FAIRCHILD SEMICONDUCTOR TM

April 1988
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74F113
Dual JK Negative Edge-Triggered Flip-Flop

General Description

The 74F113 offers individual J, K, Set and Clock inputs. When the clock goes HIGH the inputs are enabled and data may be entered. The logic level of the J and K inputs may be changed when the clock pulse is HIGH and the flip-flop will perform according to the Truth Table as long as minimum setup and hold times are observed. Input data is transferred to the outputs on the falling edge of the clock pulse.

Asynchronous input:

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

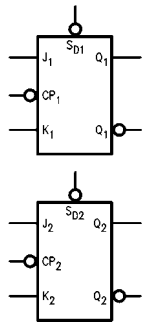
Set is independent of clock

Ordering Code:

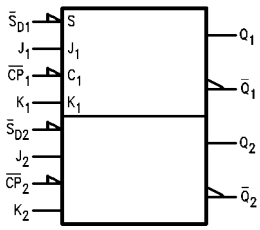
Order Number	Package Number	Package Description
74F113SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
74F113SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F113PC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

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

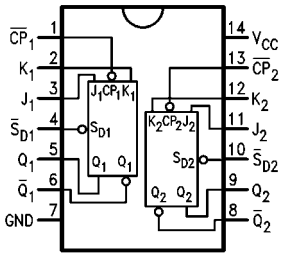
Logic Symbols



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}
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
$\overline{S}_{D1}$, $\overline{S}_{D2}$	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

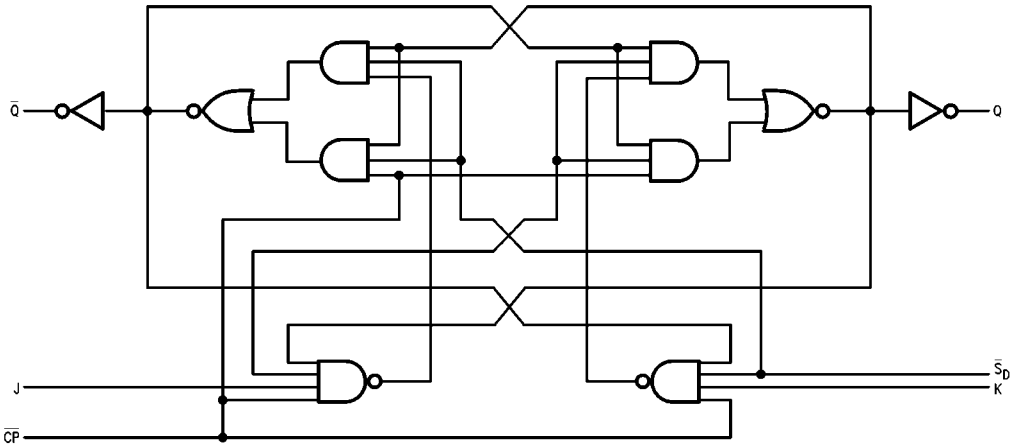
Truth Table

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

H (h) = HIGH Voltage Level
L (l) = LOW Voltage level
⌐ = HIGH-to-LOW Clock Transition
X = Immaterial
Q_0 ($\overline{Q}_0$) = Before HIGH-to-LOW Transition of Clock
Lower case letters indicate the state of the referenced input or output 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 ($\overline{S}_{Dn}$)
I_{OZH}	Output Leakage Current				50	µA	Max	V_{OUT} = 2.7V
I_{OZL}	Output Leakage Current				−50	µA	Max	V_{OUT} = 0.5V
I_{OS}	Output Short-Circuit Current		−60		−150	mA	Max	V_{OUT} = 0V
I_{CC}	Power Supply Current			12	19	mA	Max	

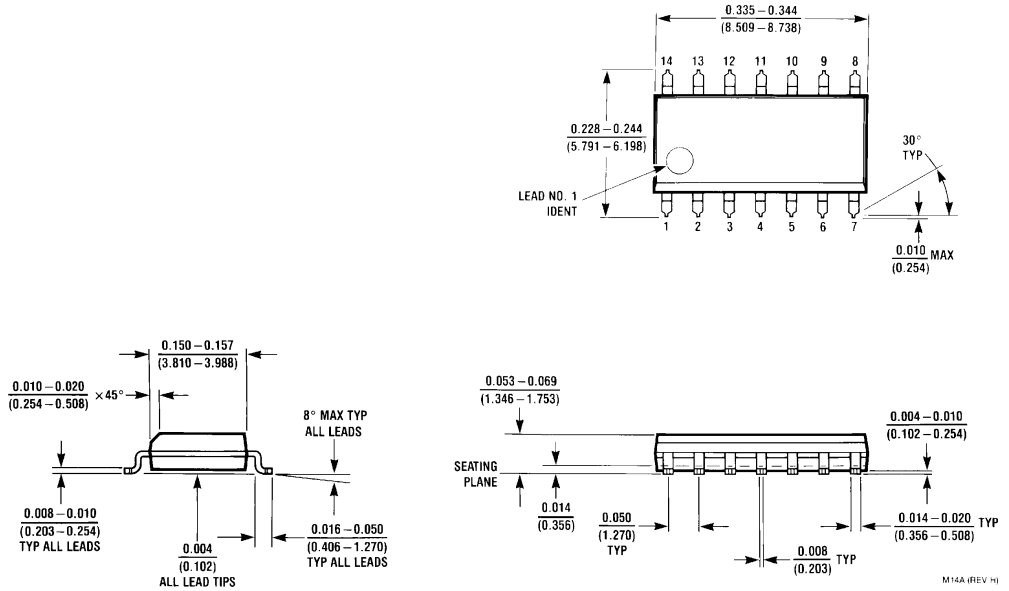
AC Electrical Characteristics

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	85	105		80		MHz
t_{PLH}	Propagation Delay	2.0	4.0	6.0	2.0	7.0	ns
t_{PHL}	$\overline{CP}_n$ to Q_n or $\overline{Q}_n$	2.0	4.0	6.0	2.0	7.0	
t_{PLH}	Propagation Delay	2.0	4.5	6.5	2.0	7.5	ns
t_{PHL}	$\overline{S}_{Dn}$ to Q_n or $\overline{Q}_n$	2.0	4.5	6.5	2.0	7.5	

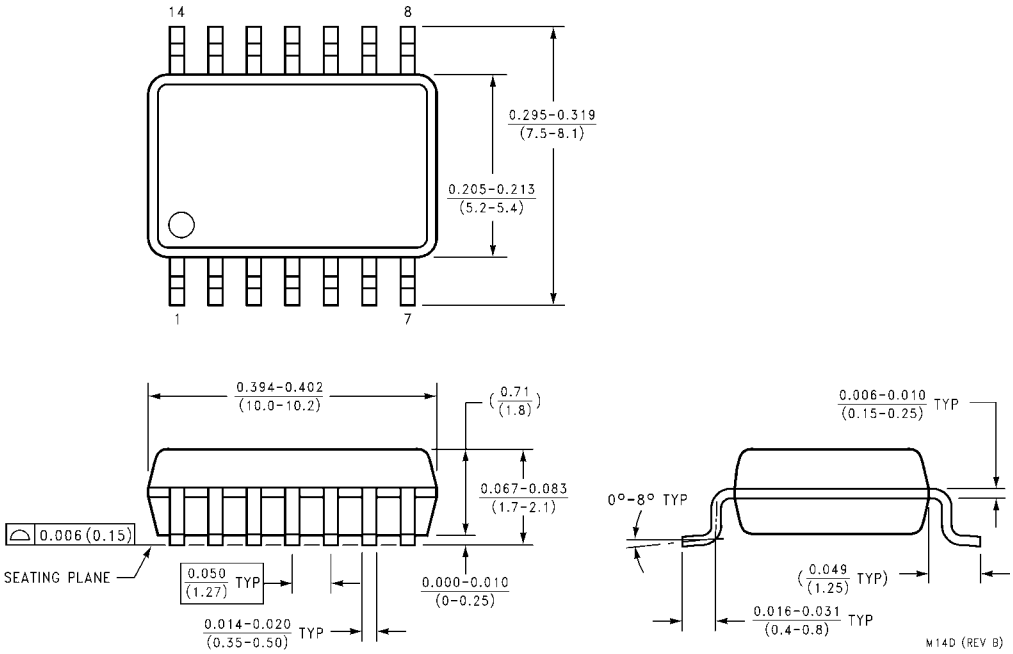
AC Operating Requirements

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		
$t_W(H)$	$\overline{CP}_n$ Pulse Width	4.5		5.0		ns
$t_W(L)$	HIGH or LOW	4.5		5.0		
$t_W(L)$	$\overline{S}_{Dn}$ Pulse Width, LOW	4.5		5.0		ns
t_{REC}	$\overline{S}_{Dn}$ to $\overline{CP}_n$ Recovery Time	4.0		5.0		ns

Physical Dimensions inches (millimeters) unless otherwise noted

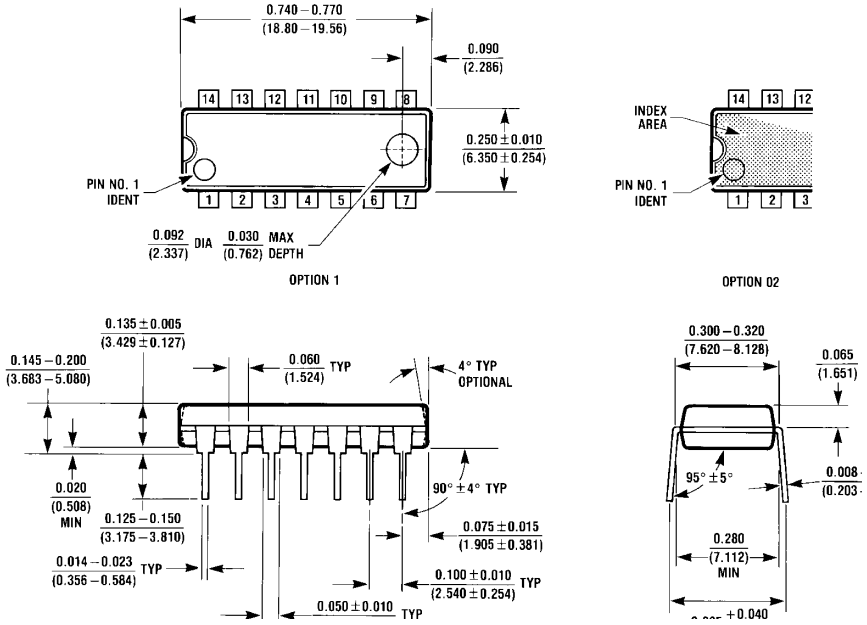


14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
Package Number M14A



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