

TC74AC14P, TC74AC14F, TC74AC14FN, TC74AC14FT

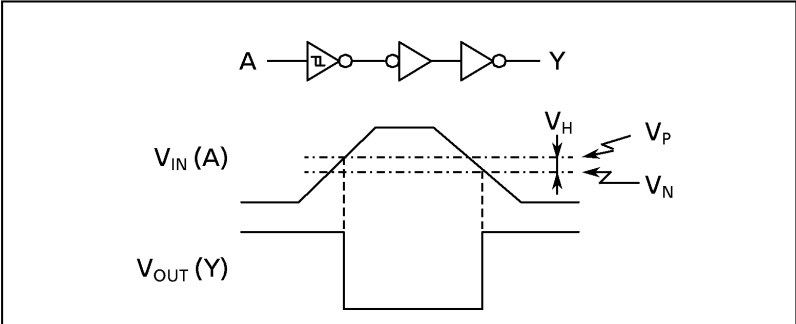
HEX SCHMITT INVERTER

The TC74AC14 is an advanced high speed CMOS SCHMITT 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 pwr dissipation. Pin configuration and function are the same as the TC74AC04 but the inputs have hysteresis and with its schmitt trigger function, the TC74AC14 can be used as a line receivers which will receive slow input signals. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

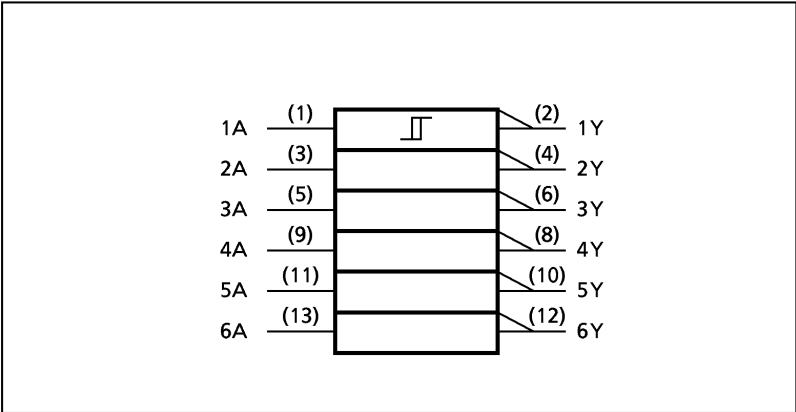
**FEATURES:**

- High Speed..... $t_{pd} = 5.3ns$  (typ.) at  $V_{CC} = 5V$
- Low Power Dissipation..... $I_{CC} = 4\mu A$ (Max.) at  $T_a = 25^{\circ}C$
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 24mA$  (Min.)  
Capability of driving  $50\Omega$  transmission lines.
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range.... $V_{CC}$  (opr) =  $2V \sim 5.5V$
- Pin and Function Compatible with 74F14

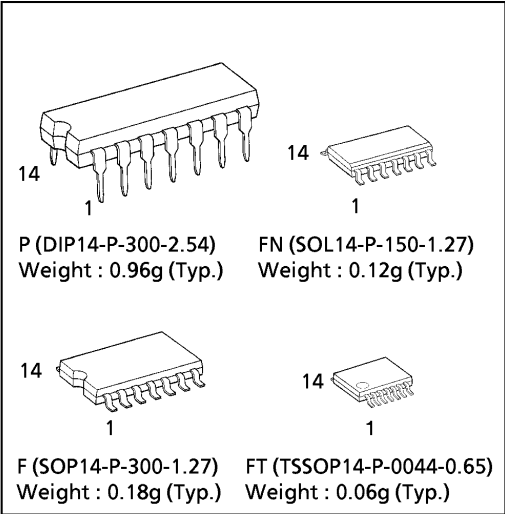
SYSTEM DIAGRAM, WAVEFORM



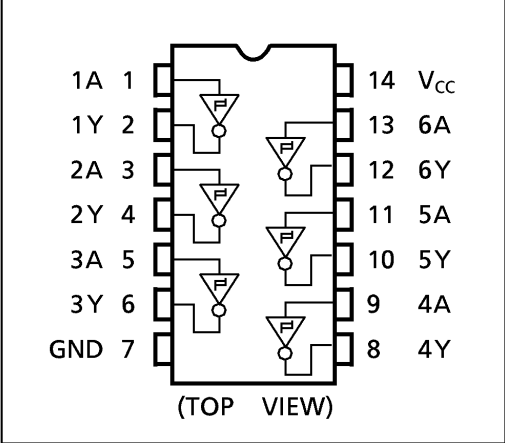
IEC LOGIC SYMBOL



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



PIN ASSIGNMENT



TRUTH TABLE

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

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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           | $I_{OUT}$ | $\pm 50$                   | mA   |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 150$                  | 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        | $V_{CC}$  | $2.0 \sim 5.5$  | 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   |

## 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.      |               |
| Positive Threshold Voltage  | $V_P$    |                          | 3.0                                                                            | —                        | —    | 2.2       | —                                 | 2.2       | V             |
|                             |          |                          | 4.5                                                                            | —                        | —    | 3.2       | —                                 | 3.2       |               |
|                             |          |                          | 5.5                                                                            | —                        | —    | 3.9       | —                                 | 3.9       |               |
| Negative Threshold Voltage  | $V_N$    |                          | 3.0                                                                            | 0.5                      | —    | —         | 0.5                               | —         | V             |
|                             |          |                          | 4.5                                                                            | 0.9                      | —    | —         | 0.9                               | —         |               |
|                             |          |                          | 5.5                                                                            | 1.1                      | —    | —         | 1.1                               | —         |               |
| Hysteresis Voltage          | $V_H$    |                          | 3.0                                                                            | 0.3                      | —    | 1.2       | 0.3                               | 1.2       | V             |
|                             |          |                          | 4.5                                                                            | 0.4                      | —    | 1.4       | 0.4                               | 1.4       |               |
|                             |          |                          | 5.5                                                                            | 0.5                      | —    | 1.6       | 0.5                               | 1.6       |               |
| High - Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IL}$        | $I_{OH} = -50\mu\text{A}$                                                      | 2.0                      | 1.9  | 2.0       | —                                 | 1.9       | V             |
|                             |          |                          |                                                                                | 3.0                      | 2.9  | 3.0       | —                                 | 2.9       |               |
|                             |          |                          |                                                                                | 4.5                      | 4.4  | 4.5       | —                                 | 4.4       |               |
|                             |          |                          | $I_{OH} = -4\text{mA}$<br>$I_{OH} = -24\text{mA}$<br>$I_{OH} = -75\text{mA}^*$ | 3.0                      | 2.58 | —         | —                                 | 2.48      |               |
|                             |          |                          |                                                                                | 4.5                      | 3.94 | —         | —                                 | 3.80      |               |
|                             |          |                          |                                                                                | 5.5                      | —    | —         | —                                 | 3.85      |               |
| Low - Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IH}$        | $I_{OL} = 50\mu\text{A}$                                                       | 2.0                      | —    | 0.0       | 0.1                               | —         | V             |
|                             |          |                          |                                                                                | 3.0                      | —    | 0.0       | 0.1                               | —         |               |
|                             |          |                          |                                                                                | 4.5                      | —    | 0.0       | 0.1                               | —         |               |
|                             |          |                          | $I_{OL} = 12\text{mA}$<br>$I_{OL} = 24\text{mA}$<br>$I_{OL} = 75\text{mA}^*$   | 3.0                      | —    | —         | 0.36                              | —         |               |
|                             |          |                          |                                                                                | 4.5                      | —    | —         | 0.36                              | —         |               |
|                             |          |                          |                                                                                | 5.5                      | —    | —         | —                                 | 1.65      |               |
| Input Leakage Current       | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND | 5.5                                                                            | —                        | —    | $\pm 0.1$ | —                                 | $\pm 1.0$ | $\mu\text{A}$ |
| 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>pLH</sub>    |                | 3.3 ± 0.3           | —         | 8.1  | 13.2 | 1.0            | 15.0 | ns   |
|                               | t <sub>pHL</sub>    |                | 5.0 ± 0.5           | —         | 6.0  | 9.7  | 1.0            | 11.0 |      |
| Input Capacitance             | C <sub>IN</sub>     |                |                     | —         | 5    | 10   | —              | 10   | pF   |
| Power Dissipation Capacitance | C <sub>PD</sub> (1) |                |                     | —         | 29   | —    | —              | —    |      |

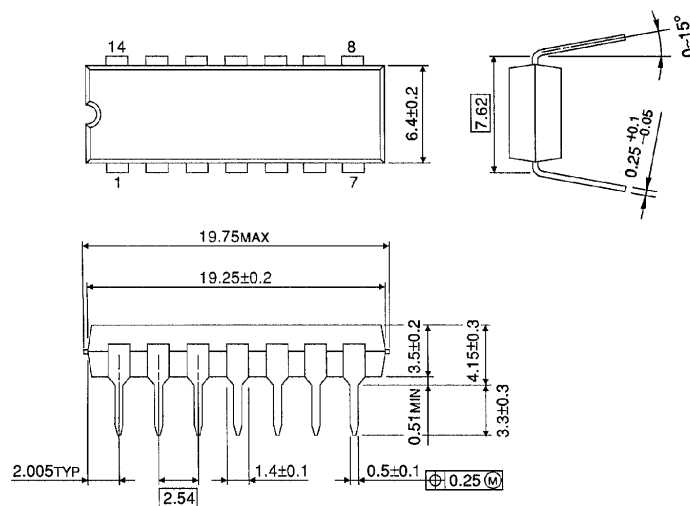
Note(1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

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)

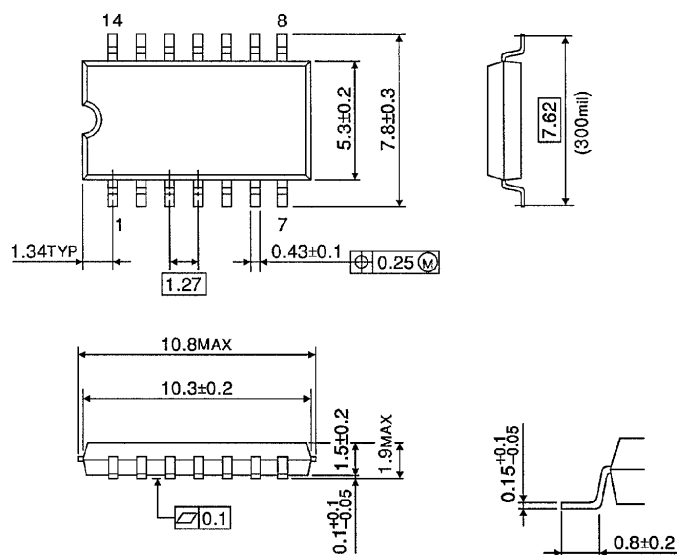
Unit in mm



Weight : 0.96g (Typ.)

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

Unit in mm

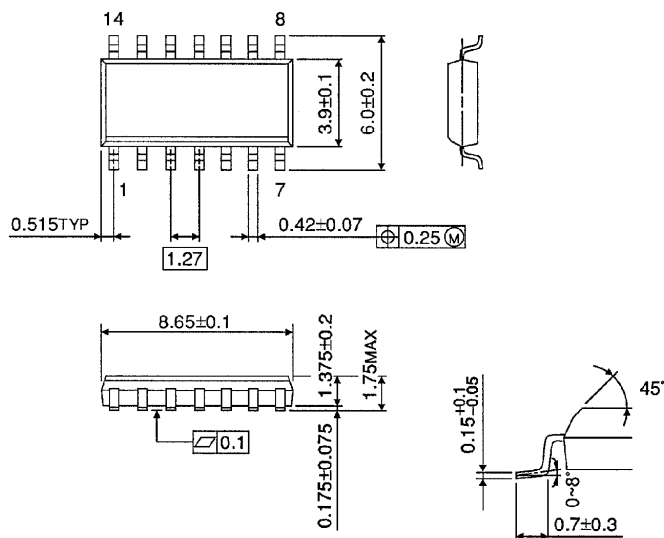


Weight : 0.18g (Typ.)

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

Unit in mm

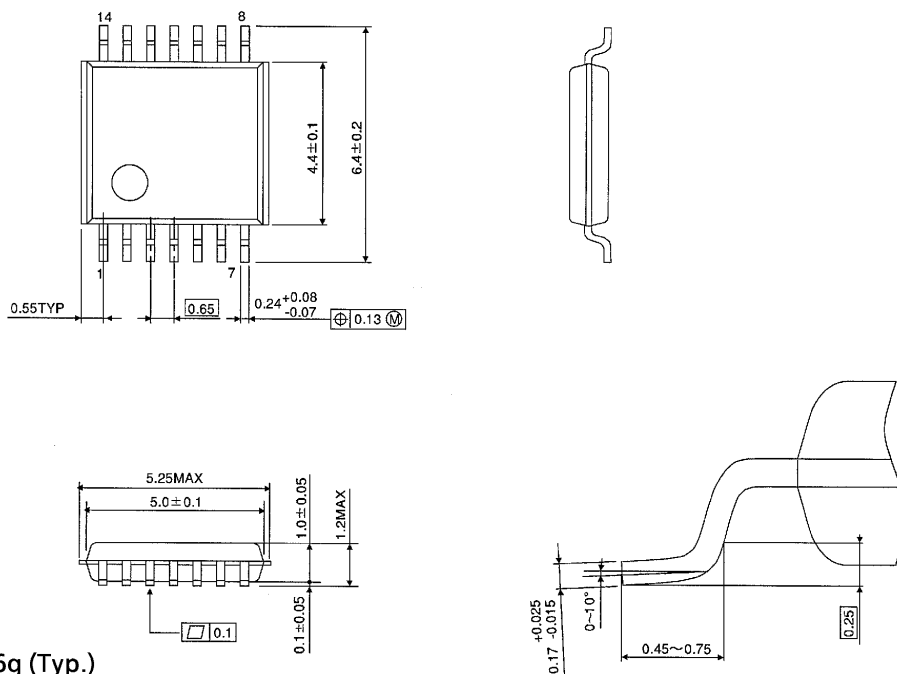
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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

Unit in mm



Weight : 0.06g (Typ.)