FAIRCHILD SEMICONDUCTOR™

April 1988
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74F74
Dual D-Type Positive Edge-Triggered Flip-Flop

General Description

The F74 is a dual D-type flip-flop with Direct Clear and Set inputs and complementary (Q, $\overline{Q}$) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

LOW input to $\overline{S}_D$ sets Q to HIGH level

LOW input to $\overline{C}_D$ sets Q to LOW level

Clear and Set are independent of clock

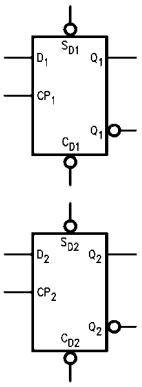
Simultaneous LOW on $\overline{C}_D$ and $\overline{S}_D$ makes both Q and $\overline{Q}$ HIGH

Ordering Code:

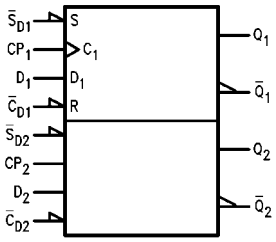
Order Number	Package Number	Package Description
74F74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
74F74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F74PC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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

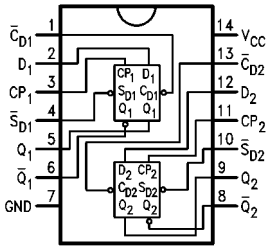
Logic Symbols



IEEE/IEC



Connection Diagram



Unit Loading/Fan Out

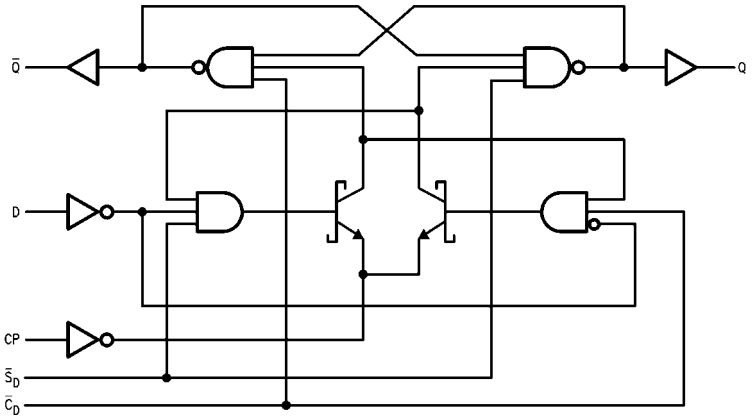
Pin Names	Description	U.L. HIGH/LOW	Input I_{IH}/I_{IL} Output I_{OH}/I_{OL}
D_1, D_2	Data Inputs	1.0/1.0	20 µA/–0.6 mA
CP_1, CP_2	Clock Pulse Inputs (Active Rising Edge)	1.0/1.0	20 µA/–0.6 mA
$\overline{C}_{D1}$, $\overline{C}_{D2}$	Direct Clear Inputs (Active LOW)	1.0/3.0	20 µA/–1.8 mA
$\overline{S}_{D1}$, $\overline{S}_{D2}$	Direct Set Inputs (Active LOW)	1.0/3.0	20 µA/–1.8 mA
Q_1, $\overline{Q}_1$, Q_2, $\overline{Q}_2$	Outputs	50/33.3	–1 mA/20 mA

Truth Table

Inputs				Outputs	
$\overline{S}_D$	$\overline{C}_D$	CP	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H
H	H	⌐	h	H	L
H	H	⌐	l	L	H
H	H	L	X	Q_0	$\overline{Q}_0$

H (h) = HIGH Voltage Level
L (l) = LOW Voltage Level
X = Immaterial
Q_0 = Previous Q ($\overline{Q}$) before LOW-to-HIGH Clock Transition
Lower case letters indicate the state of the referenced input or output one setup time prior to the LOW-to-HIGH clock transition.

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +150°C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Output	
in HIGH State (with V_{CC} = 0V)	
Standard Output	−0.5V to V_{CC}
3-STATE Output	−0.5V to +5.5V
Current Applied to Output	
in LOW State (Max)	twice the rated I_{OL} (mA)
ESD Last Passing Voltage (Min)	4000V

Recommended Operating Conditions

Free Air Ambient Temperature	0°C to +70°C
Supply Voltage	+4.5V to +5.5V

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

DC Electrical Characteristics

Symbol	Parameter		Min	Typ	Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		Recognized as a HIGH Signal
V_{IL}	Input LOW Voltage				0.8	V		Recognized as a LOW Signal
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA
V_{OH}	Output HIGH Voltage	10% V_{CC}	2.5			V	Min	I_{OH} = −1 mA
		5% V_{CC}	2.7					I_{OH} = −1 mA
V_{OL}	Output LOW Voltage	10% V_{CC}			0.5	V	Min	I_{OL} = 20 mA
I_{IH}	Input HIGH Current				5.0	µA	Max	V_{IN} = 2.7V
I_{BVI}	Input HIGH Current Breakdown Test				7.0	µA	Max	V_{IN} = 7.0V
I_{CEX}	Output HIGH Leakage Current				50	µA	Max	V_{OUT} = V_{CC}
V_{ID}	Input Leakage Test		4.75			V	0.0	I_{ID} = 1.9 µA All Other Pins Grounded
I_{OD}	Output Leakage Circuit Current				3.75	µA	0.0	V_{IOD} = 150 mV All Other Pins Grounded
I_{IL}	Input LOW Current				−0.6	mA	Max	V_{IN} = 0.5V (D, CP)
					−1.8			V_{IN} = 0.5V ($\overline{C}_D$, $\overline{S}_D$)
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CC}	Power Supply Current			10.5	16.0	mA	Max	

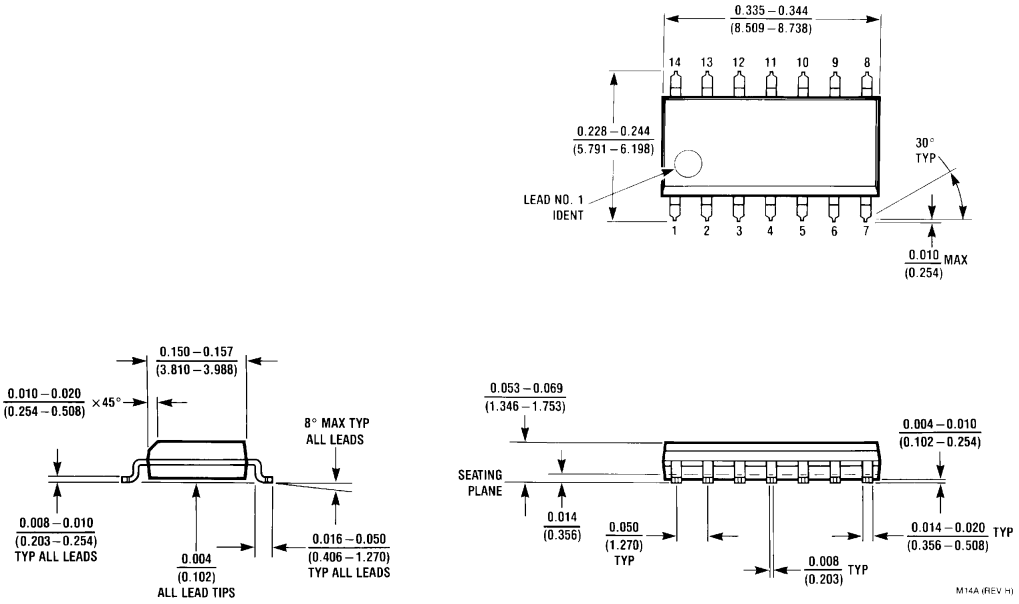
AC Electrical Characteristics

Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF			$T_A = 0°C$ to $+70°C$, $V_{CC} = +5.0V$, $C_L = 50$ pF		Units
		Min	Typ	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	100	125		100		MHz
t_{PLH}	Propagation Delay	3.8	5.3	6.8	3.8	7.8	ns
t_{PHL}	CP_n to Q_n or $\overline{Q}_n$	4.4	6.2	8.0	4.4	9.2	
t_{PLH}	Propagation Delay	3.2	4.6	6.1	3.2	7.1	ns
t_{PHL}	$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	3.5	7.0	9.0	3.5	10.5	

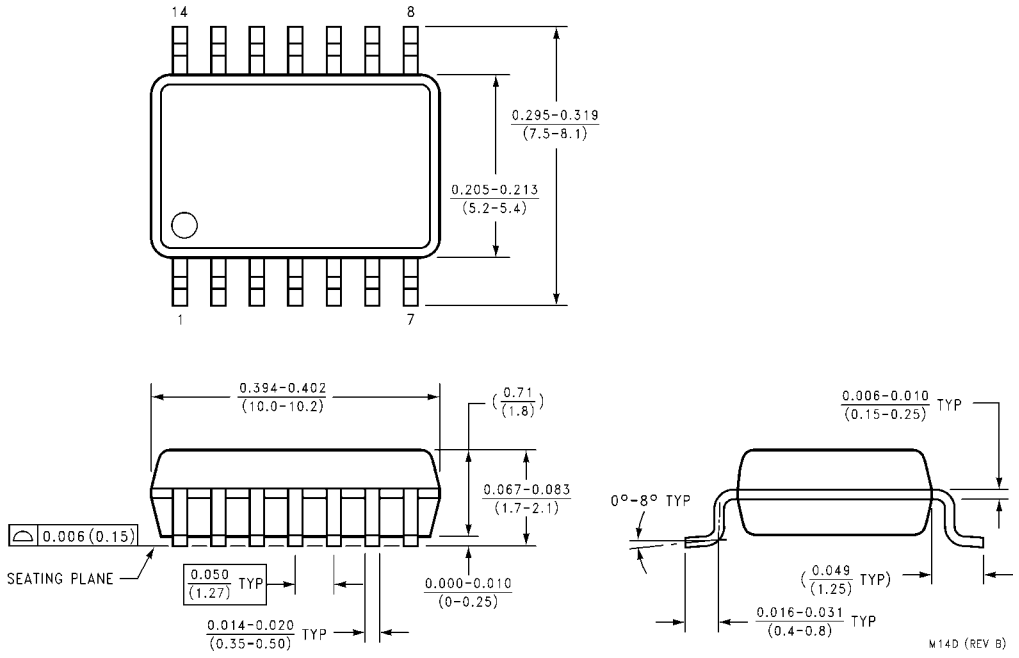
AC Operating Requirements

Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$		$T_A = 0°C$ to $+70°C$, $V_{CC} = +5.0V$		Units
		Min	Max	Min	Max	
$t_S(H)$	Setup Time, HIGH or LOW	2.0		2.0		ns
$t_S(L)$	D_n to CP_n	3.0		3.0		
$t_H(H)$	Hold Time, HIGH or LOW	1.0		1.0		
$t_H(L)$	D_n to CP_n	1.0		1.0		
$t_W(H)$	CP_n Pulse Width	4.0		4.0		ns
$t_W(L)$	HIGH or LOW	5.0		5.0		
$t_W(L)$	$\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width LOW	4.0		4.0		ns
t_{REC}	Recovery Time $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to CP	2.0		2.0		ns

Physical Dimensions inches (millimeters) unless otherwise noted

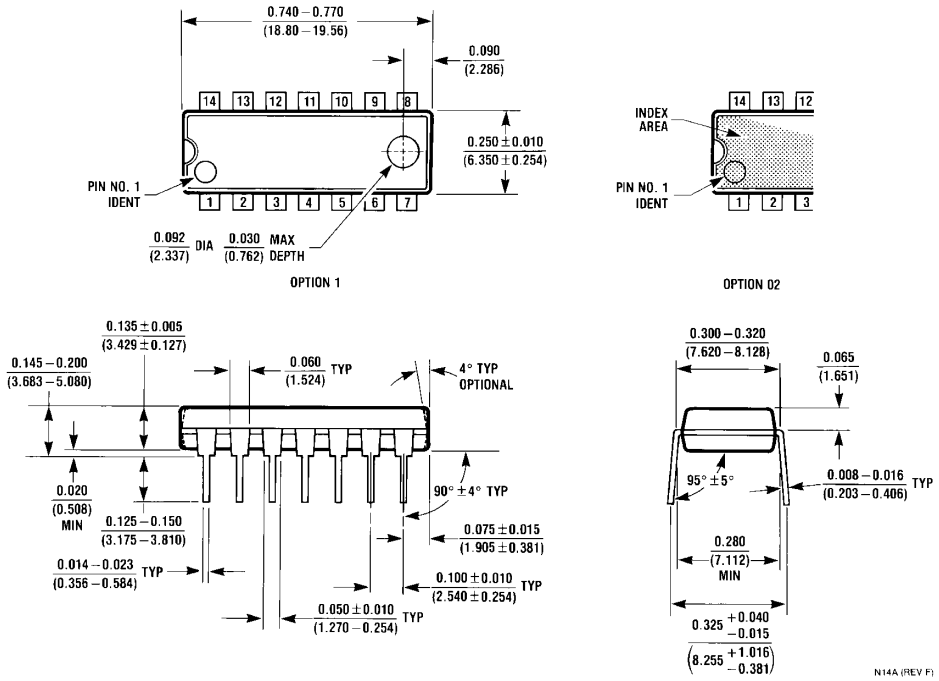


14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
Package Number M14A



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

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



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