



## PI74FCT16500T PI74FCT162500T

### Fast CMOS 18-Bit Registered Transceivers

#### Product Features:

##### Common Features:5

- PI74FCT16500T and PI74FCT162500T are high-speed, low power devices with high current drive.
- $V_{CC} = 5V \pm 10\%$
- Hysteresis on all inputs
- Packages available:
  - 56-pin 240 mil wide plastic TSSOP (A)
  - 56-pin 300 mil wide plastic SSOP (V)

##### PI74FCT16500T Features:

- High output drive:  $I_{OH} = -32\text{ mA}$ ;  $I_{OL} = 64\text{ mA}$
- Power off disable outputs permit “live insertion”
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 1.0V$   
at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$

##### PI74FCT162500T Features:

- Balanced output drivers:  $\pm 24\text{ mA}$
- Reduced system switching noise
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 0.6V$   
at  $V_{CC} = 5V$ ,  $T_A = 25^\circ C$

#### Product Description:

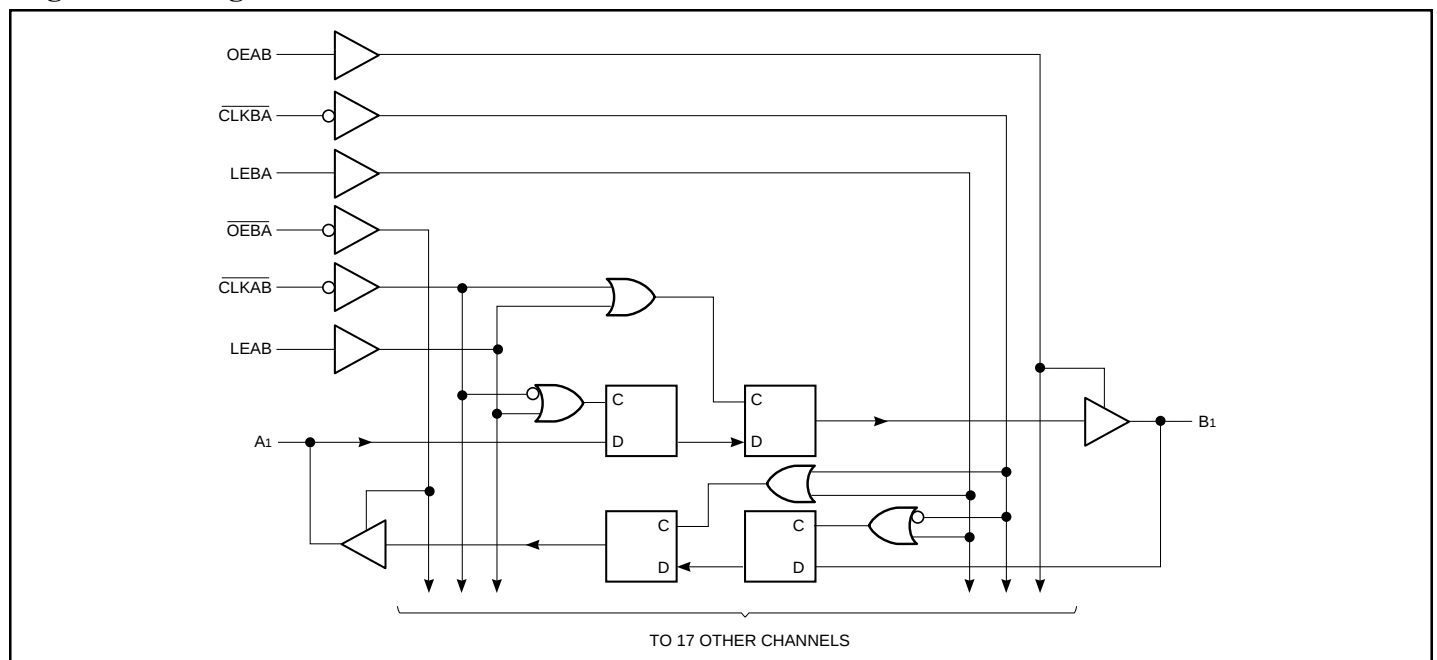
Pericom Semiconductor's PI74FCT series of logic circuits are produced in the Company's advanced 0.8 micron CMOS technology, achieving industry leading speed grades.

The PI74FCT16500T and PI74FCT162500T are 18-bit registered bus transceivers designed with D-type latches and flip-flops to allow data flow in transparent, latched, and clocked modes. The Output Enable ( $\overline{OEAB}$  and  $\overline{OEBA}$ ), Latch Enable (LEAB and LEBA) and Clock ( $\overline{CLKAB}$  and  $\overline{CLKBA}$ ) inputs control the data flow in each direction. When LEAB is HIGH, the device operates in transparent mode for A-to-B data flow. When LEAB is LOW, the A data is latched if  $\overline{CLKAB}$  is held at a HIGH or LOW logic level. The A bus data is stored in the latch/flip-flop on the HIGH-to-LOW transition of  $\overline{CLKAB}$ , if LEAB is LOW.  $\overline{OEAB}$  performs the output enable function on the B port. Data flow from B port to A port is similar using  $\overline{OEBA}$ , LEBA and  $\overline{CLKBA}$ . These high-speed, low power devices offer a flow-through organization for ease of board layout.

The PI74FCT16500T output buffers are designed with a Power-Off disable allowing “live insertion” of boards when used as backplane drivers.

The PI74FCT162500T has  $\pm 24\text{ mA}$  balanced output drivers. It is designed with current limiting resistors at its outputs to control the output edge rate resulting in lower ground bounce and undershoot. This eliminates the need for external terminating resistors for most interface applications.

#### Logic Block Diagram



## Product Pin Description

| Pin Name                  | Description                                  |
|---------------------------|----------------------------------------------|
| OEAB                      | A-to-B Output Enable Input                   |
| $\overline{\text{OEBA}}$  | B-to-A Output Enable Input (Active LOW)      |
| LEAB                      | A-to-B Latch Enable Input                    |
| LEBA                      | B-to-A Latch Enable Input                    |
| $\overline{\text{CLKAB}}$ | A-to-B Clock Input (Active LOW)              |
| $\overline{\text{CLKBA}}$ | B-to-A Clock Input (Active LOW)              |
| Ax                        | A-to-B Data Inputs or B-to-A 3-State Outputs |
| Bx                        | B-to-A Data Inputs or A-to-B 3-State Outputs |
| GND                       | Ground                                       |
| Vcc                       | Power                                        |

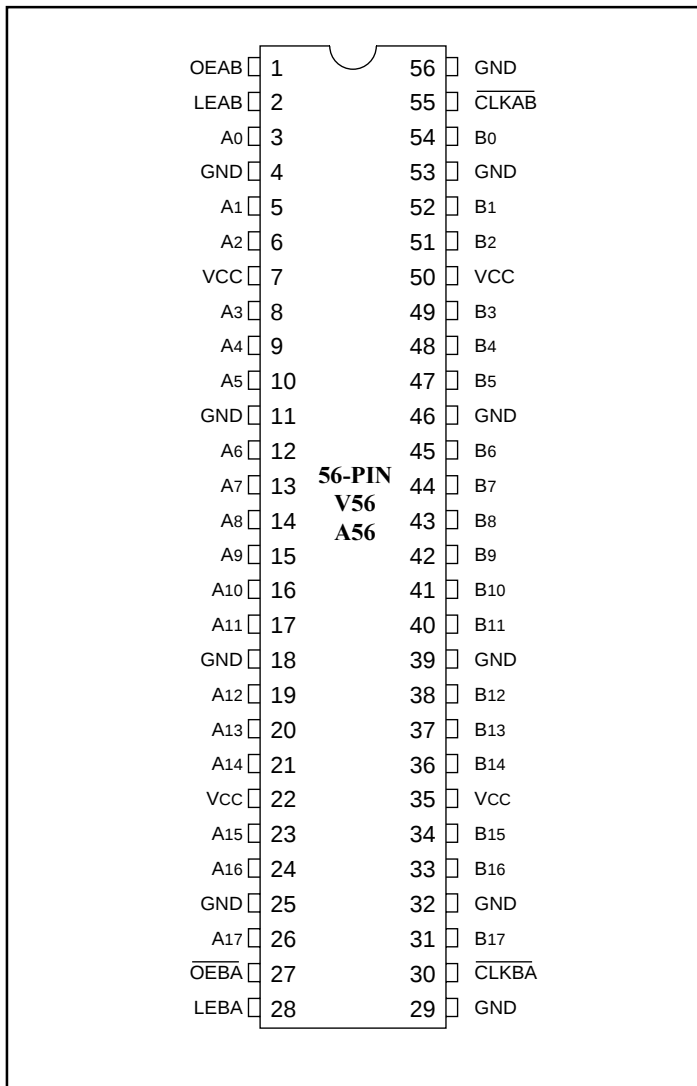
## Truth Table<sup>(1,4)</sup>

| Inputs |      |                           |    | Outputs          |
|--------|------|---------------------------|----|------------------|
| OEAB   | LEAB | $\overline{\text{CLKAB}}$ | Ax | Bx               |
| L      | X    | X                         | X  | Z                |
| H      | H    | X                         | L  | L                |
| H      | H    | X                         | H  | H                |
| H      | L    | ↓                         | L  | L                |
| H      | L    | ↓                         | H  | H                |
| H      | L    | H                         | X  | B <sup>(2)</sup> |
| H      | L    | L                         | X  | B <sup>(3)</sup> |

### NOTES:

1. A-toB data flow is shown. B-to-A data flow is similar but uses  $\overline{\text{OEBA}}$ , LEBA, and  $\overline{\text{CLKBA}}$ .
2. Output level before the indicated steady-state input conditions were established.
3. Output level before the indicated steady-state input conditions were established, provided that  $\overline{\text{CLKAB}}$  was LOW before LEAB went LOW.
4. H = High Voltage Level  
L = Low Voltage Level  
Z = High Impedance  
↓ = HIGH-to-LOW Transition

## Product Pin Configuration



### 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 & Vcc 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, TA = –40°C to +85°C, VCC = 5.0V ± 10%)

| Parameters       | Description           | Test Conditions <sup>(1)</sup>                                  |                                   | Min. | Typ <sup>(2)</sup> | Max. | Units |
|------------------|-----------------------|-----------------------------------------------------------------|-----------------------------------|------|--------------------|------|-------|
| V <sub>IH</sub>  | Input HIGH Voltage    | Guaranteed Logic HIGH Level                                     |                                   | 2.0  |                    |      | V     |
| V <sub>IL</sub>  | Input LOW Voltage     | Guaranteed Logic LOW Level                                      |                                   |      |                    | 0.8  | V     |
| I <sub>IH</sub>  | Input HIGH Current    | V <sub>CC</sub> = Max.                                          | V <sub>IN</sub> = V <sub>CC</sub> |      |                    | 1    | μA    |
| I <sub>IL</sub>  | Input LOW Current     | V <sub>CC</sub> = Max.                                          | V <sub>IN</sub> = GND             |      |                    | –1   | μA    |
| I <sub>OZH</sub> | High Impedance        | V <sub>CC</sub> = Max.                                          | V <sub>OUT</sub> = 2.7V           |      |                    | 1    | μA    |
| I <sub>OZL</sub> | Output Current        | V <sub>CC</sub> = Max.                                          | V <sub>OUT</sub> = 0.5V           |      |                    | –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>OS</sub>  | Short Circuit Current | V <sub>CC</sub> = Max. <sup>(3)</sup> , V <sub>OUT</sub> = GND  |                                   | –80  | –140               | –200 | mA    |
| I <sub>O</sub>   | Output Drive Current  | V <sub>CC</sub> = Max. <sup>(3)</sup> , V <sub>OUT</sub> = 2.5V |                                   | –50  |                    | –180 | mA    |
| V <sub>H</sub>   | Input Hysteresis      |                                                                 |                                   |      | 100                |      | mV    |

### PI74FCT16500T Output Drive Characteristics (Over the Operating Range)

| Parameters       | Description         | Test Conditions <sup>(1)</sup>                                               |                            | Min. | Typ <sup>(2)</sup> | Max. | Units |
|------------------|---------------------|------------------------------------------------------------------------------|----------------------------|------|--------------------|------|-------|
| V <sub>OH</sub>  | Output HIGH Voltage | V <sub>CC</sub> = Min., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = –3.0 mA  | 2.5  | 3.5                |      | V     |
|                  |                     |                                                                              | I <sub>OH</sub> = –15.0 mA | 2.4  | 3.5                |      |       |
|                  |                     |                                                                              | I <sub>OH</sub> = –32.0 mA | 2.0  | 3.0                |      |       |
| V <sub>OL</sub>  | Output LOW Voltage  | V <sub>CC</sub> = Min., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OL</sub> = 64 mA    |      | 0.2                | 0.55 | V     |
| 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    |

### PI74FCT162500T Output Drive Characteristics (Over the Operating Range)

| Parameters       | Description         | Test Conditions <sup>(1)</sup>                                                                                      |                            | Min. | Typ <sup>(2)</sup> | Max. | Units |
|------------------|---------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------|------|--------------------|------|-------|
| V <sub>OH</sub>  | Output HIGH Voltage | V <sub>CC</sub> = Min., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                        | I <sub>OH</sub> = –24.0 mA | 2.4  | 3.3                |      | V     |
| V <sub>OL</sub>  | Output LOW Voltage  | V <sub>CC</sub> = Min., V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                        | I <sub>OL</sub> = 24 mA    |      | 0.3                | 0.55 | V     |
| I <sub>ODL</sub> | Output LOW Current  | V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup> |                            | 60   | 115                | 150  | mA    |
| I <sub>ODH</sub> | Output HIGH Current | V <sub>CC</sub> = 5V, V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>OUT</sub> = 1.5V <sup>(3)</sup> |                            | –60  | –115               | –150 | mA    |

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

| Parameters <sup>(4)</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    |

#### 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> = 5.0V, +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 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 <sub>CC</sub>  | Quiescent Power Supply Current                  | V <sub>CC</sub> = Max.                                                                                                                                                                                                               | V <sub>IN</sub> = GND or V <sub>CC</sub>                   |      | 0.1                | 500                  | μA         |
| ΔI <sub>CC</sub> | Supply Current per Input @ TTL HIGH             | V <sub>CC</sub> = Max.                                                                                                                                                                                                               | V <sub>IN</sub> = 3.4V <sup>(3)</sup>                      |      | 0.5                | 1.5                  | mA         |
| I <sub>CCD</sub> | Supply Current per Input per MHz <sup>(4)</sup> | V <sub>CC</sub> = Max., Outputs Open<br>OEAB = $\overline{\text{OEBA}}$ = V <sub>CC</sub> or GND<br>One Bit Toggling<br>50% Duty Cycle                                                                                               | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND |      | 75                 | 120                  | μA/<br>MHz |
| I <sub>C</sub>   | Total Power Supply Current <sup>(6)</sup>       | V <sub>CC</sub> = Max.,<br>Outputs Open<br>f <sub>CP</sub> = 10 MHz (CLKAB)<br>50% Duty Cycle<br>OEAB = $\overline{\text{OEBA}}$ = V <sub>CC</sub><br>LEAB = GND<br>One Bit Toggling<br>f <sub>i</sub> = 5 MHz<br>50% Duty Cycle     | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND |      | 0.8                | 2.7 <sup>(5)</sup>   | mA         |
|                  |                                                 |                                                                                                                                                                                                                                      | V <sub>IN</sub> = 3.4V<br>V <sub>IN</sub> = GND            |      | 1.3                | 4.2 <sup>(5)</sup>   |            |
|                  |                                                 | V <sub>CC</sub> = Max., Output Open<br>f <sub>CP</sub> = 10 MHz (CLKAB)<br>50% Duty Cycle<br>OEAB = $\overline{\text{OEBA}}$ = V <sub>CC</sub><br>LEAB = GND<br>Eighteen Bits Toggling<br>f <sub>i</sub> = 2.5 MHz<br>50% Duty Cycle | V <sub>IN</sub> = V <sub>CC</sub><br>V <sub>IN</sub> = GND |      | 3.8                | 7.5 <sup>(5)</sup>   |            |
|                  |                                                 |                                                                                                                                                                                                                                      | V <sub>IN</sub> = 3.4V<br>V <sub>IN</sub> = GND            |      | 8.6                | 21.85 <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> = 5.0V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4V); 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  
ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
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)  
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.

**PI74FCT16500T Switching Characteristics over Operating Range**

| Parameters                           | Description                                                  |            | Conditions <sup>(1)</sup>                           | 16500AT |     | 16500CT |     | 16500DT |     | Unit |
|--------------------------------------|--------------------------------------------------------------|------------|-----------------------------------------------------|---------|-----|---------|-----|---------|-----|------|
|                                      |                                                              |            |                                                     | Com.    |     | Com.    |     | Com.    |     |      |
|                                      |                                                              |            |                                                     | Min     | Max | Min     | Max | Min     | Max |      |
| t <sub>MAX</sub>                     | CLKAB or CLKBA frequency                                     |            | C <sub>L</sub> = 50 pF<br><br>R <sub>L</sub> = 500Ω | —       | 150 | —       | 150 | —       | 150 | MHz  |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Ax to Bx or Ax to Bx                    |            |                                                     | 1.5     | 5.1 | 1.5     | 4.6 | 1.5     | 4.1 | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>LEBA to Ax, LEAB to Bx                  |            |                                                     | 1.5     | 5.6 | 1.5     | 5.3 | 1.5     | 4.6 | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CLKBA to Ax, CLKAB to Bx                |            |                                                     | 1.5     | 5.6 | 1.5     | 5.3 | 1.5     | 4.6 | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>OEBA to Ax, OEAB to Bx                 |            |                                                     | 1.5     | 6.0 | 1.5     | 5.6 | 1.5     | 5.0 | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time <sup>(3)</sup><br>OEBA to Ax, OEAB to Bx |            |                                                     | 1.5     | 5.6 | 1.5     | 5.2 | 1.5     | 4.8 | ns   |
| t <sub>SU</sub>                      | Setup Time HIGH or LOW<br>Ax to CLKAB, Bx to CLKBA           |            |                                                     | 3.0     | —   | 3.0     | —   | 3.0     | —   | ns   |
| t <sub>H</sub>                       | Hold Time HIGH or LOW<br>Ax to CLKAB, Bx to CLKBA            |            |                                                     | 0       | —   | 0       | —   | 0       | —   | ns   |
| t <sub>SU</sub>                      | Setup Time<br>HIGH or LOW<br>Ax to LEAB,<br>Bx to LEBA       | Clock HIGH |                                                     | 3.0     | —   | 3.0     | —   | 3.0     | —   | ns   |
|                                      |                                                              | Clock LOW  | 1.5                                                 | —       | 1.5 | —       | 1.5 | —       | ns  |      |
| t <sub>H</sub>                       | Hold Time HIGH or LOW<br>Ax to LEAB, Bx to LEBA              |            | 1.5                                                 | —       | 1.5 | —       | 1.5 | —       | ns  |      |
| t <sub>w</sub>                       | LEAB or LEBA Pulse Width<br>HIGH <sup>(3)</sup>              |            | 3.0                                                 | —       | 3.0 | —       | 3.0 | —       | ns  |      |
| t <sub>w</sub>                       | CLKAB or CLKBA Pulse Width 3.0<br>HIGH <sup>(3)</sup> or LOW |            | —                                                   | 3.0     | —   | 3.0     | —   | ns      |     |      |

**Notes:**

1. See test circuit and wave forms.
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.

**PI74FCT162500T Switching Characteristics over Operating Range**

| Parameters   | Description                                                                                      |            | Conditions <sup>(1)</sup>                           | 162500AT |     | 162500CT |     | 162500DT |     | Unit |
|--------------|--------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------|----------|-----|----------|-----|----------|-----|------|
|              |                                                                                                  |            |                                                     | Com.     |     | Com.     |     | Com.     |     |      |
|              |                                                                                                  |            |                                                     | Min      | Max | Min      | Max | Min      | Max |      |
| tMAX         | $\overline{\text{CLKAB}}$ or $\overline{\text{CLKBA}}$ frequency                                 |            | C <sub>L</sub> = 50 pF<br><br>R <sub>L</sub> = 500Ω | —        | 150 | —        | 150 | —        | 150 | MHz  |
| tPLH<br>tPHL | Propagation Delay<br>Ax to Bx or Ax to Bx                                                        |            |                                                     | 1.5      | 5.1 | 1.5      | 4.6 | 1.5      | 4.1 | ns   |
| tPLH<br>tPHL | Propagation Delay<br>LEBA to Ax, LEAB to Bx                                                      |            |                                                     | 1.5      | 5.6 | 1.5      | 5.3 | 1.5      | 4.6 | ns   |
| tPLH<br>tPHL | Propagation Delay<br>$\overline{\text{CLKBA}}$ to Ax, $\overline{\text{CLKAB}}$ to Bx            |            |                                                     | 1.5      | 5.6 | 1.5      | 5.3 | 1.5      | 4.6 | ns   |
| tPZH<br>tPZL | Output Enable Time<br>$\overline{\text{OEBA}}$ to Ax, OEAB to Bx                                 |            |                                                     | 1.5      | 6.0 | 1.5      | 5.6 | 1.5      | 5.0 | ns   |
| tPHZ<br>tPLZ | Output Disable Time <sup>(3)</sup><br>$\overline{\text{OEBA}}$ to Ax, OEAB to Bx                 |            |                                                     | 1.5      | 5.6 | 1.5      | 5.2 | 1.5      | 4.8 | ns   |
| tSU          | Setup Time HIGH or LOW<br>Ax to $\overline{\text{CLKAB}}$ , Bx to $\overline{\text{CLKBA}}$      |            |                                                     | 3.0      | —   | 3.0      | —   | 3.0      | —   | ns   |
| tH           | Hold Time HIGH or LOW<br>Ax to $\overline{\text{CLKAB}}$ , Bx to $\overline{\text{CLKBA}}$       |            |                                                     | 0        | —   | 0        | —   | 0        | —   | ns   |
| tSU          | Setup Time<br>HIGH or LOW<br>Ax to LEAB,<br>Bx to LEBA                                           | Clock HIGH |                                                     | 3.0      | —   | 3.0      | —   | 3.0      | —   | ns   |
|              |                                                                                                  | Clock LOW  |                                                     | 1.5      | —   | 1.5      | —   | 1.5      | —   | ns   |
| tH           | Hold Time HIGH or LOW<br>Ax to LEAB, Bx to LEBA                                                  |            | 1.5                                                 | —        | 1.5 | —        | 1.5 | —        | ns  |      |
| tw           | LEAB or LEBA Pulse Width<br>HIGH <sup>(3)</sup>                                                  |            | 3.0                                                 | —        | 3.0 | —        | 3.0 | —        | ns  |      |
| tw           | $\overline{\text{CLKAB}}$ or $\overline{\text{CLKBA}}$ Pulse Width<br>HIGH <sup>(3)</sup> or LOW |            | 3.0                                                 | —        | 3.0 | —        | 3.0 | —        | ns  |      |
| tsk(o)       | Output Skew <sup>(4)</sup>                                                                       |            | —                                                   | 0.5      | —   | 0.5      | —   | 0.5      | ns  |      |

**Notes:**

1. See test circuit and wave forms.
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.