



FAST CMOS OCTAL D FLIP-FLOP WITH MASTER RESET

IDT54/74FCT273T/AT/CT

FEATURES:

- Std., A, and C grades
- Low input and output leakage $\leq 1\mu\text{A}$ (max.)
- CMOS power levels
- True TTL input and output compatibility:
 - $V_{OH} = 3.3V$ (typ.)
 - $V_{OL} = 0.3V$ (typ.)
- High Drive outputs (-15mA I_{OH} , 48mA I_{OL})
- Meets or exceeds JEDEC standard 18 specifications
- Military product compliant to MIL-STD-883, Class B and DESC listed (dual marked)
- Power off disable outputs permit "live insertion"
- Available in the following packages:
 - Industrial: SOIC, SSOP, QSOP
 - Military: CERDIP, LCC

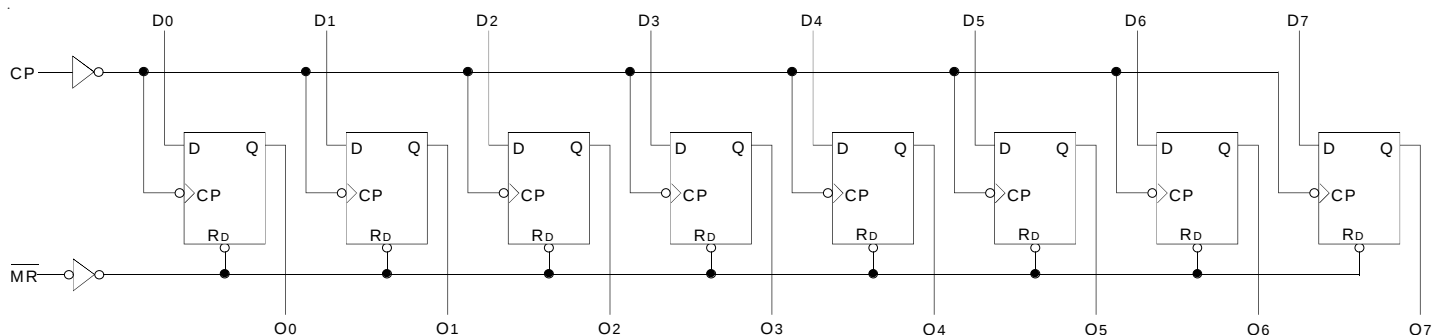
DESCRIPTION:

The FCT273T is an octal D flip-flop built using an advanced dual metal CMOS technology. The FCT273T has eight edge-triggered D-type flip-flops with individual D inputs and O outputs. The common buffered Clock (CP) and Master Reset ($\overline{MR}$) inputs load and reset (clear) all flip-flops simultaneously.

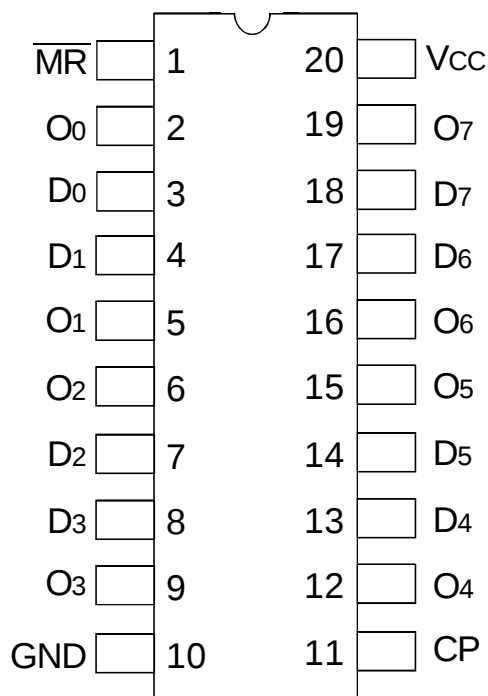
The register is fully edge-triggered. The state of each D input, one set-up time before the low-to-high clock transition, is transferred to the corresponding flip-flop's O output.

All outputs will be forced low independently of Clock or Data inputs by a low voltage level on the $\overline{MR}$ input. The device is useful for applications where the true output only is required and the Clock and Master Reset are common to all storage elements.

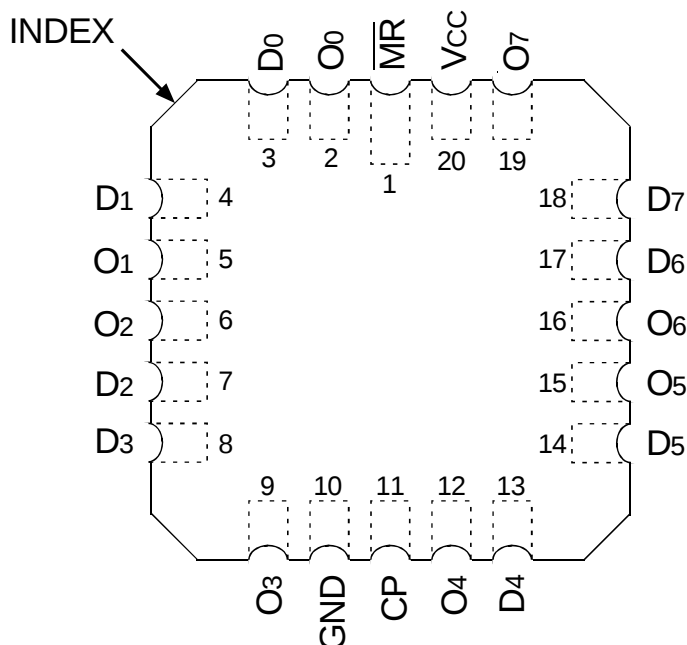
FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



CERDIP/ SOIC/ SSOP/ QSOP
TOP VIEW



LCC
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. No terminal voltage may exceed V_{CC} by +0.5V unless otherwise noted.
2. Inputs and V_{CC} terminals only.
3. Output and I/O terminals only.

CAPACITANCE (T_A = +25°C, F = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ.	Max.	Unit
C _{IN}	Input Capacitance	V _{IN} = 0V	6	10	pF
C _{OUT}	Output Capacitance	V _{OUT} = 0V	8	12	pF

NOTE:

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

PIN DESCRIPTION

Pin Names	Description
D _x	Data Inputs
$\overline{\text{MR}}$	Master Reset (Active LOW)
CP	Clock Pulse Input (Active Rising Edge)
O _x	Data Outputs

FUNCTION TABLE⁽¹⁾

Operating Mode	Inputs			Outputs
	$\overline{\text{MR}}$	CP	D _x	O _x
Reset (Clear)	L	X	X	L
Load "1"	L	↑	h	H
Load "0"	H	↑	l	L

NOTE:

1. H = HIGH voltage level steady state
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH clock transition
L = LOW voltage level steady state
l = LOW voltage level one set-up time prior to the LOW-to-HIGH clock transition
X = Don't Care
↑ = LOW-to-HIGH Clock Transition

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 ⁽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 ⁽⁴⁾	$V_{CC} = \text{Max.}$	$V_I = 2.7\text{V}$	—	—	± 1	μA
I_{IL}	Input LOW Current ⁽⁴⁾	$V_{CC} = \text{Max.}$	$V_I = 0.5\text{V}$	—	—	± 1	μA
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
I_{OS}	Short Circuit Current	$V_{CC} = \text{Max.}, V_O = \text{GND}^{(3)}$		-60	-120	-225	mA
V_{OH}	Output HIGH Voltage	$V_{CC} = \text{Min}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -6\text{mA MIL}$ $I_{OH} = -8\text{mA IND}$	2.4	3.3	—	V
			$I_{OH} = -12\text{mA MIL}$ $I_{OH} = -15\text{mA IND}$	2	3	—	
V_{OL}	Output LOW Voltage	$V_{CC} = \text{Min}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 32\text{mA MIL}$ $I_{OL} = 48\text{mA IND}$	—	0.3	0.5	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

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 $V_{CC} = 5.0\text{V}$, $+25^{\circ}\text{C}$ ambient.
3. Not more than one output should be tested at one time. Duration of the test should not exceed one second.
4. The test limit for this parameter is $\pm 5\mu\text{A}$ at $T_A = -55^{\circ}\text{C}$.

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	mA
I_{CCD}	Dynamic Power Supply Current ⁽⁴⁾	$V_{CC} = \text{Max.}$ Outputs Open $\overline{MR} = V_{CC}$ One Input Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = GND$	—	0.15	0.25	mA/ MHz
I_C	Total Power Supply Current ⁽⁶⁾	$V_{CC} = \text{Max.}$ Outputs Open $f_{CP} = 10\text{MHz}$ 50% Duty Cycle $\overline{MR} = V_{CC}$ One Bit Toggling $f_i = 5\text{MHz}$ 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = GND$	—	1.5	3.5	mA
			$V_{IN} = 3.4V$ $V_{IN} = GND$	—	2	5.5	
		$V_{CC} = \text{Max.}$ Outputs Open $f_{CP} = 10\text{MHz}$ 50% Duty Cycle $\overline{MR} = V_{CC}$ Eight Bits Toggling $f_i = 2.5\text{MHz}$ 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = GND$	—	3.8	7.3 ⁽⁵⁾	
			$V_{IN} = 3.4V$ $V_{IN} = GND$	—	6	16.3 ⁽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 ΔI_{CC} formula. These limits are guaranteed but not tested.

6. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$

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

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

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

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

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

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

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

$f_i = \text{Output Frequency}$

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

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

SWITCHING CHARACTERISTICS OVER OPERATING RANGE - INDUSTRIAL

Symbol	Parameter	Condition ⁽¹⁾	74FCT273AT		74FCT273CT		Unit
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
t _{PLH} t _{PHL}	Propagation Delay CP to O _x	C _L = 50pF R _L = 500Ω	2	7.2	2	5.8	ns
t _{PLH} t _{PHL}	Propagation Delay $\overline{\text{MR}}$ to O _x		2	7.2	2	6.1	ns
t _{SU}	Set-up Time HIGH or LOW D _x to CP		2	—	2	—	ns
t _H	Hold Time HIGH or LOW D _x to CP		1.5	—	1.5	—	ns
t _w	CP Pulse Width HIGH or LOW		6	—	6	—	ns
t _w	$\overline{\text{MR}}$ Pulse Width LOW		6	—	6	—	ns
t _{REM}	Recovery Time $\overline{\text{MR}}$ to CP		2	—	2	—	ns

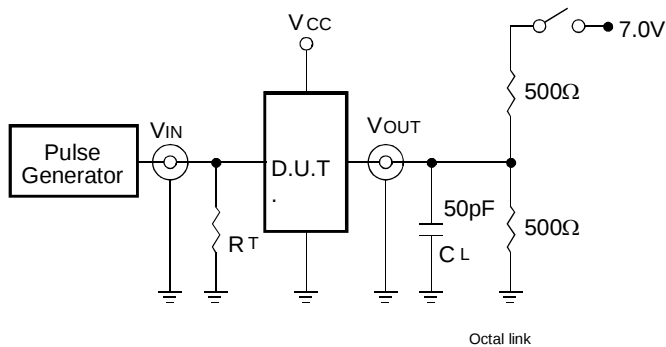
SWITCHING CHARACTERISTICS OVER OPERATING RANGE - MILITARY

Symbol	Parameter	Condition ⁽¹⁾	54FCT273T		54FCT273AT		54FCT273CT		Unit
			Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	Min. ⁽²⁾	Max.	
t _{PLH} t _{PHL}	Propagation Delay CP to O _x	C _L = 50pF R _L = 500Ω	2	15	2	8.3	2	6.5	ns
t _{PLH} t _{PHL}	Propagation Delay $\overline{\text{MR}}$ to O _x		2	15	2	8.3	2	6.8	ns
t _{SU}	Set-up Time HIGH or LOW D _x to CP		3.5	—	2	—	2	—	ns
t _H	Hold Time HIGH or LOW D _x to CP		2	—	1.5	—	1.5	—	ns
t _w	CP Pulse Width HIGH or LOW		7	—	6	—	6	—	ns
t _w	$\overline{\text{MR}}$ Pulse Width LOW		7	—	6	—	6	—	ns
t _{REM}	Recovery Time $\overline{\text{MR}}$ to CP		5	—	2.5	—	2.5	—	ns

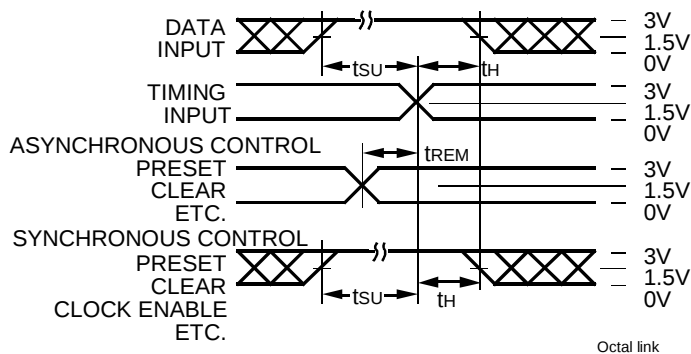
NOTES:

1. See test circuit and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.

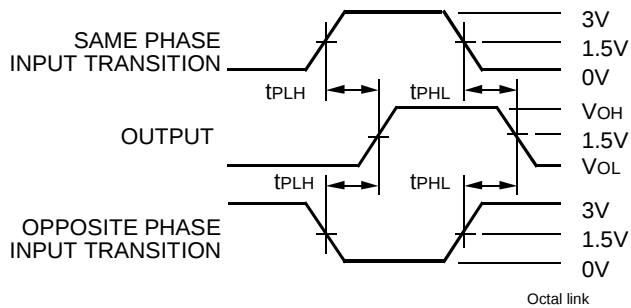
TEST CIRCUITS AND WAVEFORMS



Test Circuits for All Outputs



Set-Up, Hold, and Release Times



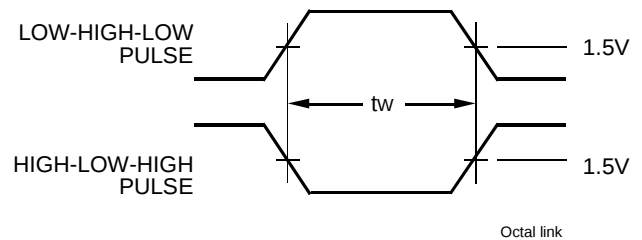
Propagation Delay

SWITCH POSITION

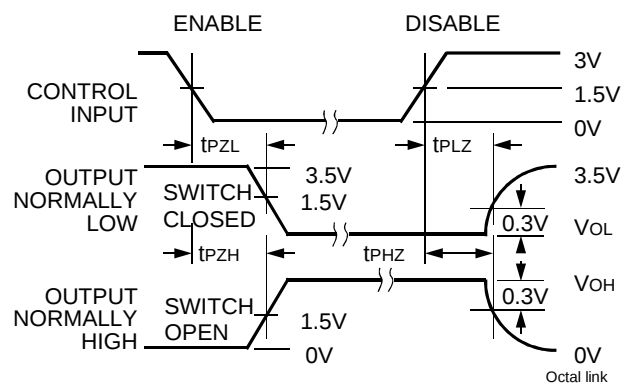
Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

DEFINITIONS:

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



Pulse Width



Enable and Disable Times

NOTES:

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

ORDERING INFORMATION

IDT	XX	FCT	XXXX	XX	X		
Temp. Range		Device Type		Package	Process		
					Blank	Industrial	
					B	MIL-STD-883, Class B	
						<u>Industrial Options</u>	
					SO	Small Outline IC	
					PY	Shrink Small Outline Package	
					Q	Quarter-size Small Outline Package	
						<u>Military Options</u>	
					D	CERDIP	
					L	Leadless Chip Carrier	
					273T	Octal D Flip-Flop with Master Reset	
					273AT		
					273CT		
					54	– 55°C to +125°C	
					74	– 40°C to +85°C	



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