

# 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  $\bar{S}_D$  sets Q to HIGH level

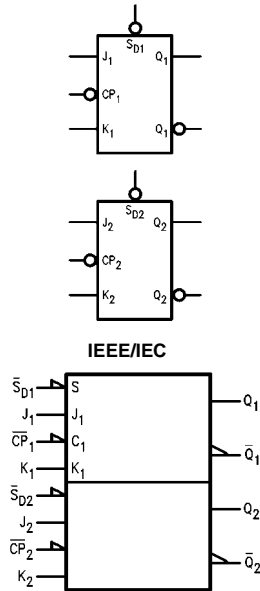
Set is independent of clock

### Ordering Code:

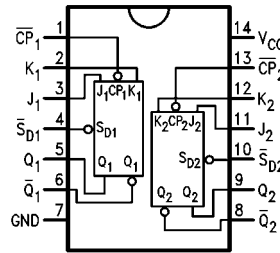
| Order Number | Package Number | Package Description   |
|--------------|----------------|---|
| 74F113SC     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow |
| 74F113SJ     | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide               |
| 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



### Connection Diagram



### Unit Loading/Fan Out

| Pin Names                                  | Description                              | U.L.<br>HIGH/LOW | Input $I_{IH}/I_{IL}$<br>Output $I_{OH}/I_{OL}$ |
|--|--|------------------|---|
| $J_1, J_2, K_1, K_2$                       | Data Inputs                              | 1.0/1.0          | 20 $\mu$ A/-0.6 mA                              |
| $\overline{CP}_1, \overline{CP}_2$         | Clock Pulse Inputs (Active Falling Edge) | 1.0/4.0          | 20 $\mu$ A/-2.4 mA                              |
| $\overline{SD}_1, \overline{SD}_2$         | Direct Set Inputs (Active LOW)           | 1.0/5.0          | 20 $\mu$ A/-3.0 mA                              |
| $Q_1, Q_2, \overline{Q}_1, \overline{Q}_2$ | Outputs                                  | 50/33.3          | -1 mA/20 mA                                     |

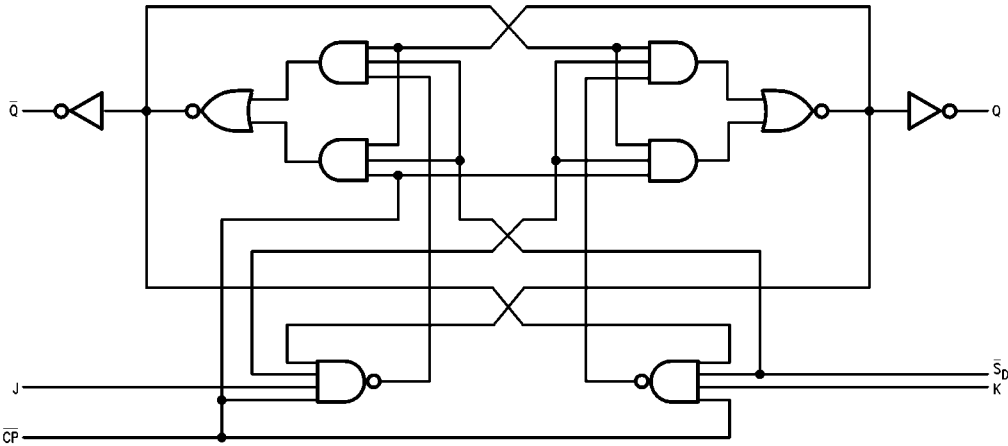
### Truth Table

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

H (h) = HIGH Voltage Level  
 L (l) = LOW Voltage level  
 $\sim$  = 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 <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.

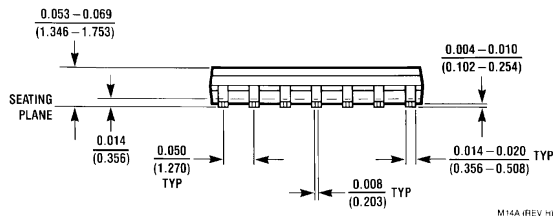
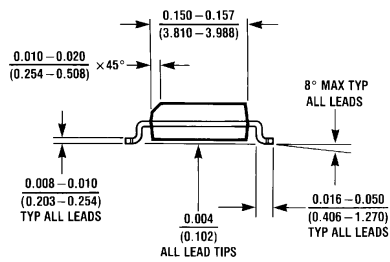
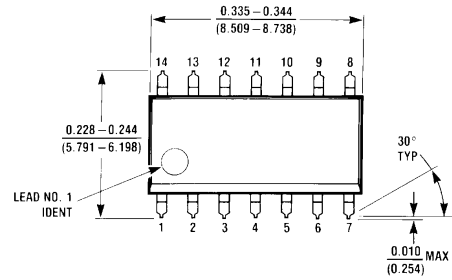
**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**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><br>5% V <sub>CC</sub> | 2.5<br>2.7 |                      | V     | Min             | I <sub>OH</sub> = -1 mA<br>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>BV1</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<br>All Other Pins Grounded   |
| I <sub>OD</sub>  | Output Leakage Circuit Current    |   |            | 3.75                 | μA    | 0.0             | V <sub>IOD</sub> = 150 mV<br>All Other Pins Grounded  |
| I <sub>IL</sub>  | Input LOW Current                 |   |            | -0.6<br>-2.4<br>-3.0 | mA    | Max             | V <sub>IN</sub> = 0.5V (J <sub>n</sub> , K <sub>n</sub> )<br>V <sub>IN</sub> = 0.5V (CP <sub>n</sub> )<br>V <sub>IN</sub> = 0.5V (SD <sub>n</sub> ) |
| I <sub>OZH</sub> | Output Leakage Current            |   |            | 50                   | μA    | Max             | V <sub>OUT</sub> = 2.7V   |
| I <sub>OZL</sub> | Output Leakage Current            |   |            | -50                  | μA    | Max             | V <sub>OUT</sub> = 0.5V   |
| I <sub>OS</sub>  | Output Short-Circuit Current      | -60                                       |            | -150                 | mA    | Max             | V <sub>OUT</sub> = 0V   |
| I <sub>CC</sub>  | Power Supply Current              |   | 12         | 19                   | mA    | Max             |   |

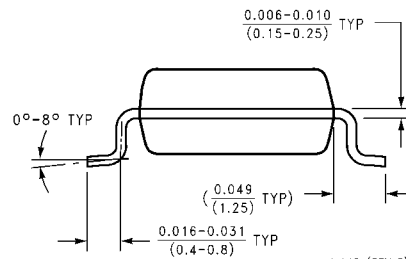
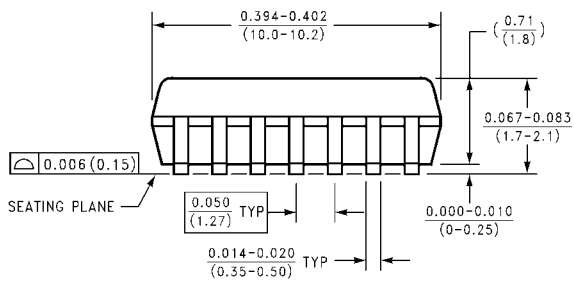
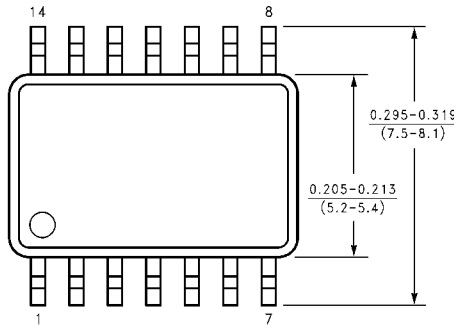
| AC Electrical Characteristics |   |   |     |  |  |       |       |
|-------------------------------|---|---|-----|--|--|-------|-------|
| Symbol                        | Parameter   | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |     |  | T <sub>A</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V<br>C <sub>L</sub> = 50 pF |       | Units |
|                               |   | Min   | Typ | Max  | Min  | Max   |       |
| f <sub>MAX</sub>              | Maximum Clock Frequency                                 | 85  | 105 |  | 80   |       | MHz   |
| t <sub>PLH</sub>              | Propagation Delay                                       | 2.0   | 4.0 | 6.0  | 2.0  | 7.0   | ns    |
| t <sub>PHL</sub>              | $\overline{CP}_n$ to Q <sub>n</sub> or $\overline{Q}_n$ | 2.0   | 4.0 | 6.0  | 2.0  | 7.0   |       |
| t <sub>PLH</sub>              | Propagation Delay                                       | 2.0   | 4.5 | 6.5  | 2.0  | 7.5   | ns    |
| t <sub>PHL</sub>              | $\overline{SD}_n$ to Q <sub>n</sub> or $\overline{Q}_n$ | 2.0   | 4.5 | 6.5  | 2.0  | 7.5   |       |
| AC Operating Requirements     |   |   |     |  |  |       |       |
| Symbol                        | Parameter   | T <sub>A</sub> = +25°C<br>V <sub>CC</sub> = +5.0V                           |     | T <sub>A</sub> = 0°C to +70°C<br>V <sub>CC</sub> = +5.0V |  | Units |       |
|                               |   | Min   | Max | Min  | Max  |       |       |
| t <sub>S</sub> (H)            | Setup Time, HIGH or LOW                                 | 4.0   |     | 5.0  |  | ns    |       |
| t <sub>S</sub> (L)            | J <sub>n</sub> or K <sub>n</sub> to $\overline{CP}_n$   | 3.0   |     | 3.5  |  |       |       |
| t <sub>H</sub> (H)            | Hold Time, HIGH or LOW                                  | 0   |     | 0  |  | ns    |       |
| t <sub>H</sub> (L)            | J <sub>n</sub> or K <sub>n</sub> to $\overline{CP}_n$   | 0   |     | 0  |  |       |       |
| t <sub>W</sub> (H)            | $\overline{CP}_n$ Pulse Width                           | 4.5   |     | 5.0  |  | ns    |       |
| t <sub>W</sub> (L)            | HIGH or LOW   | 4.5   |     | 5.0  |  |       |       |
| t <sub>W</sub> (L)            | $\overline{SD}_n$ Pulse Width, LOW                      | 4.5   |     | 5.0  |  | ns    |       |
| t <sub>REC</sub>              | $\overline{SD}_n$ to $\overline{CP}_n$<br>Recovery Time | 4.0   |     | 5.0  |  | ns    |       |

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



M14A (REV H)

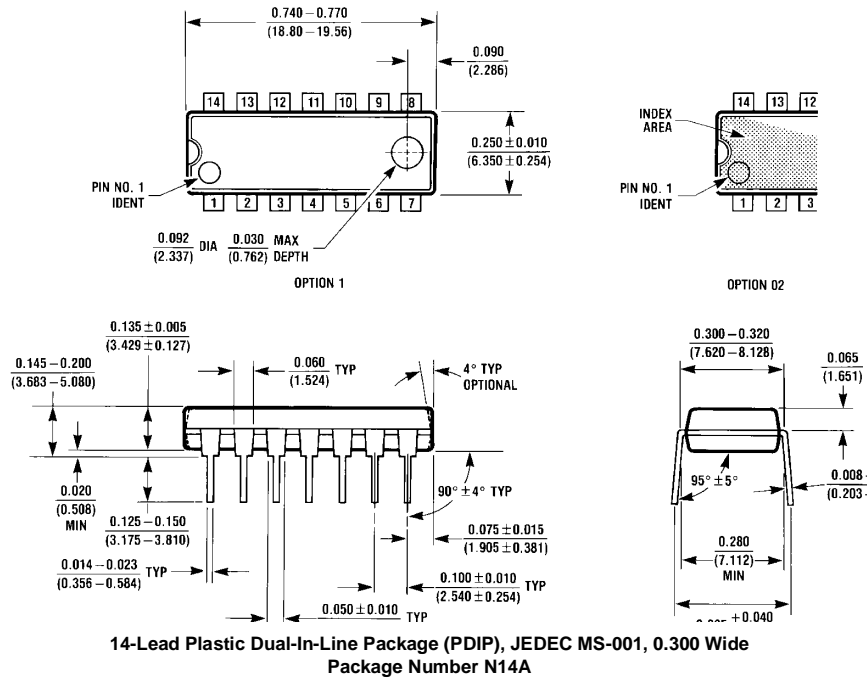
**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow Package Number M14A**



M14D (REV B)

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

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



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