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MM74HC273 Octal D-Type Flip-Flops with Clear

General Description

The MM74HC273 edge triggered flip-flops utilize advanced silicon-gate CMOS technology to implement D-type flip-flops. They possess high noise immunity, low power, and speeds comparable to low power Schottky TTL circuits. This device contains 8 master-slave flip-flops with a common clock and common clear. Data on the D input having the specified setup and hold times is transferred to the Q output on the LOW-to-HIGH transition of the CLOCK input. The CLEAR input when LOW, sets all outputs to a low state.

Each output can drive 10 low power Schottky TTL equivalent loads. The MM74HC273 is functionally as well as pin compatible to the 74LS273. All inputs are protected from damage due to static discharge by diodes to V_{CC} and ground.

Features

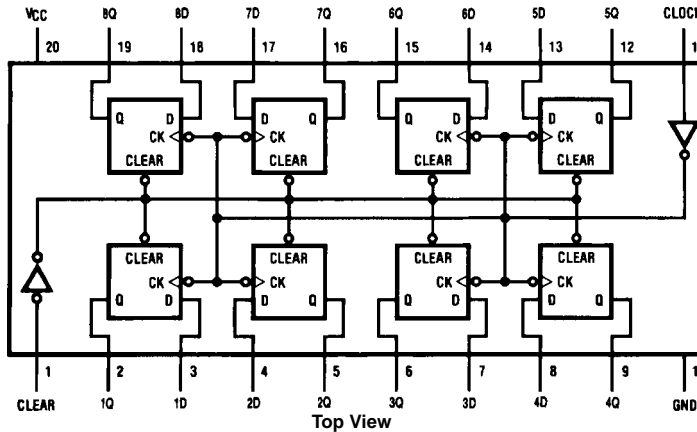
- Typical propagation delay: 18 ns
- Wide operating voltage range
- Low input current: 1 μ A maximum
- Low quiescent current: 80 μ A (74 Series)
- Output drive: 10 LS-TTL loads

Ordering Code:

Order Number	Package Number	Package Description
MM74HC273WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74HC273SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HC273MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HC273N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram



Truth Table

(Each Flip-Flop)

		Inputs		Outputs
Clear	Clock	D	Q	
L	X	X	L	L
H	↑	H	H	H
H	↑	L	L	L
H	L	X	X	Q ₀

H = HIGH Level (Steady State)

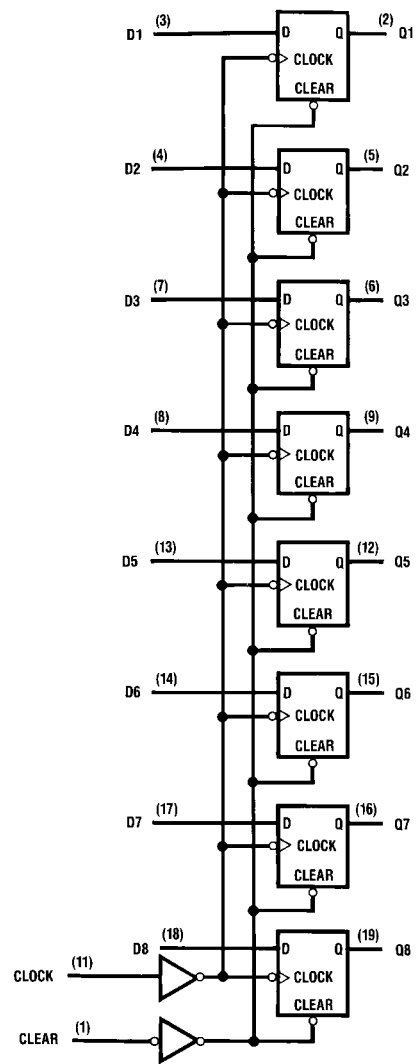
L = LOW Level (Steady State)

X = Don't Care

↑ = Transition from LOW-to-HIGH level

Q₀ = The level of Q before the indicated steady state input conditions were established

Logic Diagram



Absolute Maximum Ratings (Note 1)		Recommended Operating Conditions			
(Note 2)			Min	Max	Units
Supply Voltage (V_{CC})	-0.5 to +7.0V	Supply Voltage (V_{CC})	2	6	V
DC Input Voltage (V_{IN})	-1.5 to $V_{CC} + 1.5V$	DC Input or Output Voltage (V_{IN}, V_{OUT})	0	V_{CC}	V
DC Output Voltage (V_{OUT})	-0.5 to $V_{CC} + 0.5V$	Operating Temperature Range (T_A)	-40	+85	°C
Clamp Diode Current (I_{IK}, I_{OK})	±20 mA	Input Rise or Fall Times (t_r, t_f)			
DC Output Current, per pin (I_{OUT})	±25 mA	$V_{CC} = 2.0V$		1000	ns
DC V_{CC} or GND Current, per pin (I_{CC})	±50 mA	$V_{CC} = 4.5V$		500	ns
Storage Temperature Range (T_{STG})	-65°C to +150°C	$V_{CC} = 6.0V$		400	ns
Power Dissipation (P_D)		Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.			
(Note 3)	600 mW	Note 2: Unless otherwise specified all voltages are referenced to ground.			
S.O. Package only	500 mW	Note 3: Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C.			
Lead Temperature (T_L)					
(Soldering 10 seconds)	260°C				

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ C$			$T_A = -40 \text{ to } 85^\circ C$			$T_A = -55 \text{ to } 125^\circ C$			Units
				Typ	Guaranteed Limits		Guaranteed Limits		Guaranteed Limits				
V_{IH}	Minimum HIGH Level Input Voltage		2.0V		1.5	1.5	1.5					V	
			4.5V		3.15	3.15	3.15				V		
			6.0V		4.2	4.2	4.2				V		
V_{IL}	Maximum LOW Level Input Voltage		2.0V		0.5	0.5	0.5					V	
			4.5V		1.35	1.35	1.35				V		
			6.0V		1.8	1.8	1.8				V		
V_{OH}	Minimum HIGH Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $ I_{OUT} \leq 20 \mu A$	2.0V	2.0	1.9	1.9	1.9					V	
			4.5V	4.5	4.4	4.4	4.4				V		
			6.0V	6.0	5.9	5.9	5.9				V		
		$V_{IN} = V_{IH} \text{ or } V_{IL}$ $ I_{OUT} \leq 4.0 \text{ mA}$ $ I_{OUT} \leq 5.2 \text{ mA}$	4.5V	4.2	3.98	3.84	3.7				V		
			6.0V	5.7	5.48	5.34	5.2				V		
V_{OL}	Maximum LOW Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $ I_{OUT} \leq 20 \mu A$	2.0V	0	0.1	0.1	0.1					V	
			4.5V	0	0.1	0.1	0.1				V		
			6.0V	0	0.1	0.1	0.1				V		
		$V_{IN} = V_{IH} \text{ or } V_{IL}$ $ I_{OUT} \leq 4 \text{ mA}$ $ I_{OUT} \leq 5.2 \text{ mA}$	4.5V	0.2	0.26	0.33	0.4				V		
			6.0V	0.2	0.26	0.33	0.4				V		
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC} \text{ or } GND$	6.0V		±0.1	±1.0	±1.0				µA		
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC} \text{ or } GND$ $I_{OUT} = 0 \mu A$	6.0V		8	80	160				µA		

Note 4: For a power supply of $5V \pm 10\%$ the worst case output voltages (V_{OH} , and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at $V_{CC} = 5.5V$ and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics					
$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15\text{ pF}, t_r = t_f = 6\text{ ns}$					
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency		50	30	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Clock to Output		18	27	ns
t_{PHL}	Maximum Propagation Delay, Clear to Output		18	27	ns
t_{REM}	Minimum Removal Time, Clear to Clock		10	20	ns
t_s	Minimum Setup Time Data to Clock		10	20	ns
t_H	Minimum Hold Time Clock to Data		-2	0	ns
t_W	Minimum Pulse Width Clock or Clear		10	16	ns

AC Electrical Characteristics								
$C_L = 50\text{ pF}, t_r = t_f = 6\text{ ns}$ (unless otherwise specified)								
Symbol	Parameter	Conditions	V_{CC}	$T_A = 25^\circ C$	$T_A = -40\text{ to }85^\circ C$	$T_A = -55\text{ to }125^\circ C$	Units	
				Typ	Guaranteed Limits			
f_{MAX}	Maximum Operating Frequency		2.0V	16	5	4	3	MHz
			4.5V	74	27	21	18	MHz
			6.0V	78	31	24	20	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Clock to Output		2.0V	38	135	170	205	ns
			4.5V	14	27	34	41	ns
			6.0V	12	23	29	35	ns
t_{PHL}	Maximum Propagation Delay, Clear to Output		2.0V	42	135	170	205	ns
			4.5V	19	27	34	41	ns
			6.0V	18	23	29	35	ns
t_{REM}	Minimum Removal Time Clear to Clock		2.0V	0	25	32	37	ns
			4.5V	0	5	6	7	ns
			6.0V	0	4	5	6	ns
t_s	Minimum Setup Time Data to Clock		2.0V	26	100	125	150	ns
			4.5V	7	20	25	30	ns
			6.0V	5	17	21	25	ns
t_H	Minimum Hold Time Clock to Data		2.0V	-15	0	0	0	ns
			4.5V	-6	0	0	0	ns
			6.0V	-4	0	0	0	ns
t_W	Minimum Pulse Width Clock or Clear		2.0V	34	80	100	120	ns
			4.5V	11	16	20	24	ns
			6.0V	10	14	18	20	ns
t_r, t_f	Maximum Input Rise and Fall Time, Clock		2.0V		1000	1000	1000	ns
			4.5V		500	500	500	ns
			6.0V		400	400	400	ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time		2.0V	28	75	95	110	ns
			4.5V	11	15	19	22	ns
			6.0V	9	13	16	19	ns
C_{PD}	Power Dissipation Capacitance (Note 5)	(per flip-flop)		45				pF
C_{IN}	Maximum Input Capacitance			7	10	10	10	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted



**20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



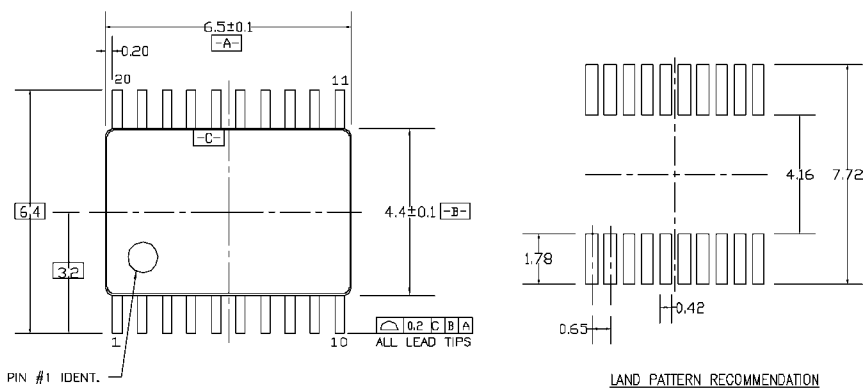
DETAIL A

- NOTES:
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
 B. DIMENSIONS ARE IN MILLIMETERS.
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M20DRevB1

20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M20D

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



PIN #1 IDENT.

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DETAIL A

NOTES:

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- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC20REVD1

20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC20

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



N20A (REV G)

**20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N20A**

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