

# TC74AC05P, TC74AC05F, TC74AC05FN

## HEX INVERTER (OPEN DRAIN)

The TC74AC05 is an advanced high speed CMOS INVERTER 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.

Pin configuration and function are the same as the TC74AC04, but the TC74AC05 has high performance MOS N - channel transistor (OPEN - DRAIN) outputs.

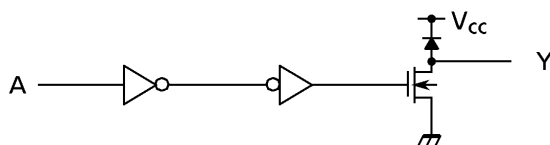
This device can, therefore, with a suitable pull - up resistors, be used in wired - OR, LED drive and other applications.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

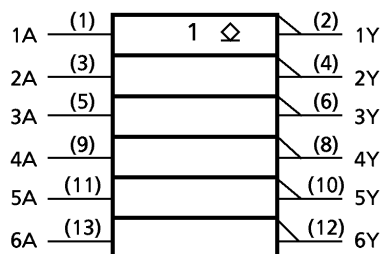
### FEATURES:

- High Speed..... $t_{pZ} = 3.4\text{ns}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Symmetrical Output Impedance..... $I_{OL} = 24\text{mA}(\text{Min.})$   
Capability of driving  $50\Omega$  transmission lines.
- Wide Operating Voltage Range.... $V_{CC}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Open Drain Structure.
- Pin and Function Compatible with 74F05

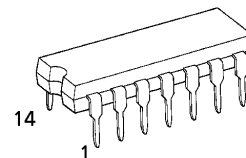
### SYSTEM DIAGRAM (per gate)



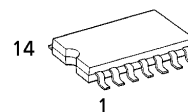
### IEC LOGIC SYMBOL



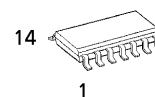
(Note) The JEDEC SOP (FN) is not available in Japan.



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

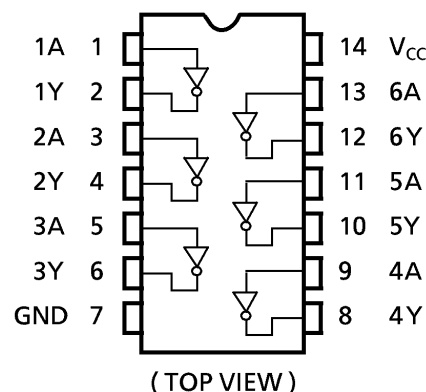


F (SOP14-P-300-1.27)  
Weight : 0.18g (Typ.)



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

### PIN ASSIGNMENT



### TRUTH TABLE

|   |   |
|---|---|
| A | Y |
| L | Z |
| H | L |

Z : High Impedance

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● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

## 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           | $I_{OUT}$ | + 50                     | mA   |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 150$                | mA   |
| Power Dissipation           | $P_D$     | 500 (DIP)* / 180 (SOP)   | 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           | $V_{CC}$  | 2.0~5.5                                                                           | V    |
| Input Voltage            | $V_{IN}$  | 0~ $V_{CC}$                                                                       | V    |
| Output Voltage           | $V_{OUT}$ | 0~ $V_{CC}$                                                                       | V    |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$                                                                     | °C   |
| Input Rise and Fall Time | $dt/dV$   | 0~100 ( $V_{CC} = 3.3 \pm 0.3\text{V}$ )<br>0~20 ( $V_{CC} = 5 \pm 0.5\text{V}$ ) | ns/V |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                            | SYMBOL   | TEST CONDITION                          | $V_{CC}$<br>(V)          | $T_a = 25^\circ\text{C}$ |             |                      | $T_a = -40 \sim 85^\circ\text{C}$ |                      | UNIT          |
|--------------------------------------|----------|-----------------------------------------|--------------------------|--------------------------|-------------|----------------------|-----------------------------------|----------------------|---------------|
|                                      |          |                                         |                          | MIN.                     | TYP.        | MAX.                 | MIN.                              | MAX.                 |               |
| High - Level Input Voltage           | $V_{IH}$ |                                         | 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            | $V_{IL}$ |                                         | 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             |
| Low - Level Output Voltage           | $V_{OL}$ | $V_{IN} = V_{IH}$                       |                          |                          |             |                      |                                   |                      | V             |
|                                      |          |                                         | $I_{OL} = 50\mu\text{A}$ | 2.0<br>3.0<br>4.5        | —<br>—<br>— | 0.0<br>0.0<br>0.1    | —<br>—<br>—                       | 0.1<br>0.1<br>0.1    |               |
|                                      |          |                                         | $I_{OL} = 12\text{mA}$   | 3.0                      | —           | 0.36                 | —                                 | 0.44                 |               |
|                                      |          |                                         | $I_{OL} = 24\text{mA}$   | 4.5                      | —           | 0.36                 | —                                 | 0.44                 |               |
|                                      |          |                                         | $I_{OL} = 75\text{mA}^*$ | 5.5                      | —           | —                    | —                                 | 1.65                 |               |
| 3 - State Output Off - State Current | $I_{OZ}$ | $V_{IN} = V_{IL}$<br>$V_{OUT} = V_{CC}$ | 5.5                      | —                        | —           | $\pm 0.5$            | —                                 | $\pm 5.0$            | $\mu\text{A}$ |
| Input Leakage Current                | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND                | 5.5                      | —                        | —           | $\pm 0.1$            | —                                 | $\pm 1.0$            |               |
| Quiescent Supply Current             | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND                | 5.5                      | —                        | —           | 4.0                  | —                                 | 40.0                 |               |

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

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

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**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        | t <sub>pLZ</sub>    |                | 3.3 ± 0.3<br>5.0 ± 0.5 | —<br>— | 4.1<br>3.5 | 7.0<br>5.3    | 1.0<br>1.0 | 8.0<br>6.0  |
| Propagation Delay Time        | t <sub>pZL</sub>    |                | 3.3 ± 0.3<br>5.0 ± 0.5 | —<br>— | 5.9<br>4.1 | 9.1<br>6.6    | 1.0<br>1.0 | 10.4<br>7.5 |
| Input Capacitance             | C <sub>IN</sub>     |                |                        | —      | 5          | 10            | —          | 10          |
| Output Capacitance            | C <sub>OUT</sub>    |                |                        | —      | 10         | —             | —          | —           |
| Power Dissipation Capacitance | C <sub>PD</sub> (1) |                |                        | —      | 8          | —             | —          | —           |

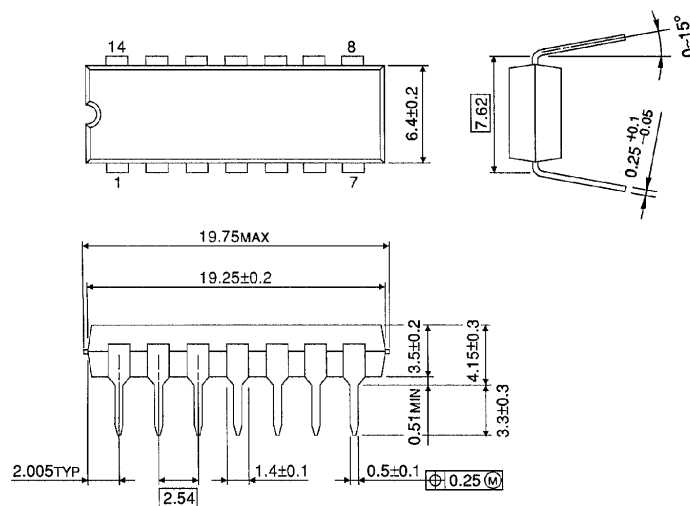
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC(\text{opr.})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 6 \text{ (per Gate)}$$

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

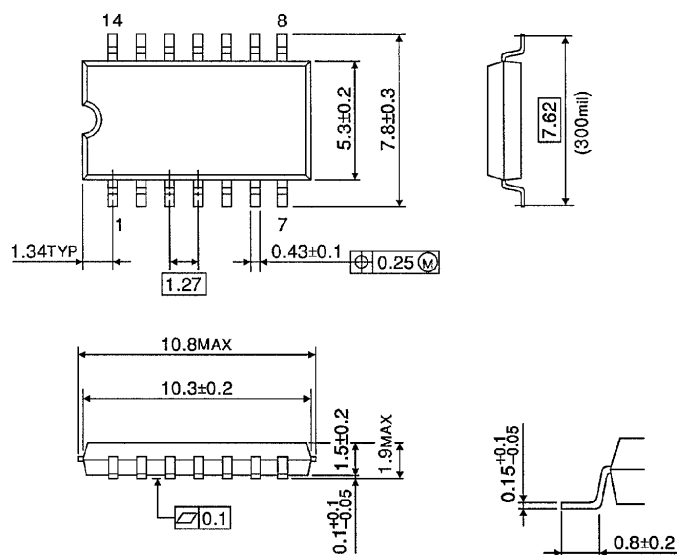
Unit in mm



Weight : 0.96g (Typ.)

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

Unit in mm

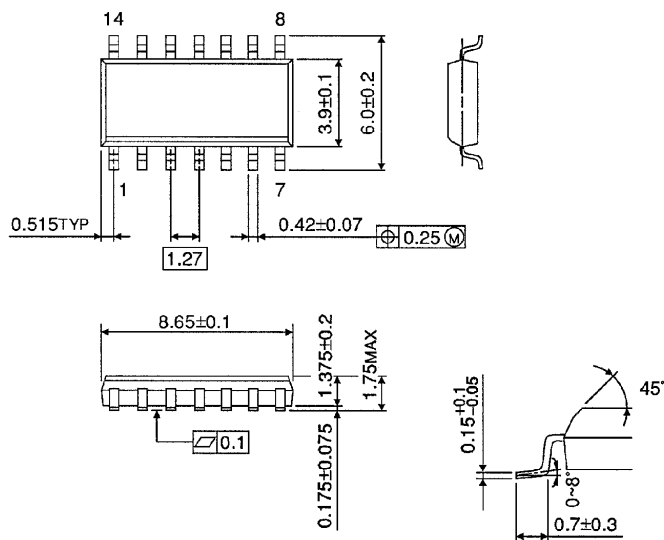


Weight : 0.18g (Typ.)

**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.)