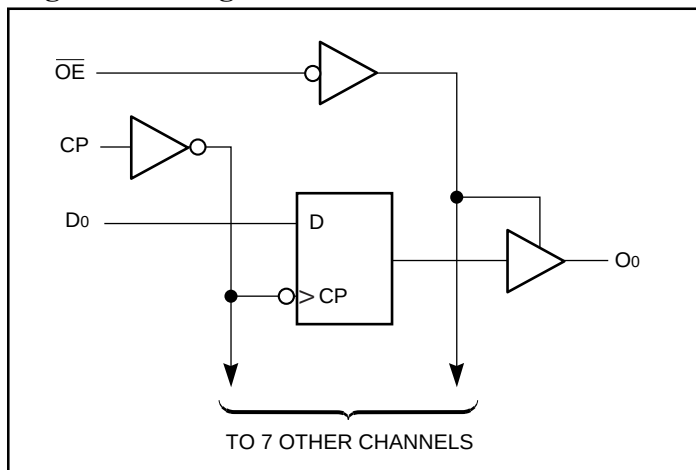


## Fast CMOS 3.3V Octal D Flip-Flop

### 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 (24mA sink and source)
- Low ground bounce outputs
- Hysteresis on all inputs
- Industrial operating temperature range: –40°C to +85°C
- Packages available:
  - 20-pin 173 mil wide plastic TSSOP (L)
  - 20-pin 150 mil wide plastic QSOP (Q)
  - 20-pin 300 mil wide plastic SOIC (S)

### Logic Block Diagram



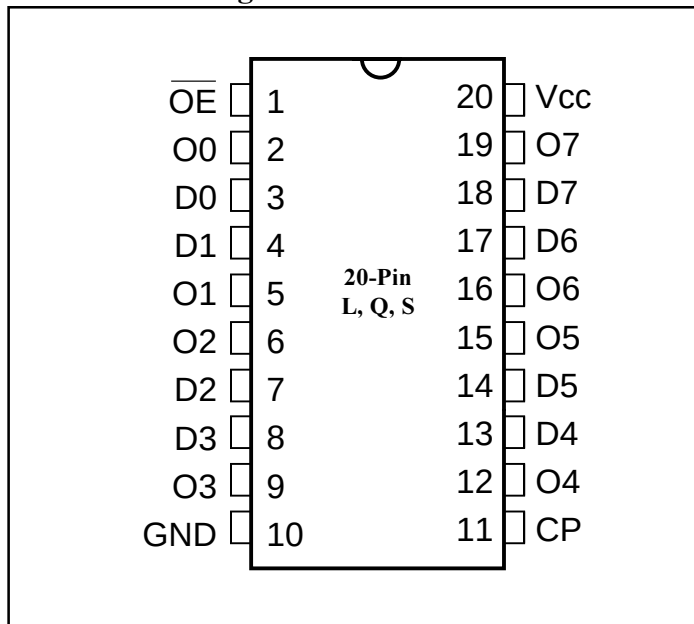
### Product Description

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

The PI74LPT374 8-bit wide octal registers designed with eight D-type flip-flops, a buffered common clock, and buffered 3-state outputs. When output enable ( $\overline{OE}$ ) is LOW, the outputs are enabled. When  $\overline{OE}$  is HIGH, the outputs are in the high impedance state. Input data meeting the setup and hold time requirements of the D inputs is transferred to the O outputs on the LOW-to-HIGH transition of the clock input.

The PI74LPT374 can be driven from either 3.3V or 5.0V devices allowing for the device to be used as a translator in a mixed 3.3V/5.0V system.

### Product Pin Configuration



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

| Inputs         |    |                 | Outputs        |
|----------------|----|-----------------|----------------|
| D <sub>N</sub> | CP | $\overline{OE}$ | O <sub>N</sub> |
| H              | ↑  | L               | H              |
| L              | ↑  | L               | L              |
| X              | X  | H               | Z              |

#### Note:

1. H = High Voltage Level, X = Don't Care,  
L = Low Voltage Level,  
Z = High Impedance, ↑ LOW-to-HIGH Transition

### Product Pin Description

| Pin Name        | Description                         |
|-----------------|-------------------------------------|
| $\overline{OE}$ | Output Enable Input (Active LOW)    |
| CP              | Clock Pulse, LOW-to-HIGH Transition |
| D7-D0           | Data Inputs                         |
| O7-O0           | 3-State Outputs                     |
| GND             | Ground                              |
| Vcc             | 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 (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 .....                                                  | 120mA           |
| 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:

1. For Max. or Min. conditions, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V<sub>CC</sub> = 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<sub>OH</sub> = V<sub>CC</sub> - 0.6V at rated current.

### Capacitance (T<sub>A</sub> = 25°C, f = 1 MHz)

| Parameters <sup>(1)</sup> | Description        | Test Conditions       | Typ | Max. | Units |
|---------------------------|--------------------|-----------------------|-----|------|-------|
| C <sub>IN</sub>           | Input Capacitance  | V <sub>IN</sub> = 0V  | 4.5 | 6    | pF    |
| C <sub>OUT</sub>          | Output Capacitance | V <sub>OUT</sub> = 0V | 5.5 | 8    | pF    |

#### Note:

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

**Power Supply Characteristics**

| Parameters      | Description                                       | Test Conditions <sup>(1)</sup>                                                                                                          |                                                          | Min. | Typ <sup>(2)</sup> | Max.               | Units                    |
|-----------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------|--------------------|--------------------|--------------------------|
| $I_{CC}$        | Quiescent Power Supply Current                    | $V_{CC} = \text{Max.}$                                                                                                                  | $V_{IN} = \text{GND or } V_{CC}$                         |      | 0.1                | 10                 | $\mu\text{A}$            |
| $\Delta I_{CC}$ | Quiescent Power Supply Current<br>TTL Inputs HIGH | $V_{CC} = \text{Max.}$                                                                                                                  | $V_{IN} = V_{CC} - 0.6\text{V}^{(3)}$                    |      | 2.0                | 30                 | $\mu\text{A}$            |
| $I_{CCD}$       | Dynamic Power Supply <sup>(4)</sup>               | $V_{CC} = \text{Max.},$<br>Outputs Open<br>$\overline{OE} = \text{GND}$<br>One Bit Toggling<br>50% Duty Cycle                           | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$               |      | 50                 | 75                 | $\mu\text{A}/\text{MHz}$ |
| $I_C$           | Total Power Supply<br>Current <sup>(6)</sup>      | $V_{CC} = \text{Max.},$<br>Outputs Open<br>$f_i = 10 \text{ MHz}$<br>50% Duty Cycle<br>$\overline{OE} = \text{GND}$<br>One Bit Toggling | $V_{IN} = V_{CC} - 0.6\text{V}$<br>$V_{IN} = \text{GND}$ |      | 0.6                | 2.3                | mA                       |
|                 |                                                   | $V_{CC} = \text{Max.},$<br>Outputs Open<br>$f_i = 2.5 \text{ MHz}$<br>50% Duty Cycle<br>$\overline{OE} = \text{GND}$<br>8 Bits Toggling | $V_{IN} = V_{CC} - 0.6\text{V}$<br>$V_{IN} = \text{GND}$ |      | 2.1                | 4.7 <sup>(5)</sup> |                          |

**Notes:**

- For conditions shown as Max. or Min., 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 TTL driven input; all other inputs at  $V_{CC}$  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  $I_{CC}$  formula. These limits are guaranteed but not tested.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$   
 $I_C = I_{CC} + \Delta I_{CC} D_{HNT} + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 $I_{CC} = \text{Quiescent Current } (I_{CCL}, I_{CCV} \text{ and } I_{CCZ})$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input}$   
 $D_H = \text{Duty Cycle for TTL Inputs High}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$   
 $f_i = \text{Input Frequency}$   
 $N_i = \text{Number of Inputs at } f_i$   
All currents are in milliamperes and all frequencies are in megahertz.

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

| Parameters                           | Description                                      | Conditions <sup>(2)</sup>                       | LPT374              |      | LPT374A             |      | LPT374C             |      | Units |
|--------------------------------------|--------------------------------------------------|-------------------------------------------------|---------------------|------|---------------------|------|---------------------|------|-------|
|                                      |                                                  |                                                 | Com.                |      | Com.                |      | Com.                |      |       |
|                                      |                                                  |                                                 | Min. <sup>(3)</sup> | Max. | Min. <sup>(3)</sup> | Max. | Min. <sup>(3)</sup> | Max. |       |
| F <sub>MAX</sub>                     | Maximum Clock Frequency                          | C <sub>L</sub> = 50 pF<br>R <sub>L</sub> = 500Ω | 150                 |      | 150                 |      | 150                 |      | MHz   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>xCLK to xOx                 |                                                 | 2.0                 | 8.0  | 2.0                 | 5.5  | 2.0                 | 4.5  | n s   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>xOE to xOx                 |                                                 | 1.5                 | 8.5  | 1.5                 | 6.5  | 1.5                 | 5.5  | n s   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time <sup>(4)</sup><br>xOE to xOx |                                                 | 1.5                 | 8.5  | 1.5                 | 5.5  | 1.5                 | 5.0  | n s   |
| t <sub>SU</sub>                      | Setup Time HIGH<br>or LOW, xDx to xCLK           |                                                 | 2.0                 |      | 2.0                 |      | 2.0                 |      | n s   |
| t <sub>H</sub>                       | Hold Time HIGH<br>or LOW, xDx to xCLK            |                                                 | 1.5                 |      | 1.5                 |      | 1.5                 |      | n s   |
| t <sub>W</sub>                       | xCLK Pulse Width <sup>(4)</sup><br>HIGH          |                                                 | 7.0                 |      | 5.0                 |      | 5.0                 |      | n s   |
| t <sub>SK(o)</sub>                   | Output Skew <sup>(5)</sup>                       |                                                 |                     | 0.5  |                     | 0.5  |                     | 0.5  | n s   |

**Notes:**

1. Propagation Delays and Enable/Disable times are with V<sub>CC</sub> = 3.3V ± 0.3V, normal range. For V<sub>CC</sub> = 2.7V, extended range, all Propagation Delays and Enable/Disable times should be degraded by 20%.
2. See test circuit and waveforms.
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.