



Integrated Device Technology, Inc.

FAST CMOS OCTAL D REGISTERS (3-STATE) IDT54/74FCT374T/AT/CT/DT - 2374T/AT/CT
IDT54/74FCT534T/AT/CT
IDT54/74FCT574T/AT/CT/DT - 2574T/AT/CT

FEATURES:

- **Common features:**
 - Low input and output leakage $\leq 1\mu\text{A}$ (max.)
 - CMOS power levels
 - True TTL input and output compatibility
 - $V_{OH} = 3.3\text{V}$ (typ.)
 - $V_{OL} = 0.3\text{V}$ (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 FCT374T/FCT534T/FCT574T:**
 - Std., A, C and D speed grades
 - High drive outputs (-15mA IOH, 48mA IOL)
- **Features for FCT2374T/FCT2574T:**
 - Std., A, and C speed grades
 - Resistor outputs (-15mA IOH, 12mA IOL Com.) (-12mA IOH, 12mA IOL Mil.)
 - Reduced system switching noise

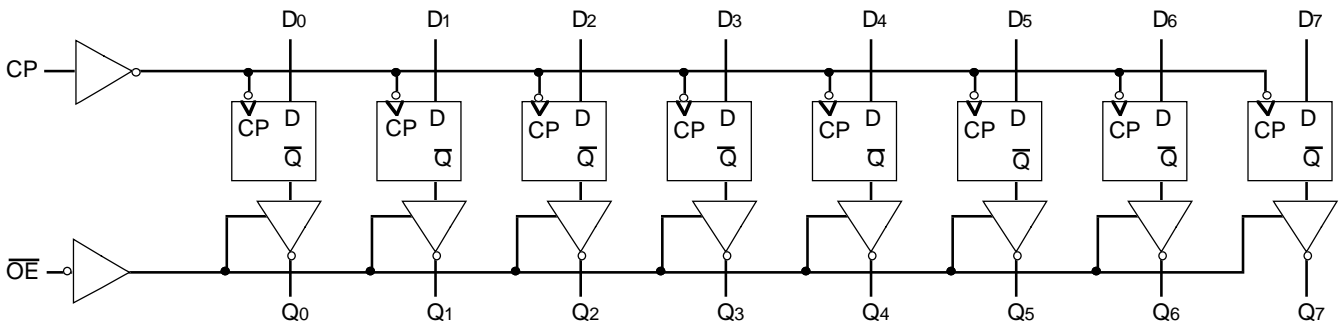
DESCRIPTION

The FCT374T/FCT2374T, FCT534T and FCT574T/FCT2574T are 8-bit registers built using an advanced dual metal CMOS technology. These registers consist of eight D-type flip-flops with a buffered common clock and buffered 3-state output control. When the output enable (\overline{OE}) input is LOW, the eight outputs are enabled. When the \overline{OE} input is HIGH, the outputs are in the high-impedance state.

Input data meeting the set-up and hold time requirements of the D inputs is transferred to the Q outputs on the LOW-to-HIGH transition of the clock input.

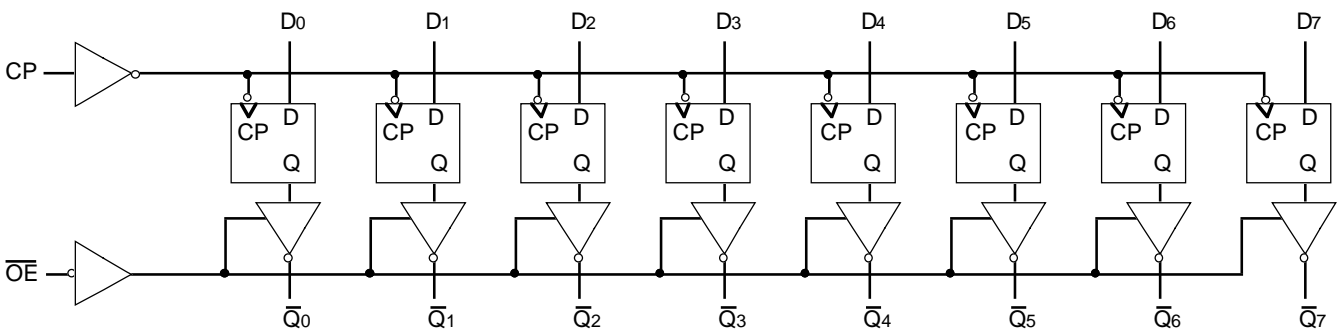
The FCT2374T and FCT2574T have balanced output drive with current limiting resistors. This offers low ground bounce, minimal undershoot and controlled output fall times-reducing the need for external series terminating resistors. FCT2xxxT parts are plug-in replacements for FCTxxxT parts.

FUNCTIONAL BLOCK DIAGRAM FCT374/FCT2374T AND FCT574/FCT2574T



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FUNCTIONAL BLOCK DIAGRAM FCT534T



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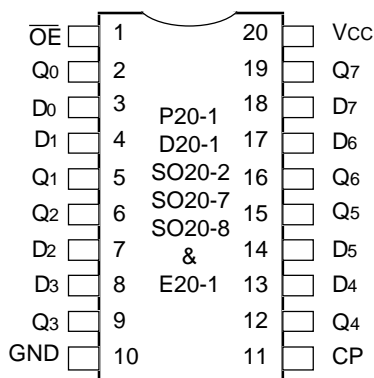
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MILITARY AND COMMERCIAL TEMPERATURE RANGES

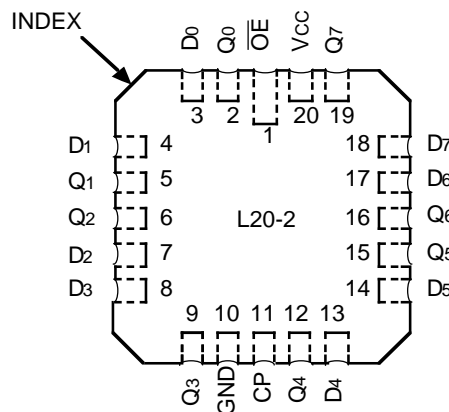
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PIN CONFIGURATIONS

IDT54/74FCT374T



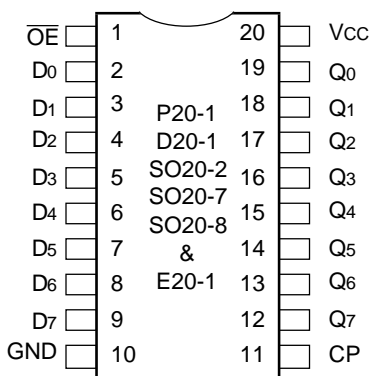
**DIP/SOIC/SSOP/QSOP/CERPACK
TOP VIEW**



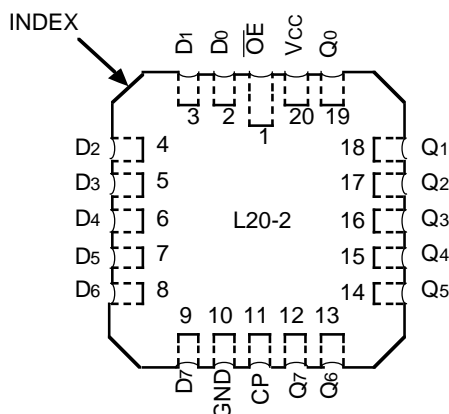
**LCC
TOP VIEW**

2569 drw 03

IDT54/74FCT574T



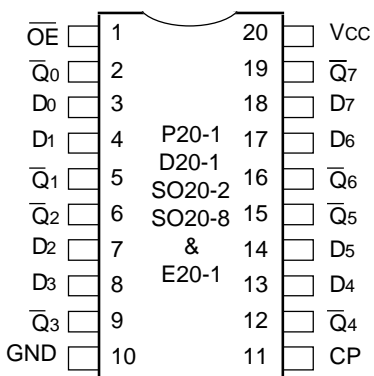
**DIP/SOIC/SSOP/QSOP/CERPACK
TOP VIEW**



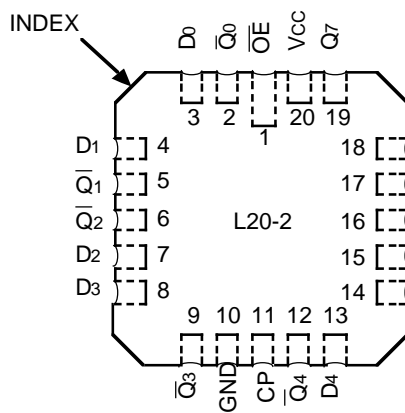
**LCC
TOP VIEW**

2569 drw 04

IDT54/74FCT534T



**DIP/SOIC/QSOP/CERPACK
TOP VIEW**



**LCC
TOP VIEW**

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PIN DESCRIPTION

| Pin Names | Description |
|-----------------|--|
| DN | D flip-flop data inputs |
| CP | Clock Pulse for the register. Enters data on LOW-to-HIGH transition. |
| QN | 3-state outputs, (true) |
| $\overline{Q}N$ | 3-state outputs, (inverted) |
| \overline{OE} | Active LOW 3-state Output Enable input |

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FUNCTION TABLE⁽¹⁾

| Function | Inputs | | | 534 | | 374/574 | |
|---------------|-----------------|----|----|-----------------|----------|---------|-----------------|
| | \overline{OE} | CP | DN | Outputs | Internal | Outputs | Internal |
| | | | | $\overline{Q}N$ | QN | QN | $\overline{Q}N$ |
| HI-Z | H | L | X | Z | NC | Z | NC |
| | H | H | X | Z | NC | Z | NC |
| LOAD REGISTER | L | ↑ | L | H | L | L | H |
| | L | ↑ | H | L | H | H | L |
| | H | ↑ | L | Z | L | Z | H |
| | H | ↑ | H | Z | H | Z | L |

NOTE:

- H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Don't Care
 Z = High Impedance
 NC = No Change
 ↑ = LOW-to-HIGH transition

2569 tbl 02

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| Symbol | Rating | Commercial | Military | Unit |
|----------------------|--------------------------------------|------------------|------------------|------|
| VTERM ⁽²⁾ | Terminal Voltage with Respect to GND | -0.5 to +7.0 | -0.5 to +7.0 | V |
| VTERM ⁽³⁾ | Terminal Voltage with Respect to GND | -0.5 to Vcc +0.5 | -0.5 to Vcc +0.5 | V |
| TA | Operating Temperature | 0 to +70 | -55 to +125 | °C |
| TBIAS | Temperature Under Bias | -55 to +125 | -65 to +135 | °C |
| TSTG | Storage Temperature | -55 to +125 | -65 to +150 | °C |
| PT | Power Dissipation | 0.5 | 0.5 | W |
| IOUT | DC Output Current | -60 to +120 | -60 to +120 | mA |

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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 Vcc by +0.5V unless otherwise noted.
- Input and Vcc terminals only.
- Outputs and I/O terminals only.

CAPACITANCE (TA = +25°C, f = 1.0MHz)

| Symbol | Parameter ⁽¹⁾ | Conditions | Typ. | Max. | Unit |
|--------|--------------------------|------------|------|------|------|
| CIN | Input Capacitance | VIN = 0V | 6 | 10 | pF |
| COU | Output Capacitance | VOU = 0V | 8 | 12 | pF |

NOTE:

- This parameter is measured at characterization but not tested.

2569 Ink 04

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 ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | 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 ⁽⁴⁾ | $V_{CC} = \text{Max.}$ | $V_I = 2.7\text{V}$ | — | — | ± 1 | μA |
| I_{IL} | Input LOW Current ⁽⁴⁾ | | $V_I = 0.5\text{V}$ | — | — | ± 1 | |
| I_{OZH} | High Impedance Output Current (3-State Output pins) ⁽⁴⁾ | $V_{CC} = \text{Max.}$ | $V_O = 2.7\text{V}$ | — | — | ± 1 | μA |
| I_{OZL} | | | $V_O = 0.5\text{V}$ | — | — | ± 1 | |
| I_I | Input HIGH Current ⁽⁴⁾ | $V_{CC} = \text{Max.}, V_I = V_{CC} (\text{Max.})$ | | — | — | ± 1 | μA |
| 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 |

2569 Ink 05

OUTPUT DRIVE CHARACTERISTICS FOR FCT374T/534T/574T

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit |
|----------|-----------------------|--|--|------|---------------------|------|------|
| V_{OH} | Output HIGH Voltage | $V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -6\text{mA MIL.}$ $I_{OH} = -8\text{mA COM'L.}$ | 2.4 | 3.3 | — | V |
| | | | $I_{OH} = -12\text{mA MIL.}$ $I_{OH} = -15\text{mA COM'L.}$ | 2.0 | 3.0 | — | V |
| | | | $I_{OL} = 32\text{mA MIL.}$ $I_{OL} = 48\text{mA COM'L.}$ | — | 0.3 | 0.5 | V |
| I_{OS} | Short Circuit Current | $V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$ | | -60 | -120 | -225 | mA |

2569 Ink 06

OUTPUT DRIVE CHARACTERISTICS FOR FCT2374T/2574T

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | 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 | $V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -12\text{mA MIL.}$ $I_{OH} = -15\text{mA COM'L.}$ | 2.4 | 3.3 | — | V |
| V_{OL} | Output LOW Voltage | $V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$ | $I_{OL} = 12\text{mA}$ | — | 0.3 | 0.50 | V |

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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 $T_A = -55^{\circ}\text{C}$.

POWER SUPPLY CHARACTERISTICS

| Symbol | Parameter | Test Conditions ⁽¹⁾ | | Min. | Typ. ⁽²⁾ | Max. | Unit | |
|---|---|--|--|---------------------|---------------------|------|--------------------|------------|
| ΔI_{CC} | Quiescent Power Supply Current TTL Inputs HIGH | $V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$ | | — | 0.5 | 2.0 | mA | |
| I_{CCD} | Dynamic Power Supply Current ⁽⁴⁾ | $V_{CC} = \text{Max.}$ Outputs Open $\overline{OE} = \text{GND}$ One Input Toggling 50% Duty Cycle | $V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$ | FCTxxxT | — | 0.15 | 0.25 | mA/ MHz |
| | | | | FCT2xxxT | — | 0.06 | 0.12 | |
| I_C | Total Power Supply Current ⁽⁶⁾ | $V_{CC} = \text{Max.}$ Outputs Open $f_{CP} = 10\text{MHz}$ 50% Duty Cycle $\overline{OE} = \text{GND}$ $f_i = 5\text{MHz}$ 50% Duty Cycle One Bit Toggling | $V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$ | FCTxxxT | — | 1.5 | 3.5 | mA |
| | | | | FCT2xxxT | — | 0.6 | 2.2 | |
| | | | $V_{IN} = 3.4$ $V_{IN} = \text{GND}$ | FCTxxxT | — | 2.0 | 5.5 | |
| | | | | FCT2xxxT | | 1.1 | 4.2 | |
| | | | $V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$ | FCTxxxT | — | 3.8 | 7.3 ⁽⁵⁾ | |
| | | | | FCT2xxxT | — | 1.5 | 4.0 ⁽⁵⁾ | |
| $V_{IN} = 3.4$ $V_{IN} = \text{GND}$ | FCTxxxT | — | 6.0 | 16.3 ⁽⁵⁾ | | | | |
| | FCT2xxxT | — | 3.8 | 13.0 ⁽⁵⁾ | | | | |

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 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.
- $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
 $I_C = I_{CC} + \Delta I_{CC} D_{HNT} + I_{CCD} (f_{CP}/2 + f_i N_i)$
 I_{CC} = Quiescent Current
 ΔI_{CC} = Power Supply Current for a TTL High Input ($V_{IN} = 3.4V$)
 D_H = Duty Cycle for TTL Inputs High
 N_T = Number of TTL Inputs at D_H
 I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
 f_{CP} = Clock Frequency for Register Devices (Zero for Non-Register Devices)
 f_i = Input Frequency
 N_i = Number of Inputs at f_i
 All currents are in milliamps and all frequencies are in megahertz.

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SWITCHING CHARACTERISTICS OVER OPERATING RANGE

| Symbol | Parameter | Conditions ⁽¹⁾ | FCT374T/534T/574T FCT2374T/2574T | | | | FCT374AT/534AT/574AT FCT2374AT/2574AT | | | | Unit |
|--------------|--|---------------------------|-------------------------------------|------|---------------------|------|--|------|---------------------|------|------|
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
| | | | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | |
| tPLH tPHL | Propagation Delay CP to QN ⁽³⁾ | CL = 50pF RL = 500Ω | 2.0 | 10.0 | 2.0 | 11.0 | 2.0 | 6.5 | 2.0 | 7.2 | ns |
| tPZH tPZL | Output Enable Time | | 1.5 | 12.5 | 1.5 | 14.0 | 1.5 | 6.5 | 1.5 | 7.5 | ns |
| tPHZ tPLZ | Output Disable Time | | 1.5 | 8.0 | 1.5 | 8.0 | 1.5 | 5.5 | 1.5 | 6.5 | ns |
| tsu | Set-up Time HIGH or LOW, DN to CP | | 2.0 | — | 2.0 | — | 2.0 | — | 2.0 | — | ns |
| tH | Hold Time HIGH or LOW, DN to CP | | 1.5 | — | 1.5 | — | 1.5 | — | 1.5 | — | ns |
| tw | CP Pulse Width HIGH or LOW | | 7.0 | — | 7.0 | — | 5.0 | — | 6.0 | — | ns |

2569 tbl 09

| Symbol | Parameter | Conditions ⁽¹⁾ | FCT374CT/534CT/574CT FCT2374CT/2574CT | | | | FCT374DT/574DT | | | | Unit |
|--------------|--|---------------------------|--|------|---------------------|------|---------------------|------|---------------------|------|------|
| | | | Com'l. | | Mil. | | Com'l. | | Mil. | | |
| | | | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | Min. ⁽²⁾ | Max. | |
| tPLH tPHL | Propagation Delay CP to QN ⁽³⁾ | CL = 50pF RL = 500Ω | 2.0 | 5.2 | 2.0 | 6.2 | 2.0 | 4.2 | — | — | ns |
| tPZH tPZL | Output Enable Time | | 1.5 | 5.5 | 1.5 | 6.2 | 1.5 | 4.8 | — | — | ns |
| tPHZ tPLZ | Output Disable Time | | 1.5 | 5.0 | 1.5 | 5.7 | 1.5 | 4.0 | — | — | ns |
| tsu | Set-up Time HIGH or LOW, DN to CP | | 2.0 | — | 2.0 | — | 2.0 | — | — | — | ns |
| tH | Hold Time HIGH or LOW, DN to CP | | 1.5 | — | 1.5 | — | 1.0 | — | — | — | ns |
| tw | CP Pulse Width HIGH or LOW ⁽⁴⁾ | | 5.0 | — | 6.0 | — | 3.0 | — | — | — | ns |

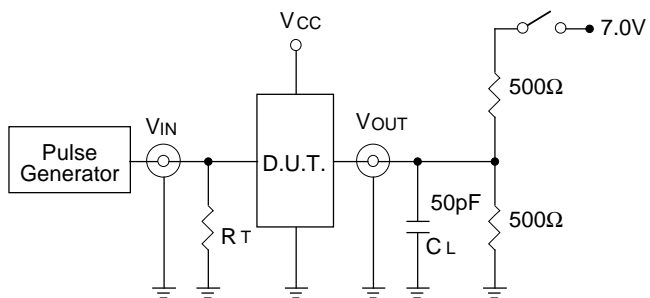
2569 tbl 10

NOTES:

1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. ON for FCT374/2374T and FCT574/2574T, ON for FCT534T.
4. This parameter is guaranteed but not tested.

TEST CIRCUITS AND WAVEFORMS

TEST CIRCUITS FOR ALL OUTPUTS



2569 drw 06

SWITCH POSITION

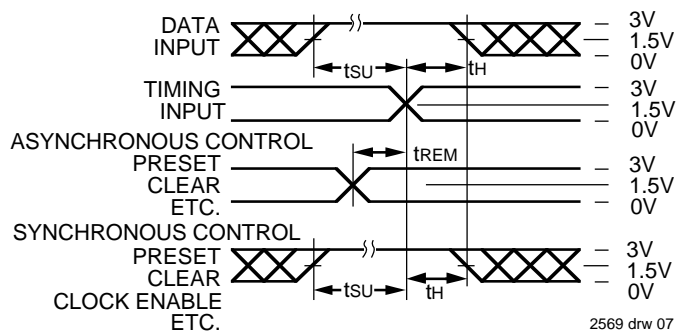
| Test | Switch |
|---|--------|
| Open Drain Disable Low Enable Low | Closed |
| All Other Tests | Open |

DEFINITIONS:

CL = Load capacitance: includes jig and probe capacitance.

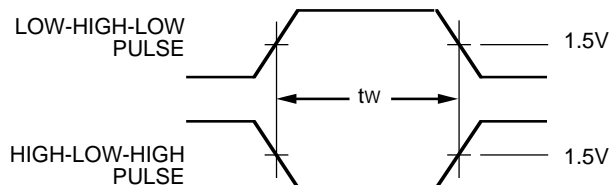
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

SET-UP, HOLD AND RELEASE TIMES



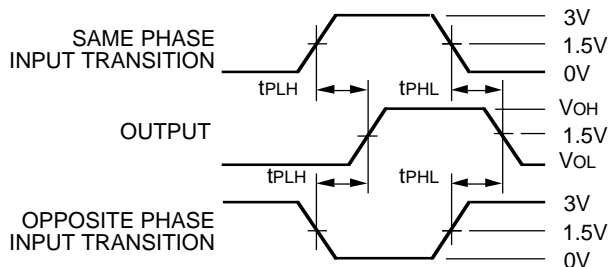
2569 drw 07

PULSE WIDTH



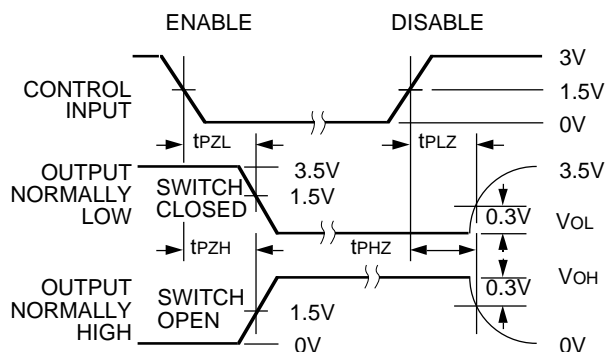
2569 drw 08

PROPAGATION DELAY



2569 drw 09

ENABLE AND DISABLE TIMES

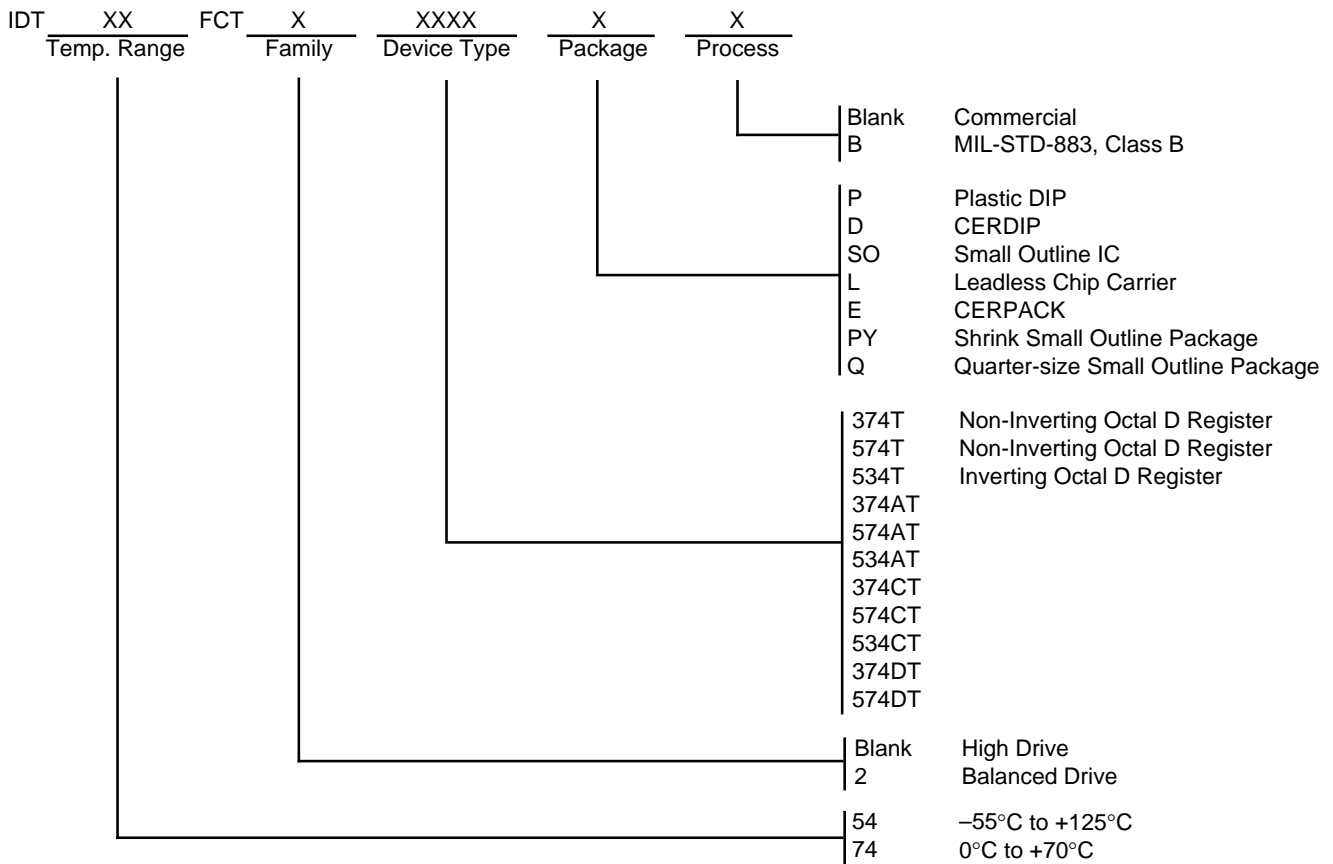


2569 drw 10

NOTES:

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

ORDERING INFORMATION



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