CD74FCT273T, CD74FCT2273T

December 1996

Fast CMOS Octal D Flip-Flops with Master Reset

Features

- **Advanced 0.8 micron CMOS Technology**
- **These Devices are Pin Compatible with Bipolar FAST™ Series at a Higher Speed and Lower Power Consumption**
- **25Ω Series Resistor On All Outputs (FCT2273T Only)**
- **TTL Input and Output Levels**
- **Low Ground Bounce Outputs**
- **Extremely Low Static Power**
- **Hysteresis on All Inputs**

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74FCT273TM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT273ATM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT273CTM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT273DTM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT273TQM	-40 to 85	20 Ld QSOP	M20.15-P
CD74FCT273ATQM	-40 to 85	20 Ld QSOP	M20.15-P
CD74FCT273CTQM	-40 to 85	20 Ld QSOP	M20.15-P
CD74FCT273DTQM	-40 to 85	20 Ld QSOP	M20.15-P
CD74FCT2273TM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT2273ATM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT2273CTM	-40 to 85	20 Ld SOIC	M20.3-P
CD74FCT2273TQM	-40 to 85	20 Ld QSOP	M20.15-P
CD74FCT2273ATQM	-40 to 85	20 Ld QSOP	M20.15-P
CD74FCT2273CTQM	-40 to 85	20 Ld QSOP	M20.15-P

NOTE: QSOP is commonly known as SSOP.

When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.

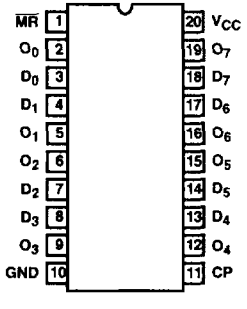
Description

The CD74FCT273T and CD74FCT2273T are 8-bit wide octal designed with eight edge-triggered D-type flip-flops with individual D inputs and O outputs. The common buffered Clock (CP) and Master Reset ($\overline{MR}$) load and resets (clear) all flip-flops simultaneously. The register is fully edge-triggered. The D input state, one setup 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 CD74FCT2273T device has a built-in 25Ω series resistor on all outputs to reduce noise due to reflections, thus eliminating the need for an external terminating resistor.

Pinouts

CD74FCT273T, CD74FCT2273T
(QSOP, SOIC)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

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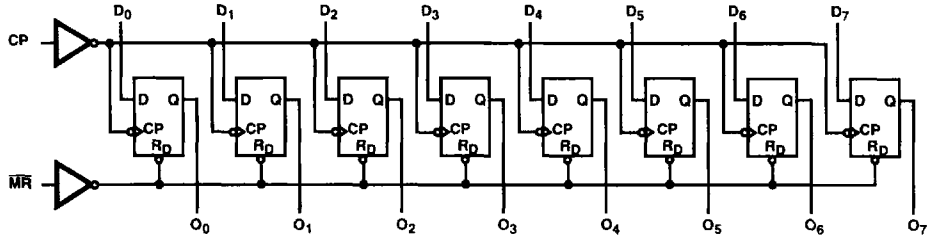
File Number **4169.2**

Functional Block Diagram



TRUTH TABLE (NOTE 1)

MODE	INPUTS			OUTPUTS
	$\overline{MR}$	CP	D_N	O_N
Reset (Clear)	L	X	X	L
Load "1"	H	↑	h	H
Load "0"	H	↑	l	L

NOTE:

1. H = High Voltage Level
   h = HIGH Voltage Level One Setup Time Prior to the LOW-to-HIGH Clock Transition
   L = Low Voltage Level
   l = LOW Voltage Level One Setup Time Prior to the LOW-to-HIGH Clock Transition
   X = Don't Care
   ↑ = LOW-to-HIGH Clock Transition

Pin Descriptions

PIN NAME	DESCRIPTION
$\overline{MR}$	Master Reset (Active LOW)
CP	Clock Pulse Input (Active Rising Edge)
D_0-D_7	Data Inputs
O_0-O_7	Data Outputs
GND	Ground
V_{CC}	Power

Absolute Maximum Ratings

DC Input Voltage . . . . . -0.5V to 7.0V
DC Output Current 120mA

Operating Conditions

Operating Temperature Range . . . . . -40°C to 85°C
Supply Voltage to Ground Potential
Inputs and V_{CC} Only . . . . . -0.5V to 7.0V
Supply Voltage to Ground Potential
Outputs and D/O Only . . . . . -0.5V to 7.0V

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} (°C/W)
SOIC Package	87
QSOP Package	110

Maximum Junction Temperature . . . . . 150°C
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . . 300°C
(Lead Tips Only)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

PARAMETER	SYMBOL	(NOTE 3) TEST CONDITIONS		MIN	(NOTE 4) TYP	MAX	UNITS
DC ELECTRICAL SPECIFICATIONS Over the Operating Range, T_A = -40°C to 85°C, V_{CC} = 5.0V ±5%							
Output HIGH Voltage	V_{OH}	V_{CC} = Min, V_{IN} = V_{IH} or V_{IL}	I_{OH} = -15.0mA	2.4	3.0	-	V
Output LOW Voltage	V_{OL}	V_{CC} = Min, V_{IN} = V_{IH} or V_{IL}	I_{OL} = 64mA	-	0.3	0.50	V
Output LOW Voltage	V_{OL}	V_{CC} = Min, V_{IN} = V_{IH} or V_{IL}	I_{OL} = 12mA (25Ω Series)	-	0.3	0.50	V
Input HIGH Voltage	V_{IH}	Guaranteed Logic HIGH Level		2.0	-	-	V
Input LOW Voltage	V_{IL}	Guaranteed Logic LOW Level		-	-	0.8	V
Input HIGH Current	I_{IH}	V_{CC} = Max	V_{IN} = V_{CC}	-	-	1	µA
Input LOW Current	I_{IL}	V_{CC} = Max	V_{IN} = GND	-	-	-1	µA
High Impedance Output Current	I_{OZH}	V_{CC} = Max	V_{OUT} = 2.7V	-	-	1	µA
	I_{OZL}		V_{OUT} = 0.5V	-	-	-1	µA
Clamp Diode Voltage	V_{IK}	V_{CC} = Min, I_{IN} = -18mA		-	-0.7	-1.2	V
Short Circuit Current	I_{OS}	V_{CC} = Max (Note 5), V_{OUT} = GND		-60	-120	-	mA
Power Down Disable	I_{OFF}	V_{CC} = GND, V_{OUT} = 4.5V		-	-	100	µA
Input Hysteresis	V_H			-	200	-	mV
CAPACITANCE T_A = 25°C, f = 1MHz							
Input Capacitance (Note 6)	C_{IN}	V_{IN} = 0V		-	6	10	pF
Output Capacitance (Note 6)	C_{OUT}	V_{OUT} = 0V		-	8	12	pF
POWER SUPPLY SPECIFICATIONS							
Quiescent Power Supply Current	I_{CC}	V_{CC} = Max	V_{IN} = GND or V_{CC}	-	0.1	500	µA
Supply Current per Input at TTL HIGH	ΔI_{CC}	V_{CC} = Max	V_{IN} = 3.4V (Note 7)	-	0.5	2.0	mA
Supply Current per Input per MHz (Note 8)	I_{CCD}	V_{CC} = 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

Electrical Specifications (Continued)

PARAMETER	SYMBOL	(NOTE 3) TEST CONDITIONS		MIN	(NOTE 4) TYP	MAX	UNITS
Total Power Supply Current (Note 10)	I_C	V_{CC} = Max, Outputs Open f_{CP} = 10MHz, 50% Duty Cycle $\overline{MR}$ = V_{CC}, 50% Duty Cycle One Bit Toggling at f_i = 5MHz	V_{IN} = V_{CC} Vin = GND	-	1.5	3.5 (Note 9)	mA
			V_{IN} = 3.4V V_{IN} = GND	-	2.0	5.5 (Note 9)	mA
		V_{CC} = Max, Outputs Open f_{CP} = 10MHz, 50% Duty Cycle $\overline{MR}$ = VCC, 50% Duty Cycle Eight Bits Toggling at f_i = 2.5MHz, 50% Duty Cycle	V_{IN} = V_{CC} V_{IN} = GND	-	3.8	7.3 (Note 9)	mA
			V_{IN} = 3.4V V_{IN} = GND	-	6.0	16.3 (Note 9)	mA

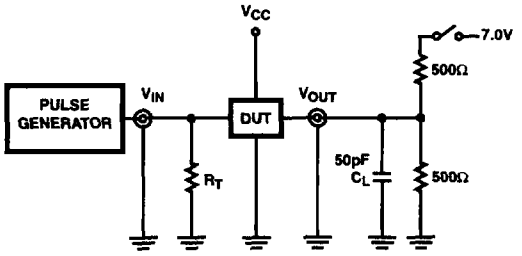
Switching Specifications Over Operating Range

PARAMETER	SYMBOL	(NOTE 11) TEST CONDITIONS	T (NOTE 12) MIN	T MAX	AT (NOTE 12) MIN	AT MAX	CT (NOTE 12) MIN	CT MAX	DT (NOTE 14) (NOTE 12) MIN	DT (NOTE 14) MAX	UNITS
Propagation Delay CP to On	t_{PLH}, t_{PHL}	C_L = 50pF R_L = 500Ω	2.0	13.0	2.0	7.2	2.0	5.8	2.0	4.4	ns
Propagation Delay $\overline{MR}$ to On	t_{PHL}, t_{PLH}	C_L = 50pF R_L = 500Ω	2.0	13.0	2.0	7.2	2.0	6.1	2.0	5.0	ns
Setup Time, HIGH or LOW D_N to CP	t_{SU}	C_L = 50pF R_L = 500Ω	3.0	-	2.0	-	2.0	-	2.0	-	ns
Hold Time, HIGH or LOW D_N to CP	t_H	C_L = 50pF R_L = 500Ω	2.0	-	1.5	-	1.5	-	1.5	-	ns
CP Pulse Width HIGH or LOW (Note 13)	t_W	C_L = 50pF R_L = 500Ω	7.0	-	6.0	-	6.0	-	3.0	-	ns
$\overline{MR}$ Pulse Width LOW (Note 13)	t_W	C_L = 50pF R_L = 500Ω	7.0	-	6.0	-	6.0	-	3.0	-	ns
Recovery Time MR to CP (Note 13)	t_{REM}	C_L = 50pF R_L = 500Ω	4.0	-	2.0	-	2.0	-	2.0	-	ns

NOTES:

3. For conditions shown as Max or Min, use appropriate value specified under Electrical Specifications for the applicable device type.
4. Typical values are at V_{CC} = 5.0V, 25°C ambient and maximum loading.
5. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
6. This parameter is determined by device characterization but is not production tested.
7. Per TTL driven input (V_{IN} = 3.4V); all other inputs at V_{CC} or GND.
8. This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
9. Values for these conditions are examples of the I_{CC} formula. These limits are guaranteed but not tested.
10. $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
    $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$
    I_{CC} = Quiescent Current
    ΔI_{CC} = Power Supply Current for a TTL High Input (Vin = 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.
11. See test circuit and wave forms.
12. *Minimum limits are guaranteed but not tested on Propagation Delays.*
13. This parameter guaranteed but not production tested.
14. Suffix DT applies to CD74FCT273T type only.

Test Circuits and Waveforms



SWITCH POSITION

TEST	SWITCH
t_{PLZ}, t_{PZL}	Closed
t_{PHZ}, t_{PZH}, t_{PLH}, t_{PHL}	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.

NOTE:

15. Pulse Generator for All Pulses: Rate ≤ 1.0MHz. $Z_{OUT} \leq 50\Omega$; t_f, $t_r \leq 2.5$ns.

FIGURE 1. TEST CIRCUIT

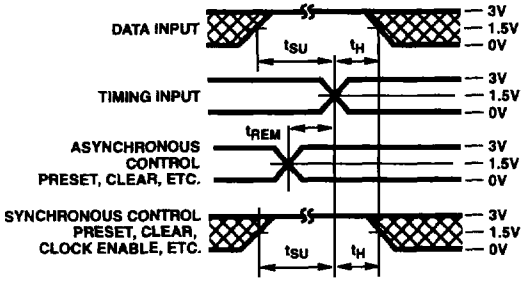


FIGURE 2. SETUP, HOLD, AND RELEASE TIMING

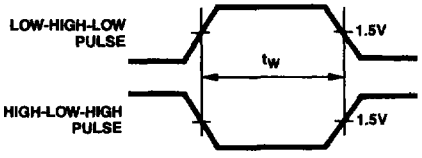


FIGURE 3. PULSE WIDTH

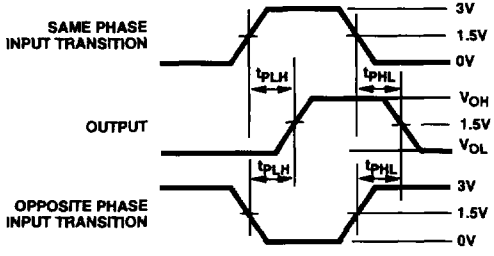


FIGURE 4. PROPAGATION DELAY