FAST CMOS 18-BIT REGISTER

IDT54/74FCT16823AT/BT/CT/ET

FEATURES:

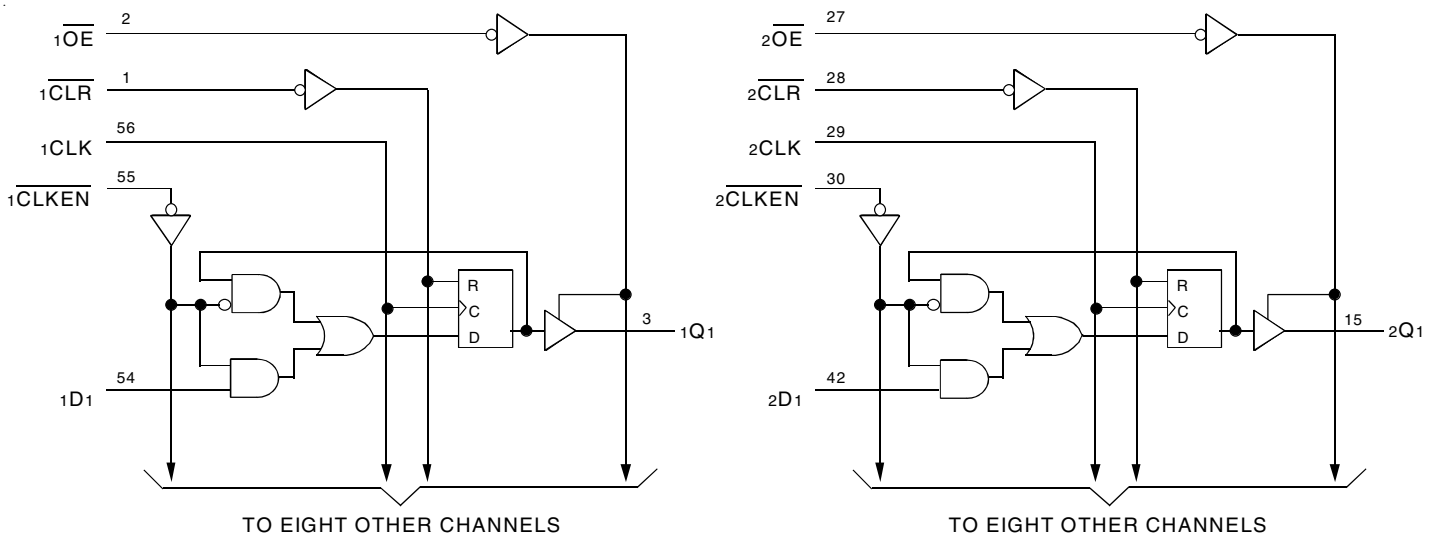
- **0.5 MICRON CMOS Technology**
- **High-speed, low-power CMOS replacement for ABT functions**
- **Typical $t_{SK(o)}$ (Output Skew) < 250ps**
- **Low input and output leakage ≤1µA (max.)**
- **ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model (C = 200pF, R = 0)**
- **V_{CC} = 5V ± 10%**
- **High drive outputs (-32mA I_{OH}, 64mA I_{OL})**
- **Power off disable outputs permit "live insertion"**
- **Typical V_{OLP} (Output Ground Bounce) < 1.0V at V_{CC} = 5V, T_A = 25°C**
- **Available in the following packages:**
  - *Industrial: SSOP, TSSOP*
  - *Military: CERPACK*

DESCRIPTION:

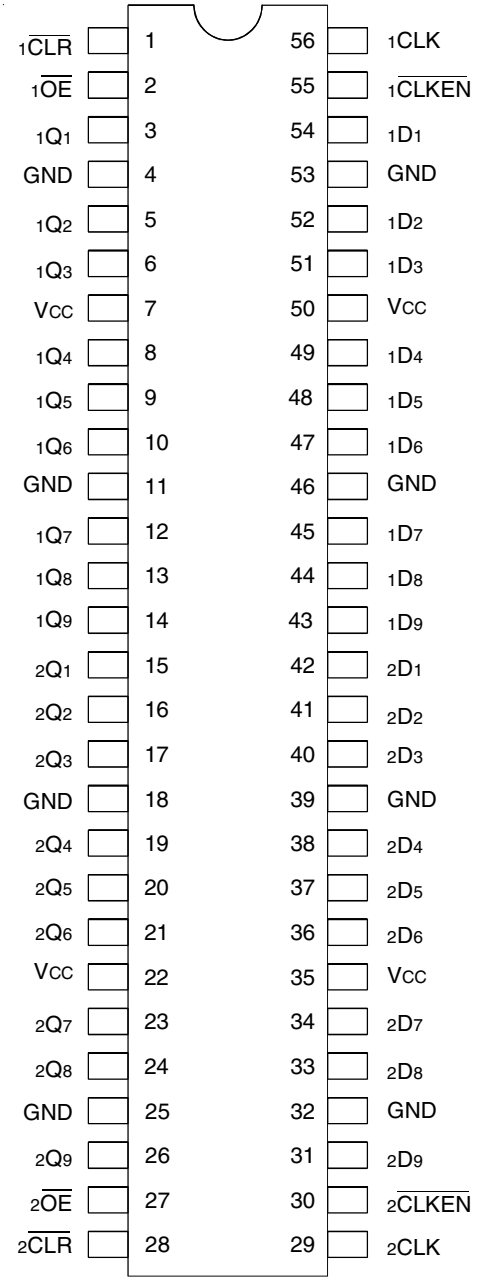
The FCT16823T 18-bit bus interface registers are built using advanced, dual metal CMOS technology. These high-speed, low-power registers with clock enable (x$\overline{CLKEN}$) and clear (x$\overline{CLR}$) controls are ideal for parity bus interfacing in high-performance synchronous systems. The control inputs are organized to operate the device as two 9-bit registers or one 18-bit register. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

The FCT16823T is 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.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



SSOP/ TSSOP/ CERPACK
TOP VIEW

ABSOLUTE MAXIMUM RATINGS(1)

Symbol	Description	Max	Unit
V_{TERM}(2)	Terminal Voltage with Respect to GND	–0.5 to +7	V
V_{TERM}(3)	Terminal Voltage with Respect to GND	–0.5 to V_{CC}+0.5	V
T_{STG}	Storage Temperature	–65 to +150	°C
I_{OUT}	DC Output Current	–60 to +120	mA

NOTES:
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 FCT162XXX Output and I/O terminals.
3. Output and I/O terminals for FCT162XXX.

CAPACITANCE (T_A = +25°C, F = 1.0MHz)

Symbol	Parameter(1)	Conditions	Typ.	Max.	Unit
C_{IN}	Input Capacitance	V_{IN} = 0V	3.5	6	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	3.5	8	pF

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

PIN DESCRIPTION

Pin Names	Description
xDx	Data Inputs
xCLK	Clock Inputs
$x\overline{CLKEN}$	Clock Enable Inputs (Active LOW)
$x\overline{CLR}$	Asynchronous Clear Inputs (Active LOW)
$x\overline{OE}$	Output Enable Inputs (Active LOW)
xQx	3-State Outputs

FUNCTION TABLE(1)

Inputs					Outputs	
$x\overline{OE}$	$x\overline{CLR}$	$x\overline{CLKEN}$	xCLK	xDx	xQx	Function
H	X	X	X	X	Z	High Z
L	L	X	X	X	L	Clear
L	H	H	X	X	Q(2)	Hold
H	H	L	↑	L	Z	Load
H	H	L	↑	H	Z	
L	H	L	↑	L	L	
L	H	L	↑	H	H	

NOTES:
1. H = HIGH Voltage Level
   L = LOW Voltage Level
   X = Don't Care
   Z = High-Impedance
2. Output level before indicated steady-state input conditions were established.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:
Industrial: T_A = –40°C to +85°C, V_{CC} = 5.0V ±10%; Military: T_A = –55°C to +125°C, V_{CC} = 5.0V ±10%

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
V_{IH}	Input HIGH Level	Guaranteed Logic HIGH Level		2	—	—	V
V_{IL}	Input LOW Level	Guaranteed Logic LOW Level		—	—	0.8	V
I_{IH}	Input HIGH Current (Input pins)[5]	V_{CC} = Max.	V_I = V_{CC}	—	—	±1	µA
	Input HIGH Current (I/O pins)[5]			—	—	±1	
I_{IL}	Input LOW Current (Input pins)[5]		V_I = GND	—	—	±1	
	Input LOW Current (I/O pins)[5]			—	—	±1	
I_{OZH}	High Impedance Output Current	V_{CC} = Max.	V_O = 2.7V	—	—	±1	µA
I_{OZL}	(3-State Output pins)[5]		V_O = 0.5V	—	—	±1	
V_{IK}	Clamp Diode Voltage	V_{CC} = Min., I_{IN} = –18mA		—	–0.7	–1.2	V
I_{OS}	Short Circuit Current	V_{CC} = Max., V_O = GND[3]		–80	–140	–250	mA
V_H	Input Hysteresis	—		—	100	—	mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	V_{CC} = Max. V_{IN} = GND or V_{CC}		—	5	500	µA

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions[1]		Min.	Typ.[2]	Max.	Unit
I_O	Output Drive Current	V_{CC} = Max., V_O = 2.5V[3]		–50	—	–180	mA
V_{OH}	Output HIGH Voltage	V_{CC} = Min.	I_{OH} = –3mA	2.5	3.5	—	V
		V_{IN} = V_{IH} or V_{IL}	I_{OH} = –12mA MIL I_{OH} = –15mA IND	2.4	3.5	—	
			I_{OH} = –24mA MIL I_{OH} = –32mA IND[4]	2	3	—	
V_{OH}	Output LOW Voltage	V_{CC} = Min. V_{IN} = V_{IH} or V_{IL}	I_{OL} = 48mA MIL I_{OL} = 64mA IND	—	0.2	0.55	V
I_{OFF}	Input/Output Power Off Leakage[5]	V_{CC} = 0V, V_{IN} or $V_O \leq$ 4.5V		—	—	±1	µA

NOTES:
1. For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient.
3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
4. Duration of the condition can not exceed one second.
5. The test limit for this parameter is ±5µA at T_A = -55°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} = Max. V_{IN} = 3.4V[3]		—	0.5	1.5	mA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC} = Max., Outputs Open xOE = $xCLKEN$ = GND One Input Toggling 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	—	75	120	µA/ MHz
I_C	Total Power Supply Current[6]	V_{CC} = Max., Outputs Open f_{CP} = 10MHz 50% Duty Cycle xOE = $xCLKEN$ = GND fi = 5MHz 50% Duty Cycle One Bit Toggling	V_{IN} = V_{CC} V_{IN} = GND	—	0.8	1.7	mA
			V_{IN} = 3.4V V_{IN} = GND	—	1.3	3.2	
		V_{CC} = Max., Outputs Open f_{CP} = 10MHz 50% Duty Cycle xOE = $xCLKEN$ = GND fi = 2.5MHz 50% Duty Cycle Eighteen Bits Toggling	V_{IN} = V_{CC} V_{IN} = GND	—	4.2	7.1[5]	
			V_{IN} = 3.4V V_{IN} = GND	—	9.2	22.1[5]	

NOTES:
1. For conditions shown as Min. or Max., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 5.0V, +25°C ambient.
3. Per TTL driven input (V_{IN} = 3.4V). All other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
5. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
   $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP} N_{CP}/2 + f_i N_i)$
   I_{CC} = Quiescent Current (I_{CCL}, I_{CCH} and I_{CCZ})
   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)
   N_{CP} = Number of Clock Inputs at f_{CP}
   f_i = Input Frequency
   N_i = Number of Inputs at f_i

SWITCHING CHARACTERISTICS OVER OPERATING RANGE - INDUSTRIAL

Symbol	Parameter	Condition[1]	FCT16823AT		FCT16823BT		FCT16823CT		FCT16823ET		Unit
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay CLK to xQx	C_L = 50pF R_L = 500Ω	1.5	10	1.5	7.5	1.5	6	1.5	4.4	ns
		C_L = 300pF[5] R_L = 500Ω	1.5	20	1.5	15	1.5	12.5	1.5	8	
t_{PHL}	Propagation Delay x$\overline{CLR}$ to xQx	C_L = 50pF R_L = 500Ω	1.5	14	1.5	9	1.5	6.1	1.5	4.4	ns
t_{PHZ} t_{PLZ}	Output EnableTime x$\overline{OE}$ to xQx	C_L = 50pF R_L = 500Ω	1.5	12	1.5	8	1.5	5.5	1.5	4.4	ns
		C_L = 300pF[5] R_L = 500Ω	1.5	23	1.5	15	1.5	12.5	1.5	9	ns
t_{PHZ}	Output Disable Time x$\overline{OE}$ to xQx	C_L = 5pF[5] R_L = 500Ω	1.5	7	1.5	6.5	1.5	5.2	1.5	3.6	ns
		C_L = 50pF) R_L = 500Ω	1.5	8	1.5	7.5	1.5	6.5	1.5	3.6	ns
t_{SU}	Set-up Time HIGH or LOW, xDx to xCLK	C_L = 50pF R_L = 500Ω	3	—	3	—	2	—	1.5	—	ns
t_H	Hold Time HIGH or LOW, xDx to xCLK		1.5	—	1.5	—	1.5	—	0	—	ns
t_{SU}	Set-up Time HIGH or LOW, x$\overline{CLKEN}$ to xCLK		3	—	3	—	3	—	2.5	—	ns
t_H	Hold Time HIGH or LOW, x$\overline{CLKEN}$ to xCLK		0	—	0	—	0	—	0	—	ns
t_W	xCLK Pulse Width HIGH or LOW		6	—	6	—	3.3	—	3[4]	—	ns
t_W	x$\overline{CLR}$ Pulse Width LOW		6	—	6	—	3.3	—	3[4]	—	ns
t_{REM}	Recovery Time x$\overline{CLR}$ to xCLK		6	—	6	—	6	—	3	—	ns
$t_{SK(o)}$	Output Skew[3]		—	0.5	—	0.5	—	0.5	—	0.5	ns

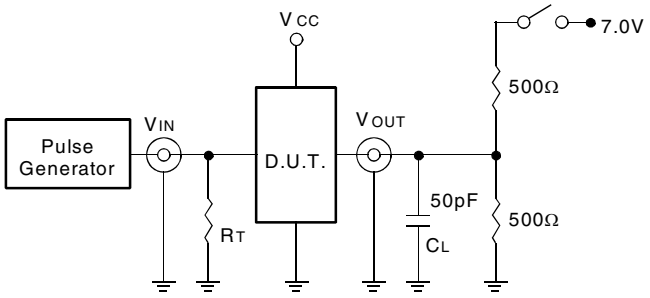
NOTES:
1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. Skew between any two outputs, of the same package, switching in the same direction. This parameter is guaranteed by design.
4. This limit is guaranteed but not tested.
5. This condition is guaranteed but not tested.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE - MILITARY

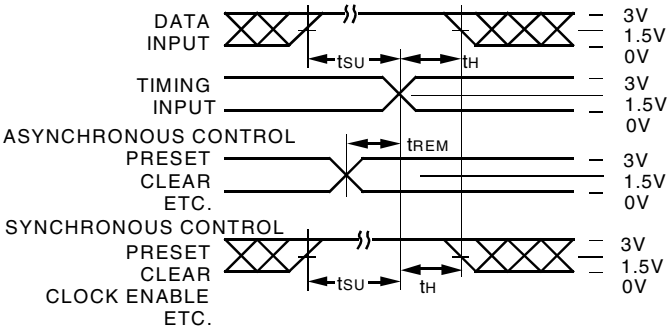
Symbol	Parameter	Condition[1]	FCT16823AT		FCT16823BT		FCT16823CT		Unit
			Min.[2]	Max.	Min.[2]	Max.	Min.[2]	Max.	
t_{PLH} t_{PHL}	Propagation Delay CLK to xQx	C_L = 50pF R_L = 500Ω	1.5	11.5	1.5	8.5	1.5	7	ns
		C_L = 300pF[5] R_L = 500Ω	1.5	20	1.5	16	1.5	13.5	
t_{PHL}	Propagation Delay x$\overline{CLR}$ to xQx	C_L = 50pF R_L = 500Ω	1.5	15	1.5	9.5	1.5	8.5	ns
t_{PHZ} t_{PLZ}	Output EnableTime x$\overline{OE}$ to xQx	C_L = 50pF R_L = 500Ω	1.5	13	1.5	9	1.5	8	ns
		C_L = 300pF[5] R_L = 500Ω	1.5	25	1.5	16	1.5	13.5	ns
t_{PHZ}	Output Disable Time x$\overline{OE}$ to xQx	C_L = 5pF[5] R_L = 500Ω	1.5	8	1.5	7	1.5	6.2	ns
		C_L = 50pF) R_L = 500Ω	1.5	9	1.5	8	1.5	6.5	ns
t_{SU}	Set-up Time HIGH or LOW, xDx to xCLK	C_L = 50pF R_L = 500Ω	4	—	3	—	3	—	ns
t_H	Hold Time HIGH or LOW, xDx to xCLK		2	—	1.5	—	1.5	—	ns
t_{SU}	Set-up Time HIGH or LOW, x$\overline{CLKEN}$ to xCLK		4	—	3	—	3	—	ns
t_H	Hold Time HIGH or LOW, x$\overline{CLKEN}$ to xCLK		2	—	0	—	0	—	ns
t_W	xCLK Pulse Width HIGH or LOW		7	—	6	—	6	—	ns
t_W	x$\overline{CLR}$ Pulse Width LOW		7	—	6	—	6	—	ns
t_{REM}	Recovery Time x$\overline{CLR}$ to xCLK		7	—	6	—	6	—	ns
$t_{SK(o)}$	Output Skew[3]		—	0.5	—	0.5	—	0.5	ns

NOTES:
1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. Skew between any two outputs, of the same package, switching in the same direction. This parameter is guaranteed by design.
4. This limit is guaranteed but not tested.
5. This condition is guaranteed but not tested.

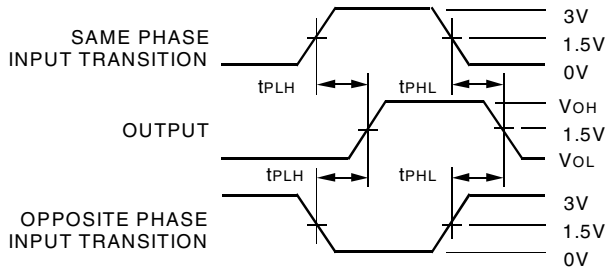
TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-up, Hold, and Release Times



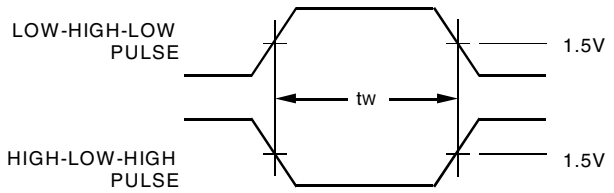
Propagation Delay

SWITCH POSITION

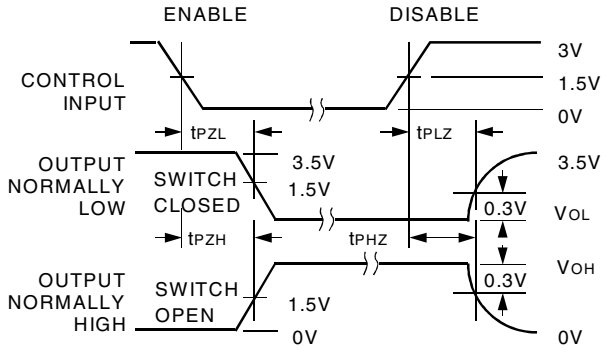
Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

DEFINITIONS:

C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.



Pulse Width

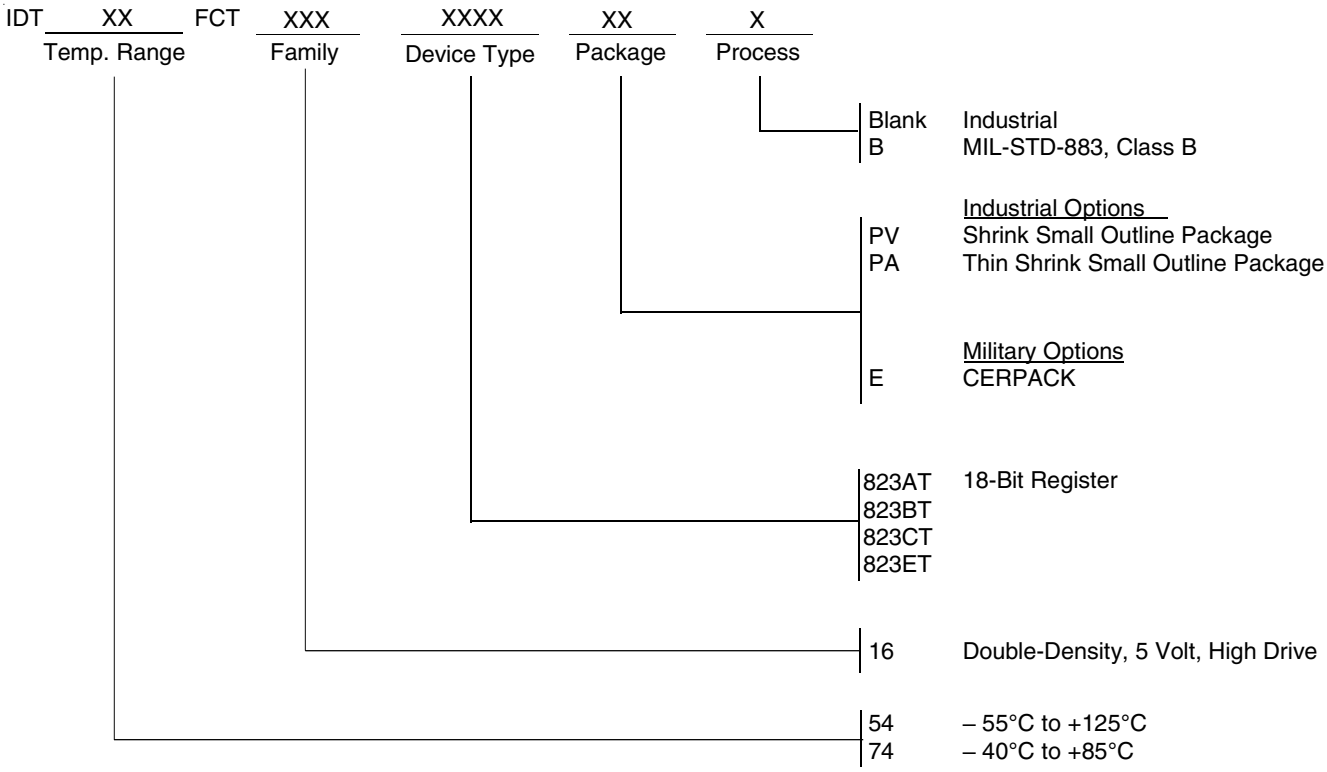


Enable and Disable Times

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
2. Pulse Generator for All Pulses: Rate ≤ 1.0MHz; t_F ≤ 2.5ns; t_R ≤ 2.5ns.

ORDERING INFORMATION



DATA SHEET DOCUMENT HISTORY

5/21/2002 Removed TVSOP package

CORPORATE HEADQUARTERS
2975 Stender Way
Santa Clara, CA 95054

for SALES:
800-345-7015 or 408-727-6116
fax: 408-492-8674
www.idt.com

for Tech Support:
logichelp@idt.com
(408) 654-6459