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# Fast CMOS 3.3V 16-Bit Transparent Latch

## Features

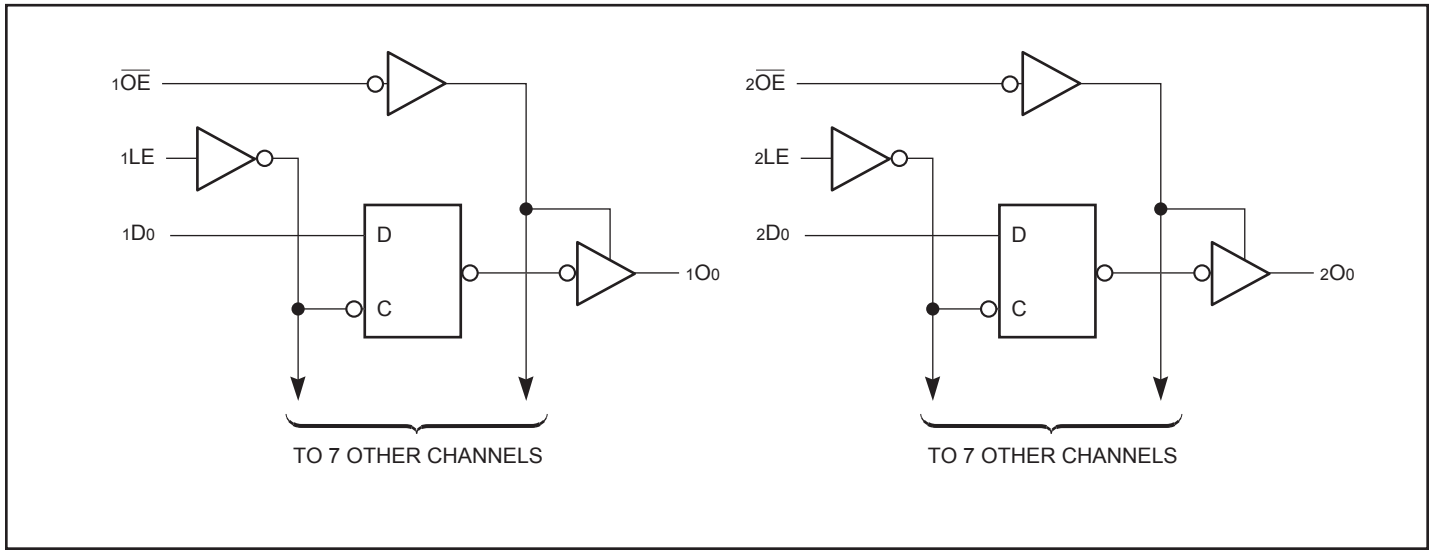
- Compatible with LCX™ and LVT™ families of products
- Supports 5V Tolerant Mixed Signal Mode Operation
  - Input can be 3V or 5V
  - Output can be 3V or connected to 5V bus
- Advanced Low Power CMOS Operation
- Excellent output drive capability:
  Balanced drives (24 mA sink and source)
- Pin compatible with industry standard double-density pinouts
- Low ground bounce outputs
- Hysteresis on all inputs
- Industrial operating temperature range: –40°C to +85°C
- Multiple center pins and distributed Vcc/GND pins minimize switching noise
- Packaging (Pb-free & Green available):
  – 48-pin 240-mil wide thin plastic TSSOP (A)
  – 48-pin 300-mil wide plastic SSOP (V)

## Description

Pericom Semiconductor's PI74LPT16373 is a 16-bit transparent latch designed with 3-state outputs and are intended for bus oriented applications. The Output Enable and Latch Enable controls are organized to operate as two 8-bit latches or one 16-bit latch. When Latch Enable (LE) is HIGH, the flip-flops appear transparent to the data. The data that meets the set-up time when LE is LOW is latched. When $\overline{OE}$ is HIGH, the bus output is in the high impedance state.

The PI74LPT16373 can be driven from either 3.3V or 5.0V devices allowing this device to be used as a translator in a mixed 3.3/5.0V system.

## Block Diagram



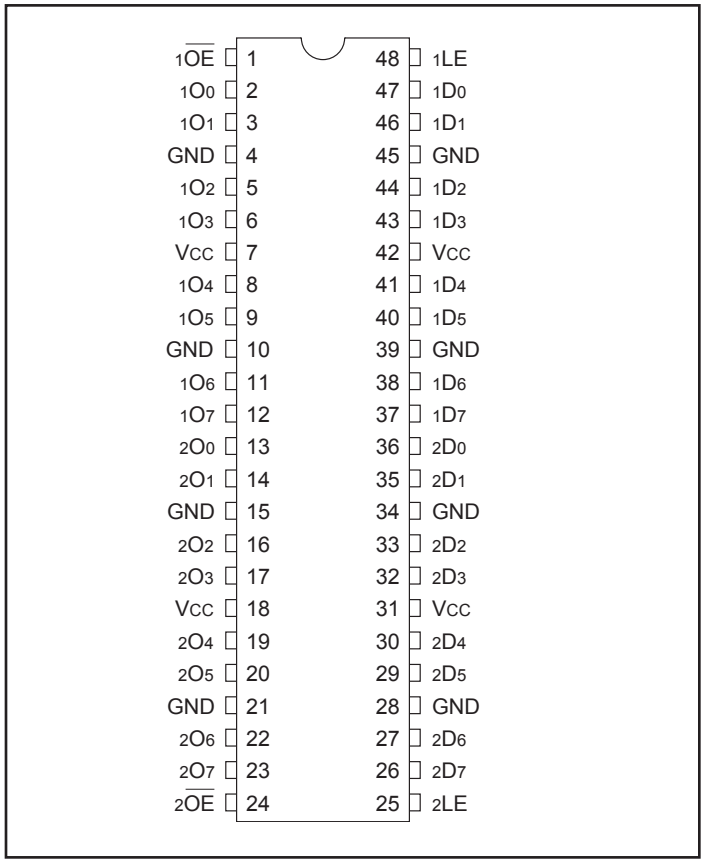
## Maximum Ratings

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

| | |
|---|---|
| Storage Temperature | –55°C to +125°C |
| Ambient Temperature with Power Applied | –40°C to +85°C |
| Supply Voltage to Ground Potential (Inputs & $V_{CC}$ Only) | –0.5V to +7.0V |
| Supply Voltage to Ground Potential (Outputs & D/O Only) | –0.5V to +7.0V |
| DC Input Voltage | –0.5V to +7.0V |
| DC Output Current | 120 mA |
| Power Dissipation | 1.0W |

**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.

## Pin Configuration




## Truth Table

| Inputs[1] | | | Outputs[1] |
|---|---|---|---|
| **xDx** | **xLE** | **xOE** | **xOx** |
| H | H | L | H |
| L | H | L | L |
| X | X | H | Z |

**Notes:**
1. H = High Voltage Level, X = Don't Care,
   L = Low Voltage Level, Z = High Impedance

## Pin Description

| Pin Name | Description |
|---|---|
| $x\overline{OE}$ | 3-State Output Enable Inputs (Active LOW) |
| xLE | Latch Enable Inputs (Active HIGH) |
| xDx | Data Inputs |
| xOx | 3-State Outputs |
| GND | Ground |
| $V_{CC}$ | Power |

## Capacitance ($T_A$ = 25°C, f = 1 MHz)

| Parameters[1] | Description | Test Conditions | Typ | Max. | Units |
|---|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{IN}$ = 0V | 4.5 | 6 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{OUT}$ = 0V | 5.5 | 8 | |

**Notes:**
1. This parameter is determined by device characterization but is not production tested.

## DC Electrical Characteristics (Over the Operating Range, $T_A$ = –40°C to +85°C, $V_{CC}$ = 2.7V to 3.6V)

| Parameters | Description | Test Conditions[1] | | Min. | Typ[2] | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage (Input pins) | Guaranteed Logic HIGH Level | | 2.2 | | 5.5 | V |
| | Input HIGH Voltage (I/O pins) | | | 2.0 | | 5.5 | |
| $V_{IL}$ | Input LOW Voltage (Input and I/O pins) | Guaranteed Logic LOW Level | | –0.5 | | 0.8 | |
| $I_{IH}$ | Input HIGH Current (Input pins) | $V_{CC}$ = Max. | $V_{IN}$ = 5.5V | | | ±1 | µA |
| | Input HIGH Current (I/O pins) | $V_{CC}$ = Max. | $V_{IN}$ = $V_{CC}$ | | | ±1 | |
| $I_{IL}$ | Input LOW Current (Input pins) | $V_{CC}$ = Max. | $V_{IN}$ = GND | | | ±1 | |
| | Input LOW Current (I/O pins) | $V_{CC}$ = Max. | $V_{IN}$ = GND | | | ±1 | |
| $I_{OZH}$ | High Impedance Output Current | $V_{CC}$ = Max. | $V_{OUT}$ = 5.5V | | | ±1 | |
| $I_{OZL}$ | (3-State Output pins) | $V_{CC}$ = Max. | $V_{OUT}$ = GND | | | ±1 | |
| $V_{IK}$ | Clamp Diode Voltage | $V_{CC}$ = Min., $I_{IN}$ = –18mA | | | –0.7 | –1.2 | V |
| $I_{ODH}$ | Output HIGH Current | $V_{CC}$ = 3.3V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$, $V_O$ = 1.5V[3] | | –36 | –60 | –110 | mA |
| $I_{ODL}$ | Output LOW Current | $V_{CC}$ = 3.3V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$, $V_O$ = 1.5V[3] | | 50 | 90 | 200 | |
| $V_{OH}$ | Output HIGH Voltage | $V_{CC}$ = Min. $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = –0.1 mA | $V_{CC}$-0.2 | | | V |
| | | | $I_{OL}$ = –3 mA | 2.4 | 3.0 | | |
| | | $V_{CC}$ = 3.0V, $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = –8 mA | 2.4[5] | 3.0 | | |
| | | | $I_{OL}$ = –24 mA | 2.0 | | | |
| $V_{OL}$ | Output LOW Voltage | $V_{CC}$ = Min. | $I_{OL}$ = 0.1 mA | | | 0.2 | |
| | | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 16 mA | | 0.2 | 0.4 | |
| | | | $I_{OL}$ = 24 mA | | 0.3 | 0.5 | |
| $I_{OS}$ | Short Circuit Current[4] | $V_{CC}$ = Max.[3], $V_{OUT}$ = GND | | –60 | –85 | –240 | mA |
| $I_{OFF}$ | Power Down Disable | $V_{CC}$ = 0V, $V_{IN}$ or $V_{OUT}$ ≤ 4.5V | | | | ±100 | µA |
| $V_H$ | Input Hysteresis | | | | 150 | | mV |

**Notes:**
1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at $V_{CC}$ = 3.3V, +25°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. This parameter is guaranteed but not tested.
5. $V_{OH}$ = $V_{CC}$ – 0.6V at rated current.

## Power Supply Characteristics

| Parameters | Description | Test Conditions(1) | | Min. | Typ(2) | Max. | Units |
|---|---|---|---|---|---|---|---|
| $I_{CC}$ | Quiescent Power Supply Current | $V_{CC}$ = Max. | $V_{IN}$ = GND or $V_{CC}$ | | 0.1 | 10 | µA |
| $\Delta I_{CC}$ | Quiescent Power Supply Current TTL Inputs HIGH | $V_{CC}$ = Max. | $V_{IN}$ = $V_{CC}$ – 0.6V(3) | | | 500 | |
| $I_{CCD}$ | Dynamic Power Supply(4) | $V_{CC}$ = Max.,<br>Outputs Open<br>x$\overline{OE}$ = GND<br>xLE = Vcc<br>One Bit Toggling<br>50% Duty Cycle | $V_{IN}$ = $V_{CC}$<br>$V_{IN}$ = GND | | 50 | 75 | µA/ MHz |
| $I_C$ | Total Power Supply Current(6) | $V_{CC}$ = Max.,<br>Outputs Open<br>fi = 10 MHz<br>50% Duty Cycle<br>x$\overline{OE}$ = GND<br>One Bit Toggling | $V_{IN}$ = $V_{CC}$ – 0.6V<br>$V_{IN}$ = GND | | 0.6<br>xLE = $V_{CC}$ | 2.3 | mA |
| | | $V_{CC}$ = Max.,<br>Outputs Open<br>fi = 2.5 MHz<br>50% Duty Cycle<br>x$\overline{OE}$ = GND<br>16 Bits Toggling | $V_{IN}$ = $V_{CC}$ – 0.6V<br>$V_{IN}$ = GND | | 2.1<br>xLE = $V_{CC}$ | 4.7(5) | |

**Notes:**

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
2. Typical values are at $V_{CC}$ = 3.3V, +25°C ambient.
3. Per TTL driven input; all other inputs at Vcc or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
5. Values for these conditions are examples of the Icc formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_I)$
   $I_{CC}$ = Quiescent Current ($I_{CCL}$, $I_{CCH}$ and $I_{CCZ}$)
   $\Delta I_{CC}$ = Power Supply Current for a TTL High Input
   $D_H$ = Duty Cycle for TTL Inputs High
   $N_T$ = Number of TTL Inputs at $D_H$
   $I_{CCD}$ = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
   $f_{CP}$ = Clock Frequency for Register Devices (Zero for Non-Register Devices)
   $N_{CP}$ = Number of Clock Inputs at $f_{CP}$
   $f_i$ = Input Frequency
   $N_I$ = Number of Inputs at $f_i$
   All currents are in milliamps and all frequencies are in megahertz.

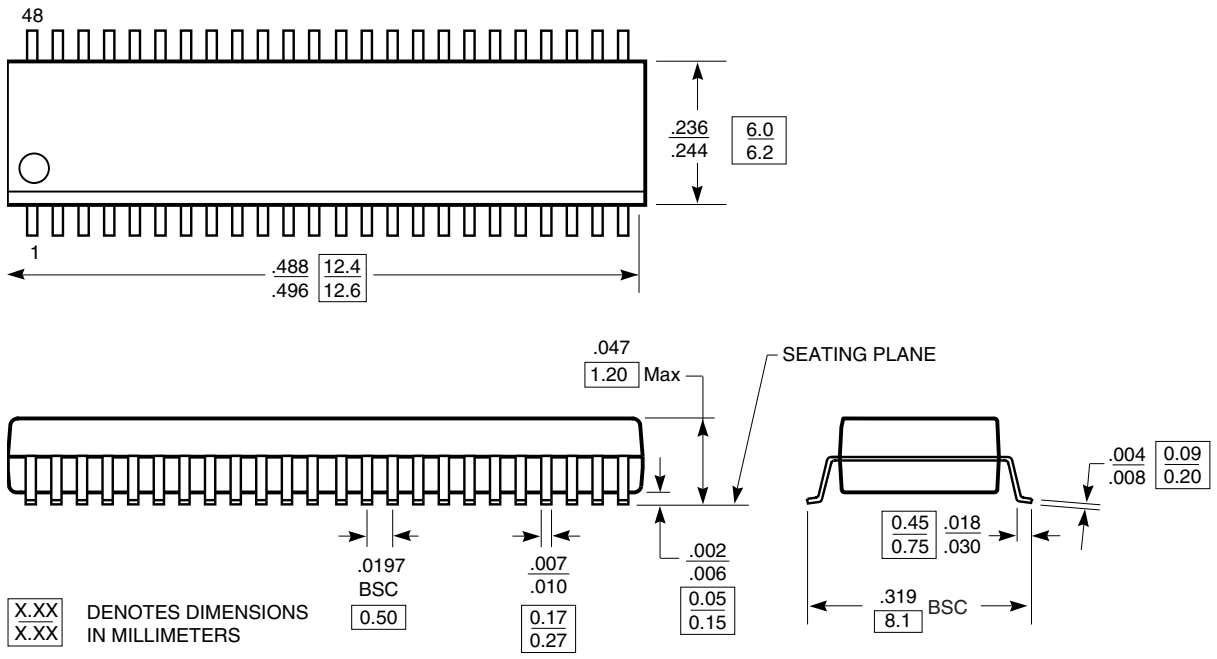
## Switching Characteristics over Operating Range[1]

| Parameters | Description | Conditions | LPT16373 | | LPT16373A | | LPT16373C | | Units |
|---|---|---|---|---|---|---|---|---|---|
| | | | Com. | | Com. | | Com. | | |
| | | | Min[2] | Max | Min[2] | Max | Min[2] | Max | |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay xDx to xOx | $C_L$ = 50pF $R_L$ = 500Ω | 1.5 | 7.0 | 1.5 | 5.2 | 1.5 | 4.2 | ns |
| $t_{PLH}$ $t_{PHL}$ | Propagation Delay xLE to xOx | | 2.0 | 7.0 | 2.0 | 6.5 | 2.0 | 5.5 | |
| $t_{PZH}$ $t_{PZL}$ | Output Enable Time xOE to xOx | | 1.5 | 7.2 | 1.5 | 6.5 | 1.5 | 5.5 | |
| $t_{PHZ}$ $t_{PLZ}$ | Output Disable Time[3] xOE to xOx | | 1.5 | 7.2 | 1.5 | 5.5 | 1.5 | 5.0 | |
| $t_{SU}$ | Setup Time HIGH or LOW, xDx to xLE | | 2.0 | | 2.0 | | 2.0 | | |
| $t_H$ | Hold Time HIGH or LOW, xDx to xLE | | 1.5 | | 1.5 | | 1.5 | | |
| $t_W$ | xLE Pulse Width[3] HIGH | | 6.0 | | 5.0 | | 5.0 | | |
| $t_{SK(o)}$ | Output Skew[4] | | | 0.5 | | 0.5 | | 0.5 | |

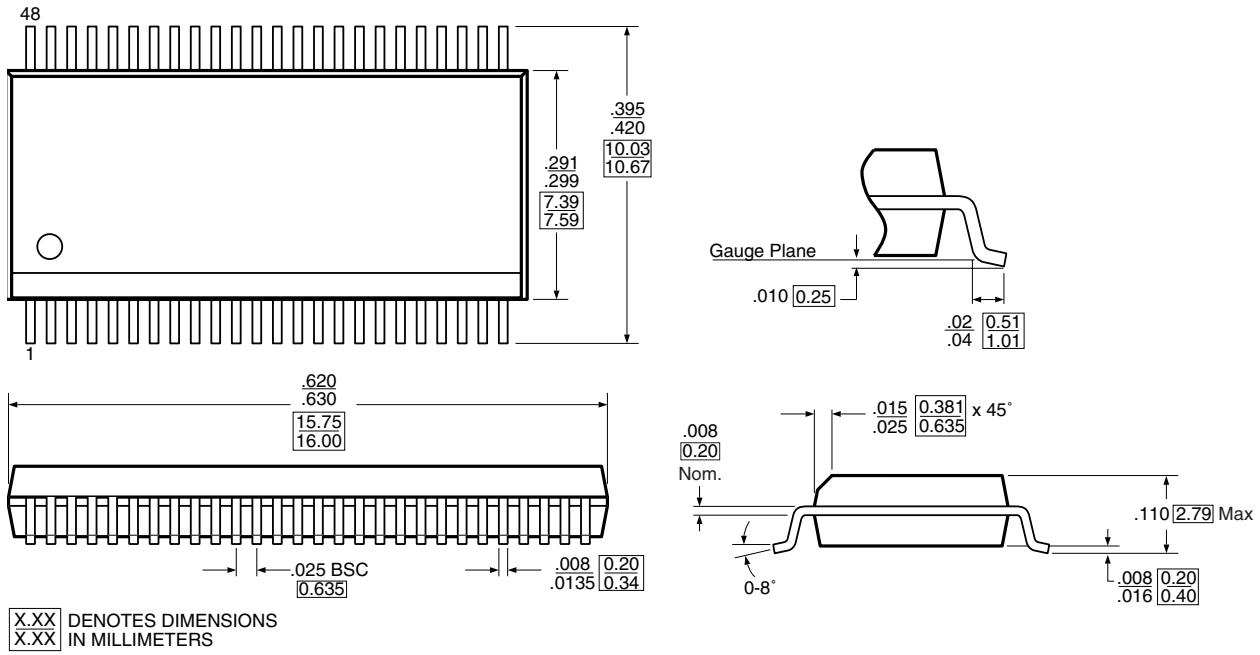
**Notes:**

1. Propagation Delays and Enable/Disable times are with $V_{CC}$ = 3.3V ±0.3V, normal range. For $V_{CC}$ = 2.7V, extended range, all Propagation Delays and Enable/Disable times should be degraded by 20%.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. This parameter is guaranteed but not production tested.
4. Skew between any two outputs, of the same package, switching in the same direction. This parameter is guaranteed by design.

## Packaging Mechanical: 48-pin TSSOP (A)




## Packaging Mechanical: 48-pin SSOP (V)



## Ordering Information

| Ordering Code | Package Code | Speed Grade | Description |
|---|---|---|---|
| PI74LPT16373A | A | Blank | 48-pin 173 mil wide plastic TSSOP |
| PI74LPT16373AA | A | A | 48-pin 173 mil wide plastic TSSOP |
| PI74LPT16373AV | V | A | 48-pin 300 mil wide plastic SSOP |
| PI74LPT16373AVE | V | A | Pb-free & Green, 48-pin 300 mil wide plastic SSOP |
| PI74LPT16373CA | A | C | 48-pin 173 mil wide plastic TSSOP |
| PI74LPT16373CV | V | C | 48-pin 300 mil wide plastic SSOP |
| PI74LPT16373CVE | V | C | Pb-free & Green, 48-pin 300 mil wide plastic SSOP |

**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