FAIRCHILD SEMICONDUCTOR™

September 1983
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MM74HC74A
Dual D-Type Flip-Flop with Preset and Clear

General Description

The MM74HC74A utilizes advanced silicon-gate CMOS technology to achieve operating speeds similar to the equivalent LS-TTL part. It possesses the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads.

This flip-flop has independent data, preset, clear, and clock inputs and Q and $\overline{Q}$ outputs. The logic level present at the data input is transferred to the output during the positive-going transition of the clock pulse. Preset and clear are independent of the clock and accomplished by a low level at the appropriate input.

The 74HC logic family is functionally 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 power supply range: 2–6V
- Low quiescent current: 40 μA maximum (74HC Series)
- Low input current: 1 μA maximum
- Fanout of 10 LS-TTL loads

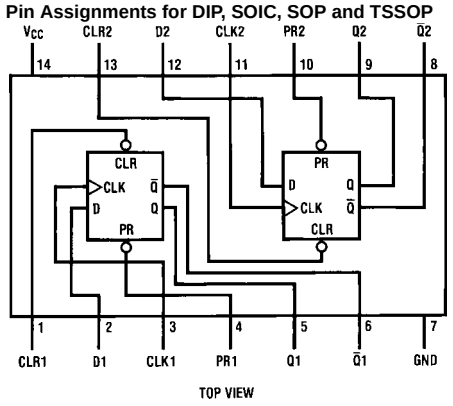
Ordering Code:

Order Number	Package Number	Package Description
MM74HC74AM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
MM74HC74ASJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HC74AMTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HC74AN	N14A	14-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

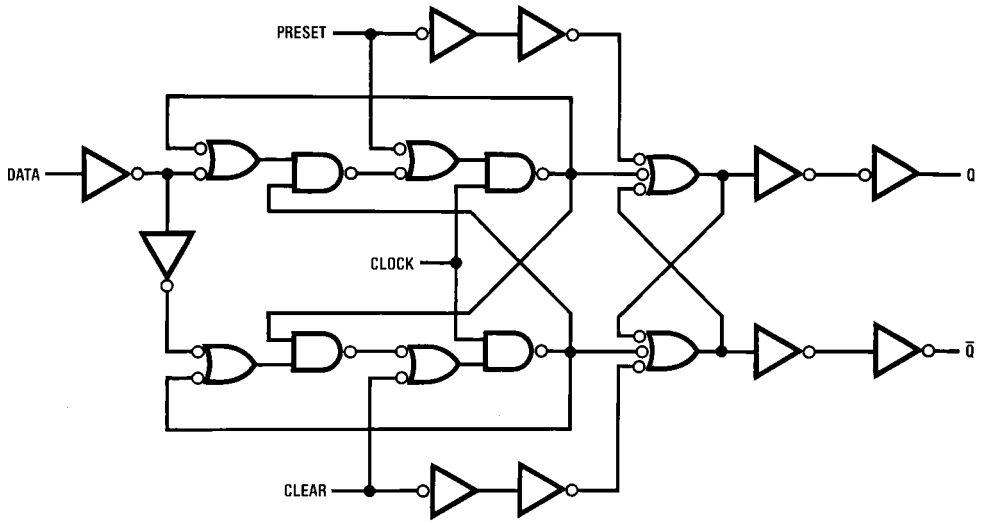
Truth Table

Inputs				Outputs	
PR	CLR	CLK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H (Note 1)	H (Note 1)
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q0	$\overline{Q}$ 0

Note: Q0 = the level of Q before the indicated input conditions were established.

Note 1: This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (HIGH) level.

Logic Diagram



Absolute Maximum Ratings (Note 2)

(Note 3)

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})	±25 mA
DC V_{CC} or GND Current, per pin (I_{CC})	±50 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Power Dissipation (P_D)	
(Note 4)	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}, $_{OUT}$)	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 2: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 3: Unless otherwise specified all voltages are referenced to ground.

Note 4: Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C.

DC Electrical Characteristics (Note 5)

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}						
		$\|I_{OUT}\| \le 20$ μA	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}						
		$\|I_{OUT}\| \le 4.0$ mA	4.5V	4.3	3.98	3.84	3.7	V
		$\|I_{OUT}\| \le 5.2$ mA	6.0V	5.2	5.48	5.34	5.2	V
V_{OL}	Maximum LOW Level Output Voltage	V_{IN} = V_{IH} or V_{IL}						
		$\|I_{OUT}\| \le 20$ μA	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}						
		$\|I_{OUT}\| \le 4.0$ mA	4.5V	0.2	0.26	0.33	0.4	V
		$\|I_{OUT}\| \le 5.2$ 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_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND	6.0V		4.0	40	80	μA
		I_{OUT} = 0 μA						

Note 5: 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

$V_{CC} = 5V$, $T_A = 25°C$, $C_L = 15$ pF, $t_r = t_f = 6$ ns

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency		72	30	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay Clock to Q or $\overline{Q}$		10	30	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay Preset or Clear to Q or $\overline{Q}$		17	40	ns
t_{REM}	Minimum Removal Time, Preset or Clear to Clock		6	5	ns
t_s	Minimum Setup Time Data to Clock		10	20	ns
t_H	Minimum Hold Time Clock to Data		0	0	ns
t_W	Minimum Pulse Width Clock, Preset or Clear		8	16	ns

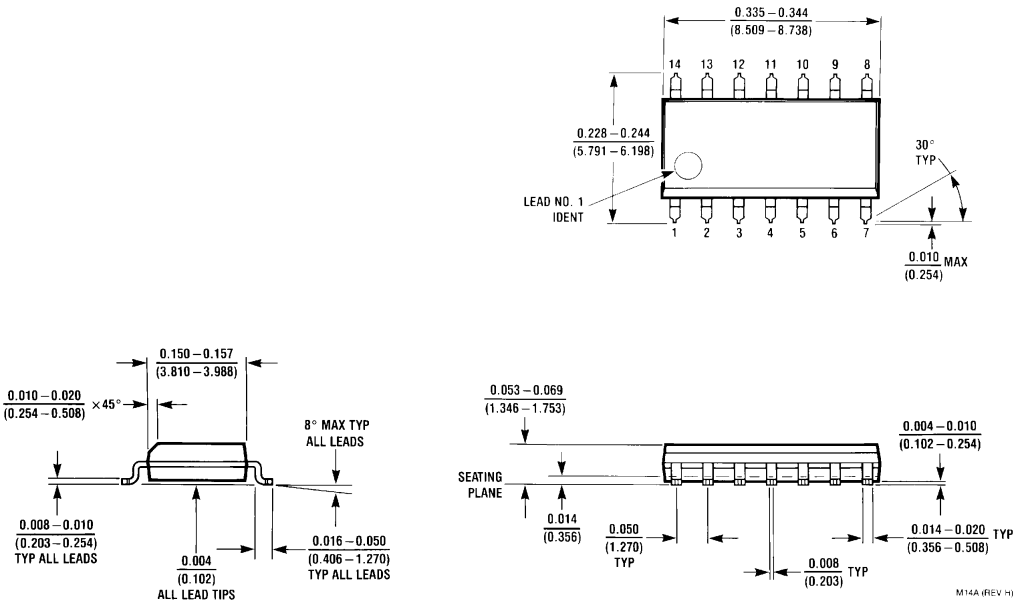
AC Electrical Characteristics

$C_L = 50$ pF, $t_r = t_f = 6$ ns (unless otherwise specified)

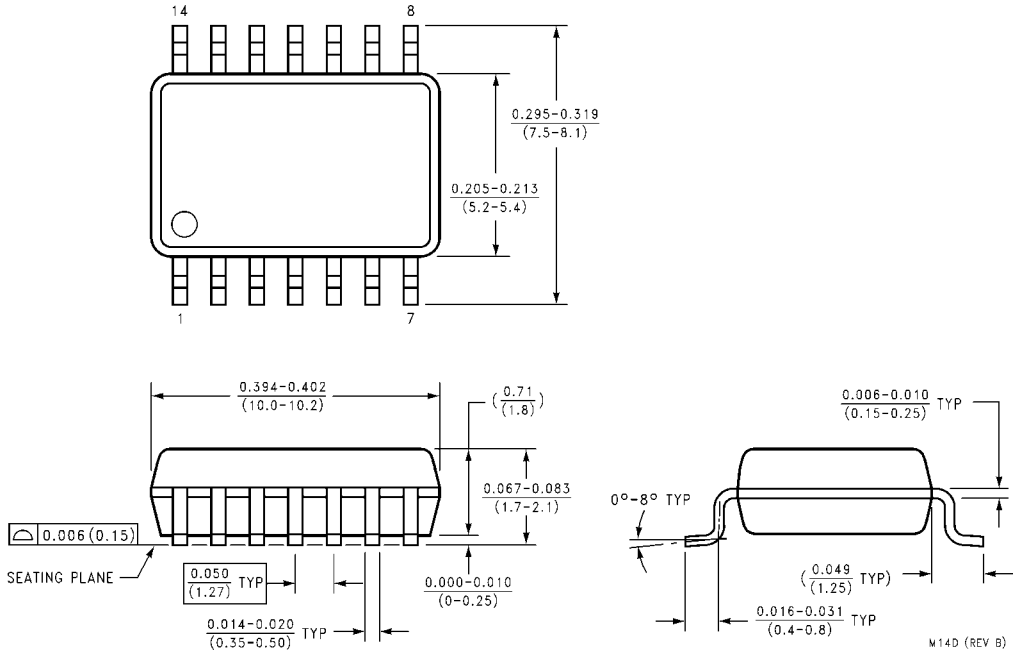
Symbol	Parameter	Conditions	V_{CC}	$T_A = 25°C$	$T_A = -40$ to $85°C$	$T_A = -55$ to $125°C$		Units
				Typ	Guaranteed Limits			
f_{MAX}	Maximum Operating Frequency		2.0V	22	6	5	4	MHz
			4.5V	72	30	24	20	MHz
			6.0V	94	35	28	24	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay Clock to Q or $\overline{Q}$		2.0V	34	110	140	165	ns
			4.5V	12	22	28	33	ns
			6.0V	10	19	24	28	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay Preset or Clear To Q or $\overline{Q}$		2.0V	66	150	190	225	ns
			4.5V	20	30	38	45	ns
			6.0V	16	26	33	38	ns
t_{REM}	Minimum Removal Time Preset or Clear To Clock		2.0V	20	50	65	75	ns
			4.5V	6	10	13	15	ns
			6.0V	5	9	11	13	ns
t_s	Minimum Setup Time Data to Clock		2.0V	35	80	100	120	ns
			4.5V	10	16	20	24	ns
			6.0V	8	14	17	20	ns
t_H	Minimum Hold Time Clock to Data		2.0V		0	0	0	ns
			4.5V		0	0	0	ns
			6.0V		0	0	0	ns
t_W	Minimum, Pulse Width Clock, Preset or Clear		2.0V	30	80	101	119	ns
			4.5V	9	16	20	24	ns
			6.0V	8	14	17	20	ns
t_{TLH}, t_{THL}	Maximum Output Rise and Fall Time		2.0V	25	75	95	110	ns
			4.5V	7	15	19	22	ns
			6.0V	6	13	16	19	ns
t_r, t_f	Maximum Input Rise and Fall Time		2.0V		1000	1000	1000	ns
			4.5V		500	500	500	ns
			6.0V		400	400	400	ns
C_{PD}	Power Dissipation Capacitance (Note 6)	(per flip-flop)		80				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note 6: 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



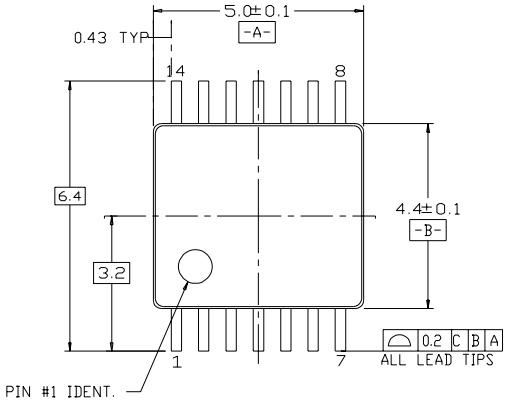
14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
Package Number M14A

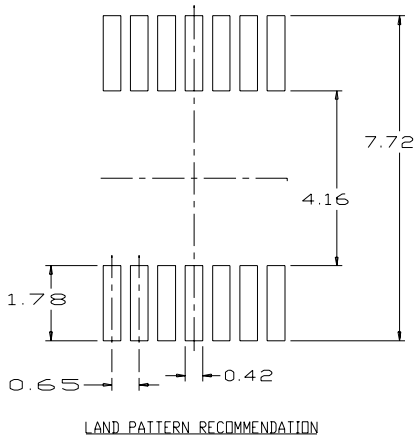


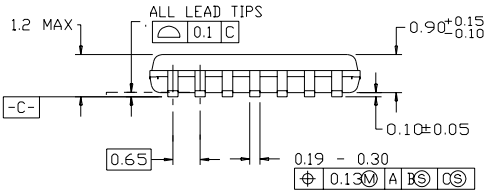
14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M14D

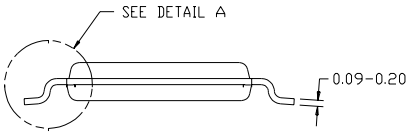
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)

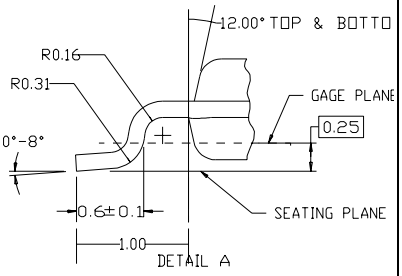
14LD, TSSOP, JEDEC MO-153, 4.4MM WIDE











NOTES:

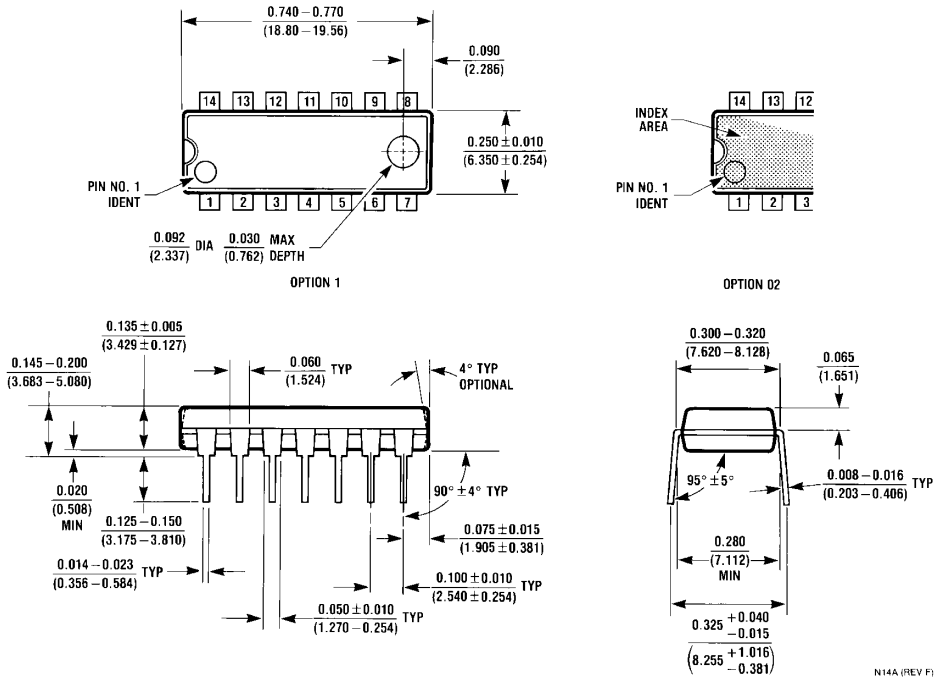
A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATED 7/93

B. DIMENSIONS ARE IN MILLIMETERS

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

14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC14

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



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N14A