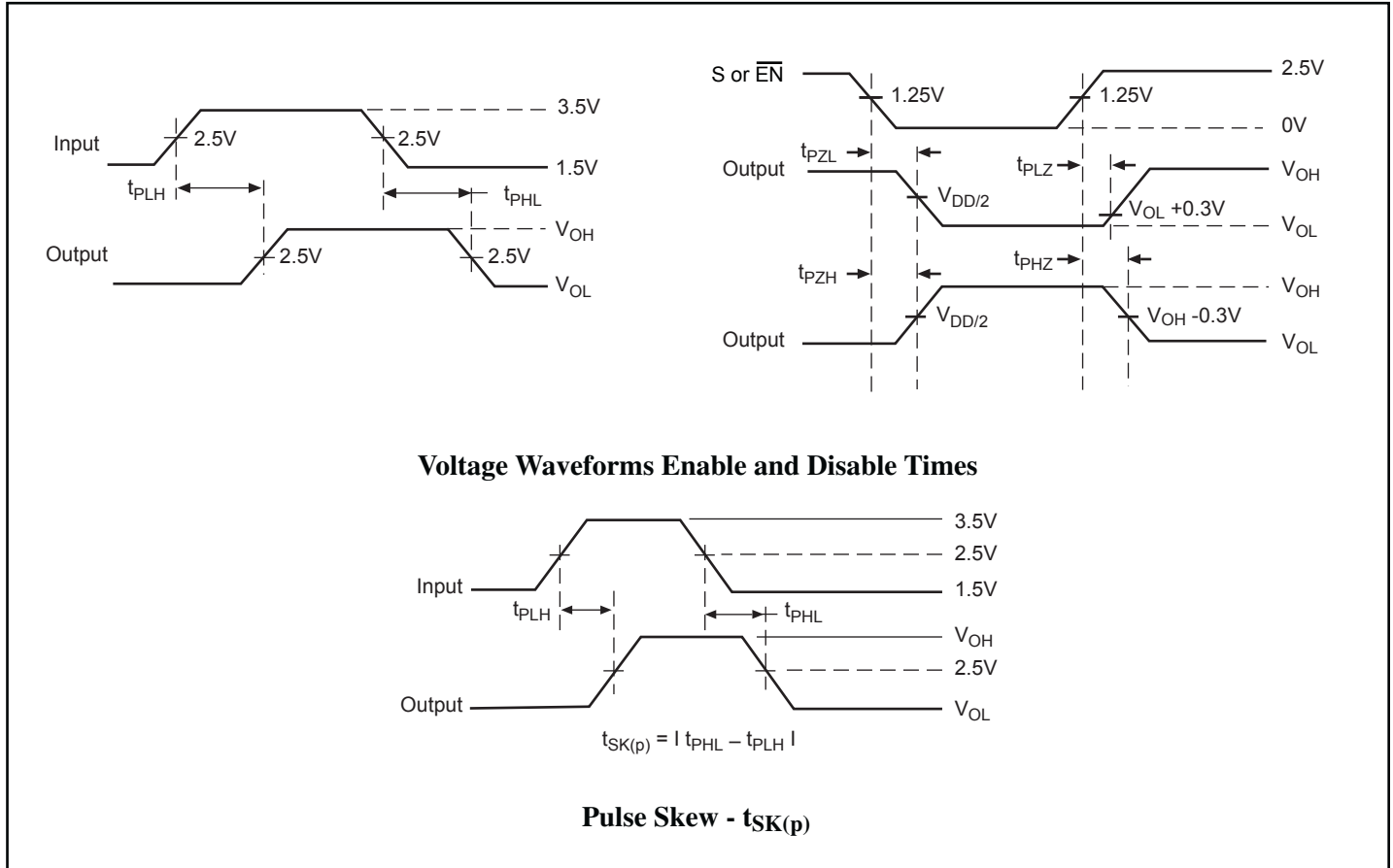
Switch Positions

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

Test Circuit for Dynamic Electrical Characteristics



Switching Waveforms





Applications Information

Logic Inputs

The logic control inputs can be driven upto 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.

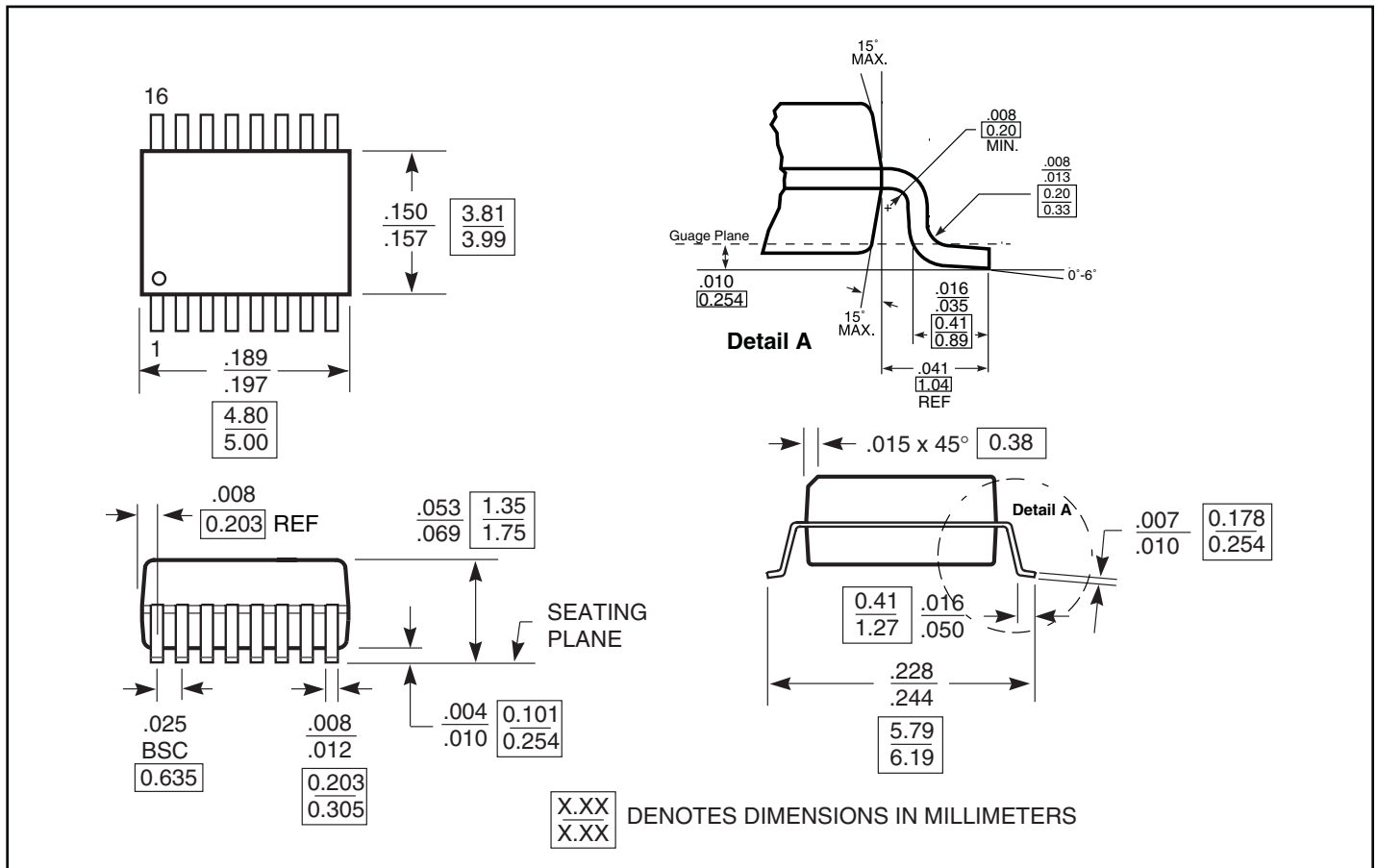
Power Supply-Sequencing

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

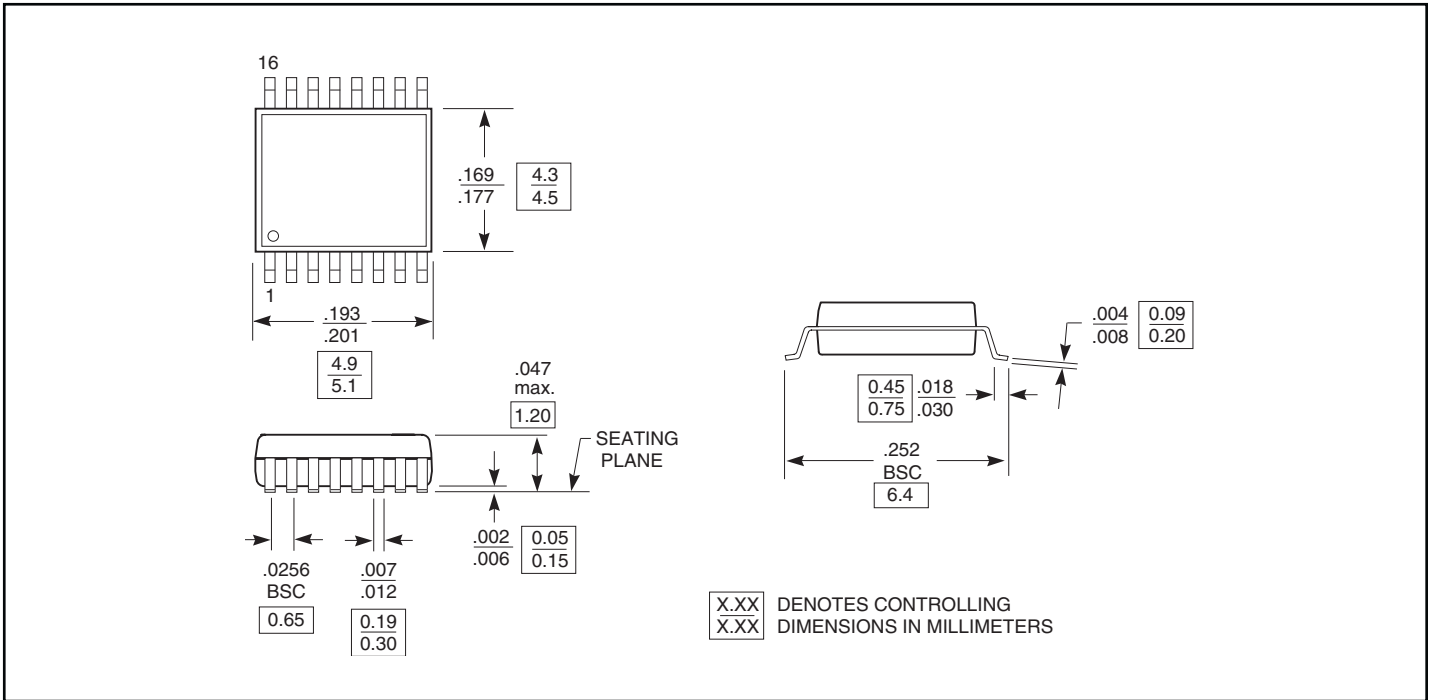
Hot Insertion

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 PI3CHxx 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.

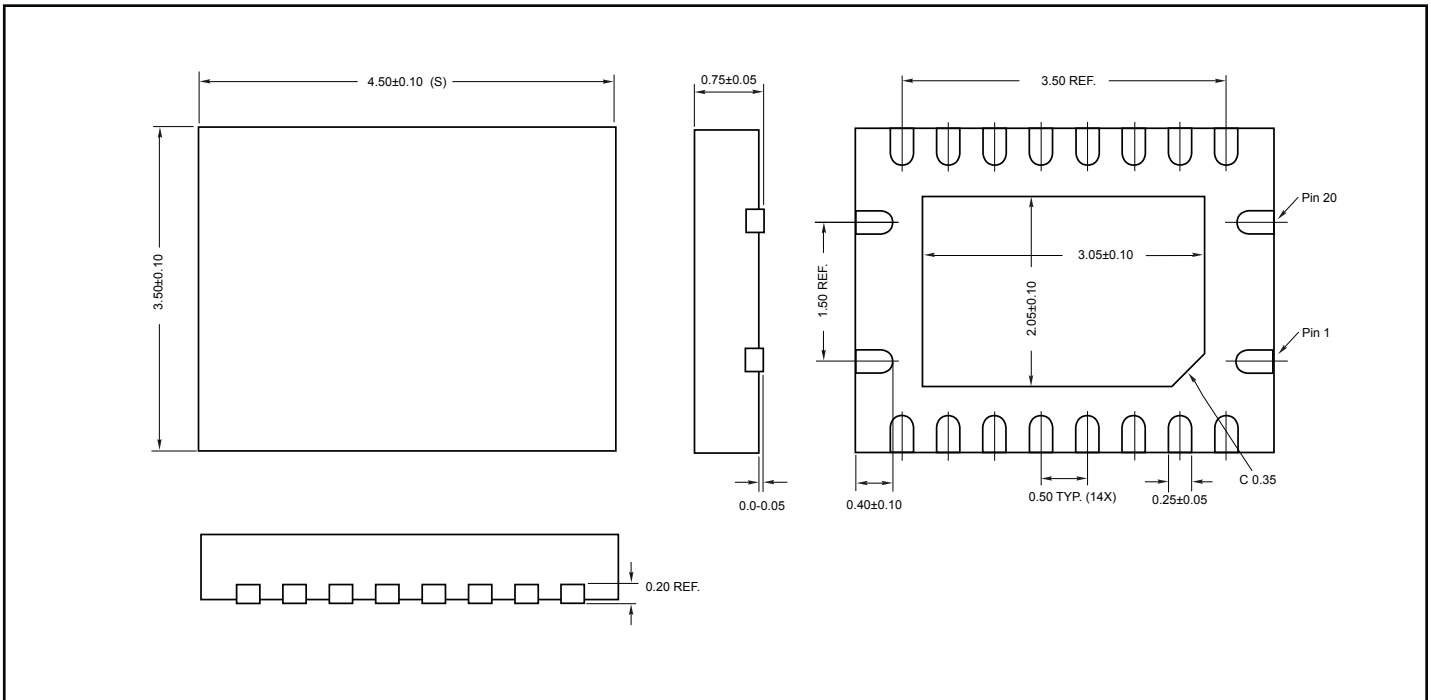
Packaging Mechanical: 16-pin QSOP (Q)



Packaging Mechanical: 16-pin TSSOP (L)



Packaging Mechanical: 20-Contact TQFN (ZH)




Ordering Information

| Ordering Code | Package Code | Package Description |
|---------------|--------------|--|
| PI3DBV14Q | Q | 150-mil, 16-pin QSOP |
| PI3DBV14QE | Q | Pb-free & Green, 150-mil, 16-pin QSOP |
| PI3DBV141L | L | 173-mil, 16-pin TSSOP |
| PI3DBV14LE | L | Pb-free & Green, 173-mil, 16-pin TSSOP |
| PI3DBV14ZHE | E | Pb-free & Green, 20-Contact TQFN |

Notes:

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