⨀ *PERICOM*®

16-Bit Transparent D-Type Latch with 3-State Outputs

Product Features

- PI74ALVTC family is designed for low-voltage operation, $V_{DD} = 1.8V$ to $3.6V$
- Supports Live Insertion
- 3.6V I/O Tolerant Inputs and Outputs
- Bus Hold
- High Drive, $-32/64mA$ @ $3.3V$
- Uses patented noise reduction circuitry
- Power-off high-impedance inputs and outputs
- Industrial operation at $-40°C$ to $+85°C$
- Packaging (Pb-free and Green available):
  - 48-pin 240 mil wide plastic TSSOP (A)
  - 48-pin 173 mil wide plastic TVSOP (K)
  - 48-pin 300 mil wide plastic SSOP (V)
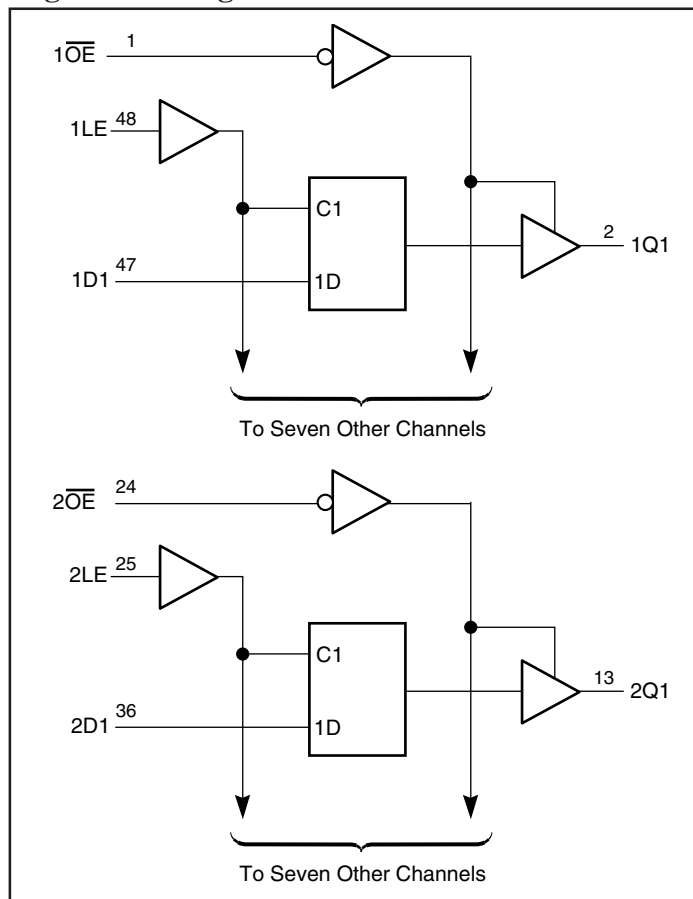
Product Description

The PI74ALVTC16373 is particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers. This device can be used as two 8-bit latches or one 16-bit latch. When the Latch Enable (LE) input is HIGH, the Q outputs follow the (D) inputs. When LE is taken LOW, the Q outputs are latched at the levels set up at the D inputs.

A buffered Output Enable ($\overline{OE}$) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or a high-impedance state in which the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without an interface or pullup components. $\overline{OE}$ does not affect internal operations of the latch. Old data can be retained or new data can be entered while the ouputs are in the high-impedance state.

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

The family offers both I/O Tolerant, which allows it to operate in mixed 1.8/3.6V systems, and "Bus Hold," which retains the data input's last state whenever the data input goes to high-impedance, preventing "floating" inputs and eliminating the need for pullup/down resistors.

Logic Block Diagram

To Seven Other Channels

To Seven Other Channels

Product Pin Description

Pin Name	Description
$\overline{OE}$	Output Enable Input (Active LOW)
LE	Latch Enable (Active HIGH)
Dx	Data Inputs
Qx	3-State Outputs
GND	Ground
V_{DD}	Power

Product Pin Configuration

Left	Pin	Pin	Right
1$\overline{OE}$	1	48	1LE
1Q1	2	47	1D1
1Q2	3	46	1D2
GND	4	45	GND
1Q3	5	44	1D3
1Q4	6	43	1D4
VDD	7	42	VDD
1Q5	8	41	1D5
1Q6	9	40	1D6
GND	10	39	GND
1Q7	11	38	1D7
1Q8	12	37	1D8
2Q1	13	36	2D1
2Q2	14	35	2D2
GND	15	34	GND
2Q3	16	33	2D3
2Q4	17	32	2D4
VDD	18	31	VDD
2Q5	19	30	2D5
2Q6	20	29	2D6
GND	21	28	GND
2Q7	22	27	2D7
2Q8	23	26	2D8
2$\overline{OE}$	24	25	2LE

Truth Table[1]

Inputs			Outputs
$\overline{OE}$	LE	D	Q
L	H	H	H
L	H	L	L
L	L	X	Q_O
H	X	X	Z

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

Maximum Ratings[1]

(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[2] (Active) .... −0.5V to V_{DD} +0.5V

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}) .... −64/128mA

DC V_{DD} or GND Current per Supply Pin (I_{DD} or GND) .... ±100mA

Storage Temperature Range, T_{stg} .... −65°C to 150°C

Notes:

1. 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.
2. Absolute maximum of I_O must be observed.

Recommended Operating Conditions[1]

			Min.	Max.	Units
V_{DD}	Supply voltage	Operating	1.8	3.6	
		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
V_I	Input voltage		−0.3	3.6	
V_O	Output voltage	Active State	0	V_{DD}	
		Off State	0	3.6	
	Output current in I_{OH}/I_{OL}	V_{DD} = 3.0V to 3.6V V_{DD} = 3.0V to 3.6V V_{DD} = 2.3V to 2.7V V_{DD} = 1.8V		−32/64 ±24 ±18 ±6	mA
$\Delta t/\Delta v$	Input transistion 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			2.0			
V_{IL}	LOW Level Input Voltage		2.7 - 3.6			0.8	
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100\mu A$		V_{DD} - 0.2			
		$I_{OH} = -12mA$	2.7	2.2			
		$I_{OH} = -18mA$		2.4			
		$I_{OH} = -24mA$	3.0	2.2			
		$I_{OH} = -32mA$		2.0			V
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100\mu A$	2.7 - 3.6			0.2	
		$I_{OL} = 12mA$	2.7			0.4	
		$I_{OL} = 18mA$				0.4	
		$I_{OL} = 24mA$	3.0			0.45	
		$I_{OL} = 32mA$				0.5	
		$I_{OL} = 64mA$				0.55	
I_I	Input Leakage Current	$V_I = V_{DD}$, or GND	3.6			±5.0	
I_{OZ}	3-STATE Output Leakage	$V_O = 3.6V$	2.7			±10	μA
I_{OFF}	Power-OFF Leakage Current	V_I or $V_O ≤ 3.6V$	0			10	
I_{ODL}	Output Current Low	$V_{IN} = V_{IH}$ or V_{IL}, $V_O = 1.5V^{(1)}$	3.6	150		334	mA
I_{ODH}	Output Current High	$V_{IN} = V_{IH}$ or V_{IL}, $V_O = 1.5V^{(1)}$		−58		−114	
I_{HOLD}	Bus Hold Current A or B Outputs	$V_I = 0.8V$	3.0	75			
		$V_I = 2.0V$		−75			
		$V_I = 0$ to $3.6V$	3.6			±500	μA
I_{DD}	Quiescent Supply Current	$V_I = V_{DD}$ or GND	2.7 - 3.6			50	
		$V_{DD} ≤ (V_I, V_O) ≤ 3.6V$				±50	
ΔI_{DD}	Increase in I_{DD} per input	$V_{IH} = V_{DD}$ -0.6V, Other inputs at V_{DD} or Gnd				400	

Notes:

1. Duration of test must not exceed 1 second with only 1 output tested at a time.

Electrical Characteristics (continued)

(Over Recommended Operating Free-Air Temperature Range unless otherwise noted

DC Characteristics (2.3V ≤ V_{DD} ≤ 2.7V)

Description	Parameters	Conditions	V_{DD}	Min.	Typ.	Max.	Units
V_{IH}	HIGH Level Input Voltage		2.3 - 2.7	1.6			
V_{IL}	LOW Level Input Voltage					0.7	
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100\mu A$		V_{DD} - 0.2			
		$I_{OH} = -12mA$	2.3	1.8			V
		$I_{OH} = -8mA$		1.7			
V_{OL}	LOW Level Output Voltage		2.3 - 2.7			0.2	
		$I_{OL} = 12mA$	2.3			0.4	
		$I_{OL} = 18mA$				0.5	
		$I_{OL} = 24mA$				0.55	
I_I	Input Leakage Current	$V_I = V_{DD}$ or GND	2.7			±5.0	
I_{OZ}	3-State Output Leakage	$V_O = 3.6V$	2.3			±10	μA
I_{OFF}	Power-OFF Leakage Current	V_I or $V_O \le 3.6V$	0			10	
I_{ODL}	Output Current Low	$V_{IN} = V_{IH}$ or V_{IL}, $V_O = 1.5V$[2]	2.7	110		264	mA
I_{ODH}	Output Current High	$V_{IN} = V_{IH}$ or V_{IL}, $V_O = 1.5V$[2]		−30		−60	
I_{HOLD}[1]	Bus Hold Current A or B Outputs	$V_I = 0.7V$	2.5		90		
		$V_I = 1.7V$			−90		
I_{DD}	Quiescent Supply Current	$V_I = V_{DD}$ or GND	2.3 - 2.7			40	μA
		$V_{DD} \le (V_I, V_O) \le 3.6V$				±40	
ΔI_{DD}	Increase in I_{DD} per input	$V_{IH} = V_{DD}$ -0.6V, Inputs at V_{DD} or Gnd				400	

Notes:
1. Not Guaranteed
2. Duration of test must not exceed 1 second with only 1 output tested at a time.

Electrical Characteristics (continued)
(Over Recommended Operating Free-Air Temperature Range unless otherwise noted)

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

Description	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			
		$I_{OH} = -6mA$		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	$V_I = V_{DD}$ or GND	2.3			±5.0	μA
I_{OZ}	3-State Output Leakage	$V_O = 3.6V$	1.8			±10	
I_{OFF}	Power-OFF Leakage Current	$V_I = V_O \leq 3.6V$	0			10	
I_{ODL}	Output Current Low	$V_{IN} = V_{IH}$ or V_{IL}, $V_O = 0.9V$[2]	1.8	50		137	mA
I_{ODH}	Output Current High	$V_{IN} = V_{IH}$ or V_{IL}, $V_O = 0.9V$[2]		−14		−34	
I_{HOLD}[1]	Bus Hold Current A or B Outputs	$V_I = 0.4$	1.8		50		
		$V_I = 1.3$			−50		
I_{DD}	Quiescent Supply Current	$V_I = V_{DD}$ or GND				20	μA
		$V_{DD} \leq (V_I,V_O) \leq 3.6V$				±20	
ΔI_{DD}	Increase in I_{DD} per input	$V_I = V_{DD}$ -06V, Other inputs at V_{DD} or Gnd				400	

Notes:
1. Not Guaranteed
2. Duration of test must not exceed 1 second with only 1 output tested at a time.

AC Electrical Characteristics

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $C_L = 50pF$, $R_L = 500\Omega$						Units
		$V_{DD} = 3.3V \pm 0.3V$		$V_{DD} = 2.5V \pm 0.2V$		$V_{DD} = 1.8V$		
		Min.	Max.	Min.	Max.	Min.	Max.	
t_{PLH}, t_{PHL}	Prop Delay, D to Q	0.5	2.5	1.0	3.2	1.5	4.0	
t_{PLH}, t_{PHL}	Prop Delay, LE to Q	1.0	3.1	1.5	4.2	2.0	4.5	
t_{PZH}, t_{PZL}	Output Enable Time	1.0	3.1	1.5	4.7	2.0	4.5	ns
t_{PHZ}, t_{PLZ}	Output Disable Time	1.5	3.7	1.5	3.5	2.0	5.0	
t_{OSHL}, t_{OSLH}	Output to Output Skew[1]		0.5		0.5		0.5	

Notes:

1. 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}).

AC Setup Requirements

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $C_L = 50pF$, $R_L = 500\Omega$						Units
		$V_{DD} = 3.3V \pm 0.3V$		$V_{DD} = 2.5V \pm 0.2V$		$V_{DD} = 1.8V$		
		Min.	Typ.	Min.	Typ.	Min.	Typ.	
t_{SU}	Setup Time, D to LE	0.5		0		0		
t_H	Hold Time, D to LE	0.8		0.5		1.0		ns
t_W	LE Pulse Width, High	1.5		1.5		1.5		

Capacitance

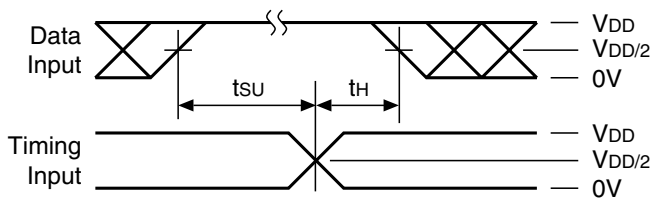| Symbol	Parameter	Conditions	$T_A = +25°C$ Typical	Units
C_{IN}	Input Capacitance	$V_{DD} = 1.8, 2.5V$ or $3.3V$, $V_I = 0V$ or V_{DD}	6	
C_{OUT}	Output Capacitance	$V_I = 0V$ or V_{DD}, $V_{DD} = 1.8V, 2.5V$ or $3.3V$	7	pF
C_{PD}	Power Dissipation Capacitance	$V_I = 0V$ or V_{DD}, $F = 10$ MHz $V_{DD} = 1.8V, 2.5V$ or $3.3V$	20	

Test Circuits and Switching Waveforms

Parameter Measurement Information
$(V_{DD} = 1.8V - 3.6V)$
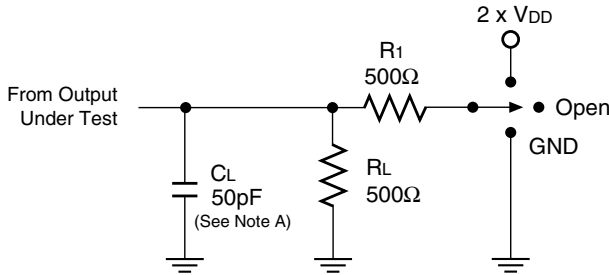
Setup, Hold, and Release Timing

Switch Position

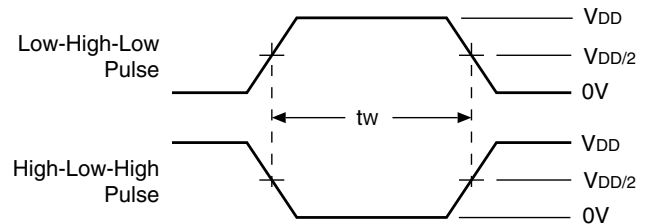| Test	S1
tpd	Open
t_{PLZ}/t_{PZL}	$2 \times V_{DD}$
t_{PHZ}/t_{PZH}	GND

Pulse Width

Propagation Delay

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: $PRR \le 10$ MHz, $Z_O = 50\Omega$, $t_r \le 2$ns, $t_f \le 2$ns, *measured from 10% to 90%, unless otherwise specified.*
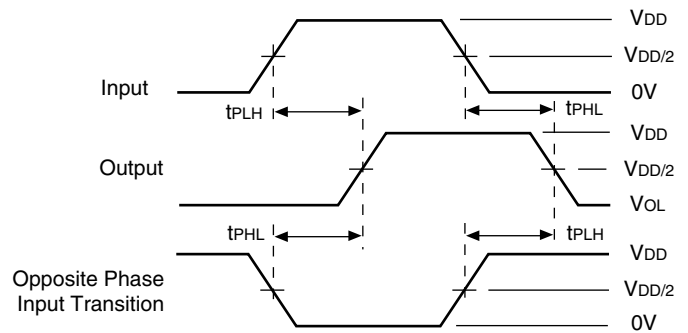 •   The outputs are measured one at a time with one transition per measurement.

Enable Disable Timing

PERICOM®

Packaging Mechanical: 48-pin SSOP(V)

X.XX DENOTES DIMENSIONS
X.XX IN MILLIMETERS
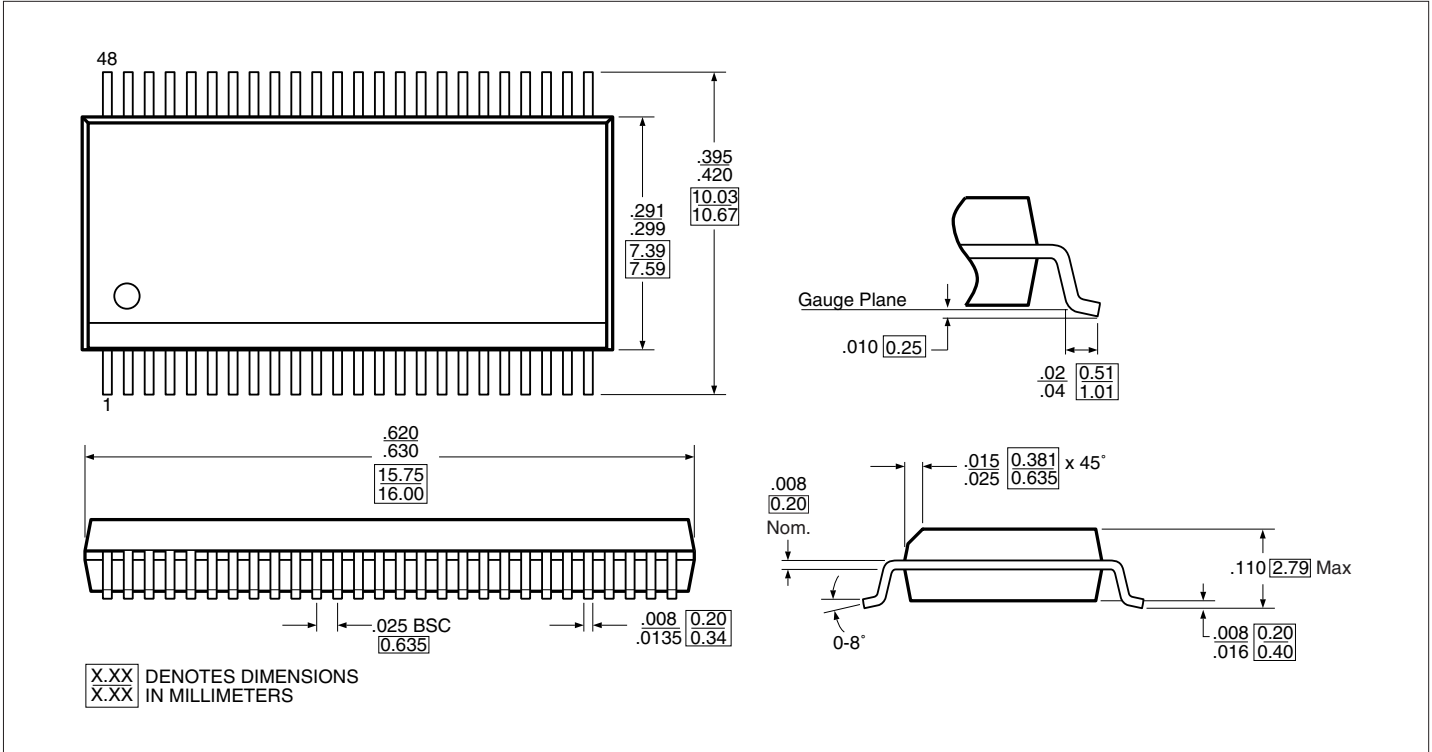
Packaging Mechanical: 48-pin TVSOP(K)
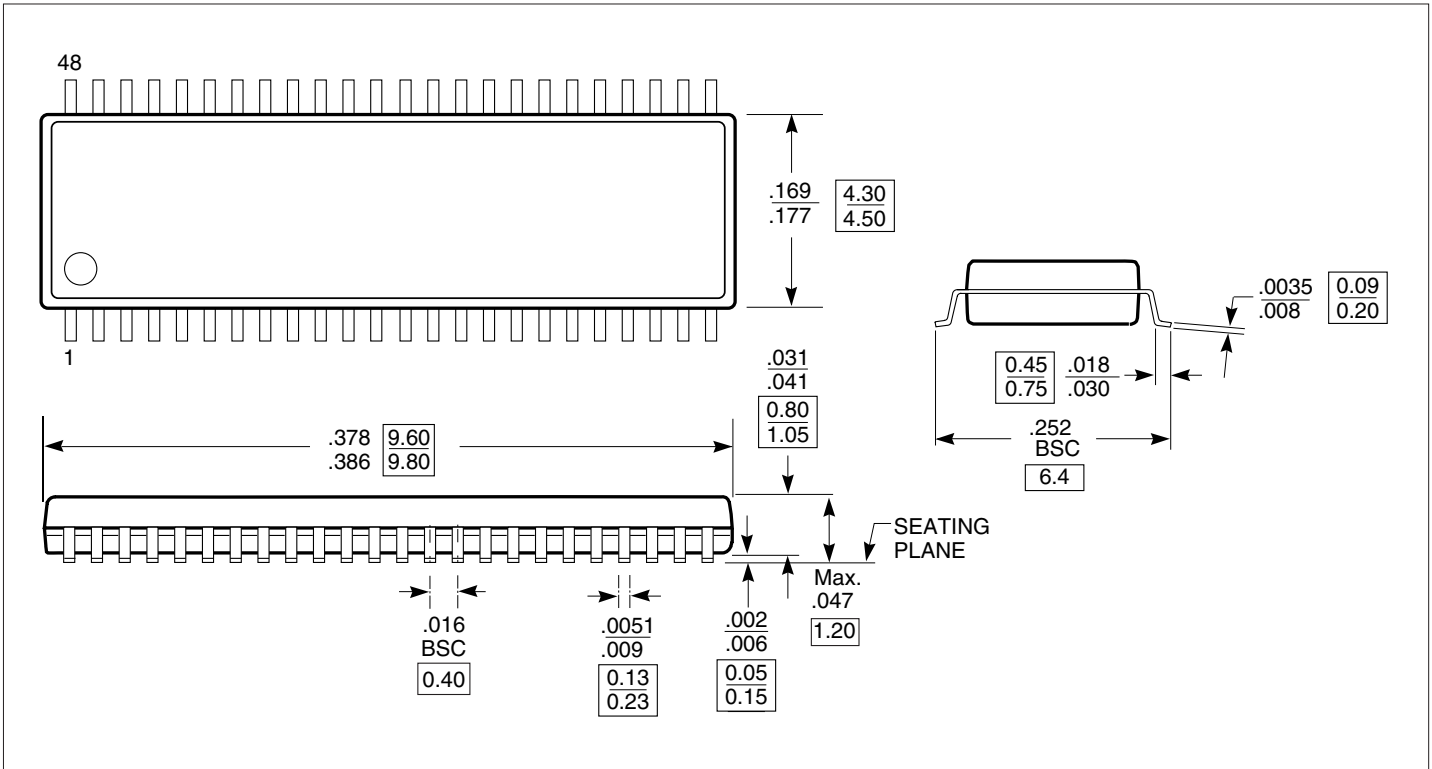
Packaging Mechanical: 48-pin TSSOP (A)
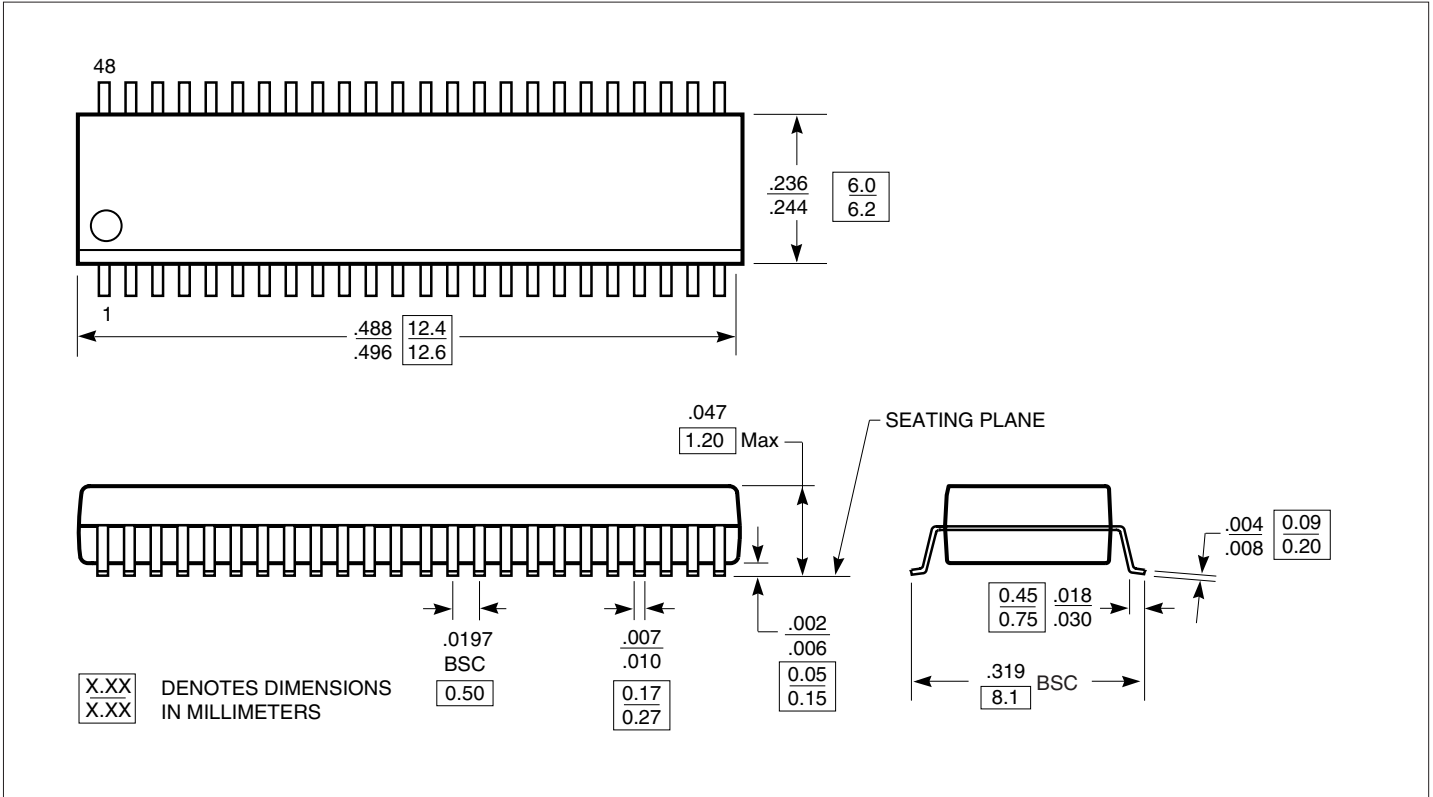
Ordering Information

Ordering Code	Package Code	Package Type
PI74ALVTC16373A	A	48-pin 240-mil wide TSSOP
PI74ALVTC16373AE	A	Pb-free & Green, 48-pin 240-mil wide TSSOP
PI74ALVTC16373V	V	48-pin 300-mil wide SSOP
PI74ALVTC16373K	K	48-pin 173-mil wide TVSOP
PI74ALVTC16373KE	K	Pb-free & Green, 48-pin 173-mil wide TVSOP

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