

## 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  $\bar{S}_D$  or  $\bar{C}_D$  prevents clocking and forces Q or  $\bar{Q}$  HIGH, respectively.

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

Asynchronous Inputs:

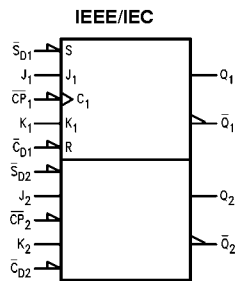
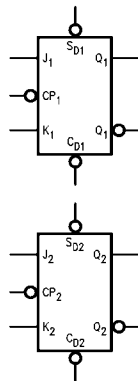
- LOW input to  $\bar{S}_D$  sets Q to HIGH level
- LOW input to  $\bar{C}_D$  sets Q to LOW level
- Clear and Set are independent of clock
- Simultaneous LOW on  $\bar{C}_D$  and  $\bar{S}_D$  makes both Q and  $\bar{Q}$  HIGH

### Ordering Code:

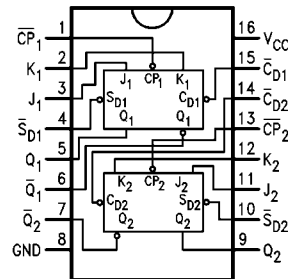
Order Number	Package Number	Package Description
74F112SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74F112SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F112PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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

### Logic Symbols



### Connection Diagram



### Unit Loading/Fan Out

Pin Names	Description	U.L.	
		HIGH/LOW	Input I <sub>H</sub> /I <sub>L</sub> Output I <sub>OH</sub> /I <sub>OL</sub>
J <sub>1</sub> , J <sub>2</sub> , K <sub>1</sub> , K <sub>2</sub>	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
$\overline{CD}_1$ , $\overline{CD}_2$	Direct Clear Inputs (Active LOW)	1.0/5.0	20 μA/-3.0 mA
$\overline{SD}_1$ , $\overline{SD}_2$	Direct Set Inputs (Active LOW)	1.0/5.0	20 μA/-3.0 mA
Q <sub>1</sub> , Q <sub>2</sub> , $\overline{Q}_1$ , $\overline{Q}_2$	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 <sub>0</sub>
H	H	~	l	h	L	H
H	H	~	h	l	H	L
H	H	~	l	l	Q <sub>0</sub>	$\overline{Q}_0$

H (h) = HIGH Voltage Level

L (l) = LOW Voltage Level

X = Immaterial

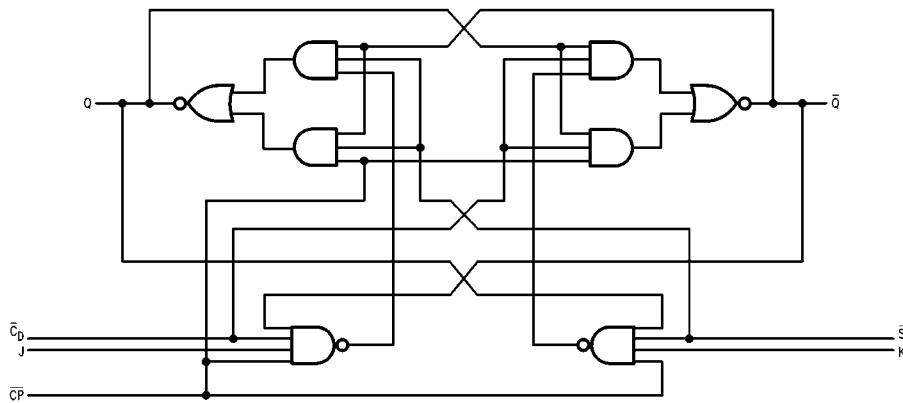
~ = HIGH-to-LOW Clock Transition

Q<sub>0</sub>( $\overline{Q}_0$ ) = 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 <sub>CC</sub> 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 <sub>CC</sub> = 0V)	
Standard Output	-0.5V to V <sub>CC</sub>
3-STATE Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (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 <sub>CC</sub>	Conditions
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	10% V <sub>CC</sub> 5% V <sub>CC</sub>	2.5 2.7		V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA
V <sub>OL</sub>	Output LOW Voltage	10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current			5.0	μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test			7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output HIGH Leakage Current			50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All other pins grounded
I <sub>OD</sub>	Output Leakage Circuit Current			3.75	μA	0.0	V <sub>IOD</sub> = 150 mV All other pins grounded
I <sub>IL</sub>	Input LOW Current			-0.6 -2.4 -3.0	mA	Max	V <sub>IN</sub> = 0.5V (J <sub>n</sub> , K <sub>n</sub> ) V <sub>IN</sub> = 0.5V ( $\overline{CP}_n$ ) V <sub>IN</sub> = 0.5V ( $\overline{CD}_n$ , $\overline{SD}_n$ )
I <sub>OS</sub>	Output Short-Circuit Current	-60		-150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CCH</sub>	Power Supply Current		12	19	mA	Max	V <sub>O</sub> = HIGH
I <sub>CCL</sub>	Power Supply Current		12	19	mA	Max	V <sub>O</sub> = LOW

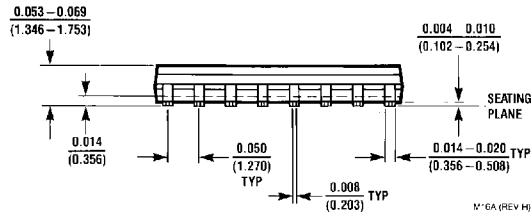
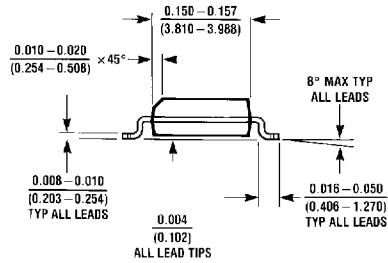
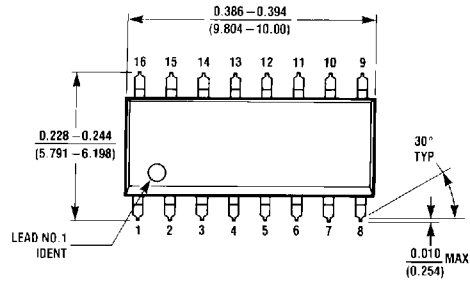
### AC Electrical Characteristics

Symbol	Parameter	$T_A = +25^\circ\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$			$T_A = 0^\circ\text{C to } +70^\circ\text{C}$ $V_{CC} = +5.0\text{V}$ $C_L = 50\text{ pF}$		Units
		Min	Typ	Max	Min	Max	
$t_{MAX}$	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	

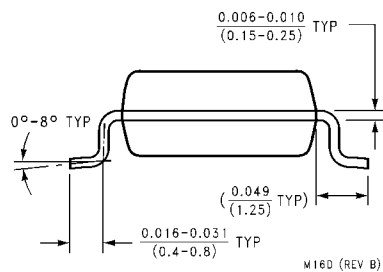
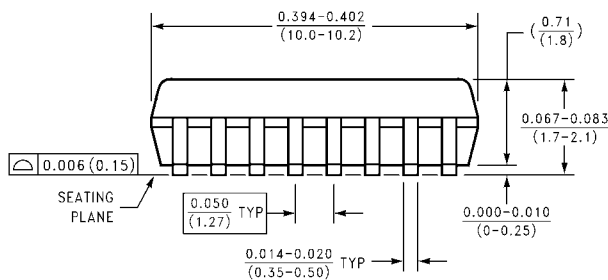
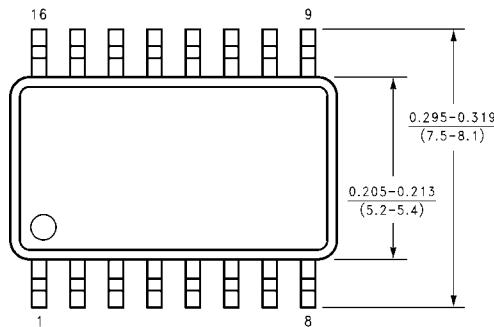
### AC Operating Requirements

Symbol	Parameter	$T_A = +25^\circ\text{C}$ $V_{CC} = +5.0\text{V}$		$T_A = 0^\circ\text{C to } +70^\circ\text{C}$ $V_{CC} = +5.0\text{V}$		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		ns
$t_{H(L)}$	$J_n$ 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

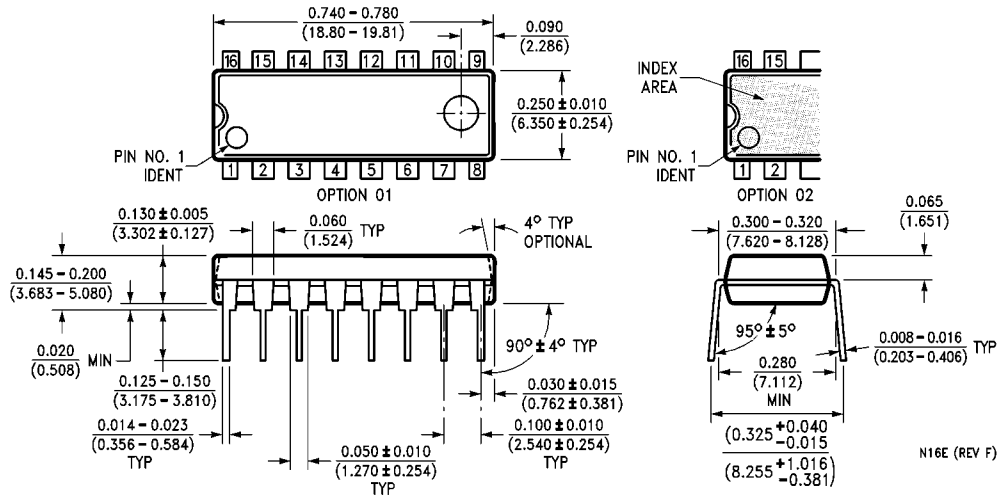


**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow Package Number M16A**



**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**

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