FAIRCHILD SEMICONDUCTOR™

October 1987
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MM74C74
Dual D-Type Flip-Flop

General Description

The MM74C74 dual D-type flip-flop is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. Each 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 or clear is independent of the clock and accomplished by a low level at the preset or clear input.

Features

- Supply voltage range: 3V to 15V
- Tenth power TTL compatible: Drive 2 LPT^{2}L loads
- High noise immunity: 0.45 V_{CC} (typ.)
- Low power: 50 nW (typ.)
- Medium speed operation: 10 MHz (typ.) with 10V supply

Applications

- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm system
- Industrial electronics
- Remote metering
- Computers

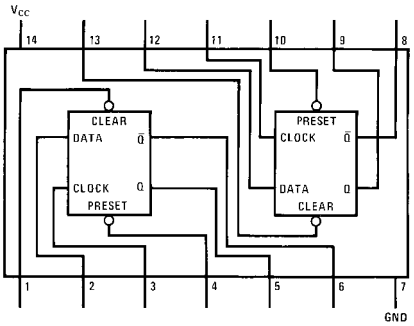
Ordering Code:

Order Number	Package Number	Package Description
MM74C74M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
MM74C74N	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 and SOIC



Note: A logic "0" on clear sets Q to logic "0".
A logic "0" on preset sets Q to logic "1".

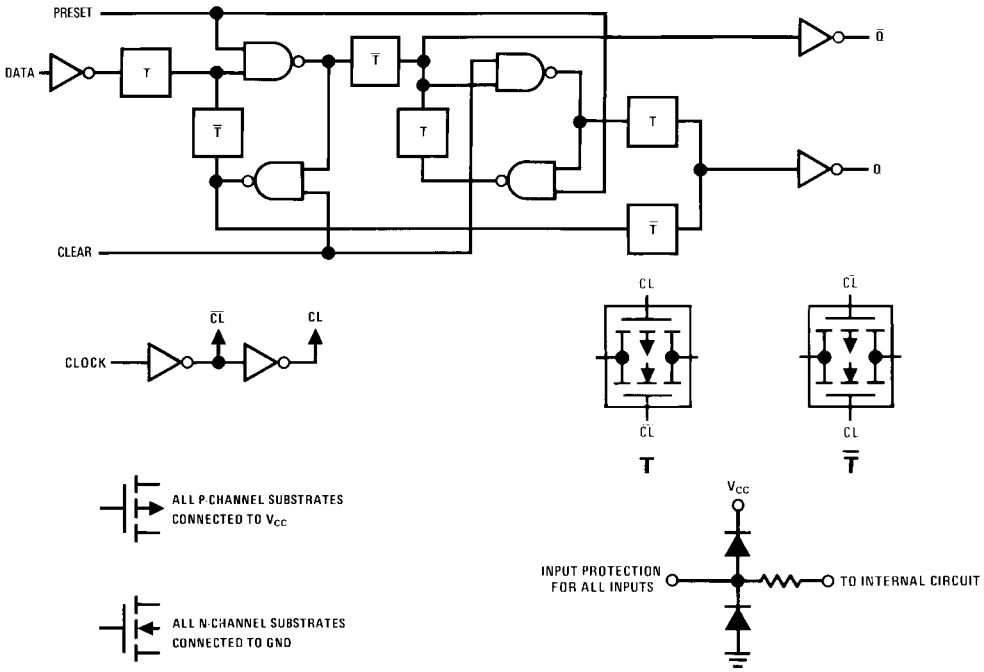
Top View

Truth Table

Preset	Clear	Q_n	$\overline{Q}_n$
0	0	0	0
0	1	1	0
1	0	0	1
1	1	Q_n (Note 1)	$\overline{Q}_n$ (Note 1)

Note 1: No change in output from previous state.

Logic Diagram



Absolute Maximum Ratings(Note 2)

Voltage at Any Pin (Note 2)	−0.3V to V_{CC} +0.3V
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Power Dissipation	
Dual-In-Line	700 mW
Small Outline	500 mW
Lead Temperature	
(Soldering, 10 seconds)	260°C
Operating V_{CC} Range	3V to 15V
V_{CC} (Max)	18V

Note 2: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 5V	3.5			V
		V_{CC} = 10V	80			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5V			1.5	V
		V_{CC} = 10V			2.0	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5V	4.5			V
		V_{CC} = 10V	9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5V			0.5	V
		V_{CC} = 10V			1.0	V
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15V			1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 15V	−1.0			μA
I_{CC}	Supply Current	V_{CC} = 15V		0.05	60	μA
CMOS/LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 4.75V	V_{CC}−1.5			
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 4.75V			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 4.75V, I_D = −360 μA	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 4.75V, I_D = 360 μA			0.4	V
OUTPUT DRIVE (See Family Characteristics Data Sheet)						
I_{SOURCE}	Output Source Current	V_{CC} = 5V, $V_{IN(0)}$ = 0V T_A = 25°C, V_{OUT} = 0V	−1.75			mA
I_{SOURCE}	Output Source Current	V_{CC} = 10V, $V_{IN(0)}$ = 0V T_A = 25°C, V_{OUT} = 0V	−8.0			mA
I_{SINK}	Output Sink Current	V_{CC} = 5V, $V_{IN(1)}$ = 5V T_A = 25°C, V_{OUT} = V_{CC}	1.75			mA
I_{SINK}	Output Sink Current	V_{CC} = 10V, $V_{IN(1)}$ = 10V T_A = 25°C, V_{OUT} = V_{CC}	8.0			mA

AC Electrical Characteristics (Note 3)

$T_A = 25°C$, $C_L = 50$ pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
C_{IN}	Input Capacitance	Any Input (Note 4)		5.0		pF
t_{pd}	Propagation Delay Time to a Logical "0" t_{pd0} or Logical "1" t_{pd1} from Clock to Q or $\overline{Q}$	$V_{CC} = 5V$		180	300	ns
		$V_{CC} = 10V$		70	110	ns
t_{pd}	Propagation Delay Time to a Logical "0" from Preset or Clear	$V_{CC} = 5V$		180	300	ns
		$V_{CC} = 10V$		70	110	ns
t_{pd}	Propagation Delay Time to a Logical "1" from Preset or Clear	$V_{CC} = 5V$		250	400	ns
		$V_{CC} = 10V$		100	150	ns
t_{S0}, t_{S1}	Time Prior to Clock Pulse that Data Must be Present t_{SETUP}	$V_{CC} = 5V$	100	50		ns
		$V_{CC} = 10V$	40	20		ns
t_{H0}, t_{H1}	Time after Clock Pulse that Data Must be Held	$V_{CC} = 5V$		–20	0	ns
		$V_{CC} = 10V$		–8.0	0	ns
t_{PW1}	Minimum Clock Pulse Width ($t_{WL} = t_{WH}$)	$V_{CC} = 5V$		100	250	ns
		$V_{CC} = 10V$		40	100	ns
t_{PW2}	Minimum Preset and Clear Pulse Width	$V_{CC} = 5V$		100	160	ns
		$V_{CC} = 10V$		40	70	ns
t_r, t_f	Maximum Clock Rise and Fall Time	$V_{CC} = 5V$	15.0			µs
		$V_{CC} = 10V$	5.0			µs
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 5V$	2.0	3.5		MHz
		$V_{CC} = 10V$	5.0	8.0		MHz
C_{PD}	Power Dissipation Capacitance	(Note 5)		40		pF

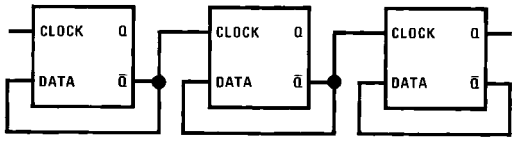
Note 3: AC Parameters are guaranteed by DC correlated testing.

Note 4: Capacitance is guaranteed by periodic testing.

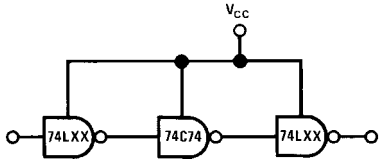
Note 5: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note—AN-90.

Typical Applications

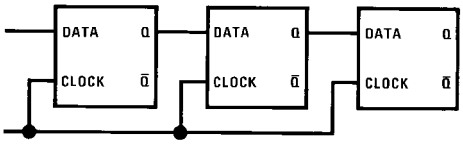
Ripple Counter (Divide by 2^n)



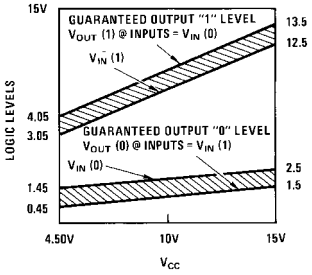
74C Compatibility



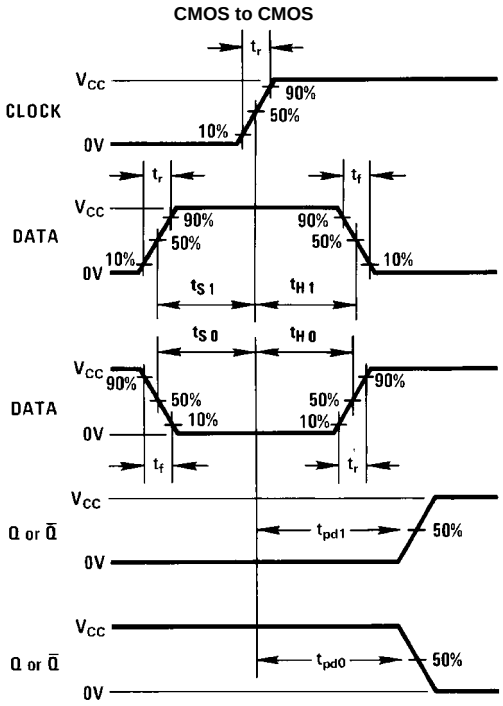
Shift Register



Guaranteed Noise Margin as a Function of V_{CC}

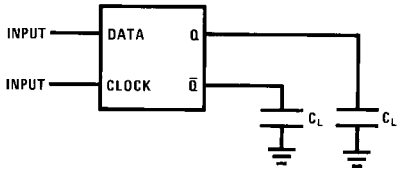


Switching Time Waveform

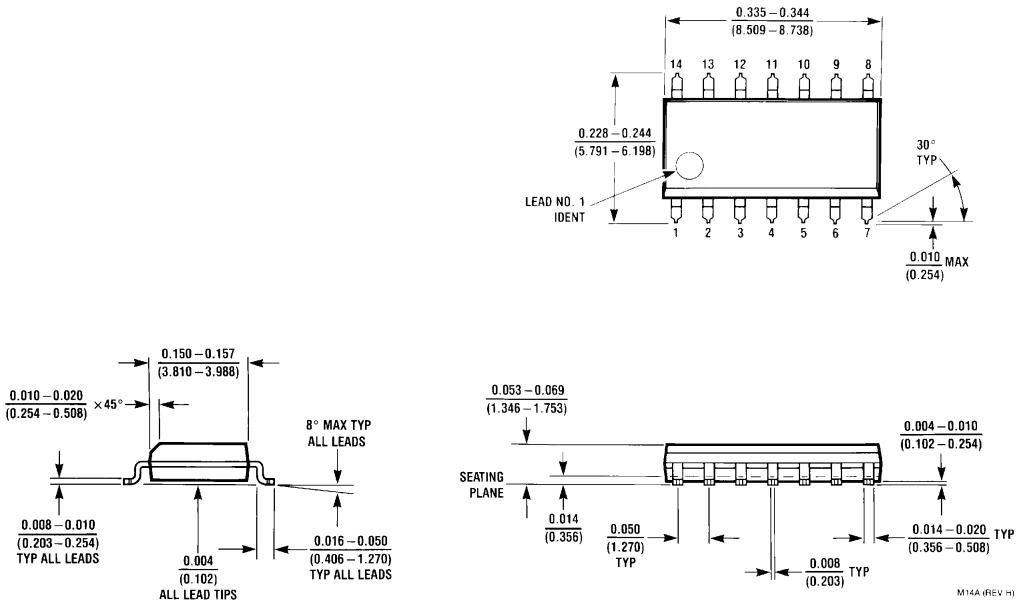


$t_r = t_f = 20$ ns

AC Test Circuit

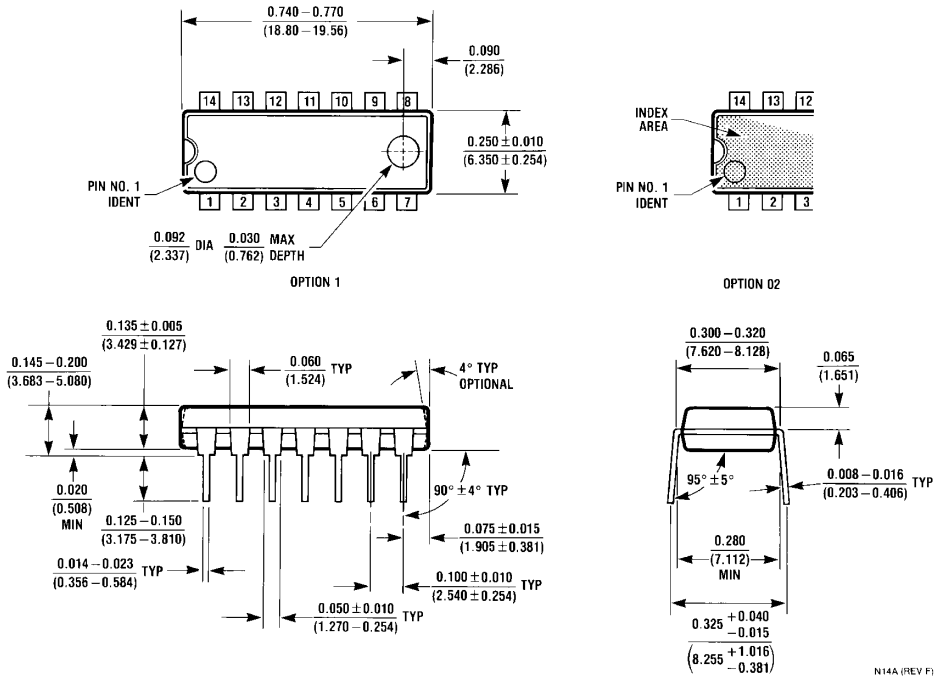


Physical Dimensions inches (millimeters) unless otherwise noted



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

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