

16-Bit Inverting Buffer/Driver with 3-State Outputs

Product Features

- The PI74VCX Family is designed for low voltage operation, $V_{DD} = 1.8V$ to $3.6V$
- 3.6V Tolerant Inputs and Outputs
- Supports Live Insertion
- Balanced Drive, $\pm 24mA$
- Uses patented Noise Reduction Circuitry
- Typical VOLP (Output Ground Bounce) $< 0.6V$ at $V_{DD} = 2.5V$, $T_A = 25^\circ C$
- Typical VOHV (Output VOH Undershoot) $< -0.6V$ at $V_{DD} = 2.5V$, $T_A = 25^\circ C$
- Power-Off high impedance inputs and outputs
- Industrial operation at $-40^\circ C$ to $+85^\circ C$
- Packaging (Pb-free & Green available):
 - 48-pin 240 mil wide plastic TSSOP (A)

Product Description

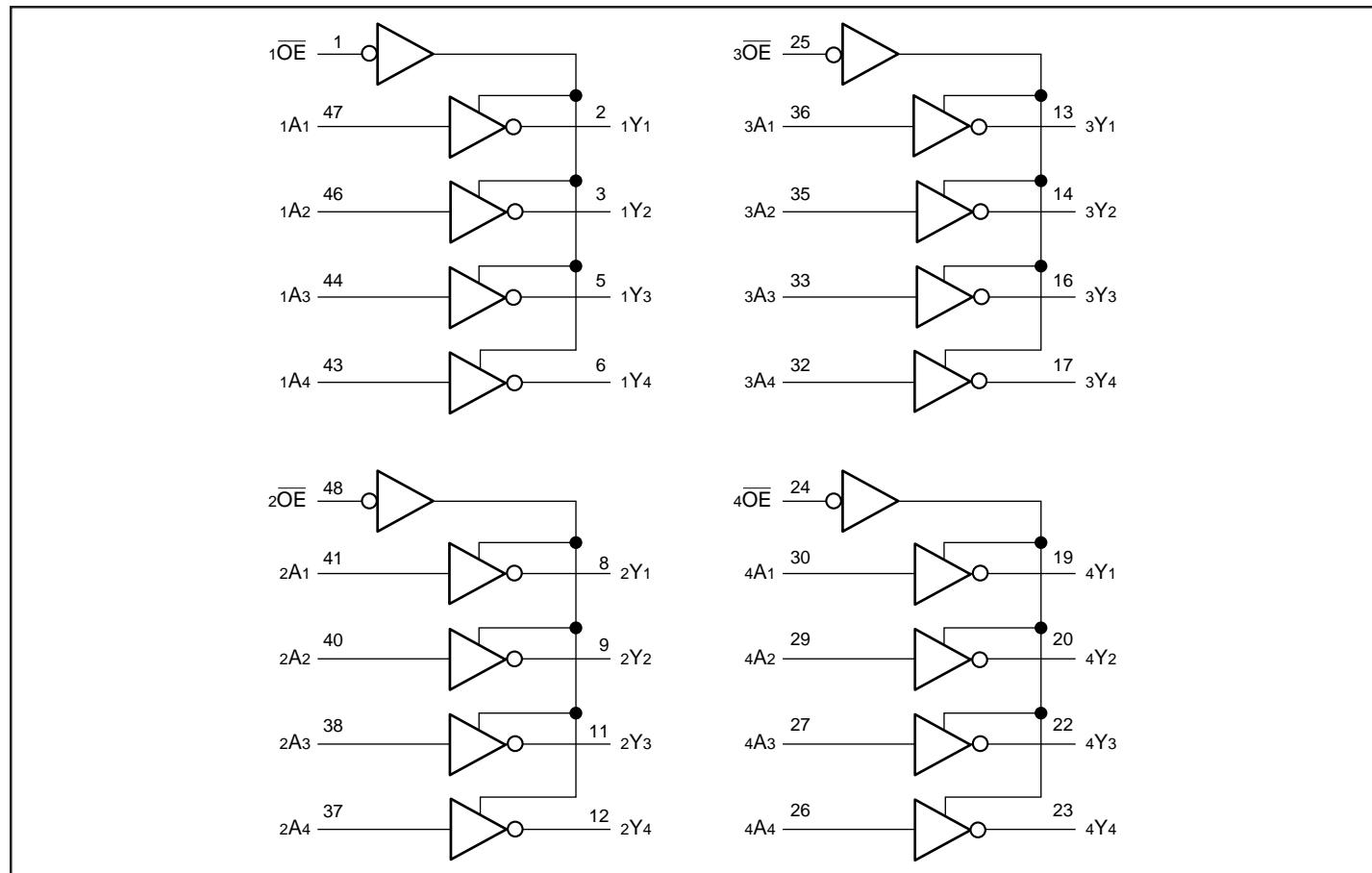
The inverting buffer/driver is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. It provides symmetrical active-low output-enable (\overline{OE}) inputs.

To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The PI74VCX family is I/O Tolerant, allowing it to operate in 1.8/3.6V systems.

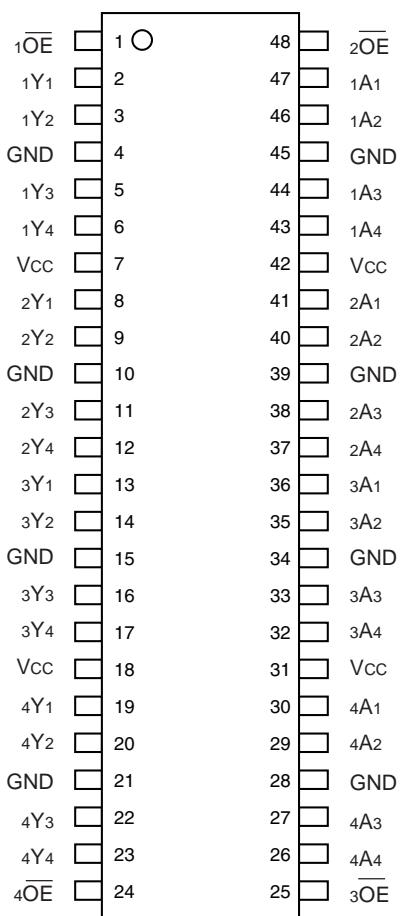
Logic Block Diagram



Product Pin Description

| Pin Name | Description |
|-------------|---|
| $n\bar{OE}$ | 3-State Output Enable Inputs (Active LOW) |
| nAx | Inputs |
| nYx | 3-State Outputs |
| GND | Ground |
| Vcc | Power |

Product Pin Configuration



Truth Table⁽¹⁾

| Inputs | | Outputs |
|-------------|-------|---------|
| $n\bar{OE}$ | nAx | nYx |
| L | L | H |
| L | H | L |
| H | X | Z |

Notes:

1. H = High Signal Level
L = Low Signal Level
X = Don't Care or Irrelevant
Z = High Impedance

Maximum Ratings

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

| | |
|---|-------------------------------|
| Supply Voltage Range, V _{DD} | 0.5V to 4.6V |
| Input Voltage Range, V _I | -0.5V to 4.6V |
| Output Voltage Range, V _O (3-Stated) | -0.5V to 4.6V |
| Output Voltage Range, V _O ⁽¹⁾ (Active) | -0.5V to V _{CC} +0.5 |
| DC Input Diode Current (I _{IK}) V _I <0V | -50mA |
| DC Output Diode Current (I _{OK}) | |
| V _O <0V | -50mA |
| V _O >V _{DD} | +50mA |
| DC Output Source/Sink Current (I _{OH} /I _{OL}) | ±50mA |
| DC V _{DD} or GND Current per Supply Pin (I _{CC} or GND) | ±100mA |
| Storage Temperature Range, T _{stg} | -65°C to 150°C |

Notes:

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.

1. Absolute maximum of I_O must be observed.

Recommended Operating Conditions⁽¹⁾

| | | | Min. | Max. | Units |
|-----------------|--|--------------------------------|------|-----------------|-------|
| V _{DD} | Supply voltage | Operating | 1.8 | 3.6 | V |
| | | Data Retention Only | 1.2 | 3.6 | |
| V _{IH} | High-level input voltage | V _{DD} = 2.7V to 3.6V | 2.0 | | |
| V _{IL} | Low-level input voltage | V _{DD} = 2.7V to 3.6V | | 0.8 | |
| V _I | Input voltage | | -0.3 | 3.6 | |
| V _O | Output voltage | Active State | 0 | V _{DD} | mA |
| | | Off State | 0 | 3.6 | |
| I _O | Output current in I _{OH} /I _{OL} | V _{DD} = 3.0V to 3.6V | | ±24 | mA |
| | | V _{DD} = 2.3V to 2.7V | | ±18 | |
| | | V _{DD} = 1.8V | | ±6 | |
| Δt/Δv | Input transition rise or fall rate ⁽²⁾ | | 0 | 10 | ns/V |
| T _A | Operating free-air temperature | | -40 | 85 | C |

Notes:

1. Unused control inputs must be held HIGH or LOW to prevent them from floating.
2. As measured between 0.8V and 2.0V, V_{DD}=3.0V.

Electrical Characteristics over Recommended Operating Free-Air Temperature Range

(unless otherwise noted)

 DC Characteristics (2.7V < V_{DD} ≤ 3.6V)

| | Parameter | Conditions | V _{DD} | Min. | Typ. | Max. | Units |
|------------------|---------------------------------------|---|-----------------|-----------------------|------|------|-------|
| V _{IH} | HIGH Level Input Voltage | | 2.7 - 3.6 | 2.0 | | | V |
| V _{IL} | LOW Level Input Voltage | | | | | 0.8 | |
| V _{OH} | HIGH Level Output Voltage | I _{OH} = -100µA | 2.7 - 3.6 | V _{DD} - 0.2 | | | V |
| | | I _{OH} = -12mA | | 2.7 | 2.2 | | |
| | | I _{OH} = -18mA | | 3.0 | 2.4 | | |
| | | I _{OH} = -24mA | | | 2.2 | | |
| V _{OL} | LOW Level Output Voltage | I _{OL} = 100µA | 2.7 - 3.6 | | | 0.2 | µA |
| | | I _{OL} = 12mA | 2.7 | | | 0.4 | |
| | | I _{OL} = 18mA | 3.0 | | | 0.4 | |
| | | I _{OL} = 24mA | | | | 0.55 | |
| I _I | Input Leakage Current | V _I = 0.0V, V _I = 3.6V | 3.6 | | | ±5.0 | µA |
| I _{OZ} | 3-STATE Output Leakage | 0 ≤ V _O ≤ 3.6V V _I = V _{IH} or V _{IL} | 2.7 - 3.6 | | | ±10 | |
| I _{OFF} | Power-OFF Leakage Current | 0 ≤ (V _I , V _O) ≤ 3.6V | 0 | | | 10 | |
| I _{DD} | Quiescent Supply Current | V _I = V _{DD} to GND | 2.7 - 3.6 | | | 20 | |
| | | V _{DD} ≤ (V _I , V _O) ≤ 3.6V | | | | ±20 | |
| ΔI _{DD} | Increase in I _{DD} per input | V _{IH} = V _{DD} - 0.6V, Other inputs at V _{DD} or Gnd | 2.7 - 3.6 | | | 750 | µA |

Electrical Characteristics over Recommended Operating Free-Air Temperature Range

(unless otherwise noted) (continued from previous page)

 DC Characteristics ($2.3V \leq V_{DD} \leq 2.7V$)

| | Parameters | Conditions | V_{DD} | Min. | Typ. | Max. | Units |
|-----------|---------------------------|--|-----------|----------------|------|-----------|---------|
| V_{IH} | HIGH Level Input Voltage | | 2.3 - 2.7 | 1.6 | | | V |
| V_{IL} | LOW Level Input Voltage | | | | | 0.7 | |
| V_{OH} | HIGH Level Output Voltage | $I_{OH} = -100\mu A$ | 2.3 | $V_{DD} - 0.2$ | | | V |
| | | $I_{OH} = -6mA$ | | 2.0 | | | |
| | | $I_{OH} = -12mA$ | | 1.8 | | | |
| | | $I_{OH} = -18mA$ | | 1.7 | | | |
| V_{OL} | LOW Level Output Voltage | $I_{OL} = 100\mu A$ | 2.3 - 2.7 | | | 0.2 | μA |
| | | $I_{OL} = 12mA$ | 2.3 | | | 0.4 | |
| | | $I_{OL} = 18mA$ | | | | 0.6 | |
| I_I | Input Leakage Current | $V_I = 0.0V, V_I = 2.7V$ | 2.7 | | | ± 5.0 | μA |
| I_{OZ} | 3-STATE Output Leakage | $0 \leq V_O \leq 3.6V$ $V_I = V_{IH}$ or V_{IL} | 2.3 - 2.7 | | | ± 10 | |
| I_{OFF} | Power-OFF Leakage Current | $0 \leq (V_I, V_O) \leq 3.6V$ | 0 | | | 10 | |
| I_{DD} | Quiescent Supply Current | $V_I = V_{DD}$ or GND | 2.3 - 2.7 | | | 20 | μA |
| | | $V_{DD} \leq (V_I, V_O) \leq 3.6V$ | | | | ± 20 | |

 DC Characteristics ($1.8V \leq V_{DD} \leq 2.3V$)

| | Parameters | Conditions | V_{DD} | Min. | Typ. | Max. | Units |
|-----------|---------------------------|--|-----------|---------------------|------|---------------------|---------|
| V_{IH} | HIGH Level Input Voltage | | 1.8 - 2.3 | $0.7 \times V_{DD}$ | | | V |
| V_{IL} | LOW Level Input Voltage | | | | | $0.2 \times V_{DD}$ | |
| V_{OH} | HIGH Level Output Voltage | $I_{OH} = -100\mu A$ | 1.8 | $V_{DD} - 0.2$ | | | V |
| | | $I_{OH} = -6mA$ | | 1.4 | | | |
| V_{OL} | LOW Level Output Voltage | $I_{OL} = 100\mu A$ | | | | 0.2 | |
| | | $I_{OL} = 6mA$ | | | | 0.3 | |
| I_I | Input Leakage Current | $V_I = 0.0V, VI = 1.8V$ | | | | ± 5.0 | μA |
| I_{OZ} | 3-STATE Output Leakage | $0 \leq V_O \leq 3.6V$ $V_I = V_{IH}$ or V_{IL} | | | | ± 10 | |
| I_{OFF} | Power-OFF Leakage Current | $0 \leq (V_I, V_O) \leq 3.6V$ | | 0 | | 10 | |
| I_{DD} | Quiescent Supply Current | $V_I = V_{DD}$ or GND | 1.8 | | | 20 | μA |
| | | $V_{DD} \leq (V_I, V_O) \leq 3.6V$ | 1.8 | | | ± 20 | |

AC Electrical Characteristics⁽¹⁾

| Symbol | Parameter | TA = -40°C to +85°C, C _L = 30pF, R _L = 500Ω | | | | | | Units | |
|--|---|---|------|---------------------------------|------|------------------------|------|-------|--|
| | | V _{DD} = 3.3V ±0.3V | | V _{DD} = 2.5V ±0.2V | | V _{DD} = 1.8V | | | |
| | | Min. | Max. | Min. | Max. | Min. | Max. | | |
| t _{PHL} , t _{PLH} | Prop Delay | 0.8 | 2.5 | 1.0 | 3.0 | 1.5 | 5.0 | ns | |
| t _{PZL} , t _{PZH} | Output Enable Time | 0.8 | 3.5 | 1.0 | 4.1 | 1.5 | 6.5 | | |
| t _{PLZ} , t _{PHZ} | Output Disable Time | 0.8 | 3.5 | 1.0 | 3.8 | 1.5 | 5.0 | | |
| t _{OSHL} t _{OSLH} | Output to Output Skew ⁽²⁾ | | 0.5 | | 0.5 | | 0.5 | | |

Notes:

1. For CL = 50pF add approximately 300ps to AC maximum specification
2. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH or LOW (t_{OSHL}) or LOW to HIGH (t_{OSLH}).

Dynamic Switching Characteristics

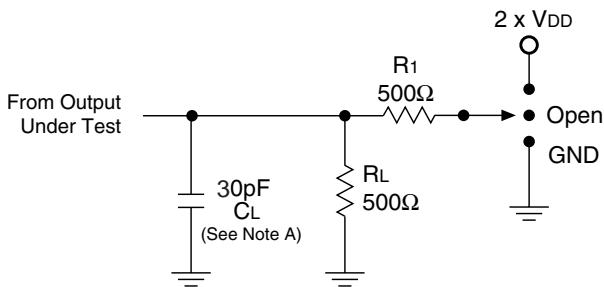
| Symbol | Parameter | Conditions | V _{DD} | T _A = +25°C Typical | Units |
|------------------|--|--|-------------------|-----------------------------------|-------|
| V _{OLP} | Quiet Output Dynamic Peak V _{OL} | C _L = 50pF, V _{IH} = V _{DD} , V _{IL} = 0V | 1.8 2.5 3.3 | 0.25 0.6 0.8 | V |
| V _{OLV} | Quiet Output Dynamic Valley V _{OL} | C _L = 50pF, V _{IH} = V _{DD} , V _{IL} = 0V | 1.8 2.5 3.3 | -0.25 -0.6 -0.8 | |
| V _{OHV} | Quiet Output Dynamic Valley V _{OH} | C _L = 50pF, V _{IH} = V _{DD} , V _{IL} = 0V | 1.8 2.5 3.3 | 1.5 1.9 2.2 | |

Capacitance

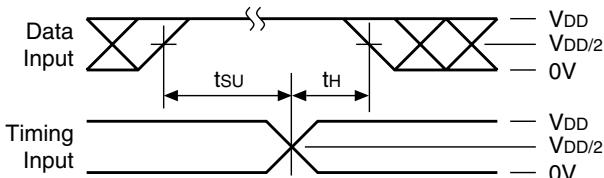
| Symbol | Parameter | Conditions | T _A = +25°C Typical | Units |
|------------------|-------------------------------|--|-----------------------------------|-------|
| C _{IN} | Input Capacitance | V _{DD} = 1.8V, 2.5V or 3.3V, V _I = 0V or V _{DD} | 6 | pF |
| C _{OUT} | Output Capacitance | V _I = 0V or V _{DD} , V _{DD} = 1.8V, 2.5V or 3.3V | 7 | |
| C _{PD} | Power Dissipation Capacitance | V _I = 0V or V _{DD} , F = 10MHz V _{DD} = 1.8V, 2.5V or 3.3V | 20 | |

Test Circuits and Switching Waveforms

Parameter Measurement Information (VDD = 1.8V - 3.6V)



Setup, Hold, and Release Timing



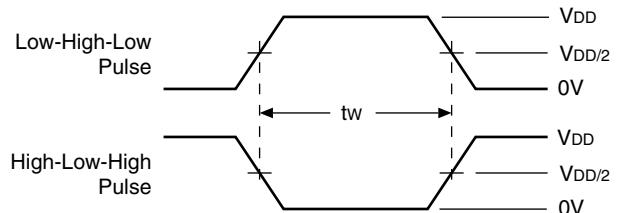
Notes:

- A. C_L includes probe and jig capacitance.
- B. 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.
- All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_0 = 50\Omega$, $t_r \leq 2\text{ns}$, $t_f \leq 2\text{ns}$, ***measured from 10% to 90%, unless otherwise specified.***
- The outputs are measured one at a time with one transition per measurement.

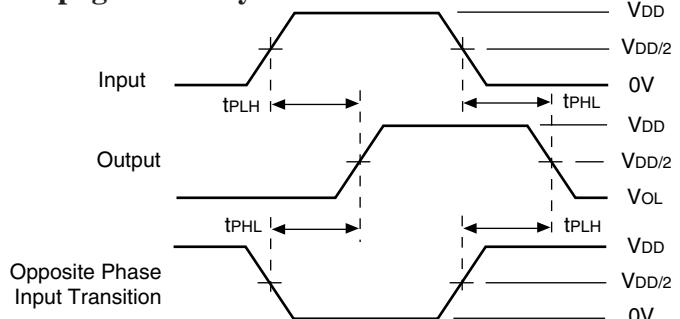
Switch Position

| Test | S1 |
|-------------------|-------------------|
| tpd | Open |
| t_{PLZ}/t_{PZL} | $2 \times V_{DD}$ |
| t_{PHZ}/t_{PZH} | GND |

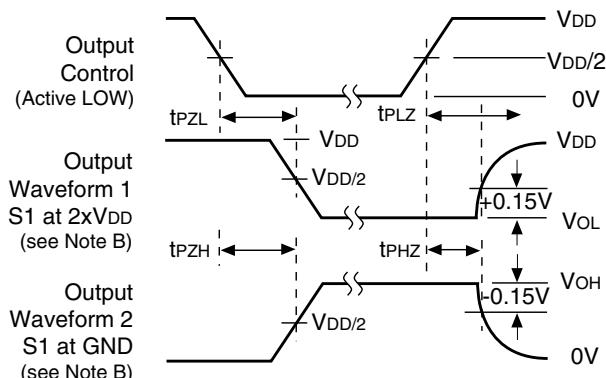
Pulse Width



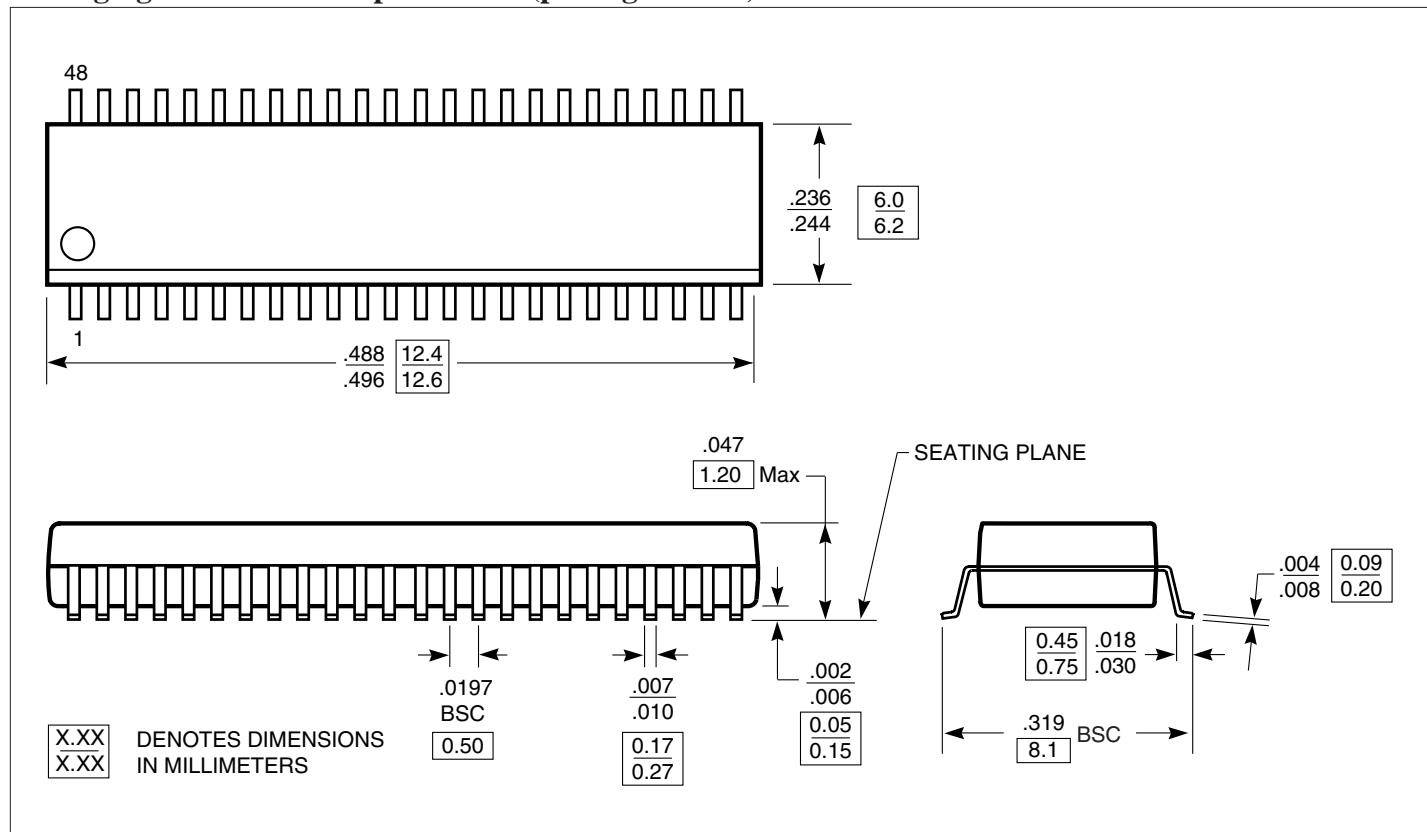
Propagation Delay



Enable Disable Timing



Packaging Mechanical: 48-pin TSSOP (package code A)



Ordering Information

| Ordering Code | Package Type | Package Description |
|----------------|--------------|---|
| PI74VCX16240A | A | 56-pin, 240 mil wide plastic TSSOP |
| PI74VCX16240AE | A | Pb-free & Green, 56-pin, 240 mil wide plastic TSSOP |

Notes:

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