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September 1983
Revised May 2005

MM74HC374
3-STATE Octal D-Type Flip-Flop

General Description

The MM74HC374 high speed Octal D-Type Flip-Flops utilize advanced silicon-gate CMOS technology. They possess the high noise immunity and low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LS-TTL loads. Due to the large output drive capability and the 3-STATE feature, these devices are ideally suited for interfacing with bus lines in a bus organized system.

These devices are positive edge triggered flip-flops. Data at the D inputs, meeting the setup and hold time requirements, are transferred to the Q outputs on positive going transitions of the CLOCK (CK) input. When a high logic level is applied to the OUTPUT CONTROL (OC) input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The 74HC logic family is speed, function, and pinout compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

- Typical propagation delay: 20 ns
- Wide operating voltage range: 2–6V
- Low input current: 1 μA maximum
- Low quiescent current: 80 μA maximum
- Compatible with bus-oriented systems
- Output drive capability: 15 LS-TTL loads

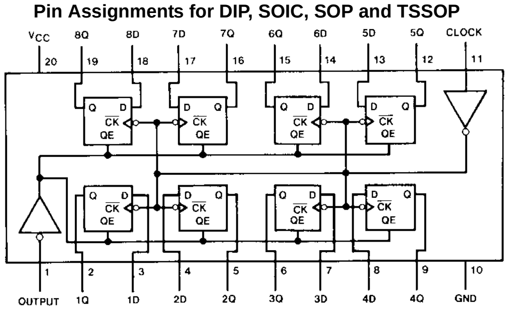
Ordering Code:

Order Number	Package Number	Package Description
MM74HC374WM	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
MM74HC374SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HC374MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HC374N	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

Pin Assignments for DIP, SOIC, SOP and TSSOP



Top View

Truth Table

Output Control	Clock	Data	Output
L	$\uparrow$	H	H
L	$\uparrow$	L	L
L	L	X	Q_0
H	X	X	Z

H = HIGH Level
L = LOW Level
X = Don't Care
$\uparrow$ = Transition from LOW-to-HIGH
Z = High Impedance State
Q_0 = The level of the output before steady state input conditions were established

Absolute Maximum Ratings (Note 1)

(Note 2)

Supply Voltage (V_{CC})	−0.5 to +7.0V
DC Input Voltage (V_{IN})	−1.5 to V_{CC} +1.5V
DC Output Voltage (V_{OUT})	−0.5 to V_{CC} +0.5V
Clamp Diode Current (I_{IK}, I_{OK})	±20 mA
DC Output Current, per pin (I_{OUT})	±35 mA
DC V_{CC} or GND Current, per pin (I_{CC})	±70 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Power Dissipation (P_D)	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temperature (T_L)	
(Soldering 10 seconds)	260°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage			
(V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temperature Range (T_A)	−40	+85	°C
Input Rise or Fall Times			
(t_r, t_f) V_{CC} = 2.0V		1000	ns
V_{CC} = 4.5V		500	ns
V_{CC} = 6.0V		400	ns

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C.

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC}	T_A = 25°C		T_A = −40 to 85°C	T_A = −55 to 125°C	Units
				Typ	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	$V_{IN} = V_{IH}$ or V_{IL}						
		$\|I_{OUT}\| \le 20\ \mu A$	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
		$V_{IN} = V_{IH}$ or V_{IL}						
		$\|I_{OUT}\| \le 6.0$ mA	4.5V	4.2	3.98	3.84	3.7	V
		$\|I_{OUT}\| \le 7.8$ mA	6.0V	5.7	5.48	5.34	5.2	V
V_{OL}	Maximum LOW Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL}						
		$\|I_{OUT}\| \le 20\ \mu A$	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
		$V_{IN} = V_{IH}$ or V_{IL}						
		$\|I_{OUT}\| \le 6.0$ mA	4.5V	0.2	0.26	0.33	0.4	V
		$\|I_{OUT}\| \le 7.8$ mA	6.0V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		±0.1	±1.0	±1.0	μA
I_{OZ}	Maximum 3-STATE Output Leakage Current	$V_{IN} = V_{IH}$, OC = V_{IH} $V_{OUT} = V_{CC}$ or GND	6.0V		±0.5	±5	±10	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0\ \mu A$	6.0V		8.0	80	160	μA

Note 4: For a power supply of 5V ±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

$V_{CC} = 5V$, $T_A = 25°C$, $t_r = t_f = 6$ ns

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency		50	35	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay Clock to Q	$C_L = 45$ pF	20	32	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	$R_L =$ kΩ $C_L = 45$ pF	19	28	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	$R_L =$ kΩ $C_L = 5$ pF	17	25	ns
t_S	Minimum Setup Time			20	ns
t_H	Minimum Hold Time			5	ns
t_W	Minimum Pulse Width		9	16	ns

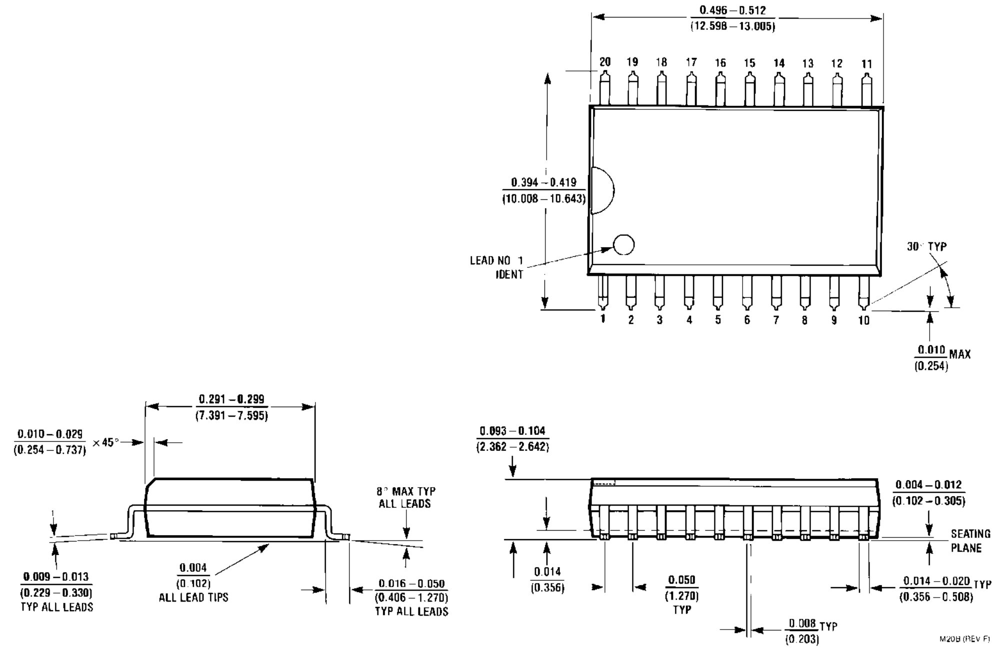
AC Electrical Characteristics

V_{CC} = 2.0–6.0V, C_L = 50 pF, $t_r = t_f$ = 6 ns (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A = 25°C$		$T_A = -40$ to 85°C	$T_A = -55$ to 125°C	Units
				Typ	Guaranteed Limits			
f_{MAX}	Maximum Operating Frequency	C_L = 50 pF	2.0V		6	5	4	MHz
			4.5V		30	24	20	MHz
			6.0V		35	28	23	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Clock to Q	C_L = 50 pF	2.0V	68	180	225	270	ns
		C_L = 150 pF	2.0V	110	230	288	345	ns
		C_L = 50 pF	4.5V	22	36	45	48	ns
		C_L = 150 pF	4.5V	30	46	57	69	ns
		C_L = 50 pF	6.0V	20	31	39	46	ns
		C_L = 150 pF	6.0V	28	40	50	60	ns
t_{PZH}, t_{PZL}	Maximum Output Enable Time	R_L = 1 kΩ						
		C_L = 50 pF	2.0V	50	150	189	225	ns
		C_L = 150 pF	2.0V	80	200	250	300	ns
		C_L = 50 pF	4.5V	21	30	37	45	ns
		C_L = 150 pF	4.5V	30	40	50	60	ns
		C_L = 50 pF	6.0V	19	26	31	39	ns
		C_L = 150 pF	6.0V	26	35	44	53	ns
t_{PHZ}, t_{PLZ}	Maximum Output Disable Time	R_L = 1 kΩ	2.0V	50	150	189	225	ns
		C_L = 50 pF	4.5V	21	30	37	45	ns
			6.0V	19	26	31	39	ns
t_S	Minimum Setup Time		2.0V		50	60	75	ns
			4.5V		9	13	15	ns
			6.0V		9	11	13	ns
t_H	Minimum Hold Time		2.0V		5	30	5	ns
			4.5V		5	5	5	ns
			6.0V		5	5	5	ns
t_W	Minimum Pulse Width		2.0V	30	80	100	120	ns
			4.5V	9	16	20	24	ns
			6.0V	8	14	18	20	ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time	C_L = 50 pF	2.0V	25	60	75	90	ns
			4.5V	7	12	15	18	ns
			6.0V	6	10	13	15	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
C_{PD}	Power Dissipation Capacitance (Note 5)	(per flip-flop)						
		OC = V_{CC}		30				pF
		OC = GND		50				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

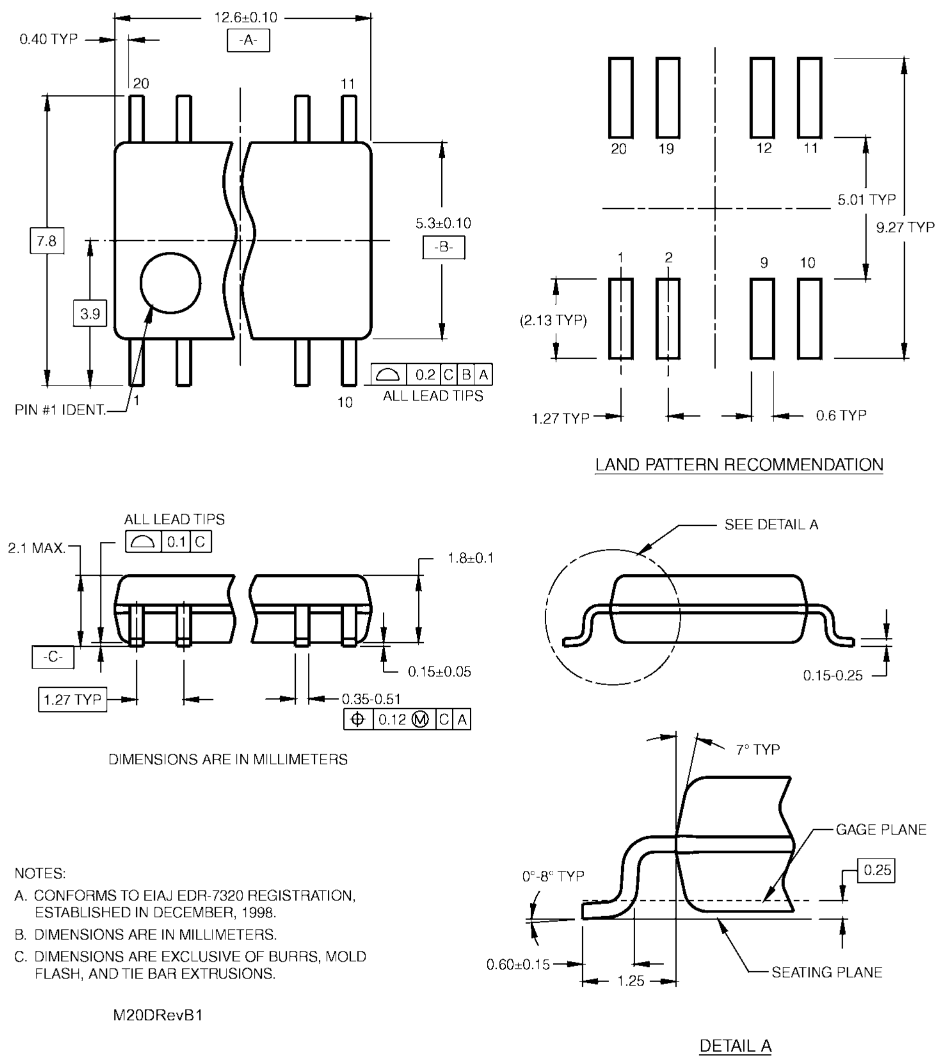
Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted



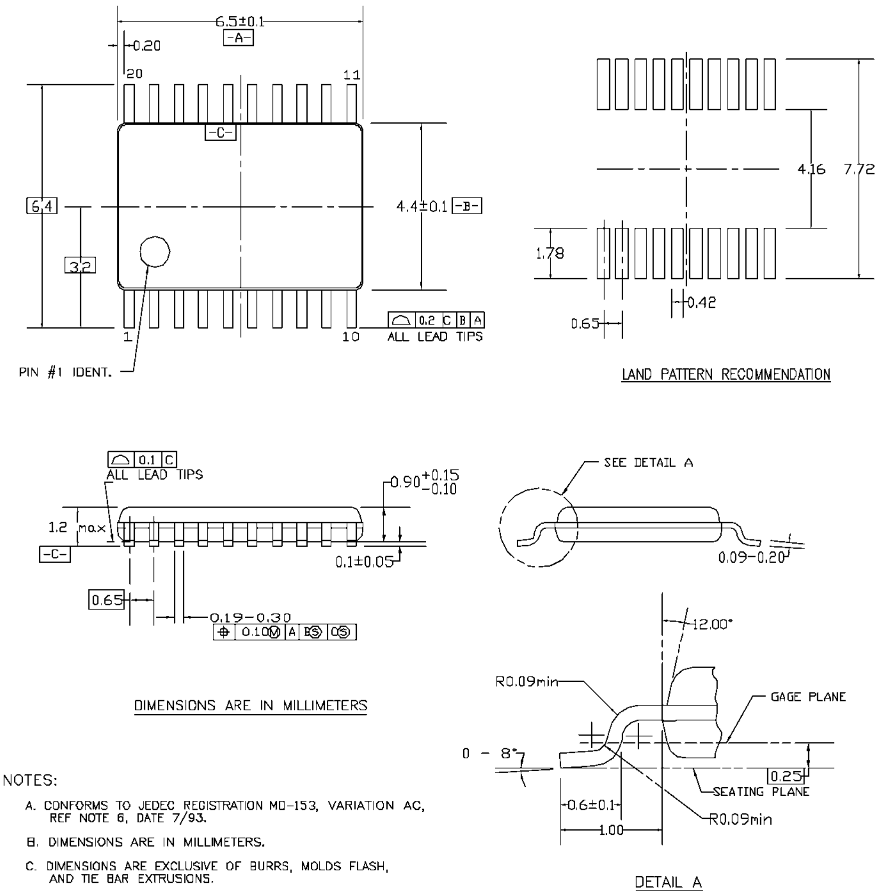
20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
Package Number M20B

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



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

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



NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.

B. DIMENSIONS ARE IN MILLIMETERS.

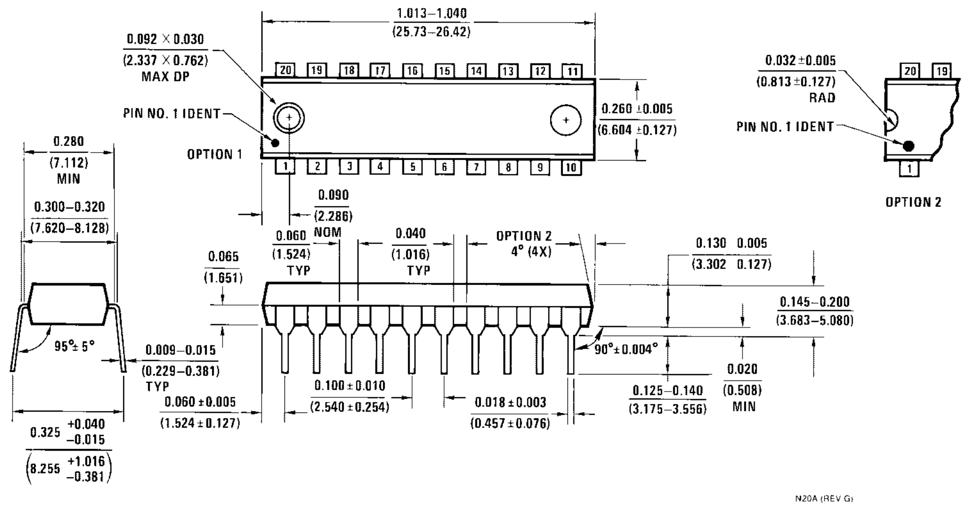
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.

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)



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

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