



Integrated Device Technology, Inc.

# FAST CMOS OCTAL FLIP-FLOP WITH MASTER RESET

**IDT54/74FCT273**  
**IDT54/74FCT273A**  
**IDT54/74FCT273C**

## FEATURES:

- IDT54/74FCT273 equivalent to FAST™ speed;
- **IDT54/74FCT273A 45% faster than FAST**
- **IDT54/74FCT273C 55% faster than FAST**
- Equivalent to FAST output drive over full temperature and voltage supply extremes
- IOL = 48mA (commercial) and 32mA (military)
- CMOS power levels (1mW typ. static)
- TTL input and output level compatible
- CMOS output level compatible
- Substantially lower input current levels than FAST (5µA max.)
- Octal D flip-flop with Master Reset
- JEDEC standard pinout for DIP and LCC
- Product available in Radiation Tolerant and Radiation Enhanced versions
- Military product compliant to MIL-STD-883, Class B

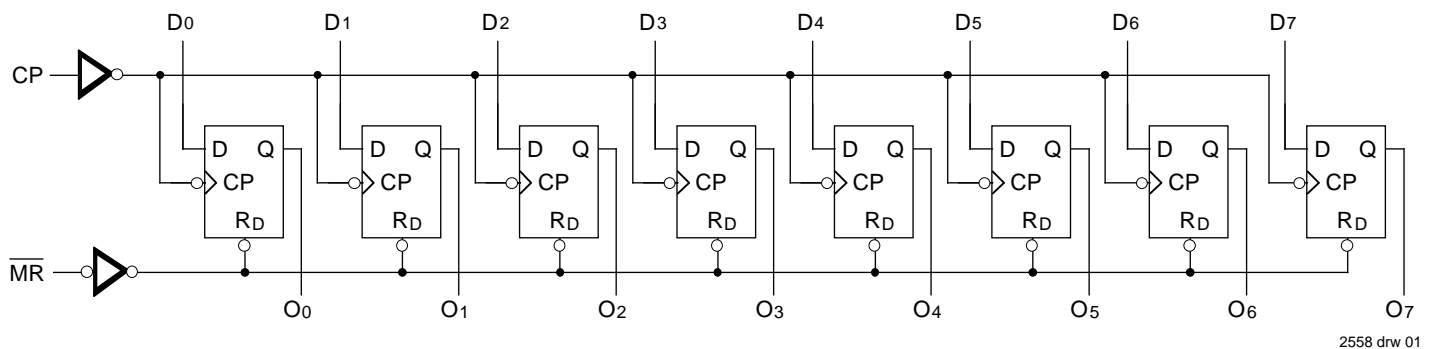
## DESCRIPTION:

The IDT54/74FCT273/A/C are octal D flip-flops built using an advanced dual metal CMOS technology. The IDT54/74FCT273/A/C have 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.

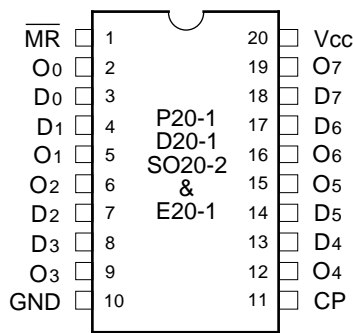
The register is fully edge-triggered. The state of each D input, one set-up time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's O output.

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.

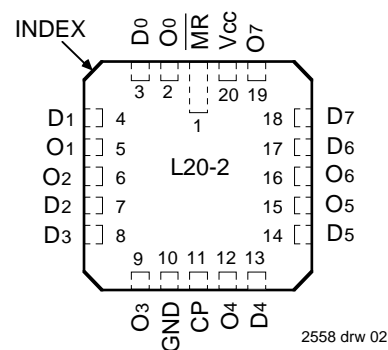
## FUNCTIONAL BLOCK DIAGRAM



## PIN CONFIGURATIONS



**DIP/SOIC/CERPACK  
TOP VIEW**



**LCC  
TOP VIEW**

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**MILITARY AND COMMERCIAL TEMPERATURE RANGES**

**MAY 1992**

## PIN DESCRIPTION

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

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## FUNCTION TABLE

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

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### NOTES:

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

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Rating	Commercial	Military	Unit
$V_{\text{TERM}}^{(2)}$	Terminal Voltage with Respect to GND	-0.5 to +7.0	-0.5 to +7.0	V
$V_{\text{TERM}}^{(3)}$	Terminal Voltage with Respect to GND	-0.5 to $V_{\text{CC}}$	-0.5 to $V_{\text{CC}}$	V
$T_{\text{A}}$	Operating Temperature	0 to +70	-55 to +125	°C
$T_{\text{BIAS}}$	Temperature Under Bias	-55 to +125	-65 to +135	°C
$T_{\text{STG}}$	Storage Temperature	-55 to +125	-65 to +150	°C
$P_{\text{T}}$	Power Dissipation	0.5	0.5	W
$I_{\text{OUT}}$	DC Output Current	120	120	mA

### NOTES:

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- 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  $V_{\text{CC}}$  by +0.5V unless otherwise noted.
- Input and  $V_{\text{CC}}$  terminals only.
- Outputs and I/O terminals only.

## CAPACITANCE ( $T_{\text{A}} = +25^{\circ}\text{C}$ , $f = 1.0\text{MHz}$ )

Symbol	Parameter <sup>(1)</sup>	Conditions	Typ.	Max.	Unit
$C_{\text{IN}}$	Input Capacitance	$V_{\text{IN}} = 0\text{V}$	6	10	pF
$C_{\text{OUT}}$	Output Capacitance	$V_{\text{OUT}} = 0\text{V}$	8	12	pF

### NOTE:

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- This parameter is guaranteed by characterization data and not tested.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:  $V_{LC} = 0.2V$ ;  $V_{HC} = V_{CC} - 0.2V$

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

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	$V_{CC} = \text{Max.}$ $V_I = V_{CC}$ $V_I = 2.7V$ $V_I = 0.5V$ $V_I = GND$	—	—	5	$\mu A$	
$I_{IL}$	Input LOW Current		—	—	$5^{(4)}$		
			—	—	$-5^{(4)}$		
			—	—	-5		
$V_{IK}$	Clamp Diode Voltage	$V_{CC} = \text{Min.}, I_N = -18mA$	—	-0.7	-1.2	V	
$I_{OS}$	Short Circuit Current	$V_{CC} = \text{Max.}^{(3)}, V_O = GND$	-60	-120	—	mA	
$V_{OH}$	Output HIGH Voltage	$V_{CC} = 3V, V_{IN} = V_{LC} \text{ or } V_{HC}, I_{OH} = -32\mu A$	$V_{HC}$	$V_{CC}$	—	V	
		$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -300\mu A$	$V_{HC}$	$V_{CC}$		—
			$I_{OH} = -12mA \text{ MIL.}$	2.4	4.3		—
			$I_{OH} = -15mA \text{ COM'L.}$	2.4	4.3		—
$V_{OL}$	Output LOW Voltage	$V_{CC} = 3V, V_{IN} = V_{LC} \text{ or } V_{HC}, I_{OL} = 300\mu A$	—	GND	$V_{LC}$	V	
		$V_{CC} = \text{Min.}$ $V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 300\mu A$	—	GND		$V_{LC}^{(4)}$
			$I_{OL} = 32mA \text{ MIL.}$	—	0.3		0.5
			$I_{OL} = 48mA \text{ COM'L.}$	—	0.3		0.5

### 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  $V_{CC} = 5.0V$ ,  $+25^{\circ}C$  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. This parameter is guaranteed but not tested.

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## POWER SUPPLY CHARACTERISTICS

$V_{LC} = 0.2V$ ;  $V_{HC} = V_{CC} - 0.2V$

Symbol	Parameter	Test Conditions <sup>(1)</sup>	Min.	Typ. <sup>(2)</sup>	Max.	Unit	
I <sub>CC</sub>	Quiescent Power Supply Current	V <sub>CC</sub> = Max. V <sub>IN</sub> ≥ V <sub>HC</sub> ; V <sub>IN</sub> ≤ V <sub>LC</sub>	—	0.2	1.5	mA	
ΔI <sub>CC</sub>	Quiescent Power Supply Current TTL Inputs HIGH	V <sub>CC</sub> = Max. V <sub>IN</sub> = 3.4V <sup>(3)</sup>	—	0.5	2.0	mA	
I <sub>CCD</sub>	Dynamic Power Supply Current <sup>(4)</sup>	V <sub>CC</sub> = Max. Outputs Open MR = V <sub>CC</sub> One Input Toggling 50% Duty Cycle	V <sub>IN</sub> ≥ V <sub>HC</sub> V <sub>IN</sub> ≤ V <sub>LC</sub>	—	0.15	0.25	mA/MHz
I <sub>C</sub>	Total Power Supply Current <sup>(6)</sup>	V <sub>CC</sub> = Max. Outputs Open f <sub>CP</sub> = 10MHz 50% Duty Cycle MR = V <sub>CC</sub> One Bit Toggling at f <sub>i</sub> = 5MHz 50% Duty Cycle	V <sub>IN</sub> ≥ V <sub>HC</sub> V <sub>IN</sub> ≤ V <sub>LC</sub> (FCT)	—	1.7	4.0	mA
		V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	2.2	6.0		
		V <sub>CC</sub> = Max. Outputs Open f <sub>CP</sub> = 10MHz 50% Duty Cycle MR = V <sub>CC</sub> Eight Bits Toggling f <sub>i</sub> = 2.5MHz 50% Duty Cycle	V <sub>IN</sub> ≥ V <sub>HC</sub> V <sub>IN</sub> ≤ V <sub>LC</sub> (FCT)	—	4.0	7.8 <sup>(5)</sup>	
		V <sub>IN</sub> = 3.4V V <sub>IN</sub> = GND	—	6.2	16.8 <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<sub>CC</sub> = 5.0V, +25°C ambient.
- Per TTL driven input (V<sub>IN</sub> = 3.4V); all other inputs at V<sub>CC</sub> 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<sub>CC</sub> formula. These limits are guaranteed but not tested.

- I<sub>C</sub> = I<sub>QUIESCENT</sub> + I<sub>INPUTS</sub> + I<sub>DYNAMIC</sub>  
 $I_C = I_{CC} + \Delta I_{CC} \cdot DH_{NT} + I_{CCD} (f_{CP}/2 + f_i N_i)$   
 I<sub>CC</sub> = Quiescent Current  
 ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
 DH = Duty Cycle for TTL Inputs High  
 NT = Number of TTL Inputs at DH  
 I<sub>CCD</sub> = Dynamic Current Caused by an Output Transition Pair (HLH or LHL)  
 f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
 f<sub>i</sub> = Input Frequency  
 N<sub>i</sub> = Number of Inputs at f<sub>i</sub>  
 All currents are in milliamps and all frequencies are in megahertz.

2558 tbl 04

### SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Symbol	Parameter	Condition <sup>(1)</sup>	IDT54/74FCT273				IDT54/74FCT273A				IDT54/74FCT273C				Unit
			Com'l.		Mil.		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.	Min. <sup>(2)</sup>	Max.	Min. <sup>(2)</sup>	Max.	
tPLH	Propagation Delay	CL = 50 pF RL = 500Ω	2.0	13.0	2.0	15.0	2.0	7.2	2.0	8.3	2.0	5.8	2.0	6.5	ns
tPHL	Clock to Output														
tPHL	Propagation Delay MR to Output		2.0	13.0	2.0	15.0	2.0	7.2	2.0	8.3	2.0	6.1	2.0	6.8	ns
tsu	Set-up Time HIGH or LOW Data to CP		3.0	—	3.5	—	2.0	—	2.0	—	2.0	—	2.0	—	ns
th	Hold Time HIGH or LOW Data to CP		2.0	—	2.0	—	1.5	—	1.5	—	1.5	—	1.5	—	ns
tw	Clock Pulse Width HIGH or LOW		7.0	—	7.0	—	6.0	—	6.0	—	6.0	—	6.0	—	ns
tw	MR Pulse Width LOW		7.0	—	7.0	—	6.0	—	6.0	—	6.0	—	6.0	—	ns
tREM	Recovery Time MR to CP	4.0	—	5.0	—	2.0	—	2.5	—	2.0	—	2.5	—	ns	

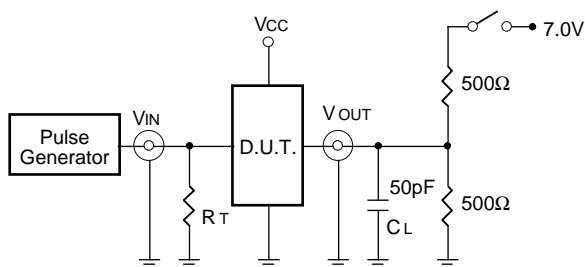
**NOTES:**

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

2558 tbl 07

## TEST CIRCUITS AND WAVEFORMS

### TEST CIRCUITS FOR ALL OUTPUTS



### SWITCH POSITION

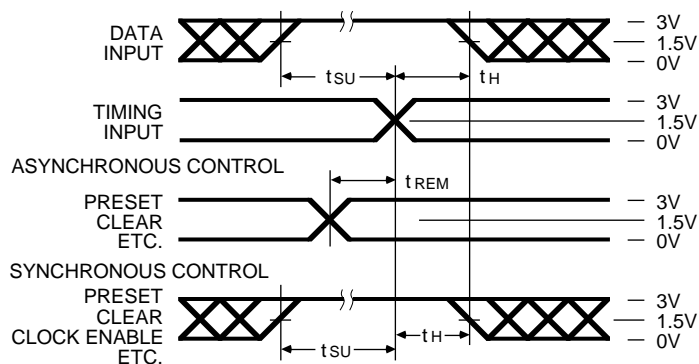
Test	Switch
Open Drain Disable Low Enable Low	Closed
All Other Tests	Open

#### DEFINITIONS:

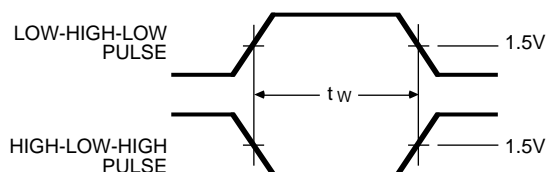
CL = Load capacitance: includes jig and probe capacitance.  
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

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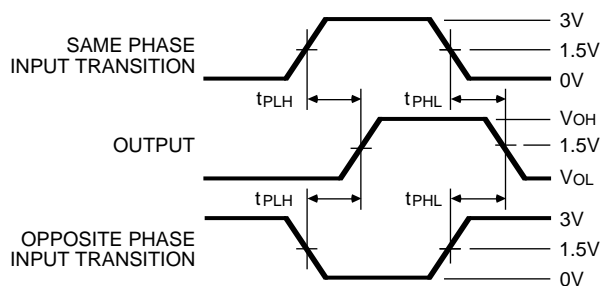
### SET-UP, HOLD AND RELEASE TIMES



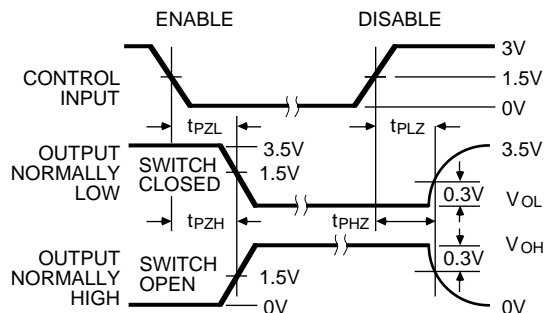
### PULSE WIDTH



### PROPAGATION DELAY



### ENABLE AND DISABLE TIMES

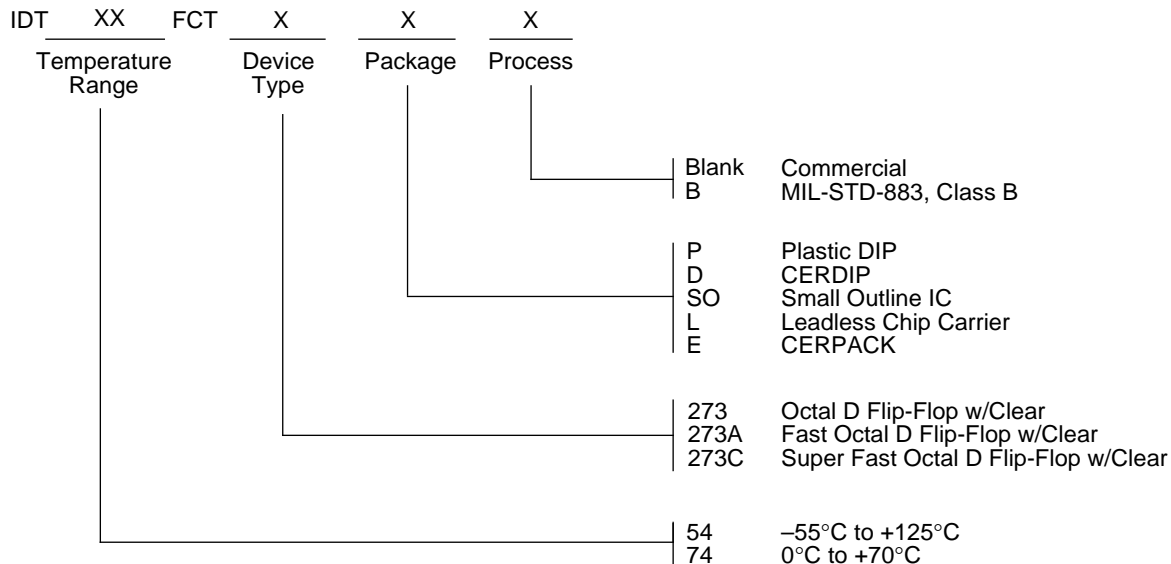


#### NOTES

- Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.
- Pulse Generator for All Pulses: Rate  $\leq 1.0$  MHz;  $Z_o \leq 50\Omega$ ;  $t_f \leq 2.5$ ns;  $t_r \leq 2.5$ ns.

2558 drw 04

**ORDERING INFORMATION**



2558 drw 03