



# FAST CMOS OCTAL TRANSPARENT LATCH

**IDT54/74FCT2373T/AT/CT**

## FEATURES:

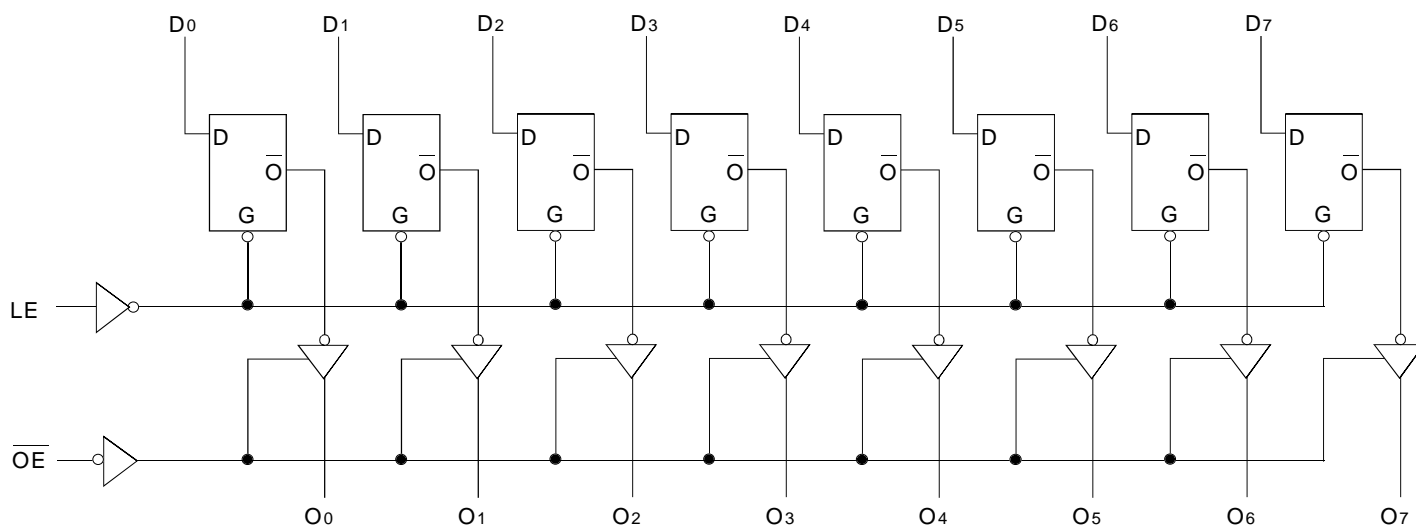
- Low input and output leakage  $\leq 1\mu\text{A}$  (max.)
- CMOS power levels
- True TTL input and output compatibility
  - $V_{OH} = 3.3\text{V}$  (typ.)
  - $V_{OL} = 0.3\text{V}$  (typ.)
- Meets or exceeds JEDEC standard 18 specifications
- Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
- Std., A and C speed grades
- Resistor output (-15mA  $I_{OH}$ , 12mA  $I_{OL}$  Ind.)  
(-12mA  $I_{OH}$ , 12mA  $I_{OL}$  Mil.)
- Reduced system switching noise
- Available in the following packages:
  - Industrial: SOIC, QSOP, TSSOP
  - Military: CERDIP, LCC, CERPACK

## DESCRIPTION:

The FCT2373T is an octal transparent latch built using an advanced dual metal CMOS technology. These octal latches have 3-state outputs and are intended for bus oriented applications. The flip-flops appear transparent to the data when Latch Enable (LE) is high. When LE is low, the data that meets the set-up time is latched. Data appears on the bus when the Output Enable ( $\overline{OE}$ ) is low. When  $\overline{OE}$  is high, the bus output is in the high-impedance state.

The FCT2373T has balanced drive outputs 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 FCT2373T parts are plug-in replacements for FCT373T parts.

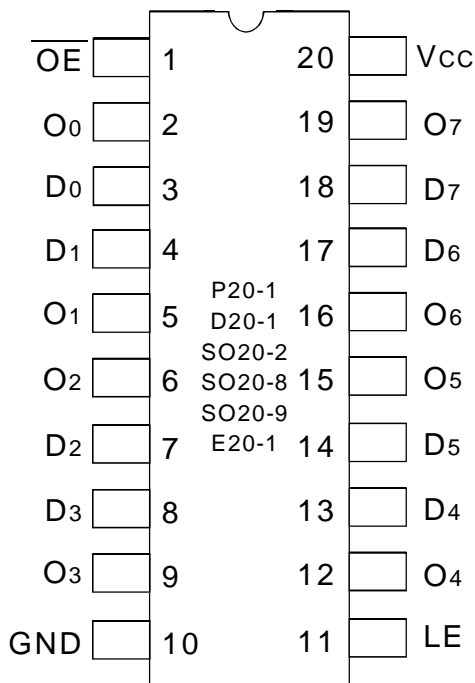
## FUNCTIONAL BLOCK DIAGRAM



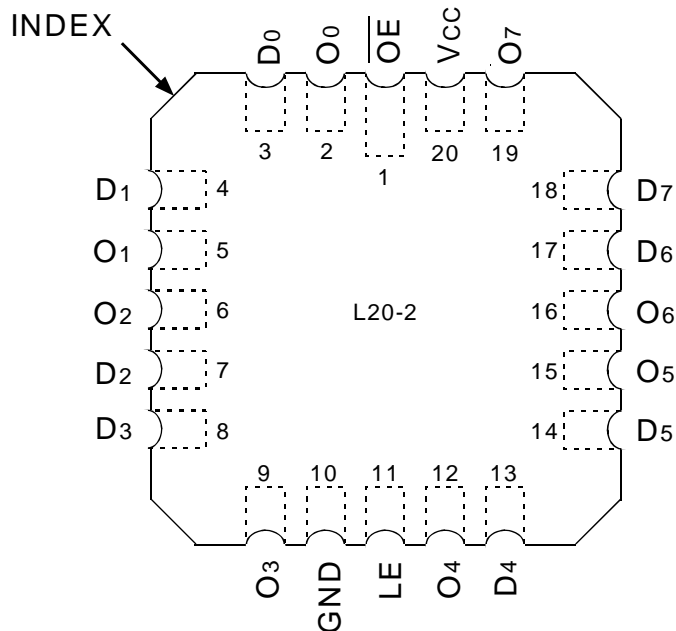
**MILITARY AND INDUSTRIAL TEMPERATURE RANGES**

**MAY 2001**

## PIN CONFIGURATION



DIP/ SOIC/ QSOP/ TSSOP/ CERPACK  
TOP VIEW



LCC  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Rating	Max.	Unit
VTERM <sup>(2)</sup>	Terminal Voltage with Respect to GND	-0.5 to +7	V
VTERM <sup>(3)</sup>	Terminal Voltage with Respect to GND	-0.5 to V <sub>CC</sub> +0.5	V
TSTG	Storage Temperature	-65 to +150	°C
I <sub>OUT</sub>	DC Output Current	-60 to +120	mA

8T-link

### 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.
- Inputs and V<sub>CC</sub> terminals only.
- Outputs and I/O terminals only.

## 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

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### NOTE:

- This parameter is measured at characterization but not tested.

## PIN DESCRIPTION

Pin Names	Description
D <sub>N</sub>	Data Inputs
LE	Latch Enable Input (Active HIGH)
$\overline{OE}$	Output Enable Input (Active LOW)
O <sub>N</sub>	3-State Outputs

## FUNCTION TABLE (1)

Inputs			Outputs
D <sub>N</sub>	LE	$\overline{OE}$	O <sub>N</sub>
L	H	L	L
H	H	L	H
X	X	H	Z

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
Z = High-Impedance

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$ ; 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>	$V_{CC} = \text{Max.}$	$V_I = 2.7\text{V}$	—	—	$\pm 1$	$\mu\text{A}$
$I_{IL}$	Input LOW Current <sup>(4)</sup>		$V_I = 0.5\text{V}$	—	—	$\pm 1$	$\mu\text{A}$
$I_{OZH}$	High Impedance Output Current (3-State output pins) <sup>(4)</sup>	$V_{CC} = \text{Max.}$	$V_O = 2.7\text{V}$	—	—	$\pm 1$	$\mu\text{A}$
$I_{OZL}$			$V_O = 0.5\text{V}$	—	—	$\pm 1$	
$I_I$	Input HIGH Current	$V_{CC} = \text{Max.}, V_I = V_{CC} (\text{Max.})$		—	—	$\pm 1$	$\mu\text{A}$
$V_{IK}$	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	$\mu\text{A}$

## OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions <sup>(1)</sup>		Min.	Typ. <sup>(2)</sup>	Max.	Unit
$I_{ODL}$	Input LOW Current	$V_{CC} = 0\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 1.5\text{V}^{(3)}$		16	48	—	$\mu\text{A}$
$I_{ODH}$	Input HIGH Current	$V_{CC} = 0\text{V}, V_{IN} = V_{IH} \text{ or } V_{IL}, V_{OUT} = 1.5\text{V}^{(3)}$		-16	-48	—	$\mu\text{A}$
$V_{OH}$	Output HIGH Voltage	$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -12\text{mA MIL}$ $I_{OH} = -15\text{mA IND}$	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	0.5	V

### NOTES:

1. For conditions shown as max. or min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at  $V_{CC} = 5.0\text{V}$ ,  $+25^{\circ}\text{C}$  ambient and maximum loading.
3. Not more than one output should be shorted at one time. Duration of the short circuit test should not exceed one second.
4. The test limit for this parameter is  $\pm 5\mu\text{A}$  at  $T_A = -55^{\circ}\text{C}$ .
5. 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	$V_{CC} = \text{Max.}$ $V_{IN} = 3.4V^{(3)}$		—	0.5	2	mA
$I_{CCD}$	Dynamic Power Supply Current <sup>(4)</sup>	$V_{CC} = \text{Max.}$ Outputs Open $\overline{OE} = \text{GND}$ One Input Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	0.06	0.12	mA/ MHz
$I_C$	Total Power Supply Current <sup>(6)</sup>	$V_{CC} = \text{Max.}$ Outputs Open $f_i = 10\text{MHz}$ 50% Duty Cycle $\overline{OE} = \text{GND}$ $LE = V_{CC}$ One Bit Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	—	0.6	2.2	mA
			$V_{IN} = 3.4$ $V_{IN} = \text{GND}$	—	0.9	3.2	
		$V_{CC} = \text{Max.}$ Outputs Open $f_i = 2.5\text{MHz}$ 50% Duty Cycle $\overline{OE} = \text{GND}$ $LE = V_{CC}$ Eight Bits Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$		1.2	3.4 <sup>(5)</sup>	
			$V_{IN} = 3.4$ $V_{IN} = \text{GND}$	—	3.2	11.4 <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.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$

$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$$

$I_{CC} = \text{Quiescent Current}$

$\Delta I_{CC} = \text{Power Supply Current for a TTL High Input } (V_{IN} = 3.4V)$

$D_H = \text{Duty Cycle for TTL Inputs High}$

$N_T = \text{Number of TTL Inputs at } D_H$

$I_{CCD} = \text{Dynamic Current Caused by an Input Transition Pair (HLH or LHL)}$

$f_{CP} = \text{Clock Frequency for Register Devices (Zero for Non-Register Devices)}$

$f_i = \text{Input Frequency}$

$N_i = \text{Number of Inputs at } f_i$

All currents are in milliamps and all frequencies are in megahertz.

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE - INDUSTRIAL (1)**

Symbol	Parameter	Condition <sup>(1)</sup>	FCT2373T		FCT2373AT		FCT2373CT		Unit
			Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay D <sub>N</sub> to O <sub>N</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	8	1.5	5.2	1.5	4.2	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay LE to O <sub>N</sub>		2	13	2	8.5	2	5.5	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time		1.5	12	1.5	6.5	1.5	5.5	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time		1.5	7.5	1.5	5.5	1.5	5	ns
t <sub>SU</sub>	Set-up Time HIGH or LOW, D <sub>N</sub> to LE		2	—	2	—	2	—	ns
t <sub>H</sub>	Hold Time HIGH or LOW, D <sub>N</sub> to LE		1.5	—	1.5	—	1.5	—	ns
t <sub>w</sub>	LE Pulse Width HIGH <sup>(3)</sup>		6	—	5	—	5	—	ns

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE - MILITARY (1)**

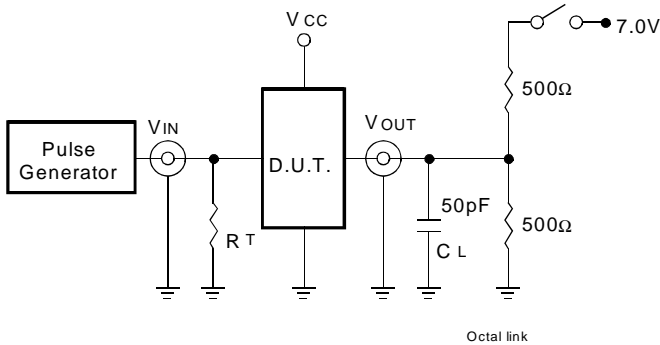
Symbol	Parameter	Condition <sup>(1)</sup>	FCT2373T		FCT2373AT		FCT2373CT		Unit
			Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay D <sub>N</sub> to O <sub>N</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	8.5	1.5	5.6	1.5	5.1	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay LE to O <sub>N</sub>		2	15	2	9.8	2	8	ns
t <sub>PZH</sub> t <sub>PZL</sub>	Output Enable Time		1.5	13.5	1.5	7.5	1.5	6.3	ns
t <sub>PHZ</sub> t <sub>PLZ</sub>	Output Disable Time		1.5	10	1.5	6.5	1.5	5.9	ns
t <sub>SU</sub>	Set-up Time HIGH or LOW, D <sub>N</sub> to LE		2	—	2	—	2	—	ns
t <sub>H</sub>	Hold Time HIGH or LOW, D <sub>N</sub> to LE		1.5	—	1.5	—	1.5	—	ns
t <sub>w</sub>	LE Pulse Width HIGH <sup>(3)</sup>		6	—	6	—	6	—	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 tested.

## TEST CIRCUITS AND WAVEFORMS

### TEST CIRCUITS FOR ALL OUTPUTS



### SWITCH POSITION

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

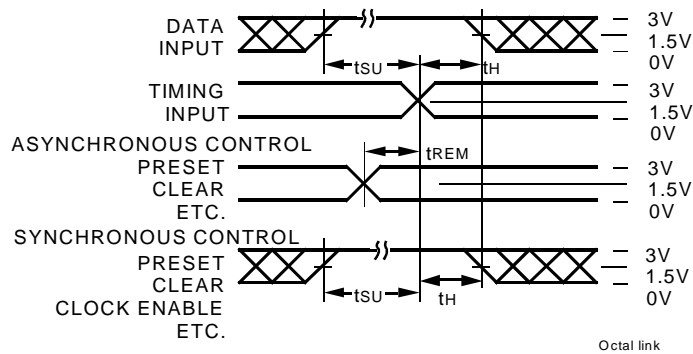
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#### DEFINITIONS:

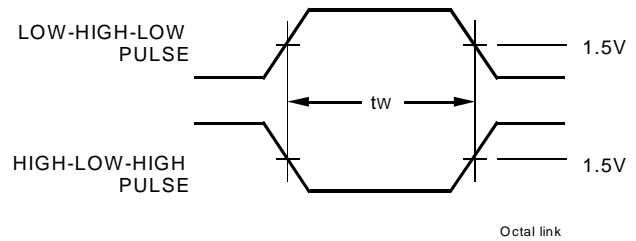
CL = Load capacitance: includes jig and probe capacitance.

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

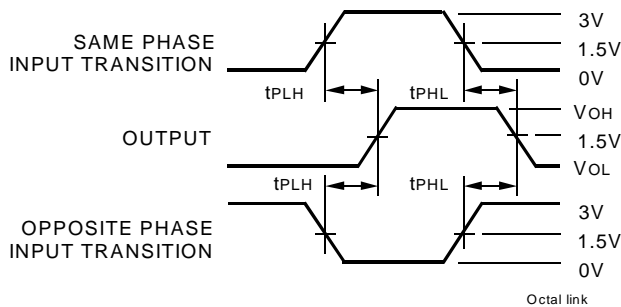
### SET-UP, HOLD, AND RELEASE TIMES



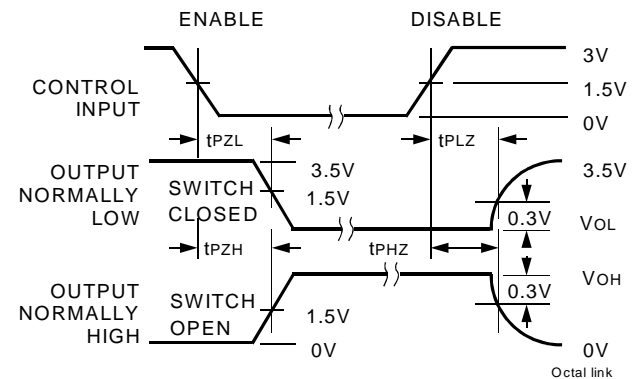
### PULSE WIDTH



### PROPAGATION DELAY



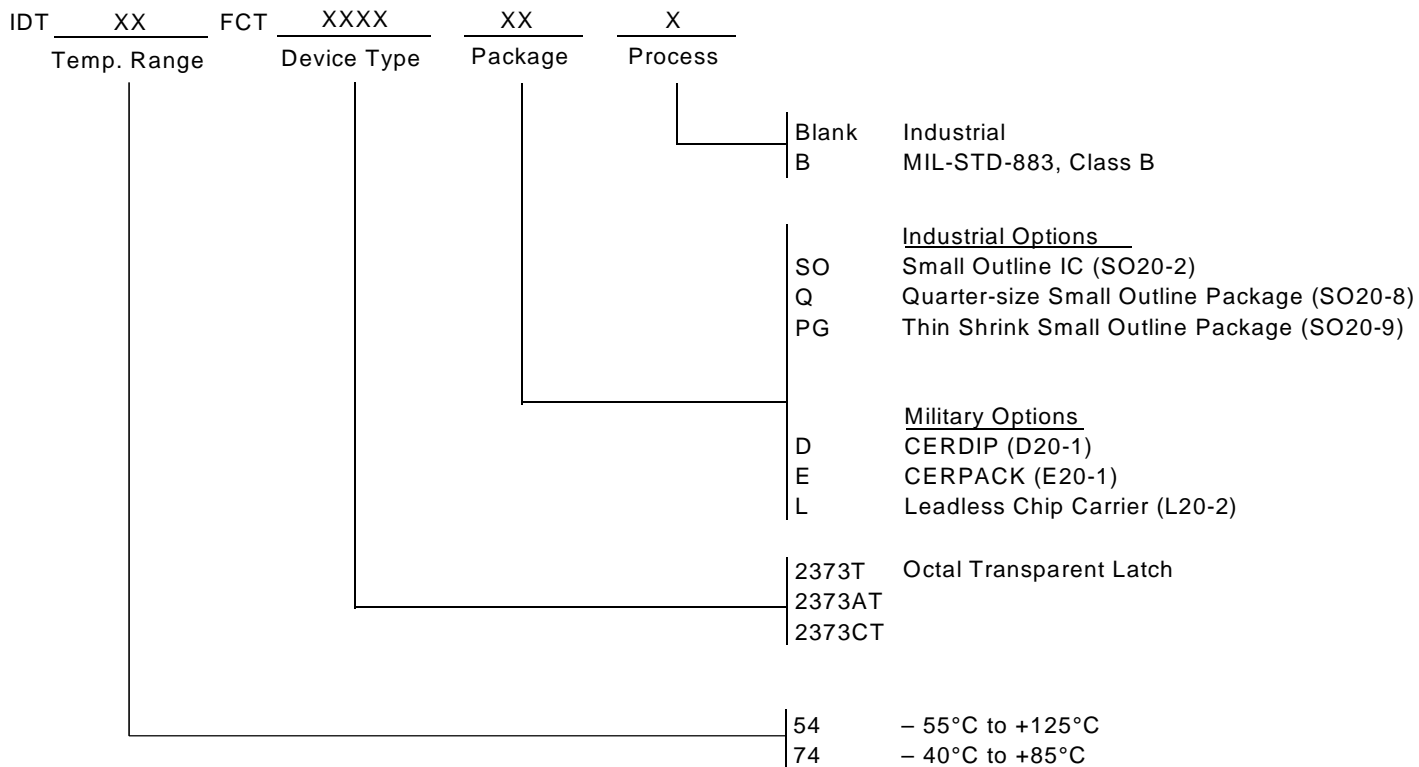
### ENABLE AND DISABLE TIMES



#### 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**



**CORPORATE HEADQUARTERS**  
 2975 Stender Way  
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 800-345-7015 or 408-727-6116  
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