FAIRCHILD SEMICONDUCTOR™

April 1988
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74F112
Dual JK Negative Edge-Triggered Flip-Flop

General Description

The 74F112 contains two independent, high-speed JK flip-flops with Direct Set and Clear inputs. Synchronous state changes are initiated by the falling edge of the clock. Triggering occurs at a voltage level of the clock and is not directly related to the transition time. The J and K inputs can change when the clock is in either state without affecting the flip-flop, provided that they are in the desired state during the recommended setup and hold times relative to the falling edge of the clock. A LOW signal on $\overline{S}_D$ or $\overline{C}_D$ prevents clocking and forces Q or $\overline{Q}$ HIGH, respectively.

Simultaneous LOW signals on $\overline{S}_D$ and $\overline{C}_D$ force both Q and $\overline{Q}$ HIGH.

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

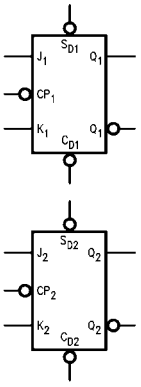
Simultaneous LOW on $\overline{C}_D$ and $\overline{S}_D$ makes both Q and $\overline{Q}$ HIGH

Ordering Code:

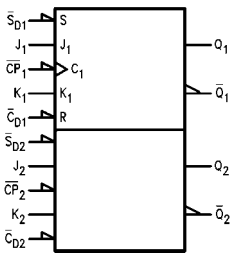
Order Number	Package Number	Package Description
74F112SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74F112SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F112PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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

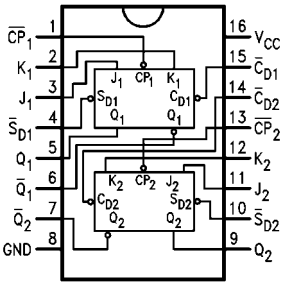
Logic Symbols



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}
J_1, J_2, K_1, K_2	Data Inputs	1.0/1.0	20 µA/–0.6 mA
$\overline{CP}_1$, $\overline{CP}_2$	Clock Pulse Inputs (Active Falling Edge)	1.0/4.0	20 µA/–2.4 mA
$\overline{C}_{D1}$, $\overline{C}_{D2}$	Direct Clear Inputs (Active LOW)	1.0/5.0	20 µA/–3.0 mA
$\overline{S}_{D1}$, $\overline{S}_{D2}$	Direct Set Inputs (Active LOW)	1.0/5.0	20 µA/–3.0 mA
Q_1, Q_2, $\overline{Q}_1$, $\overline{Q}_2$	Outputs	50/33.3	–1 mA/20 mA

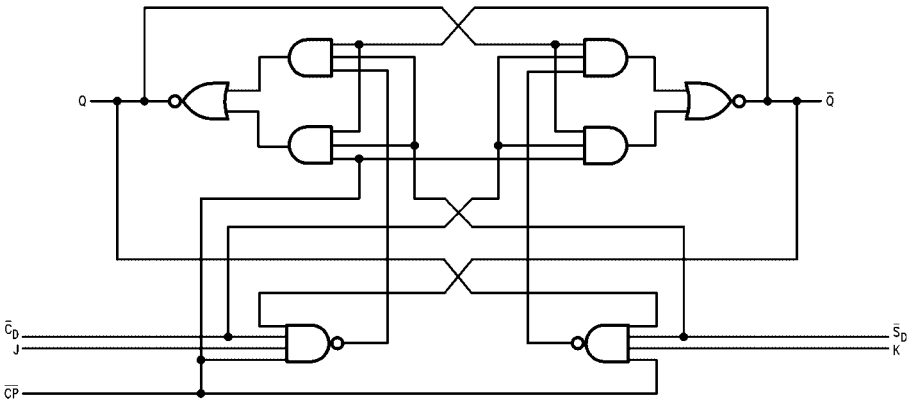
Truth Table

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

H (h) = HIGH Voltage Level
L (l) = LOW Voltage Level
X = Immaterial
⌐ = HIGH-to-LOW Clock Transition
Q_0($\overline{Q}_0$) = Before HIGH-to-LOW Transition of Clock
Lower case letters indicate the state of the referenced input or output one setup time prior to the HIGH-to-LOW clock transition.

Logic Diagram

(One Half Shown)



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)

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	10% V_{CC}	2.5			V	Min	I_{OH} = −1 mA
	Voltage	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 (J_n, K_n)
					−2.4			V_{IN} = 0.5V ($\overline{CP}_n$)
					−3.0			V_{IN} = 0.5V ($\overline{C}_{Dn}$, $\overline{S}_{Dn}$)
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CCH}	Power Supply Current			12	19	mA	Max	V_O = HIGH
I_{CCL}	Power Supply Current			12	19	mA	Max	V_O = LOW

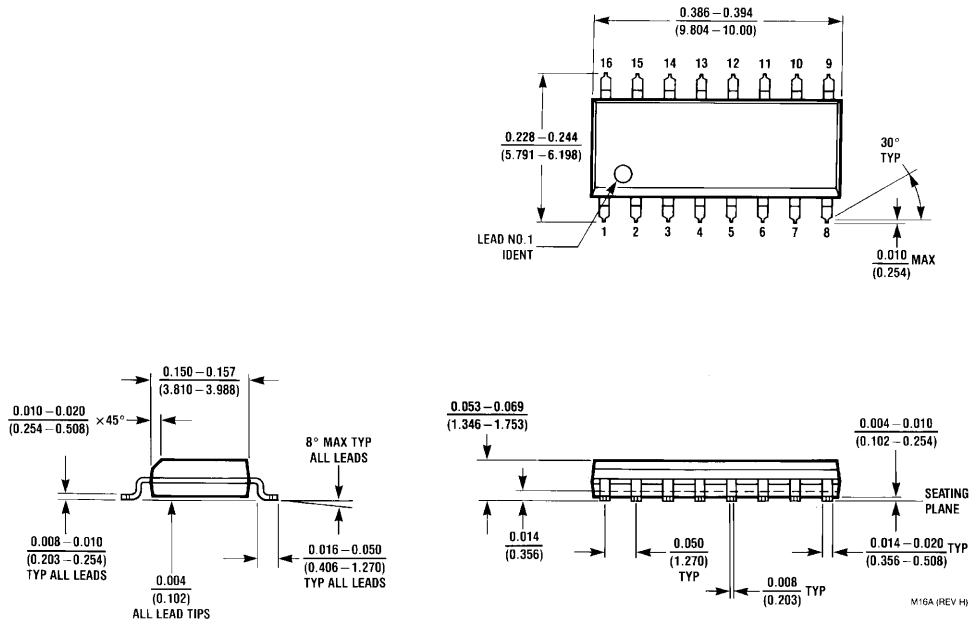
AC Electrical Characteristics

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	85	105		80		MHz
t_{PLH}	Propagation Delay	2.0	5.0	6.5	2.0	7.5	ns
t_{PHL}	$\overline{CP}_n$ to Q_n or $\overline{Q}_n$	2.0	5.0	6.5	2.0	7.5	
t_{PLH}	Propagation Delay	2.0	4.5	6.5	2.0	7.5	ns
t_{PHL}	$\overline{C}_{Dn}$, $\overline{S}_{Dn}$ to $\overline{Q}_n$, $\overline{Q}_n$	2.0	4.5	6.5	2.0	7.5	

AC Operating Requirements

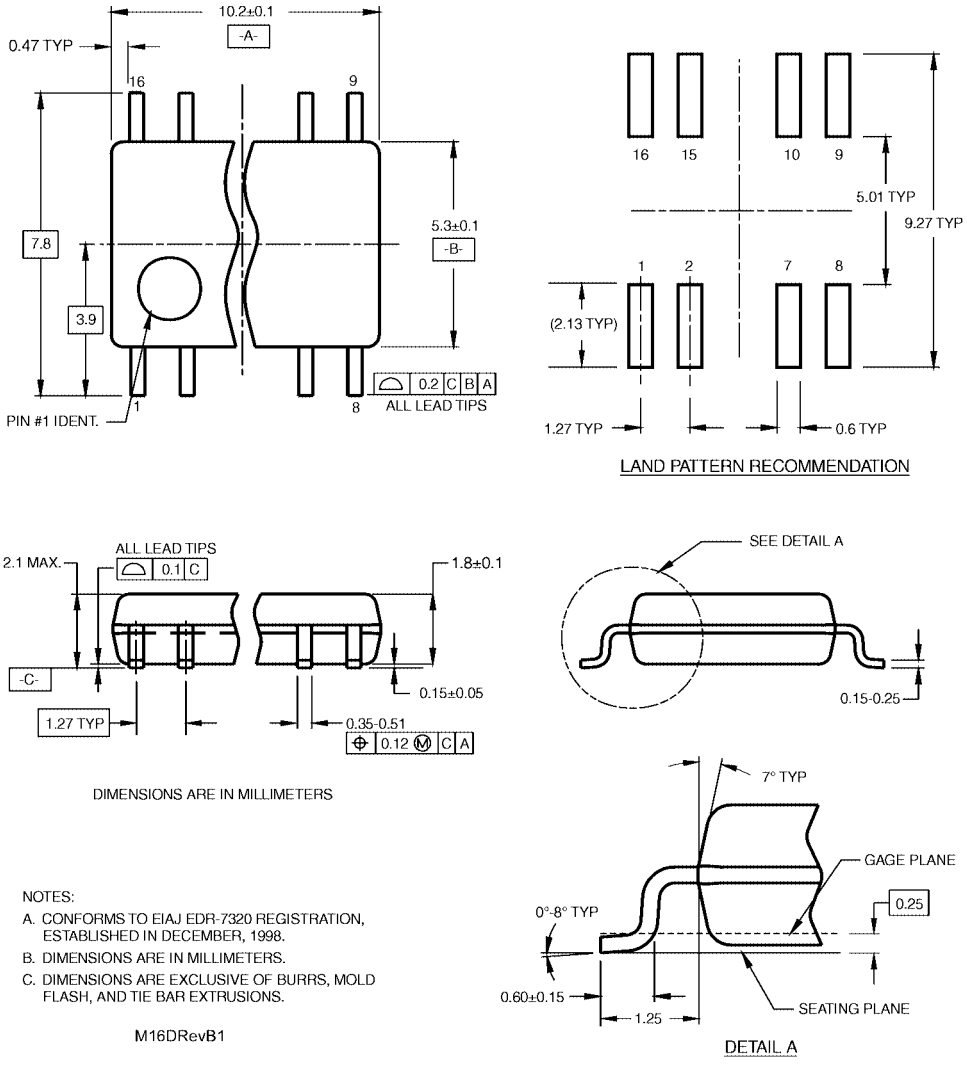
Symbol	Parameter	$T_A = +25°C$, $V_{CC} = +5.0V$		$T_A = 0°C$ to $+70°C$, $V_{CC} = +5.0V$		Units
		Min	Max	Min	Max	
$t_S(H)$	Setup Time, HIGH or LOW	4.0		5.0		ns
$t_S(L)$	J_n or K_n to $\overline{CP}_n$	3.0		3.5		
$t_H(H)$	Hold Time, HIGH or LOW	0		0		
$t_H(L)$	J_n or K_n to $\overline{CP}_n$	0		0		
$t_W(H)$	$\overline{CP}$ Pulse Width	4.5		5.0		ns
$t_W(L)$	HIGH or LOW	4.5		5.0		
$t_W(L)$	Pulse Width, LOW $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$	4.5		5.0		ns
t_{REC}	Recovery Time $\overline{S}_{Dn}$, $\overline{C}_{Dn}$ to $\overline{CP}$	4.0		5.0		ns

Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
Package Number M16A

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



NOTES:

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

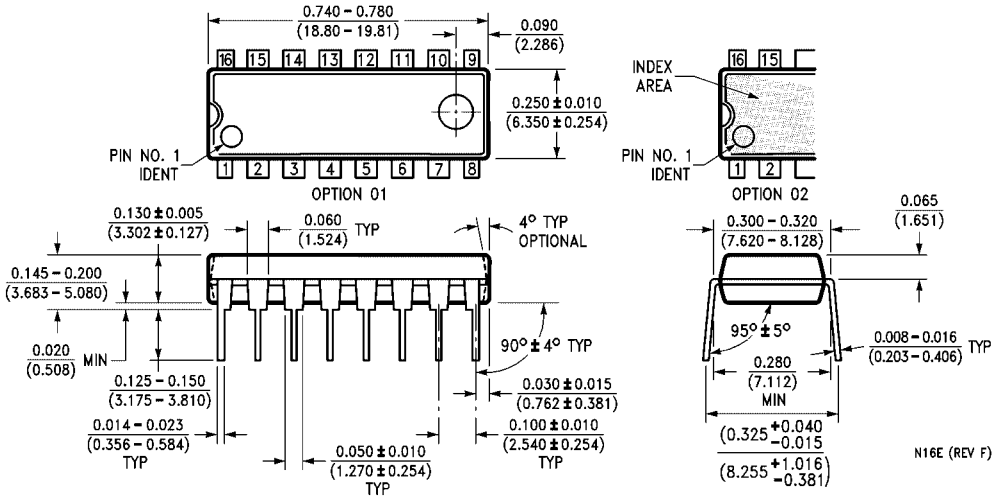
B. DIMENSIONS ARE IN MILLIMETERS.

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

M16DRevB1

16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

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



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N16E