



Integrated Device Technology, Inc.

## FAST CMOS 18-BIT REGISTERED TRANSCEIVER

IDT54/74FCT16501AT/CT/ET  
IDT54/74FCT162501AT/CT/ET

### FEATURES:

- **Common features:**
  - 0.5 MICRON CMOS Technology
  - **High-speed, low-power CMOS replacement for ABT functions**
  - **Typical tsk(o) (Output Skew) < 250ps**
  - **Low input and output leakage  $\leq 1\mu\text{A}$  (max)**
  - ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)
  - 25 mil pitch SSOP and Cerpack Packages and 19.6 mil pitch TSSOP Package
  - Extended commercial range of  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$
  - $V_{CC} = 5V \pm 10\%$
- **Features for FCT16501AT/CT/ET:**
  - High drive outputs ( $-32\text{mA}$  IOH,  $64\text{mA}$  IOL)
  - Power off disable outputs permit "live insertion"
  - Typical VOLP (Output Ground Bounce) < 1.0V at  $V_{CC} = 5V$ ,  $T_A = 25^\circ\text{C}$
- **Features for FCT162501AT/CT/ET:**
  - Balanced Output Drivers:  $\pm 24\text{mA}$  (commercial),  $\pm 16\text{mA}$  (military)
  - Reduced system switching noise
  - Typical VOLP (Output Ground Bounce) < 0.6V at  $V_{CC} = 5V$ ,  $T_A = 25^\circ\text{C}$

### DESCRIPTION:

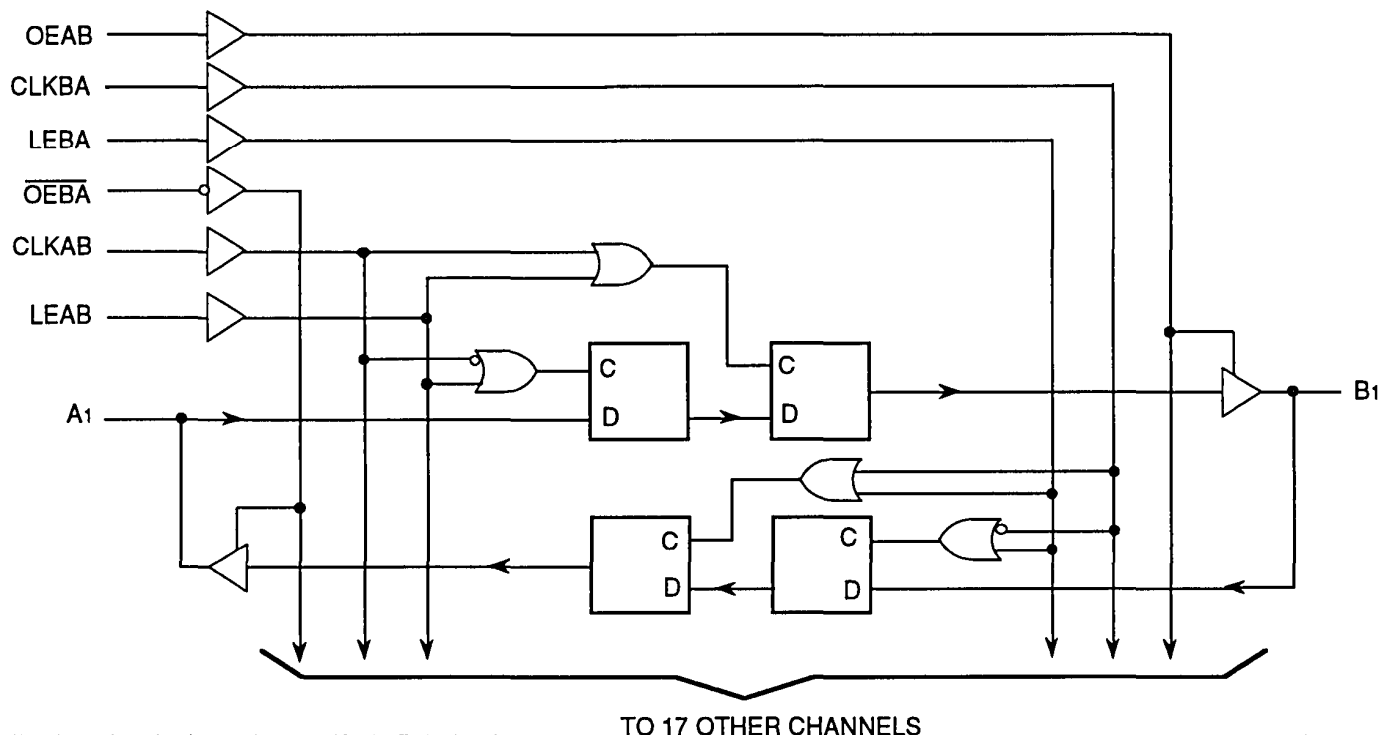
The IDT54/74FCT16501AT/CT/ET and IDT54/74FCT162501AT/CT/ET 18-bit registered transceivers are

built using advanced dual metal CMOS technology. These high-speed, low-power 18-bit registered bus transceivers combine D-type latches and D-type flip-flops to allow data flow in transparent, latched and clocked modes. Data flow in each direction is controlled by output-enable (OEAB and  $\overline{\text{OEBA}}$ ), latch enable (LEAB and LEBA) and clock (CLKAB and CLKBA) inputs. For A-to-B data flow, the device operates in transparent mode when LEAB is HIGH. When LEAB is LOW, the A data is latched if CLKAB is held at a HIGH or LOW logic level. If LEAB is LOW, the A bus data is stored in the latch/flip-flop on the LOW-to-HIGH transition of CLKAB. OEAB performs the output enable function on the B port. Data flow from the B port to the A port is similar but requires using  $\overline{\text{OEBA}}$ , LEBA and CLKBA. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

The IDT54/74FCT16501AT/CT/ET are ideally suited for driving high-capacitance loads and low-impedance backplanes. The output buffers are designed with power off disable capability to allow "live insertion" of boards when used as backplane drivers.

The IDT54/74FCT162501AT/CT/ET have balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot, and controlled output fall times—reducing the need for external series terminating resistors. The IDT54/74FCT162501AT/CT/ET are plug-in replacements for the IDT54/74FCT16501AT/CT/ET and 54/74ABT16501 for on-board bus interface applications.

### FUNCTIONAL BLOCK DIAGRAM



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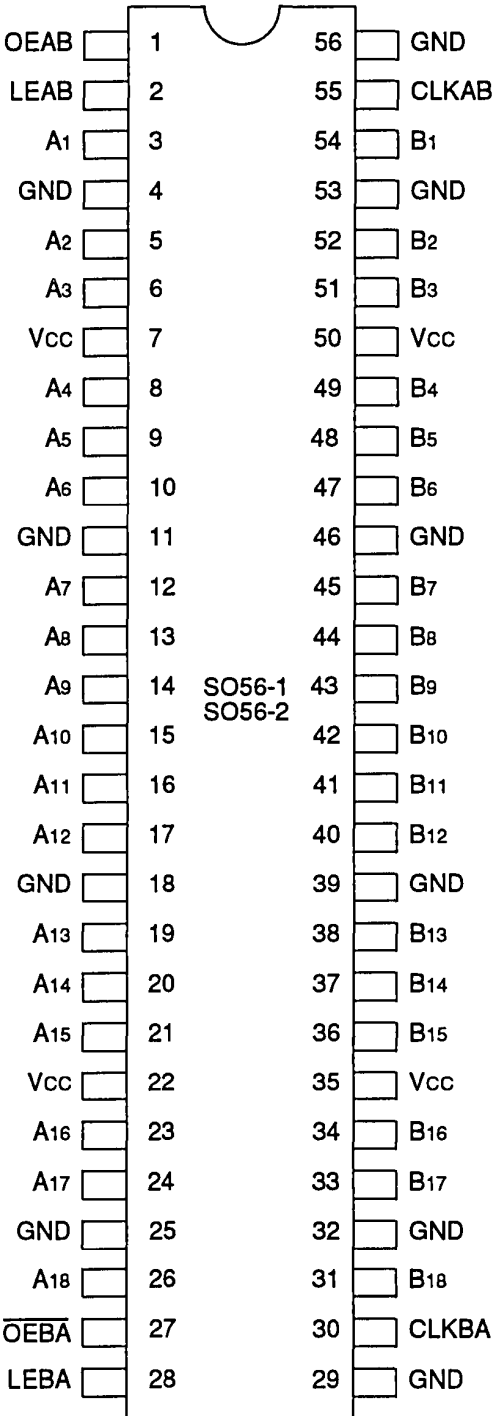
TO 17 OTHER CHANNELS

2547 drw 01

MILITARY AND COMMERCIAL TEMPERATURE RANGES

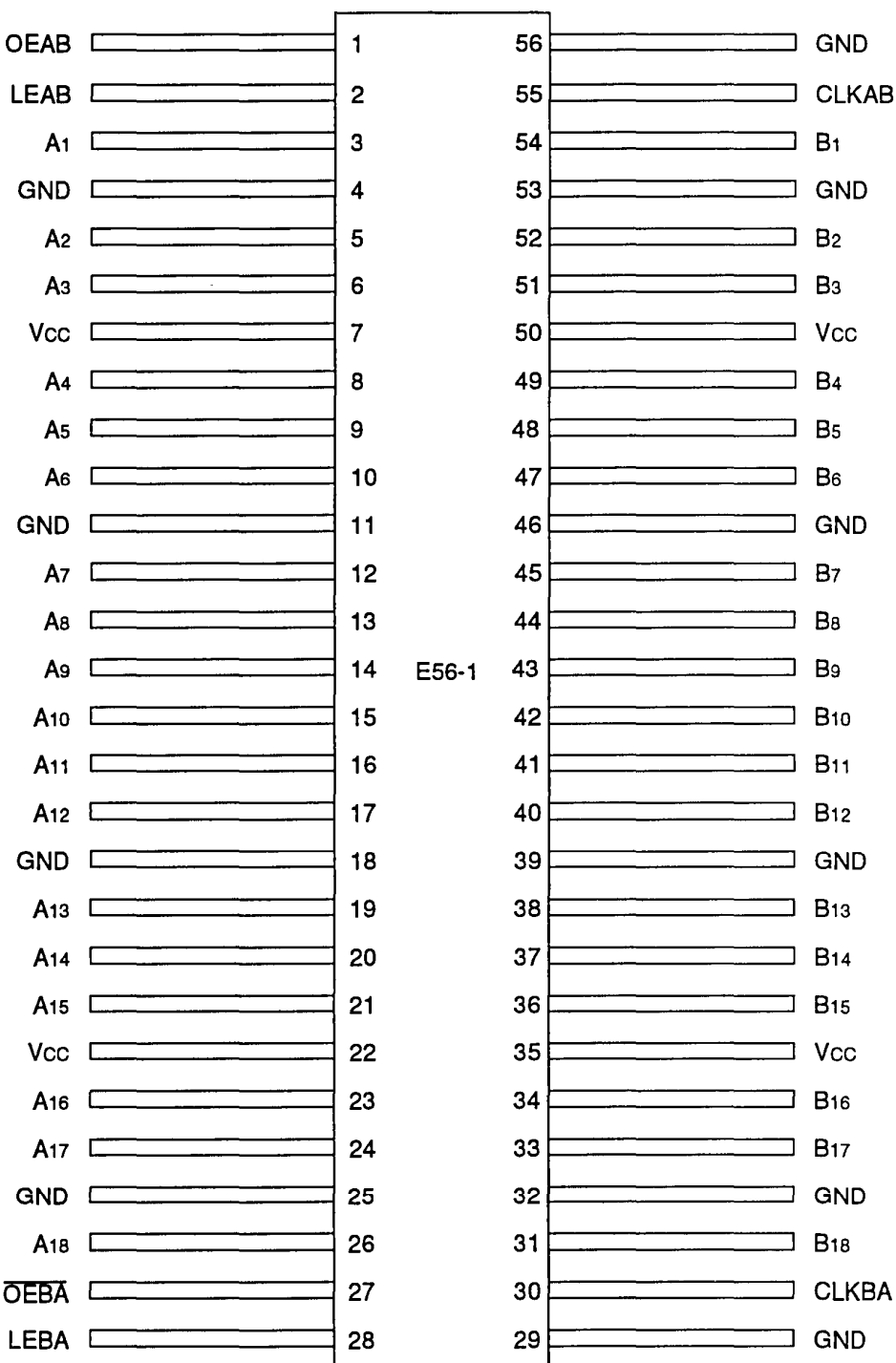
AUGUST 1993

PIN CONFIGURATIONS



SSOP  
TSSOP  
TOP VIEW

2547 drw 02



CERPACK  
TOP VIEW

2547 drw 03

## PIN DESCRIPTION

| Pin Names         | Description                                  |
|-------------------|----------------------------------------------|
| OEAB              | A-to-B Output Enable Input                   |
| $\overline{OEBA}$ | B-to-A Output Enable Input (Active LOW)      |
| LEAB              | A-to-B Latch Enable Input                    |
| LEBA              | B-to-A Latch Enable Input                    |
| CLKAB             | A-to-B Clock Input                           |
| CLKBA             | B-to-A Clock Input                           |
| 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 |

2547 tbl 01

## FUNCTION TABLE<sup>(1,4)</sup>

| Inputs |      |       |    | Outputs          |
|--------|------|-------|----|------------------|
| OEAB   | LEAB | 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    | L     | X  | B <sup>(2)</sup> |
| H      | L    | H     | X  | B <sup>(3)</sup> |

### NOTES:

2547 tbl 02

1. A-to-B data flow is shown. B-to-A data flow is similar but uses  $\overline{OEBA}$ , LEBA, and 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 CLKAB was HIGH before LEAB went LOW.
4. H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-impedance  
↑ = LOW-to-HIGH Transition

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Symbol                           | Rating                               | Commercial              | Military                | Unit |
|----------------------------------|--------------------------------------|-------------------------|-------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup> | Terminal Voltage with Respect to GND | −0.5 to +7.0            | −0.5 to +7.0            | V    |
| V <sub>TERM</sub> <sup>(3)</sup> | Terminal Voltage with Respect to GND | −0.5 to V <sub>CC</sub> | −0.5 to V <sub>CC</sub> | V    |
| T <sub>A</sub>                   | Operating Temperature                | −40 to +85              | −55 to +125             | °C   |
| T <sub>BIAS</sub>                | Temperature Under Bias               | −55 to +125             | −65 to +135             | °C   |
| T <sub>STG</sub>                 | Storage Temperature                  | −55 to +125             | −65 to +150             | °C   |
| P <sub>T</sub>                   | Power Dissipation                    | 1.0                     | 1.0                     | W    |
| I <sub>OUT</sub>                 | DC Output Current                    | −60 to +120             | −60 to +120             | mA   |

### NOTES:

2547 lmk 03

1. Stresses greater than those listed under ABSOLUTE 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. All device terminals except FCT162XXXT Output and I/O terminals.
3. Output and I/O terminals for FCT162XXXT.

## CAPACITANCE (T<sub>A</sub> = +25°C, f = 1.0MHz)

| Symbol           | Parameter <sup>(1)</sup> | Conditions            | Typ. | Max. | Unit |
|------------------|--------------------------|-----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V  | 4.5  | 6.0  | pF   |
| C <sub>I/O</sub> | I/O Capacitance          | V <sub>OUT</sub> = 0V | 5.5  | 8.0  | pF   |

### NOTE:

2547 lmk 04

1. This parameter is measured at characterization but not tested.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial: TA = -40°C to +85°C, Vcc = 5.0V ± 10%; Military: TA = -55°C to +125°C, Vcc = 5.0V ± 10%

| Symbol                                                   | Parameter                                                             | Test Conditions <sup>(1)</sup>                   |                       | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|----------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------|-----------------------|------|---------------------|------|------|
| V <sub>IH</sub>                                          | Input HIGH Level                                                      | Guaranteed Logic HIGH Level                      |                       | 2.0  | —                   | —    | V    |
| V <sub>IL</sub>                                          | Input LOW Level                                                       | Guaranteed Logic LOW Level                       |                       | —    | —                   | 0.8  | V    |
| I <sub>IH</sub>                                          | Input HIGH Current (Input pins) <sup>(5)</sup>                        | Vcc = Max.                                       | V <sub>I</sub> = Vcc  | —    | —                   | ±1   | μA   |
|                                                          | Input HIGH Current (I/O pins) <sup>(5)</sup>                          |                                                  |                       | —    | —                   | ±1   |      |
| I <sub>IL</sub>                                          | Input LOW Current (Input pins) <sup>(5)</sup>                         |                                                  | V <sub>I</sub> = GND  | —    | —                   | ±1   |      |
|                                                          | Input LOW Current (I/O pins) <sup>(5)</sup>                           |                                                  |                       | —    | —                   | ±1   |      |
| I <sub>OZH</sub>                                         | High Impedance Output Current<br>(3-State Output pins) <sup>(5)</sup> | Vcc = Max.                                       | V <sub>O</sub> = 2.7V | —    | —                   | ±1   | μA   |
| I <sub>OZL</sub>                                         |                                                                       |                                                  | V <sub>O</sub> = 0.5V | —    | —                   | ±1   |      |
| V <sub>IK</sub>                                          | Clamp Diode Voltage                                                   | Vcc = Min., I <sub>IN</sub> = -18mA              |                       | —    | -0.7                | -1.2 | V    |
| I <sub>OS</sub>                                          | Short Circuit Current                                                 | Vcc = Max., V <sub>O</sub> = GND <sup>(3)</sup>  |                       | -80  | -140                | -200 | mA   |
| I <sub>O</sub>                                           | Output Drive Current                                                  | Vcc = Max., V <sub>O</sub> = 2.5V <sup>(3)</sup> |                       | -50  | —                   | -180 | mA   |
| V <sub>H</sub>                                           | Input Hysteresis                                                      | —                                                |                       | —    | 100                 | —    | mV   |
| I <sub>CC1</sub><br>I <sub>CC2</sub><br>I <sub>CC3</sub> | Quiescent Power Supply Current                                        | Vcc = Max., V <sub>IN</sub> = GND or Vcc         |                       | —    | 5                   | 500  | μA   |

2547 Ink 05

## OUTPUT DRIVE CHARACTERISTICS FOR FCT16501T

| Symbol           | Parameter                                     | Test Conditions <sup>(1)</sup>                                     |                                                                               | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|------------------|-----------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------|------|---------------------|------|------|
| V <sub>OH</sub>  | Output HIGH Voltage                           | Vcc = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -3mA                                                        | 2.5  | 3.5                 | —    | V    |
|                  |                                               |                                                                    | I <sub>OH</sub> = -12mA MIL.<br>I <sub>OH</sub> = -15mA COM'L.                | 2.4  | 3.5                 | —    | V    |
|                  |                                               |                                                                    | I <sub>OH</sub> = -24mA MIL.<br>I <sub>OH</sub> = -32mA COM'L. <sup>(4)</sup> | 2.0  | 3.0                 | —    | V    |
|                  |                                               |                                                                    |                                                                               | —    | 0.2                 | 0.55 | V    |
| V <sub>OL</sub>  | Output LOW Voltage                            | Vcc = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OL</sub> = 48mA MIL.<br>I <sub>OL</sub> = 64mA COM'L.                  | —    | 0.2                 | 0.55 | V    |
| I <sub>OFF</sub> | Input/Output Power Off Leakage <sup>(5)</sup> | Vcc = 0V, V <sub>IN</sub> or V <sub>O</sub> ≤ 4.5V                 |                                                                               | —    | —                   | ±1   | μA   |

2547 Ink 06

## OUTPUT DRIVE CHARACTERISTICS FOR FCT162501T

| Symbol           | Parameter           | Test Conditions <sup>(1)</sup>                                                                          |                                                                | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|------------------|---------------------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------|---------------------|------|------|
| I <sub>ODL</sub> | Output LOW Current  | Vcc = 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 | Vcc = 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   |
| V <sub>OH</sub>  | Output HIGH Voltage | Vcc = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                      | I <sub>OH</sub> = -16mA MIL.<br>I <sub>OH</sub> = -24mA COM'L. | 2.4  | 3.3                 | —    | V    |
| V <sub>OL</sub>  | Output LOW Voltage  | Vcc = Min.<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                      | I <sub>OL</sub> = 16mA MIL.<br>I <sub>OL</sub> = 24mA COM'L.   | —    | 0.3                 | 0.55 | V    |

### NOTES:

2547 Ink 07

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at Vcc = 5.0V, +25°C ambient.
- Not more than one output should be tested at one time. Duration of the test should not exceed one second.
- Duration of the condition can not exceed one second.
- The test limit for this parameter is ± 5μA at TA = -55°C.

## POWER SUPPLY CHARACTERISTICS

| Symbol          | Parameter                                      | Test Conditions <sup>(1)</sup>                                                                                                                                                                                              |                                            | Min. | Typ. <sup>(2)</sup> | Max.                | Unit                 |
|-----------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------|---------------------|---------------------|----------------------|
| $\Delta I_{CC}$ | Quiescent Power Supply Current TTL Inputs HIGH | $V_{CC} = \text{Max.}$<br>$V_{IN} = 3.4V^{(3)}$                                                                                                                                                                             |                                            | —    | 0.5                 | 1.5                 | mA                   |
| $I_{CCD}$       | Dynamic Power Supply Current <sup>(4)</sup>    | $V_{CC} = \text{Max.}$ , Outputs Open<br>$OEAB = \overline{OEBA} = V_{CC} \text{ or GND}$<br>One Input Toggling<br>50% Duty Cycle                                                                                           | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 75                  | 120                 | $\mu A / \text{MHz}$ |
| $I_C$           | Total Power Supply Current <sup>(6)</sup>      | $V_{CC} = \text{Max.}$ , Outputs Open<br>$f_{CP} = 10\text{MHz (CLKAB)}$<br>50% Duty Cycle<br>$OEAB = \overline{OEBA} = V_{CC}$<br>$LEAB = \text{GND}$<br>One Bit Toggling<br>$f_i = 5\text{MHz}$<br>50% Duty Cycle         | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 0.8                 | 1.7                 | mA                   |
|                 |                                                |                                                                                                                                                                                                                             | $V_{IN} = 3.4V$<br>$V_{IN} = \text{GND}$   | —    | 1.3                 | 3.2                 |                      |
|                 |                                                | $V_{CC} = \text{Max.}$ , Outputs Open<br>$f_{CP} = 10\text{MHz (CLKAB)}$<br>50% Duty Cycle<br>$OEAB = \overline{OEBA} = V_{CC}$<br>$LEAB = \text{GND}$<br>Eighteen Bits Toggling<br>$f_i = 2.5\text{MHz}$<br>50% Duty Cycle | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | —    | 3.8                 | 6.5 <sup>(5)</sup>  |                      |
|                 |                                                |                                                                                                                                                                                                                             | $V_{IN} = 3.4V$<br>$V_{IN} = \text{GND}$   | —    | 8.5                 | 20.8 <sup>(5)</sup> |                      |

### NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 5.0V$ ,  $+25^\circ\text{C}$  ambient.
- Per TTL driven input ( $V_{IN} = 3.4V$ ). All other inputs at  $V_{CC}$  or  $\text{GND}$ .
- 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.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP} / 2 + f_i N_i)$   
 $I_{CC} = \text{Quiescent Current (} I_{CCL}, I_{CCH} \text{ and } I_{CCZ} \text{)}$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL HIGH Input (} V_{IN} = 3.4V \text{)}$   
 $D_H = \text{Duty Cycle for TTL Inputs HIGH}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $N_{CP} = \text{Number of Clock Inputs at } f_{CP}$   
 $f_i = \text{Input Frequency}$   
 $N_i = \text{Number of Inputs at } f_i$

2547 tbl 08

## SWITCHING CHARACTERISTICS OVER OPERATING RANGE

| Symbol       | Parameter                                                | Condition <sup>(1)</sup> | FCT16501AT/162501AT |      |                     |      | FCT16501CT/162501CT |      |                     |      | FCT16501ET/162501ET |      |                     |      | Unit |    |
|--------------|----------------------------------------------------------|--------------------------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|---------------------|------|------|----|
|              |                                                          |                          | Com'l.              |      | Mil.                |      | Com'l.              |      | Mil.                |      | Com'l.              |      | Mil.                |      |      |    |
|              |                                                          |                          | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. | Min. <sup>(2)</sup> | Max. |      |    |
| fMAX         | CLKAB or CLKBA frequency <sup>(3)</sup>                  | CL = 50pF                | —                   | 150  | —                   | 150  | —                   | 150  | —                   | 150  | —                   | 150  | —                   | —    | MHz  |    |
| tPLH<br>tPHL | Propagation Delay<br>Ax to Bx or Bx to Ax                | RL = 500Ω                | 1.5                 | 5.1  | 1.5                 | 5.6  | 1.5                 | 4.6  | 1.5                 | 4.6  | 1.5                 | 3.8  | —                   | —    | ns   |    |
| tPLH<br>tPHL | Propagation Delay<br>LEBA to Ax, LEAB to Bx              |                          | 1.5                 | 5.6  | 1.5                 | 6.0  | 1.5                 | 5.3  | 1.5                 | 5.6  | 1.5                 | 4.2  | —                   | —    | ns   |    |
| tPLH<br>tPHL | Propagation Delay<br>CLKBA to Ax, CLKAB to Bx            |                          | 1.5                 | 5.6  | 1.5                 | 6.0  | 1.5                 | 5.3  | 1.5                 | 5.4  | 1.5                 | 4.2  | —                   | —    | ns   |    |
| tPZH<br>tPZL | Output Enable Time<br>OEBA to Ax, OEAB to Bx             |                          | 1.5                 | 6.0  | 1.5                 | 6.4  | 1.5                 | 5.6  | 1.5                 | 6.0  | 1.5                 | 4.8  | —                   | —    | ns   |    |
| tPHZ<br>tPLZ | Output Disable Time<br>OEBA to Ax, OEAB to Bx            |                          | 1.5                 | 5.6  | 1.5                 | 6.0  | 1.5                 | 5.2  | 1.5                 | 5.6  | 1.5                 | 4.0  | —                   | —    | ns   |    |
| tSU          | Set-up Time, HIGH or LOW<br>Ax to CLKAB, Bx to CLKBA     |                          | 3.0                 | —    | 3.0                 | —    | 3.0                 | —    | 3.0                 | —    | 2.4                 | —    | —                   | —    | ns   |    |
| tH           | Hold Time HIGH or LOW<br>Ax to CLKAB, Bx to CLKBA        |                          | 0                   | —    | 0                   | —    | 0                   | —    | 0                   | —    | 0                   | —    | —                   | —    | ns   |    |
| tSU          | Set-up Time<br>HIGH or LOW                               |                          | Clock<br>LOW        | 3.0  | —                   | 3.0  | —                   | 3.0  | —                   | 3.0  | —                   | 2.0  | —                   | —    | —    | ns |
|              | Ax to LEAB,<br>Bx to LEBA                                |                          | Clock<br>HIGH       | 1.5  | —                   | 1.5  | —                   | 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  | —                   | 1.5  | —                   | 0.5  | —                   | —    | —                   | ns   |      |    |
| tW           | LEAB or LEBA Pulse Width<br>HIGH <sup>(3)</sup>          | 3.0                      | —                   | 3.0  | —                   | 3.0  | —                   | 3.0  | —                   | 3.0  | —                   | —    | —                   | ns   |      |    |
| tW           | CLKAB or CLKBA Pulse Width<br>HIGH or LOW <sup>(3)</sup> | 3.0                      | —                   | 3.0  | —                   | 3.0  | —                   | 3.0  | —                   | 3.0  | —                   | —    | —                   | ns   |      |    |
| tsk(o)       | Output Skew <sup>(4)</sup>                               | —                        | 0.5                 | —    | 0.5                 | —    | 0.5                 | —    | 0.5                 | —    | 0.5                 | —    | —                   | ns   |      |    |

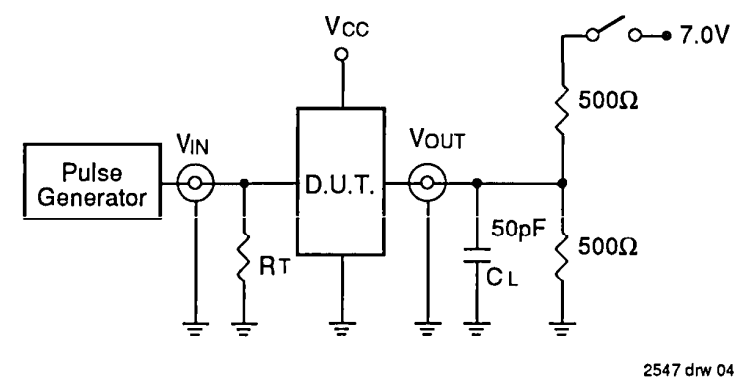
### NOTES:

- See test circuits and waveforms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- This parameter is guaranteed but not tested.
- Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

2547 tbl 09

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS

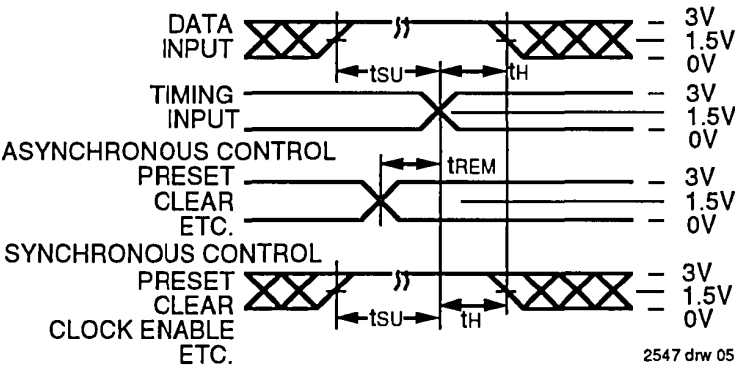


SWITCH POSITION

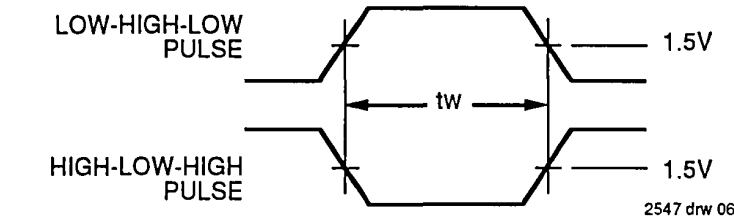
| Test                                    | Switch |
|-----------------------------------------|--------|
| Open Drain<br>Disable Low<br>Enable Low | Closed |
| All Other Tests                         | Open   |

**DEFINITIONS:** 2547 Ink 10  
CL= Load capacitance: includes jig and probe capacitance.  
RT= Termination resistance: should be equal to ZOUT of the Pulse Generator.

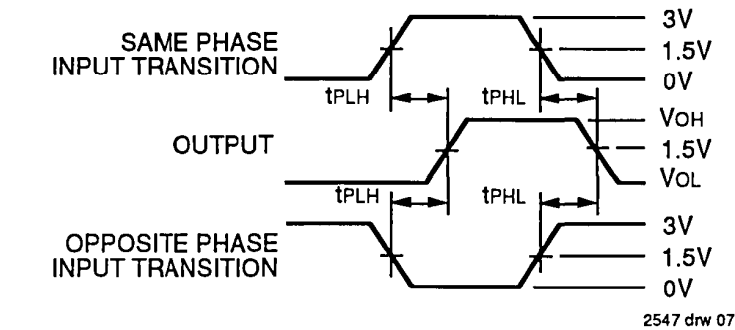
SET-UP, HOLD AND RELEASE TIMES



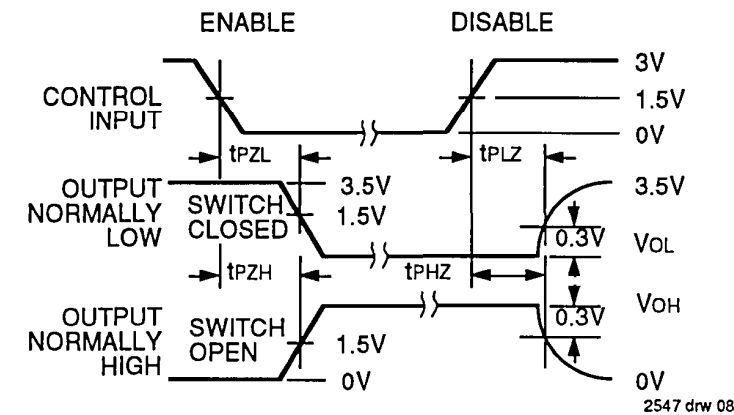
PULSE WIDTH



PROPAGATION DELAY

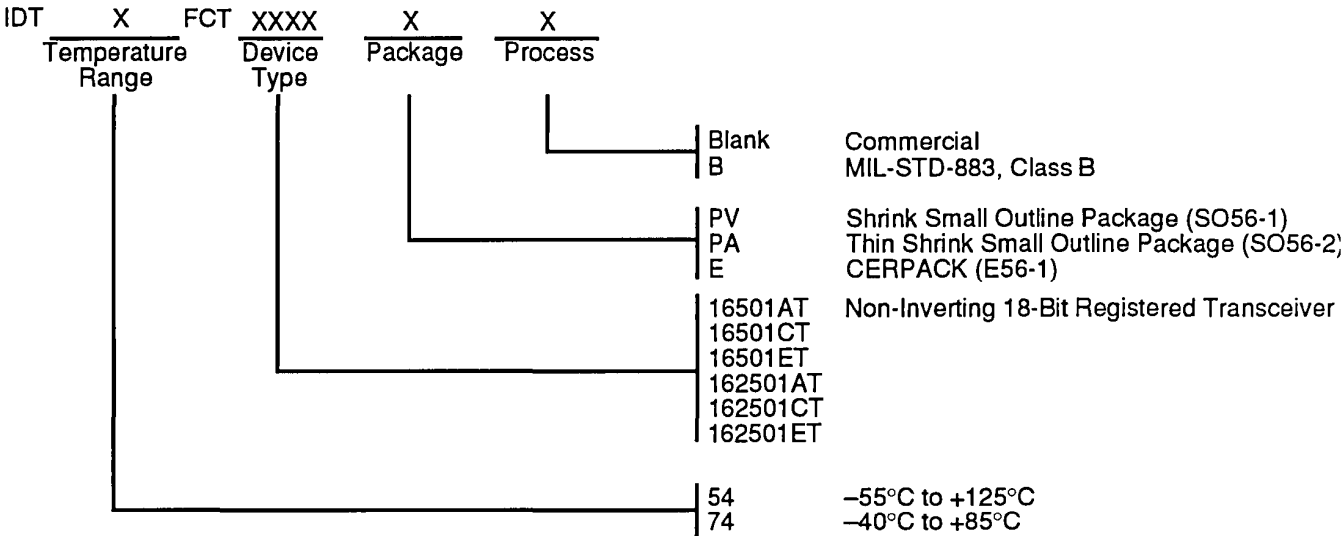


ENABLE AND DISABLE TIMES



- NOTES:**
- 1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
  - 2. Pulse Generator for All Pulses: Rate ≤ 1.0 MHz;  $t_F \leq 2.5\text{ns}$ ;  $t_R \leq 2.5\text{ns}$

ORDERING INFORMATION



2547 drw 09