

# TC74AC112P, TC74AC112F, TC74AC112FN

## DUAL J - K FLIP FLOP WITH PRESET AND CLEAR

The TC74AC112 is an advanced high speed CMOS DUAL J-K FLIP FLOP fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

In accordance with the logic level given J and K input this device changes state on negative going transition of the clock pulse.  $\overline{\text{CLEAR}}$  and  $\overline{\text{PRESET}}$  are independent of the clock and accomplished by a low logic level on the corresponding input. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES:

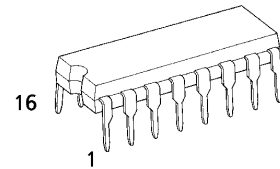
- High Speed.....  $f_{\text{MAX}} = 170\text{MHz}$  (typ.)  
at  $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation.....  $I_{\text{CC}} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity.....  $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}}$  (Min.)
- Symmetrical Output Impedance...  $|I_{\text{OH}}| = I_{\text{OL}} = 24\text{mA}(\text{Min.})$   
Capability of driving  $50\Omega$  transmission lines.
- Balanced Propagation Delays.....  $t_{\text{PLH}} \approx t_{\text{PHL}}$
- Wide Operating Voltage Range...  $V_{\text{CC}}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Pin and Function Compatible with 74F112

### TRUTH TABLE

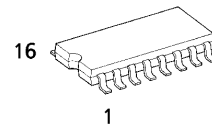
| INPUTS |    |   |   |                        | OUTPUTS          |                       | FUNCTION  |
|--------|----|---|---|------------------------|------------------|-----------------------|-----------|
| CLR    | PR | J | K | $\overline{\text{CK}}$ | Q                | $\overline{\text{Q}}$ |           |
| L      | H  | X | X | X                      | L                | H                     | CLEAR     |
| H      | L  | X | X | X                      | H                | L                     | PRESET    |
| L      | L  | X | X | X                      | H                | H                     |           |
| H      | H  | L | L | $\downarrow$           | $Q_n$            | $\overline{Q}_n$      | NO CHANGE |
| H      | H  | L | H | $\downarrow$           | L                | H                     |           |
| H      | H  | H | L | $\downarrow$           | H                | L                     |           |
| H      | H  | H | H | $\downarrow$           | $\overline{Q}_n$ | $Q_n$                 | TOGGLE    |
| H      | H  | X | X | $\uparrow$             | $Q_n$            | $\overline{Q}_n$      | NO CHANGE |

X : Don't Care

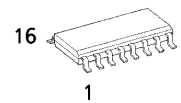
(Note) The JEDEC SOP (FN) is not available in Japan.



P (DIP16-P-300-2.54A)  
Weight : 1.00g (Typ.)

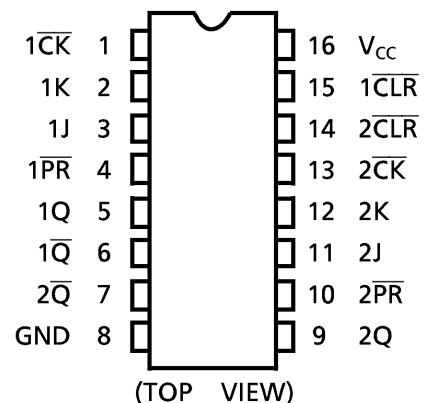


F (SOP16-P-300-1.27)  
Weight : 0.18g (Typ.)

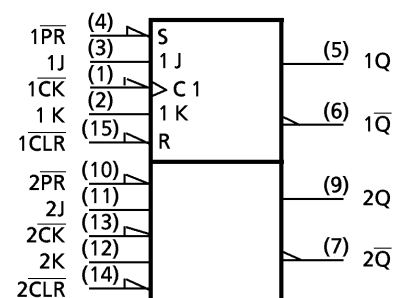


FN (SOL16-P-150-1.27)  
Weight : 0.13g (Typ.)

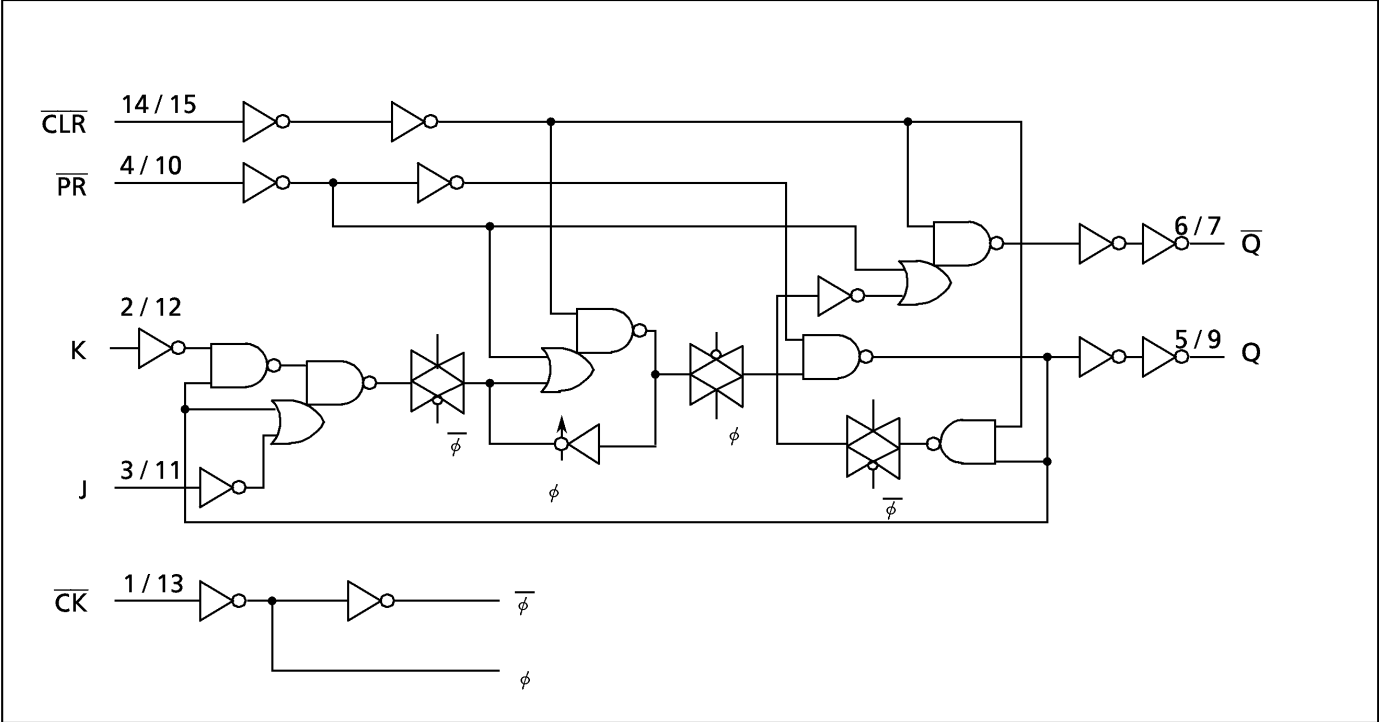
### PIN ASSIGNMENT



### IEC LOGIC SYMBOL



SYSTEM DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | VALUE                    | UNIT        |
|-----------------------------|-----------|--------------------------|-------------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 7.0$          | V           |
| DC Input Voltage            | $V_{IN}$  | $-0.5 \sim V_{CC} + 0.5$ | V           |
| DC Output Voltage           | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V           |
| Input Diode Current         | $I_{IK}$  | $\pm 20$                 | mA          |
| Output Diode Current        | $I_{OK}$  | $\pm 50$                 | mA          |
| DC Output Current           | $I_{OUT}$ | $\pm 50$                 | mA          |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 100$                | mA          |
| Power Dissipation           | $P_D$     | 500 (DIP)* / 180 (SOP)   | mW          |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$           | $^{\circ}C$ |

\*500mW in the range of  $T_a = -40^{\circ}C \sim 65^{\circ}C$ . From  $T_a = 65^{\circ}C$  to  $85^{\circ}C$  a derating factor of  $-10mW/^{\circ}C$  should be applied up to 300mW.

RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL    | VALUE                                                               | UNIT        |
|--------------------------|-----------|---------------------------------------------------------------------|-------------|
| Supply Voltage           | $V_{CC}$  | 2.0~5.5                                                             | V           |
| Input Voltage            | $V_{IN}$  | 0~ $V_{CC}$                                                         | V           |
| Output Voltage           | $V_{OUT}$ | 0~ $V_{CC}$                                                         | V           |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$                                                       | $^{\circ}C$ |
| Input Rise and Fall Time | $dt/dV$   | 0~100 ( $V_{CC} = 3.3 \pm 0.3V$ )<br>0~20 ( $V_{CC} = 5 \pm 0.5V$ ) | ns/V        |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                   | SYMBOL          | TEST CONDITION                                          |                          | V <sub>CC</sub><br>(V) | Ta = 25°C            |                   |                      | Ta = -40~85°C        |                      | UNIT |
|-----------------------------|-----------------|---------------------------------------------------------|--------------------------|------------------------|----------------------|-------------------|----------------------|----------------------|----------------------|------|
|                             |                 |                                                         |                          |                        | MIN.                 | TYP.              | MAX.                 | MIN.                 | MAX.                 |      |
| High - Level Input Voltage  | V <sub>IH</sub> |                                                         |                          | 2.0<br>3.0<br>5.5      | 1.50<br>2.10<br>3.85 | —<br>—<br>—       | —<br>—<br>—          | 1.50<br>2.10<br>3.85 | —<br>—<br>—          | V    |
| Low - Level Input Voltage   | V <sub>IL</sub> |                                                         |                          | 2.0<br>3.0<br>5.5      | —<br>—<br>—          | —<br>—<br>—       | 0.50<br>0.90<br>1.65 | —<br>—<br>—          | 0.50<br>0.90<br>1.65 | V    |
| High - Level Output Voltage | V <sub>OH</sub> | V <sub>IN</sub> =<br>V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -50μA  | 2.0<br>3.0<br>4.5      | 1.9<br>2.9<br>4.4    | 2.0<br>3.0<br>4.5 | —<br>—<br>—          | 1.9<br>2.9<br>4.4    | —<br>—<br>—          | V    |
|                             |                 |                                                         | I <sub>OH</sub> = -4mA   | 3.0                    | 2.58                 | —                 | —                    | 2.48                 | —                    |      |
|                             |                 |                                                         | I <sub>OH</sub> = -24mA  | 4.5                    | 3.94                 | —                 | —                    | 3.80                 | —                    |      |
|                             |                 |                                                         | I <sub>OH</sub> = -75mA* | 5.5                    | —                    | —                 | —                    | 3.85                 | —                    |      |
| Low - Level Output Voltage  | V <sub>OL</sub> | V <sub>IN</sub> =<br>V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OL</sub> = 50μA   | 2.0<br>3.0<br>4.5      | —<br>—<br>—          | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1    | —<br>—<br>—          | 0.1<br>0.1<br>0.1    | V    |
|                             |                 |                                                         | I <sub>OL</sub> = 12mA   | 3.0                    | —                    | —                 | 0.36                 | —                    | 0.44                 |      |
|                             |                 |                                                         | I <sub>OL</sub> = 24mA   | 4.5                    | —                    | —                 | 0.36                 | —                    | 0.44                 |      |
|                             |                 |                                                         | I <sub>OL</sub> = 75mA*  | 5.5                    | —                    | —                 | —                    | —                    | 1.65                 |      |
| Input Leakage Current       | I <sub>IN</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                |                          | 5.5                    | —                    | —                 | ±0.1                 | —                    | ±1.0                 | μA   |
| Quiescent Supply Current    | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                |                          | 5.5                    | —                    | —                 | 4.0                  | —                    | 40.0                 |      |

\* : This spec indicates the capability of driving 50Ω transmission lines.

One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIREMENTS ( Input t<sub>r</sub> = t<sub>f</sub> = 3ns )

| PARAMETER                                                                    | SYMBOL            | TEST CONDITION |  | Ta = 25°C           | Ta = -40~85°C | UNIT |
|------------------------------------------------------------------------------|-------------------|----------------|--|---------------------|---------------|------|
|                                                                              |                   |                |  | V <sub>CC</sub> (V) | LIMIT         |      |
| Minimum Pulse Width<br>( $\overline{\text{CK}}$ )                            | t <sub>W(L)</sub> |                |  | 3.3 ± 0.3           | 7.5           | ns   |
|                                                                              | t <sub>W(H)</sub> |                |  | 5.0 ± 0.5           | 5.0           |      |
| Minimum Pulse Width<br>( $\overline{\text{CLR}}$ , $\overline{\text{PR}}$ )  | t <sub>W(L)</sub> |                |  | 3.3 ± 0.3           | 7.0           |      |
|                                                                              |                   |                |  | 5.0 ± 0.5           | 5.0           |      |
| Minimum Set - up Time                                                        | t <sub>s</sub>    |                |  | 3.3 ± 0.3           | 11.0          |      |
|                                                                              |                   |                |  | 5.0 ± 0.5           | 6.0           |      |
| Minimum Hold Time                                                            | t <sub>h</sub>    |                |  | 3.3 ± 0.3           | 0.0           |      |
|                                                                              |                   |                |  | 5.0 ± 0.5           | 0.0           |      |
| Minimum Removal Time<br>( $\overline{\text{CLR}}$ , $\overline{\text{PR}}$ ) | t <sub>rem</sub>  |                |  | 3.3 ± 0.3           | 3.0           |      |
|                                                                              |                   |                |  | 5.0 ± 0.5           | 2.0           |      |

AC ELECTRICAL CHARACTERISTICS (  $C_L = 50\text{pF}$  ,  $R_L = 500\ \Omega$  , Input  $t_r = t_f = 3\text{ns}$  )

| PARAMETER                                                                                     | SYMBOL             | TEST CONDITION | Ta = 25°C           |      |      | Ta = -40~85°C |      | UNIT |
|-----------------------------------------------------------------------------------------------|--------------------|----------------|---------------------|------|------|---------------|------|------|
|                                                                                               |                    |                | V <sub>CC</sub> (V) | MIN. | TYP. | MAX.          | MIN. | MAX. |
| Propagation Delay Time<br>( $\overline{\text{CK}} - Q, \overline{Q}$ )                        | $t_{\text{PLH}}$   |                | $3.3 \pm 0.3$       | —    | 9.1  | 15.5          | 1.0  | 17.8 |
|                                                                                               | $t_{\text{PHL}}$   |                | $5.0 \pm 0.5$       | —    | 6.5  | 9.4           | 1.0  | 10.8 |
| Propagation Delay Time<br>( $\overline{\text{CLR}}, \overline{\text{PR}} - Q, \overline{Q}$ ) | $t_{\text{PLH}}$   |                | $3.3 \pm 0.3$       | —    | 8.6  | 14.6          | 1.0  | 16.8 |
|                                                                                               | $t_{\text{PHL}}$   |                | $5.0 \pm 0.5$       | —    | 5.8  | 8.3           | 1.0  | 9.6  |
| Maximum<br>Clock Frequency                                                                    | $f_{\text{MAX}}$   |                | $3.3 \pm 0.3$       | 45   | 90   | —             | 45   | —    |
|                                                                                               |                    |                | $5.0 \pm 0.5$       | 80   | 150  | —             | 80   | —    |
| Input Capacitance                                                                             | $C_{\text{IN}}$    |                |                     | —    | 5    | 10            | —    | 10   |
| Power Dissipation Capacitance                                                                 | $C_{\text{PD}}(1)$ |                |                     | —    | 85   | —             | —    | —    |

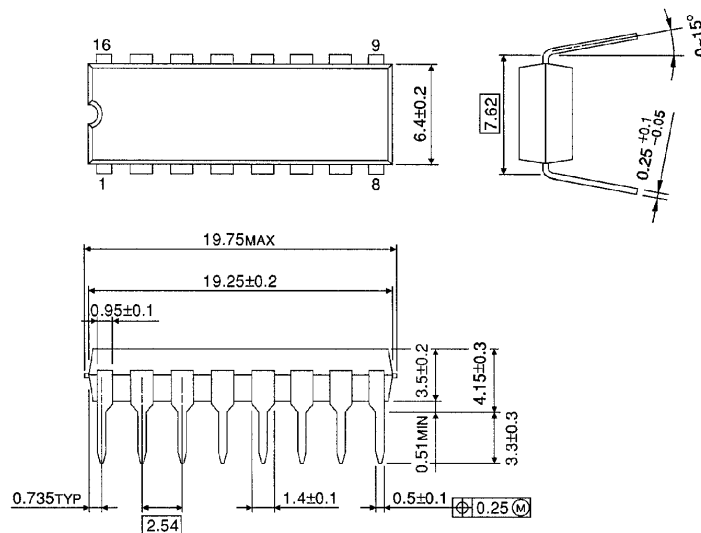
Note(1)  $C_{\text{PD}}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{\text{CC}}(\text{opr.}) = C_{\text{PD}} \cdot V_{\text{CC}} \cdot f_{\text{IN}} + I_{\text{CC}} / 2 \text{ (per F / F)}$$

## DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)

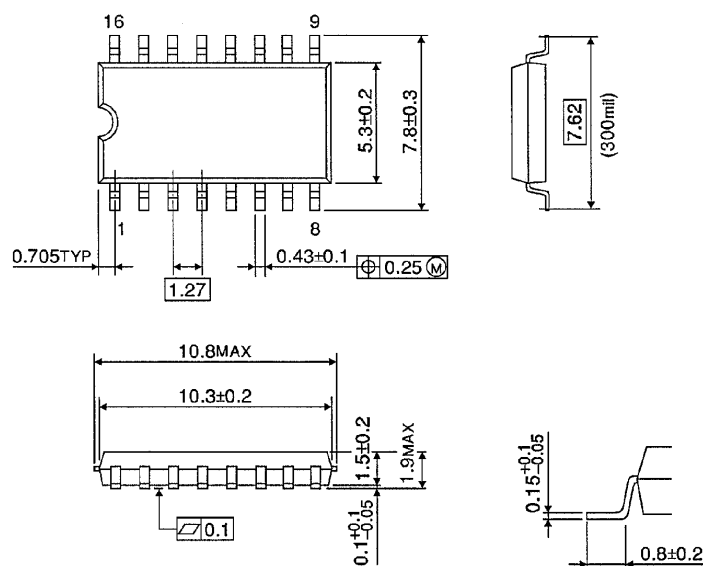
Unit in mm



Weight : 1.00g (Typ.)

## SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)

Unit in mm

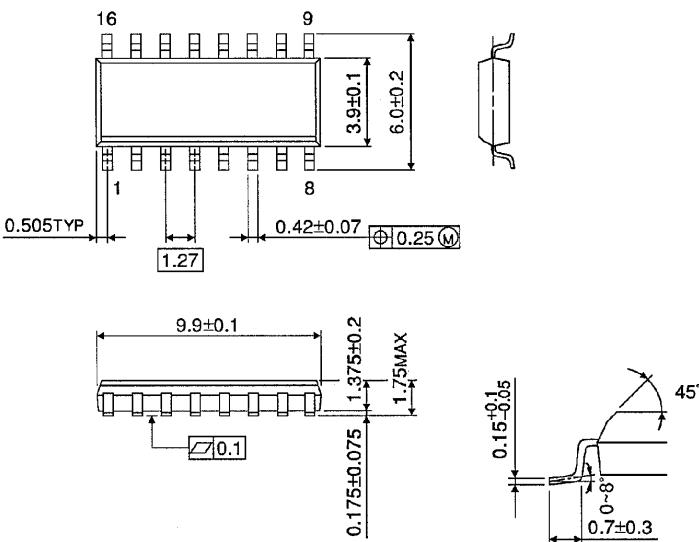


Weight : 0.18g (Typ.)

SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

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000707EBA

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