FAIRCHILD SEMICONDUCTOR™

February 1984
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MM74HCT74
Dual D-Type Flip-Flop with Preset and Clear

General Description

The MM74HCT74 utilizes advanced silicon-gate CMOS technology to achieve operation 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 74HCT logic family is functionally and pin-out 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.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

Features

- Typical propagation delay: 20 ns
- Low quiescent current: 40 μA maximum (74HCT Series)
- Low input current: 1 μA maximum
- Fanout of 10 LS-TTL loads
- Meta-stable hardened

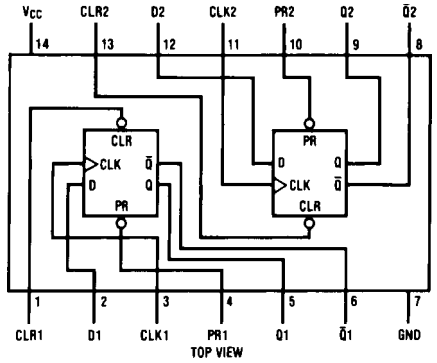
Ordering Code:

Order Number	Package Number	Package Description
MM74HCT74M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCT74SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
M74HCT74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT74N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM74HCT74N_NL	N14A	Pb-Free 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.
Pb-Free package per JEDEC J-STD-020B.

Connection Diagram

Pin Assignments for DIP, SOIC, SOP and TSSOP



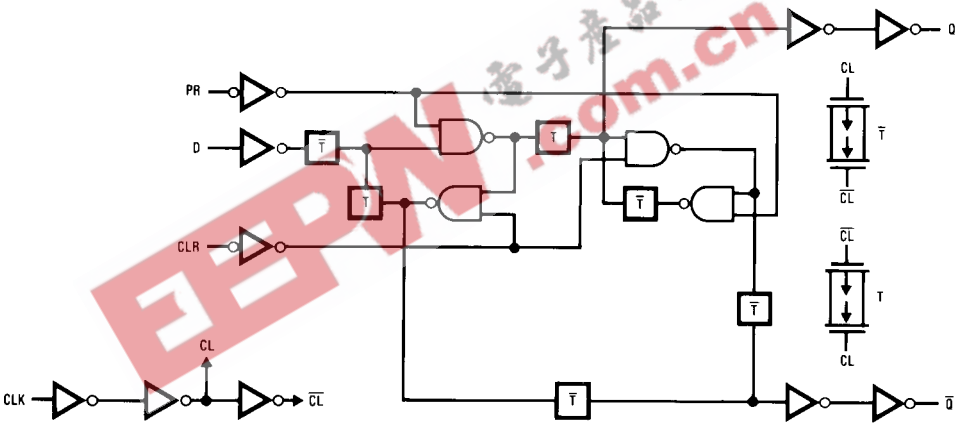
Truth Table

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

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})	4.5	5.5	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)		500	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

V_{CC} = 5V ±10% (unless otherwise specified)

Symbol	Parameter	Conditions	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			2.0	2.0	2.0	V
V_{IL}	Maximum LOW Level Input Voltage			0.8	0.8	0.8	V
V_{OH}	Minimum HIGH Level Output Voltage	V_{IN} = V_{IH} or V_{IL}					
		$\|I_{OUT}\|$ = 20 µA	V_{CC}	V_{CC} − 0.1	V_{CC} − 0.1	V_{CC} − 0.1	V
		$\|I_{OUT}\|$ = 4.0 mA, V_{CC} = 4.5V	4.2	3.98	3.84	3.7	V
		$\|I_{OUT}\|$ = 4.8 mA, V_{CC} = 5.5V	5.2	4.98	4.84	4.7	V
V_{OL}	Maximum LOW Level Voltage	V_{IN} = V_{IH} or V_{IL}					
		$\|I_{OUT}\|$ = 20 µA	0	0.1	0.1	0.1	V
		$\|I_{OUT}\|$ = 4.0 mA, V_{CC} = 4.5V	0.2	0.26	0.33	0.4	V
		$\|I_{OUT}\|$ = 4.8 mA, V_{CC} = 5.5V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	V_{IN} = V_{CC} or GND, V_{IH} or V_{IL}		±0.0.5	±0.5	±1.0	µA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND					
		I_{OUT} = 0 µA		2.0	20	80	µA
		V_{IN} = 2.4V or 0.5V (Note 5)		0.3	0.4	0.5	mA

Note 5: This is measured per pin. All other inputs are held at V_{CC} Ground.

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 from Clock to Q or $\overline{Q}$		50	30	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay Clock to Q or $\overline{Q}$		18	30	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay from Preset or Clear to Q or $\overline{Q}$		18	30	ns
t_{REM}	Minimum Removal Time, Preset or Clear to Clock			20	ns
t_S	Minimum Setup Time Data to Clock			20	ns
t_H	Minimum Hold Time Clock to Data		−3	0	ns
t_W	Minimum Pulse Width Clock, Preset or Clear		8	16	ns

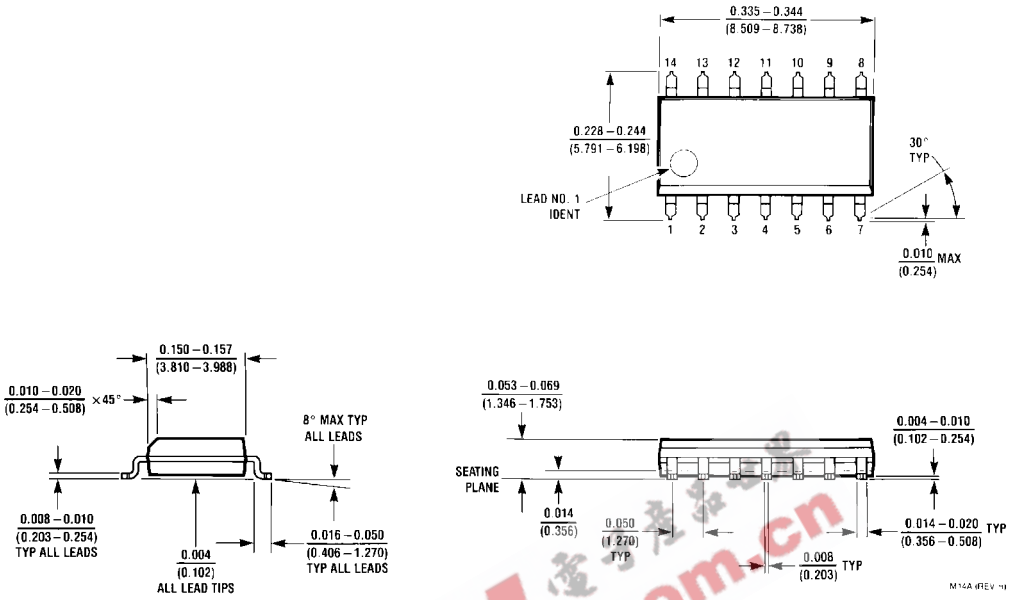
AC Electrical Characteristics

V_{CC} = 5.0V ± 10%, C_L = 50 pF, $t_r = t_f$ = 6 ns unless otherwise specified

Symbol	Parameter	Conditions	T_A = 25°C	T_A = −40° to +85°C	Units
			Typ	Guaranteed Limits	
f_{MAX}	Maximum Operating Frequency			27	21	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay from Clock to Q or $\overline{Q}$		21	35	44	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay from Preset or Clear to Q or $\overline{Q}$		21	35	44	ns
t_{REM}	Minimum Removal Time Preset or Clear to Clock			20	25	ns
t_S	Minimum Setup Time Data to Clock			20	25	ns
t_H	Minimum Hold Time Clock to Data		−3	0	0	ns
t_W	Minimum Pulse Width Clock, Preset or Clear		9	16	20	ns
t_r, t_f	Maximum Clock Input Rise and Fall Time			500	500	ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time			15	19	ns
C_{PD}	Power Dissipation Capacitance (Note 6)	(per flip-flop)	10			pF
C_{IN}	Maximum Input Capacitance		5	10	10	pF

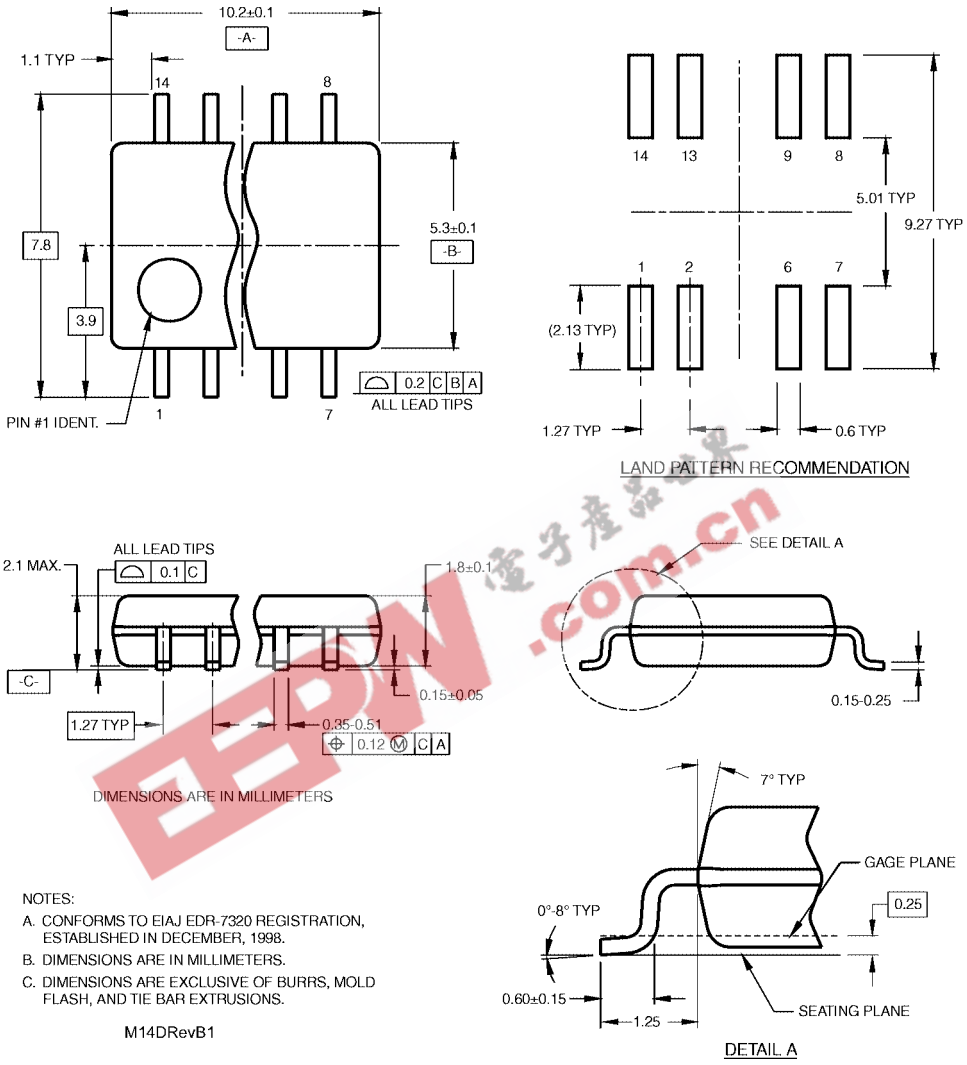
Note 6: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A

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



NOTES:

A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.

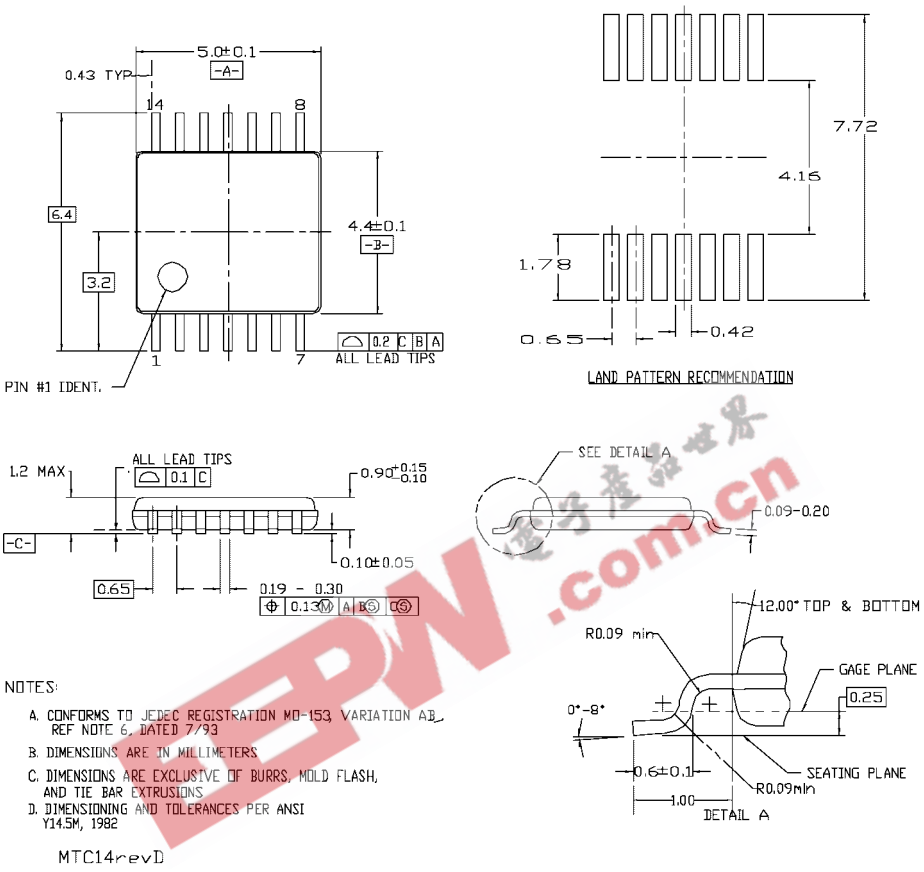
B. DIMENSIONS ARE IN MILLIMETERS.

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

M14DRevB1

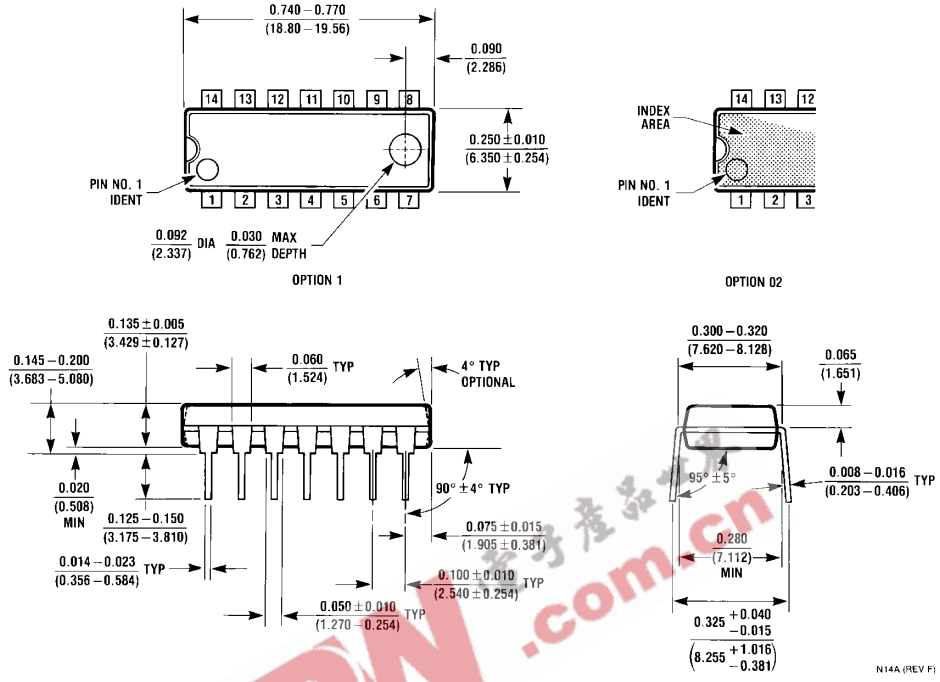
Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M14D

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



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

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