

# TC74ACT74P, TC74ACT74F, TC74ACT74FN, TC74ACT74FT

## DUAL D-TYPE FLIP FLOP WITH PRESET AND CLEAR

The TC74ACT74 is an advanced high speed CMOS D-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.

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

The signal level applied to the D INPUT is transferred to Q OUTPUT during the positive going transition of the CK pulse.

CLR and  $\overline{PR}$  are independent of the CK and are accomplished by setting the appropriate input to an "L" level. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES:

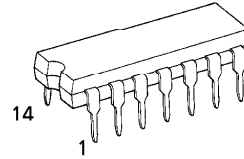
- High Speed..... $f_{MAX} = 180\text{MHz}(\text{typ.})$   
at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs ...  $V_{IL} = 0.8\text{V}(\text{Max.})$   
 $V_{IH} = 2.0\text{V}(\text{Min.})$
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 24\text{mA}(\text{Min.})$   
Capability of driving 50 $\Omega$  transmission lines.
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Pin and Function Compatible with 74F74

### TRUTH TABLE

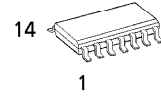
| INPUTS |                 |   |              | OUTPUTS |                  | FUNCTION  |
|--------|-----------------|---|--------------|---------|------------------|-----------|
| CLR    | $\overline{PR}$ | D | CK           | Q       | $\overline{Q}$   |           |
| L      | H               | X | X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

X : Don't Care

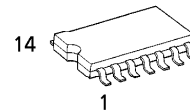
(Note) The JEDEC SOP (FN) is not available in Japan.



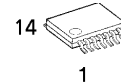
P (DIP14-P-300-2.54)  
Weight : 0.96g (Typ.)



FN (SOL14-P-150-1.27)  
Weight : 0.12g (Typ.)

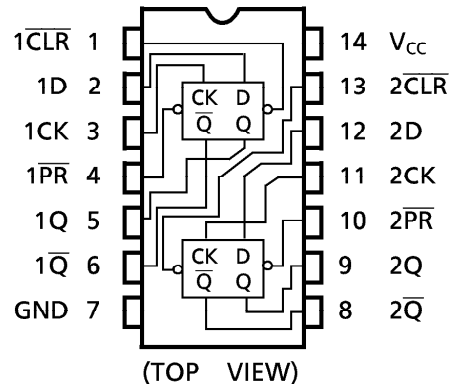


F (SOP14-P-300-1.27)  
Weight : 0.18g (Typ.)

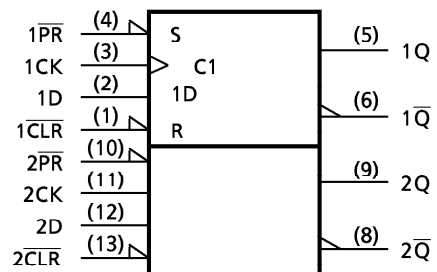


FT (TSSOP14-P-0044-0.65)  
Weight : 0.06g (Typ.)

### PIN ASSIGNMENT



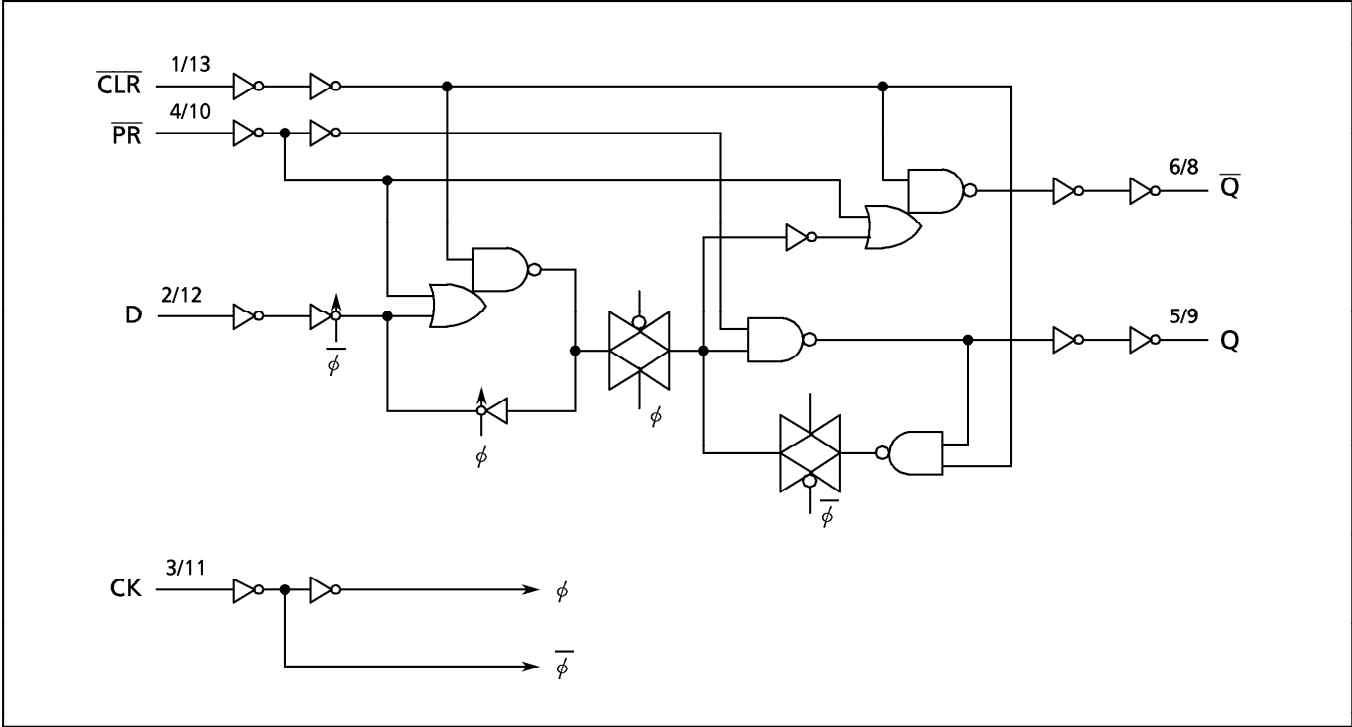
### IEC LOGIC SYMBOL



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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/TSSOP) | mW   |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$               | °C   |

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

RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL    | VALUE           | UNIT |
|--------------------------|-----------|-----------------|------|
| Supply Voltage           | $V_{CC}$  | $4.5 \sim 5.5$  | V    |
| Input Voltage            | $V_{IN}$  | $0 \sim V_{CC}$ | V    |
| Output Voltage           | $V_{OUT}$ | $0 \sim V_{CC}$ | V    |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$   | °C   |
| Input Rise and Fall Time | $dt/dV$   | $0 \sim 10$     | ns/V |

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- The information contained herein is subject to change without notice.

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                   | SYMBOL   | TEST CONDITION                                               |                                                               | $V_{CC}$<br>(V)   | Ta = 25°C        |               |                  | Ta = -40~85°C       |                     | UNIT    |
|-----------------------------|----------|--------------------------------------------------------------|---------------------------------------------------------------|-------------------|------------------|---------------|------------------|---------------------|---------------------|---------|
|                             |          |                                                              |                                                               |                   | MIN.             | TYP.          | MAX.             | MIN.                | MAX.                |         |
| High - Level Input Voltage  | $V_{IH}$ |                                                              |                                                               | 4.5<br>5.5        | 2.0              | —             | —                | 2.0                 | —                   | V       |
| Low - Level Input Voltage   | $V_{IL}$ |                                                              |                                                               | 4.5<br>5.5        | —                | —             | 0.8              | —                   | 0.8                 | V       |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IH}$ or $V_{IL}$                                | $I_{OH} = -50\mu A$<br>$I_{OH} = -24mA$<br>$I_{OH} = -75mA^*$ | 4.5<br>4.5<br>5.5 | 4.4<br>3.94<br>— | 4.5<br>—<br>— | —<br>—<br>—      | 4.4<br>3.80<br>3.85 | —<br>—<br>—         | V       |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IH}$ or $V_{IL}$                                | $I_{OL} = 50\mu A$<br>$I_{OL} = 24mA$<br>$I_{OL} = 75mA^*$    | 4.5<br>4.5<br>5.5 | —<br>—<br>—      | 0.0<br>—<br>— | 0.1<br>0.36<br>— | —<br>—<br>—         | 0.1<br>0.44<br>1.65 | V       |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND                                     |                                                               | 5.5               | —                | —             | $\pm 0.1$        | —                   | $\pm 1.0$           | $\mu A$ |
| Quiescent Supply Current    | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND                                     |                                                               | 5.5               | —                | —             | 4.0              | —                   | 40.0                |         |
|                             | $I_C$    | PER INPUT : $V_{IN} = 3.4V$<br>OTHER INPUT : $V_{CC}$ or GND |                                                               | 5.5               | —                | —             | 1.35             | —                   | 1.5                 | mA      |

\* : 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  $t_r = t_f = 3ns$  )

| PARAMETER                                                   | SYMBOL               | TEST CONDITION | $V_{CC}$      | Ta = 25°C | Ta = -40~85°C | UNIT |
|-------------------------------------------------------------|----------------------|----------------|---------------|-----------|---------------|------|
|                                                             |                      |                |               | LIMIT     | LIMIT         |      |
| Minimum Pulse Width (CK)                                    | $t_W(L)$<br>$t_W(H)$ |                | $5.0 \pm 0.5$ | 5.0       | 5.0           | ns   |
| Minimum Pulse Width ( $\overline{CLR}$ , $\overline{PR}$ )  | $t_W(L)$             |                | $5.0 \pm 0.5$ | 5.7       | 6.5           |      |
| Minimum Set - up Time                                       | $t_s$                |                | $5.0 \pm 0.5$ | 3.5       | 3.5           |      |
| Minimum Hold Time                                           | $t_h$                |                | $5.0 \pm 0.5$ | 1.5       | 1.5           |      |
| Minimum Removal Time ( $\overline{CLR}$ , $\overline{PR}$ ) | $t_{rem}$            |                | $5.0 \pm 0.5$ | 2.0       | 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>( CK−Q , Q̅ )        | t <sub>pLH</sub><br>t <sub>pHL</sub> |                | 5.0 ± 0.5             | —         | 6.1  | 9.2  | 1.0            | 10.5 | ns   |
| Propagation Delay Time<br>( CLR̅ , PR−Q , Q̅ ) | t <sub>pLH</sub><br>t <sub>pHL</sub> |                | 5.0 ± 0.5             | —         | 6.5  | 10.1 | 1.0            | 11.5 |      |
| Maximum<br>Clock Frequency                     | f <sub>MAX</sub>                     |                | 5.0 ± 0.5             | 95        | 160  | —    | 95             | —    | MHz  |
| Input Capacitance                              | C <sub>IN</sub>                      |                |                       | —         | 5    | 10   | —              | 10   | pF   |
| Power Dissipation Capacitance                  | C <sub>PD</sub> ( 1 )                |                |                       | —         | 35   | —    | —              | —    |      |

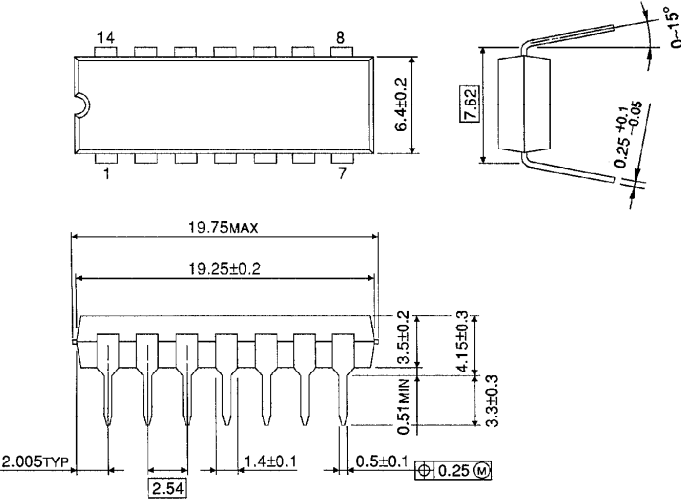
Note(1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)

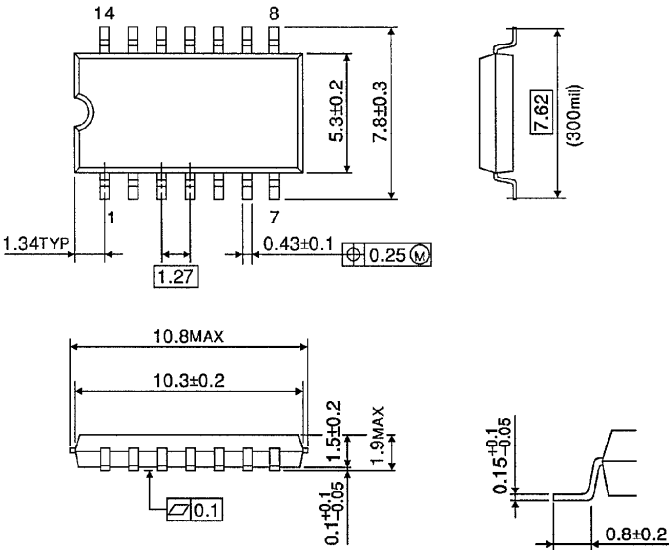
Unit in mm



Weight : 0.96g (Typ.)

SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27)

Unit in mm

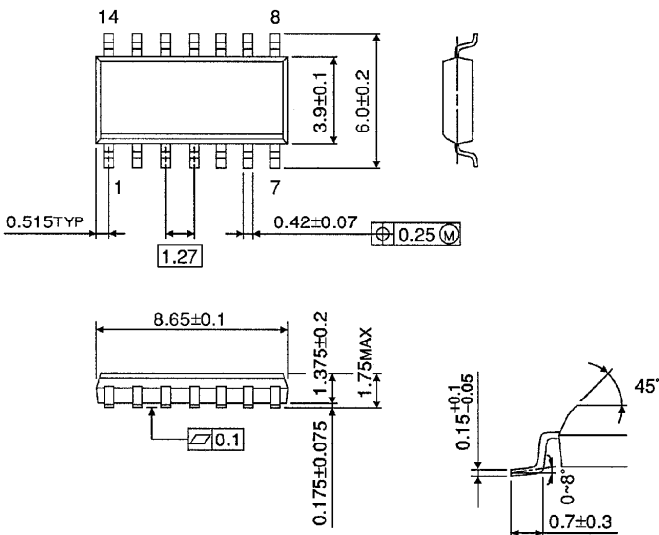


Weight : 0.18g (Typ.)

SOP 14PIN (150mil BODY) OUTLINE DRAWING (SOL14-P-150 -1.27)

Unit in mm

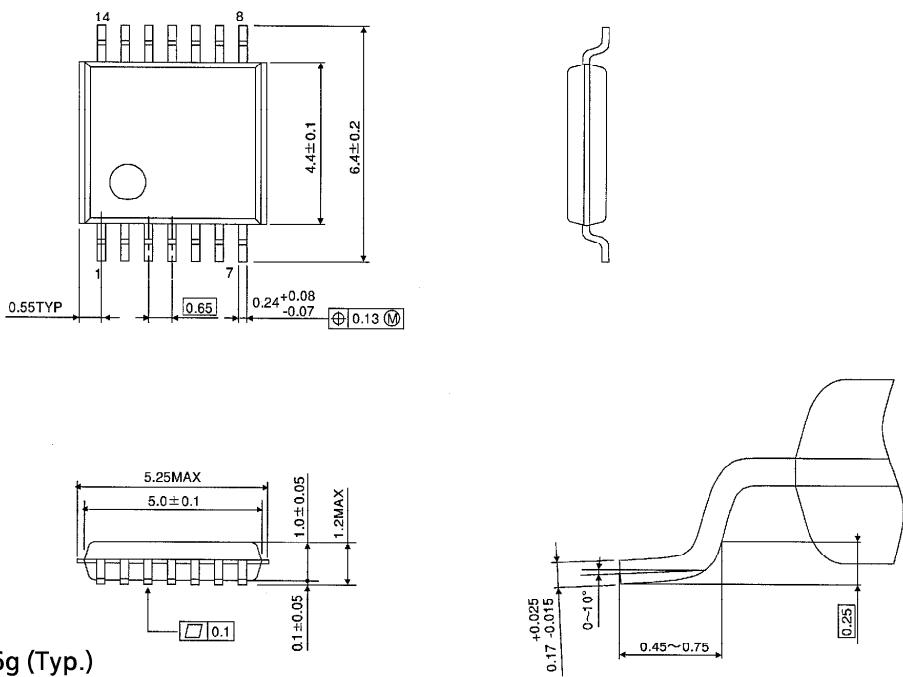
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

TSSOP 14PIN (170mil BODY) OUTLINE DRAWING (TSSOP14-P-0044-0.65)

Unit in mm



Weight : 0.06g (Typ.)