

**Fast CMOS 16-Bit Latched Transceivers**
**Product Features**

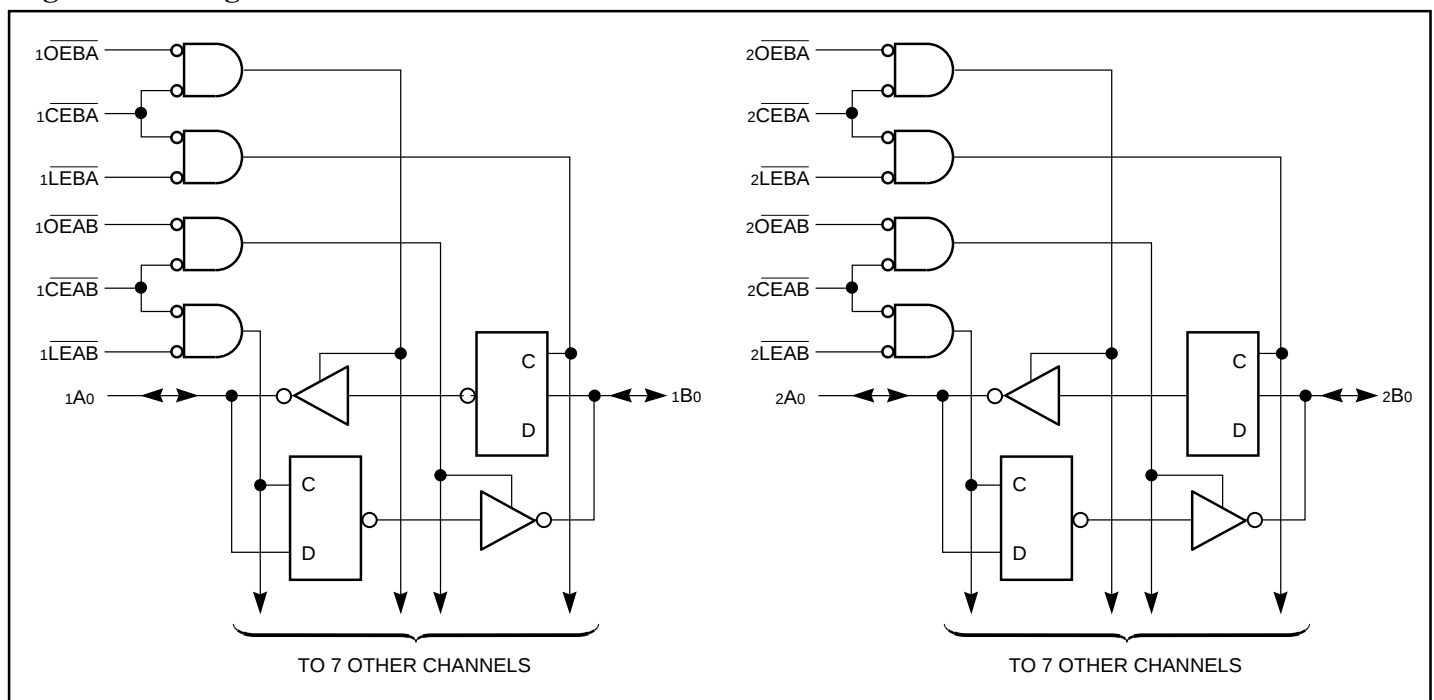
- Compatible with LCX™ and LVT™ families of products
- Supports 5V Tolerant Mixed Signal Mode Operation
  - Input can be 3V or 5V
  - Output can be 3V or connected to 5V bus
- Advanced Low Power CMOS Operation
- Excellent output drive capability:  
Balanced drives (24 mA sink and source)
- Pin compatible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

**Product Description**

Pericom Semiconductor's PI74LPT series of logic circuits are produced using the Company's advanced 0.6 micron CMOS technology, achieving industry leading speed grades.

The PI74LPT16543 is 16-bit latched transceivers organized with two sets of eight D-type latches with separate input and output controls for each set. For data flow from A to B, for example, the A-to-B Enable ( $\overline{\text{xCEAB}}$ ) input must be LOW in order to enter data from  $\text{xAx}$  or to take data from  $\text{xBx}$ , as indicated in the Truth Table. With  $\overline{\text{xCEAB}}$  LOW, a LOW signal makes the A-to-B latches transparent; a subsequent LOW-to-HIGH transition of the  $\overline{\text{xLEAB}}$  signal puts the A latches in the storage mode and their outputs no longer change the A inputs. With  $\overline{\text{xCEAB}}$  and  $\overline{\text{xOEAB}}$  both LOW, the 3-state B output buffers are active and reflect the data present at the output of the A latches. Control of data from B to A is similar, but uses the  $\overline{\text{xCEAB}}$ ,  $\overline{\text{xLEAB}}$ , and  $\overline{\text{xOEAB}}$  inputs.

The PI74LPT16543 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.

**Logic Block Diagram**


## Product Pin Description

| Pin Name           | Description                                  |
|--------------------|----------------------------------------------|
| $\overline{xOEAB}$ | A-to-B Output Enable Input (Active LOW)      |
| $\overline{xOEBA}$ | B-to-A Output Enable Input (Active LOW)      |
| $\overline{xCEAB}$ | A-to-B Enable Input (Active LOW)             |
| $\overline{xCEBA}$ | B-to-A Enable Input (Active LOW)             |
| $\overline{xLEAB}$ | A-to-B Latch Enable Input (Active LOW)       |
| $\overline{xLEBA}$ | B-to-A Latch Enable Input (Active LOW)       |
| $xAx$              | A-to-B Data Inputs or B-to-A 3-State Outputs |
| $xBx$              | B-to-A Data Inputs or B-to-A 3-State Outputs |
| GND                | Ground                                       |
| VCC                | Power                                        |

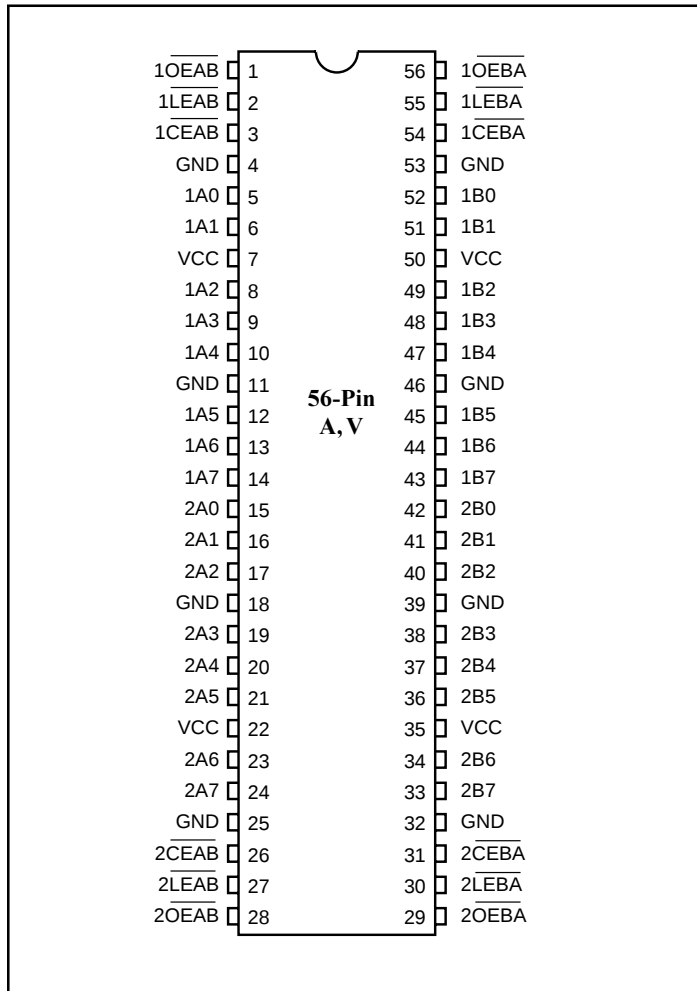
## Truth Table<sup>(1)</sup>

| Inputs             |                    |                    | Latch Status   | Output Buffers     |
|--------------------|--------------------|--------------------|----------------|--------------------|
| $\overline{xCEAB}$ | $\overline{xLEAB}$ | $\overline{xOEAB}$ | $xAx$ TO $xBx$ | $xBx$              |
| H                  | X                  | X                  | Storing        | High Z             |
| X                  | H                  | X                  | Storing        | X                  |
| X                  | X                  | H                  | X              | High Z             |
| L                  | L                  | L                  | Transparent    | Current A Inputs   |
| L                  | H                  | L                  | Storing        | Previous* A Inputs |

### NOTES:

- \*Before  $\overline{xLEAB}$  LOW-to-HIGH Transistion  
H = High Voltage Level  
L = Low Voltage Level  
X = Don't Care or Irrelevant  
Z = High Impedance
- A-to-B data flow shown. B-to-A flow control is the same, except using  $\overline{xCEBA}$ ,  $\overline{xLEBA}$ , and  $\overline{xOEBA}$ .

## Product Pin Configuration



## 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 <sub>CC</sub> 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.

## DC Electrical Characteristics (Over the Operating Range, T<sub>A</sub> = –40°C to +85°C, V<sub>CC</sub> = 2.7V to 3.6V)

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

### Notes:

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at V<sub>CC</sub> = 3.3V, +25°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.
- This parameter is guaranteed but not tested.
- V<sub>OH</sub> = V<sub>CC</sub> – 0.6V at rated current.

**Power Supply Characteristics**

| Parameters       | Description                                       | Test Conditions <sup>(1)</sup>                                                                                         |                                                                   | Min. | Typ <sup>(2)</sup> | Max.               | Units      |
|------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------|--------------------|--------------------|------------|
| I <sub>CC</sub>  | Quiescent Power Supply Current                    | V <sub>CC</sub> = Max.                                                                                                 | V <sub>IN</sub> = GND or V <sub>CC</sub>                          |      | 0.1                | 10                 | μA         |
| ΔI <sub>CC</sub> | Quiescent Power Supply Current<br>TTL Inputs HIGH | V <sub>CC</sub> = Max.                                                                                                 | V <sub>IN</sub> = V <sub>CC</sub> – 0.6V <sup>(3)</sup>           |      | 2.0                | 30                 | μA         |
| I <sub>CCD</sub> | Dynamic Power Supply <sup>(4)</sup>               | V <sub>CC</sub> = Max.,<br>Outputs Open<br>xOE = GND<br>One Bit Toggling<br>50% Duty Cycle                             | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND        |      | 50                 | 75                 | μA/<br>MHz |
| I <sub>C</sub>   | Total Power Supply<br>Current <sup>(6)</sup>      | V <sub>CC</sub> = Max.,<br>Outputs Open<br>f <sub>i</sub> = 10 MHz<br>50% Duty Cycle<br>xOE = GND<br>One Bit Toggling  | V <sub>IN</sub> = V <sub>CC</sub> – 0.6V<br>V <sub>IN</sub> = GND |      | 0.6                | 2.3                | mA         |
|                  |                                                   | V <sub>CC</sub> = Max.,<br>Outputs Open<br>f <sub>i</sub> = 2.5 MHz<br>50% Duty Cycle<br>xOE = GND<br>16 Bits Toggling | V <sub>IN</sub> = V <sub>CC</sub> – 0.6V<br>V <sub>IN</sub> = GND |      | 2.1                | 4.7 <sup>(5)</sup> |            |

**Notes:**

- For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device.
- Typical values are at V<sub>CC</sub> = 3.3V, +25°C ambient.
- Per TTL driven input; all other inputs at V<sub>CC</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.
- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  

$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$$

I<sub>CC</sub> = Quiescent Current (I<sub>CC1</sub>, I<sub>CC2</sub> and I<sub>CCZ</sub>)  
ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input  
D<sub>H</sub> = Duty Cycle for TTL Inputs High  
N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>  
I<sub>CCD</sub> = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
N<sub>CP</sub> = Number of Clock Inputs at f<sub>CP</sub>  
f<sub>i</sub> = Input Frequency  
N<sub>i</sub> = Number of Inputs at f<sub>i</sub>  
All currents are in milliamps and all frequencies are in megahertz.

**Switching Characteristics over Operating Range<sup>(1)</sup>**

| Parameters   | Description                                                        | Conditions <sup>(2)</sup> | LPT16543           |      | LPT16543A          |     | LPT16543C          |     | Unit |
|--------------|--------------------------------------------------------------------|---------------------------|--------------------|------|--------------------|-----|--------------------|-----|------|
|              |                                                                    |                           | Com.               |      | Com.               |     | Com.               |     |      |
|              |                                                                    |                           | Min <sup>(3)</sup> | Max  | Min <sup>(3)</sup> | Max | Min <sup>(3)</sup> | Max |      |
| tPLH<br>tPHL | Propagation Delay<br>Transparent Mode<br>xAx to xBx or xBx to xAx  | CL = 50 pF<br>RL = 500Ω   | 2.5                | 8.5  | 2.5                | 6.5 | 2.5                | 5.3 | ns   |
| tPLH<br>tPHL | Propagation Delay<br>xLEBA to xAx, xLEAB to xBx                    |                           | 2.5                | 12.5 | 2.5                | 8.0 | 2.5                | 7.0 | ns   |
| tpZH<br>tpZL | Output Enable Time<br>xOEBA or xOEAB to xAx or xBx                 |                           | 2.0                | 12.0 | 2.0                | 9.0 | 2.0                | 8.0 | ns   |
| tpHZ<br>tPLZ | Output Disable Time <sup>(4)</sup><br>xOEBA or xOEAB to xAx or xBx |                           | 2.0                | 9.0  | 2.0                | 7.5 | 2.0                | 6.5 | ns   |
| tsu          | Setup Time HIGH or LOW<br>xAx or xBx to xLEAB or xLEBA             |                           | 3.0                | —    | 2.0                | —   | 2.0                | —   | ns   |
| th           | Hold Time HIGH or LOW<br>xAx or xBx to xLEAB or xLEBA              |                           | 2.0                | —    | 2.0                | —   | 2.0                | —   | ns   |
| tw           | xLEAB or xLEBA Pulse Width<br>LOW                                  |                           | 5.0                | —    | 5.0                | —   | 5.0                | —   | ns   |
| tsk(0)       | Output Skew <sup>(5)</sup>                                         |                           | —                  | 0.5  | —                  | 0.5 | —                  | 0.5 | ns   |

**Notes:**

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

**Capacitance** (TA = 25°C, f = 1 MHz)

| Parameters <sup>(1)</sup> | Description        | Test Conditions | Typ | Max. | Units |
|---------------------------|--------------------|-----------------|-----|------|-------|
| CIN                       | Input Capacitance  | VIN = 0V        | 4.5 | 6    | pF    |
| COU                       | Output Capacitance | VOU = 0V        | 5.5 | 8    | pF    |

**Note:**

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