



Integrated Device Technology, Inc.

# FAST CMOS OCTAL LATCHED TRANSCEIVER

IDT54/74FCT543T/AT/CT/DT  
IDT54/74FCT2543T/AT/CT

## FEATURES:

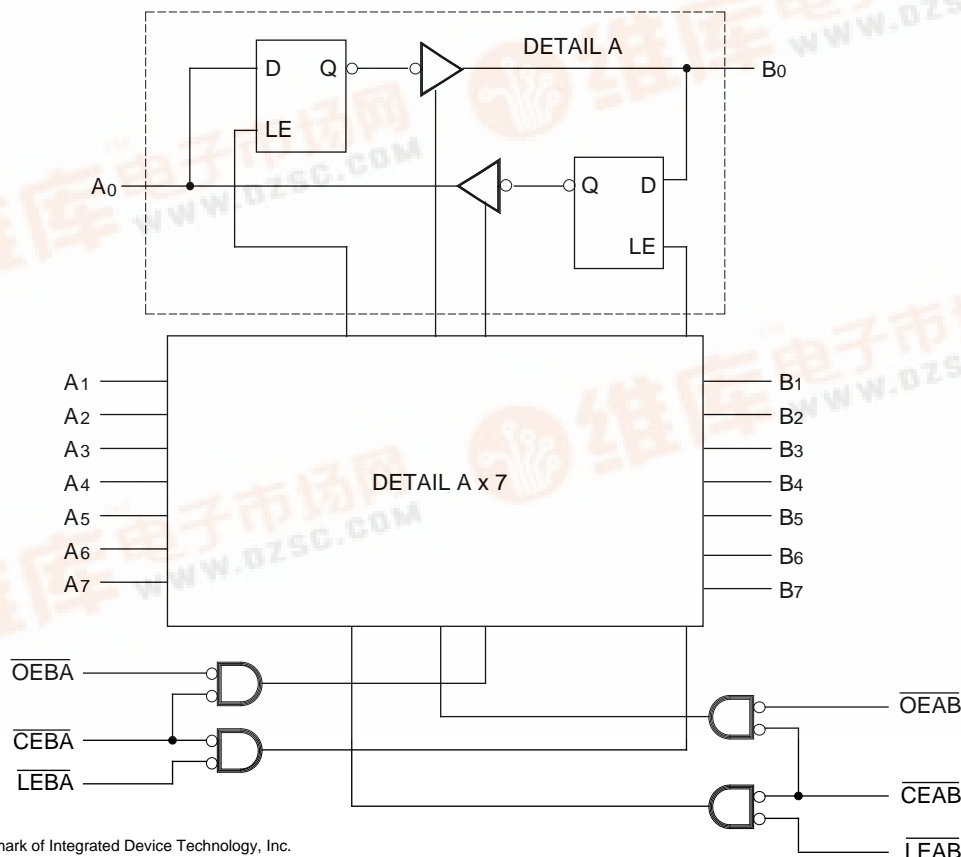
- **Common features:**
  - Low input and output leakage  $\leq 1\mu A$  (max.)
  - CMOS power levels
  - True TTL input and output compatibility
    - $V_{OH} = 3.3V$  (typ.)
    - $V_{OL} = 0.3V$  (typ.)
  - Meets or exceeds JEDEC standard 18 specifications
  - Product available in Radiation Tolerant and Radiation Enhanced versions
  - Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
  - Available in DIP, SOIC, SSOP, QSOP, CERPACK and LCC packages
- **Features for FCT543T:**
  - Std., A, C and D speed grades
  - High drive outputs (-15mA IOH, 64mA IOL)
  - Power off disable outputs permit "live insertion"
- **Features for FCT2543T:**
  - Std., A, and C speed grades
  - Resistor outputs (-15mA IOH, 12mA IOL Com.)  
(-12mA IOH, 12mA IOL Mil.)
  - Reduced system switching noise

## DESCRIPTION:

The FCT543T/FCT2543T is a non-inverting octal transceiver built using an advanced dual metal CMOS technology. This device contains 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 ( $\overline{CEAB}$ ) input must be LOW in order to enter data from  $A_0$ - $A_7$  or to take data from  $B_0$ - $B_7$ , as indicated in the Function Table. With  $\overline{CEAB}$  LOW, a LOW signal on the A-to-B Latch Enable ( $\overline{LEAB}$ ) input makes the A-to-B latches transparent; a subsequent LOW-to-HIGH transition of the  $\overline{LEAB}$  signal puts the A latches in the storage mode and their outputs no longer change with the A inputs. With  $\overline{CEAB}$  and  $\overline{OEAB}$  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  $\overline{CEBA}$ ,  $\overline{LEBA}$  and  $\overline{OEBA}$  inputs.

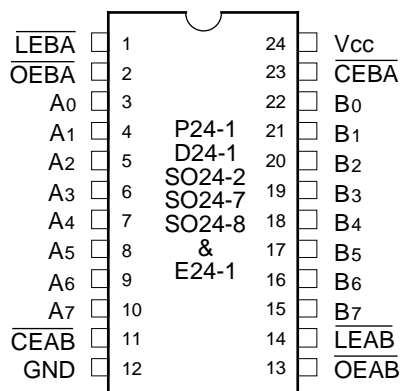
The FCT2543T has balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot and controlled output fall times-reducing the need for external series terminating resistors. FCT2xxxT parts are plug-in replacements for FCTxxxT parts.

## FUNCTIONAL BLOCK DIAGRAM



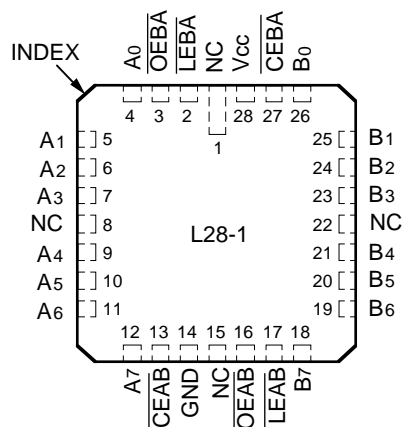
2613 drw 01

## PIN CONFIGURATIONS



2613 drw 02

DIP/SOIC/SSOP/QSOP/CERPACK  
TOP VIEW



2613 drw 03

LCC  
TOP VIEW

## PIN DESCRIPTION

| Pin Names         | Description                                  |
|-------------------|--|
| $\overline{OEAB}$ | A-to-B Output Enable Input (Active LOW)      |
| $\overline{OEBA}$ | B-to-A Output Enable Input (Active LOW)      |
| $\overline{CEAB}$ | A-to-B Enable Input (Active LOW)             |
| $\overline{CEBA}$ | B-to-A Enable Input (Active LOW)             |
| $\overline{LEAB}$ | A-to-B Latch Enable Input (Active LOW)       |
| $\overline{LEBA}$ | B-to-A Latch Enable Input (Active LOW)       |
| A0–A7             | A-to-B Data Inputs or B-to-A 3-State Outputs |
| B0–B7             | B-to-A Data Inputs or A-to-B 3-State Outputs |

2613 tbl 01

## 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 | –0.5 to V <sub>CC</sub> +0.5 | V    |
| T <sub>A</sub>                   | Operating Temperature                | 0 to +70                     | –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                    | 0.5                          | 0.5                          | W    |
| I <sub>OUT</sub>                 | DC Output Current                    | –60 to +120                  | –60 to +120                  | mA   |

2613 Ink 03

### NOTES:

- 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. No terminal voltage may exceed V<sub>CC</sub> by +0.5V unless otherwise noted.
- Input and V<sub>CC</sub> terminals only.
- Outputs and I/O terminals only.

## FUNCTION TABLE<sup>(1, 2)</sup>

For A-to-B (Symmetric with B-to-A)

| Inputs            |                   |                   | Latch Status | Output Buffers     |
|-------------------|-------------------|-------------------|--------------|--------------------|
| $\overline{CEAB}$ | $\overline{LEAB}$ | $\overline{OEAB}$ | A-to-B       | B0–B7              |
| H                 | —                 | —                 | Storing      | High Z             |
| —                 | H                 | —                 | Storing      | —                  |
| —                 | —                 | H                 | —            | High Z             |
| L                 | L                 | L                 | Transparent  | Current A Inputs   |
| L                 | H                 | L                 | Storing      | Previous* A Inputs |

### NOTES:

2613 tbl 02

- \* Before  $\overline{LEAB}$  LOW-to-HIGH Transition  
H = HIGH Voltage Level  
L = LOW Voltage Level  
— = Don't Care or Irrelevant
- A-to-B data flow shown; B-to-A flow control is the same, except using  $\overline{CEBA}$ ,  $\overline{LEBA}$  and  $\overline{OEBA}$ .

## 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  | 6    | 10   | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 8    | 12   | pF   |

2613 Ink 04

### NOTE:

- This parameter is measured at characterization but not tested.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Commercial:  $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$ ; Military:  $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol    | Parameter   | Test Conditions <sup>(1)</sup>                         | Min.                | Typ. <sup>(2)</sup> | Max.    | Unit          |
|-----------|---|--|---------------------|---------------------|---------|---------------|
| $V_{IH}$  | Input HIGH Level  | Guaranteed Logic HIGH Level                            | 2.0                 | —                   | —       | V             |
| $V_{IL}$  | Input LOW Level   | Guaranteed Logic LOW Level                             | —                   | —                   | 0.8     | V             |
| $I_{IH}$  | Input HIGH Current <sup>(4)</sup>                                     | $V_{CC} = \text{Max.}$<br>$V_I = 2.7\text{V}$          | —                   | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{IL}$  | Input LOW Current <sup>(4)</sup>                                      |  | $V_I = 0.5\text{V}$ | —                   | —       |               |
| $I_{OZH}$ | High Impedance Output Current<br>(3-State Output pins) <sup>(4)</sup> | $V_{CC} = \text{Max.}$<br>$V_O = 2.7\text{V}$          | —                   | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZL}$ |   |  | $V_O = 0.5\text{V}$ | —                   | —       |               |
| $I_I$     | Input HIGH Current <sup>(4)</sup>                                     | $V_{CC} = \text{Max.}, V_I = V_{CC} (\text{Max.})$     | —                   | —                   | $\pm 1$ | $\mu\text{A}$ |
| $V_{IK}$  | Clamp Diode Voltage   | $V_{CC} = \text{Min.}, I_{IN} = -18\text{mA}$          | —                   | -0.7                | -1.2    | V             |
| $V_H$     | Input Hysteresis  | —  | —                   | 200                 | —       | mV            |
| $I_{CC}$  | Quiescent Power Supply Current  | $V_{CC} = \text{Max.}, V_{IN} = \text{GND or } V_{CC}$ | —                   | 0.01                | 1       | mA            |

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## OUTPUT DRIVE CHARACTERISTICS FOR 543T/AT/CT/DT

| Symbol    | Parameter                                     | Test Conditions <sup>(1)</sup>                                 | Min.   | Typ. <sup>(2)</sup> | Max.    | Unit          |   |
|-----------|---|--|--|---------------------|---------|---------------|---|
| $V_{OH}$  | Output HIGH Voltage                           | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -6\text{mA MIL.}$<br>$I_{OH} = -8\text{mA COM'L.}$   | 2.4                 | 3.3     | —             | V |
|           |   |  | $I_{OH} = -12\text{mA MIL.}$<br>$I_{OH} = -15\text{mA COM'L.}$ | 2.0                 | 3.0     | —             | V |
| $V_{OL}$  | Output LOW Voltage                            | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$ | —  | 0.3                 | 0.55    | V             |   |
| $I_{OS}$  | Short Circuit Current                         | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$                 | -60  | -120                | -225    | mA            |   |
| $I_{OFF}$ | Input/Output Power Off Leakage <sup>(5)</sup> | $V_{CC} = 0\text{V}, V_{IN} \text{ or } V_O \leq 4.5\text{V}$  | —  | —                   | $\pm 1$ | $\mu\text{A}$ |   |

2613 Ink 06

## OUTPUT DRIVE CHARACTERISTICS FOR 2543T/AT/CT/DT

| Symbol    | Parameter           | Test Conditions <sup>(1)</sup>  | Min. | Typ. <sup>(2)</sup> | Max. | Unit |
|-----------|---------------------|---|------|---------------------|------|------|
| $I_{ODL}$ | Output LOW Current  | $V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 1.5\text{V}^{(3)}$ | 16   | 48                  | —    | mA   |
| $I_{ODH}$ | Output HIGH Current | $V_{CC} = 5\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 1.5\text{V}^{(3)}$ | -16  | -48                 | —    | mA   |
| $V_{OH}$  | Output HIGH Voltage | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$                        | 2.4  | 3.3                 | —    | V    |
| $V_{OL}$  | Output LOW Voltage  | $V_{CC} = \text{Min.}$<br>$V_{IN} = V_{IH} \text{ or } V_{IL}$                        | —    | 0.3                 | 0.50 | V    |

2613 Ink 07

### NOTES:

- For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
- Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^\circ\text{C}$  ambient.
- Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
- The test limit for this parameter is  $\pm 5\mu\text{A}$  at  $T_A = -55^\circ\text{C}$ .
- This parameter is guaranteed but not tested.

## 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                 | 2.0  | mA                  |            |
| $I_{CCD}$       | Dynamic Power Supply Current <sup>(4)</sup>    | $V_{CC} = \text{Max.}$ , Outputs Open<br>$\overline{CEAB}$ and $\overline{OEAB} = \text{GND}$<br>$\overline{CEBA} = V_{CC}$<br>One Input Toggling<br>50% Duty Cycle  | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | FCTxxxT  | —                   | 0.15 | 0.25                | mA/<br>MHz |
|                 |  |  |  | FCT2xxxT | —                   | 0.06 | 0.12                |            |
| $I_C$           | Total Power Supply Current <sup>(6)</sup>      | $V_{CC} = \text{Max.}$ , Outputs Open<br>$f_{CP} = 10\text{MHz}$ ( $\overline{LEAB}$ )<br>50% Duty Cycle<br>$\overline{CEAB}$ and $\overline{OEAB} = \text{GND}$<br>$\overline{CEBA} = V_{CC}$<br>One Bit Toggling<br>at $f_i = 5\text{MHz}$<br>50% Duty Cycle | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | FCTxxxT  | —                   | 1.5  | 3.5                 | mA         |
|                 |  |  |  |          | FCT2xxxT            | —    | 0.6                 |            |
|                 |  |  | $V_{IN} = 3.4V$<br>$V_{IN} = \text{GND}$   | FCTxxxT  | —                   | 2.0  | 5.5                 |            |
|                 |  |  |  |          | FCT2xxxT            | —    | 1.1                 |            |
|                 |  |  | $V_{IN} = V_{CC}$<br>$V_{IN} = \text{GND}$ | FCTxxxT  | —                   | 3.8  | 7.3 <sup>(5)</sup>  |            |
|                 |  |  |  |          | FCT2xxxT            | —    | 1.5                 |            |
|                 |  |  | $V_{IN} = 3.4V$<br>$V_{IN} = \text{GND}$   | FCTxxxT  | —                   | 6.0  | 16.3 <sup>(5)</sup> |            |
|                 |  |  |  |          | FCT2xxxT            | —    | 3.8                 |            |

### NOTES:

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- 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  $I_C$  formula. These limits are guaranteed but not tested.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 $I_{CC} = \text{Quiescent Current}$   
 $\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$   
 $D_H = \text{Duty Cycle for TTL Inputs High}$   
 $N_T = \text{Number of TTL Inputs at } D_H$   
 $I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$   
 $f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$   
 $f_i = \text{Input Frequency}$   
 $N_i = \text{Number of Inputs at } f_i$   
 All currents are in milliamps and all frequencies are in megahertz.

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

| Symbol       | Parameter   | Condition <sup>(1)</sup> | FCT543T/<br>FCT2543T |      |                     |      | FCT543AT/<br>FCT2543AT |      |                     |      | Unit |
|--------------|---|--------------------------|----------------------|------|---------------------|------|------------------------|------|---------------------|------|------|
|              |   |                          | 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. |      |
| tPLH<br>tPHL | Propagation Delay<br>Transparent Mode<br>An to Bn or Bn to An               | CL = 50pF<br>RL = 500Ω   | 1.5                  | 8.5  | 1.5                 | 10.0 | 1.5                    | 6.5  | 1.5                 | 7.5  | ns   |
| tPLH<br>tPHL | Propagation Delay<br>LEBA to An, LEAB to Bn                                 |                          | 1.5                  | 12.5 | 1.5                 | 14.0 | 1.5                    | 8.0  | 1.5                 | 9.0  | ns   |
| tPZH<br>tPZL | Output Enable Time<br>OEBA or OEAB to An or Bn<br>CEBA or CEAB to An or Bn  |                          | 1.5                  | 12.0 | 1.5                 | 14.0 | 1.5                    | 9.0  | 1.5                 | 10.0 | ns   |
| tPHZ<br>tPLZ | Output Disable Time<br>OEBA or OEAB to An or Bn<br>CEBA or CEAB to An or Bn |                          | 1.5                  | 9.0  | 1.5                 | 13.0 | 1.5                    | 7.5  | 1.5                 | 8.5  | ns   |
| tsu          | Set-up Time, HIGH or LOW<br>An or Bn to LEBA or LEAB                        |                          | 3.0                  | —    | 3.0                 | —    | 2.0                    | —    | 2.0                 | —    | ns   |
| th           | Hold Time, HIGH or LOW<br>An or Bn to LEBA or LEAB                          |                          | 2.0                  | —    | 2.0                 | —    | 2.0                    | —    | 2.0                 | —    | ns   |
| tw           | LEBA or LEAB Pulse Width<br>LOW   |                          | 5.0                  | —    | 5.0                 | —    | 5.0                    | —    | 5.0                 | —    | ns   |

2513 tbl 09

| Symbol       | Parameter   | Condition <sup>(1)</sup> | FCT543CT/<br>FCT2543CT |      |                     |      | FCT543DT            |      |                     |      | Unit |
|--------------|---|--------------------------|------------------------|------|---------------------|------|---------------------|------|---------------------|------|------|
|              |   |                          | 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. |      |
| tPLH<br>tPHL | Propagation Delay<br>Transparent Mode<br>An to Bn or Bn to An               | CL = 50pF<br>RL = 500Ω   | 1.5                    | 5.3  | 1.5                 | 6.1  | 1.5                 | 4.4  | —                   | —    | ns   |
| tPLH<br>tPHL | Propagation Delay<br>LEBA to An, LEAB to Bn                                 |                          | 1.5                    | 7.0  | 1.5                 | 8.0  | 1.5                 | 5.0  | —                   | —    | ns   |
| tPZH<br>tPZL | Output Enable Time<br>OEBA or OEAB to An or Bn<br>CEBA or CEAB to An or Bn  |                          | 1.5                    | 8.0  | 1.5                 | 9.0  | 1.5                 | 5.4  | —                   | —    | ns   |
| tPHZ<br>tPLZ | Output Disable Time<br>OEBA or OEAB to An or Bn<br>CEBA or CEAB to An or Bn |                          | 1.5                    | 6.5  | 1.5                 | 7.5  | 1.5                 | 4.3  | —                   | —    | ns   |
| tsu          | Set-up Time, HIGH or LOW<br>An or Bn to LEBA or LEAB                        |                          | 2.0                    | —    | 2.0                 | —    | 1.5                 | —    | —                   | —    | ns   |
| th           | Hold Time, HIGH or LOW<br>An or Bn to LEBA or LEAB                          |                          | 2.0                    | —    | 2.0                 | —    | 1.5                 | —    | —                   | —    | ns   |
| tw           | LEBA or LEAB Pulse Width<br>LOW   |                          | 5.0                    | —    | 5.0                 | —    | 3.0 <sup>(3)</sup>  | —    | —                   | —    | ns   |

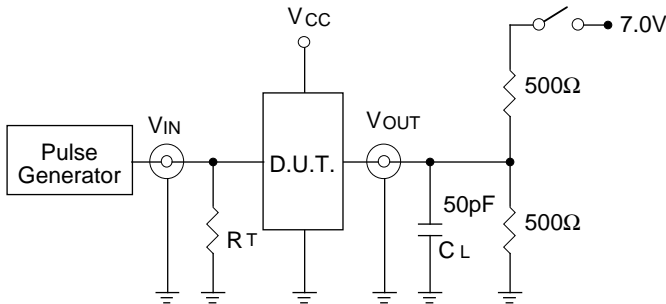
**NOTES:**

1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. This limit is guaranteed but not tested.

2513 tbl 10

## TEST CIRCUITS AND WAVEFORMS

### TEST CIRCUITS FOR ALL OUTPUTS



2513 drw 05

### SWITCH POSITION

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

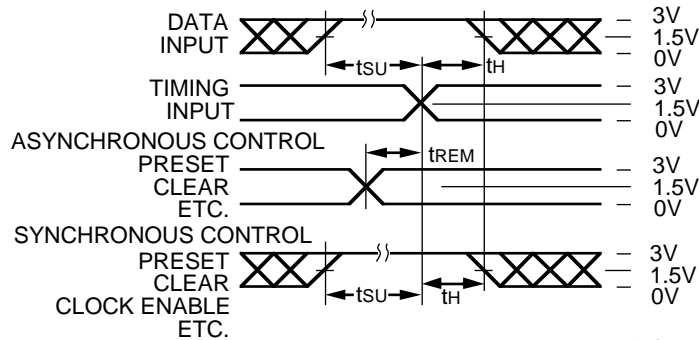
2513 Ink 11

#### DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

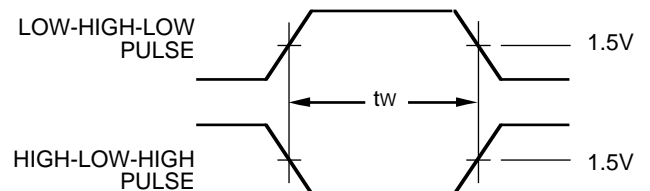
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

### SET-UP, HOLD AND RELEASE TIMES



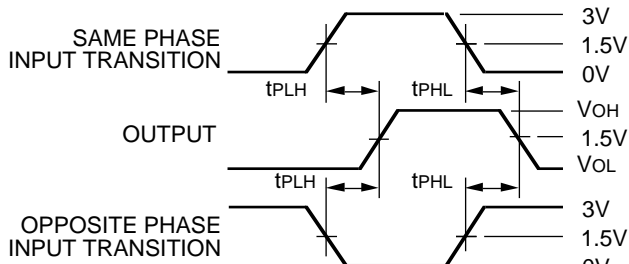
2513 drw 06

### PULSE WIDTH



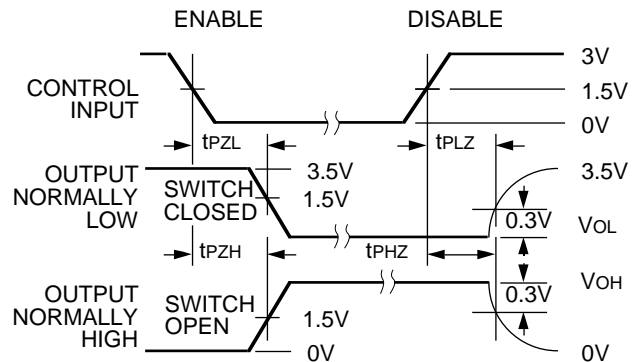
2513 drw 07

### PROPAGATION DELAY



2513 drw 08

### ENABLE AND DISABLE TIMES



2513 drw 09

#### NOTES:

- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
- Pulse Generator for All Pulses: Rate  $\leq$  1.0MHz;  $t_f \leq$  2.5ns;  $t_r \leq$  2.5ns

**ORDERING INFORMATION**

