

# **TC74LVX14F, TC74LVX14FN, TC74LVX14FT**

## **HEX SCHMITT INVERTER**

The TC74LVX14 is a high speed CMOS HEX SCHMITT INVERTER fabricated with silicon gate C<sup>2</sup>MOS technology. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation. This device is suitable for low voltage and battery operated systems.

Pin configuration and function are the same as the TC74LVX04 but the inputs have hysteresis and with its schmitt trigger function, the TC74LVX14 can be used as a line receivers which will receive slow input signals. An input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage.

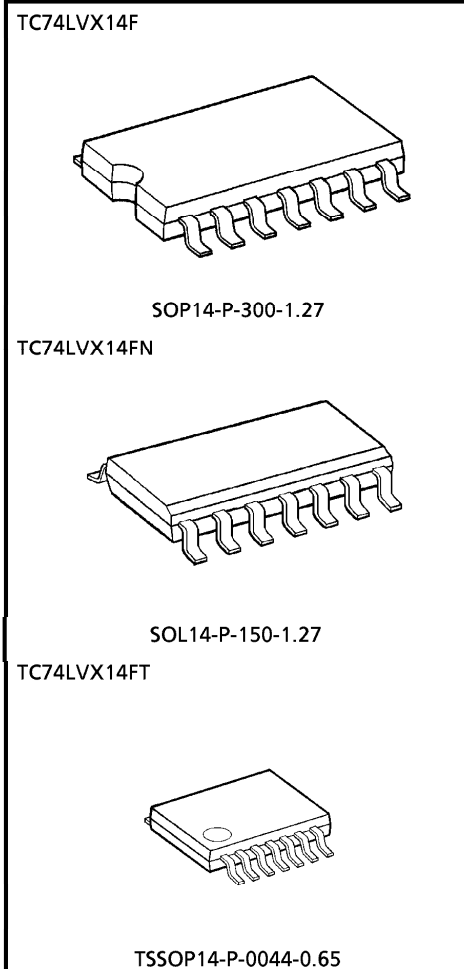
This device can be used to interface 5V to 3V systems and two supply systems such as battery back up.

This circuit prevents device destruction due to mismatched supply and input voltages.

### **FEATURES**

- High speed :  $t_{pd} = 6.8ns$  (Typ.) ( $V_{CC} = 3.3V$ )
- Low power dissipation :  $I_{CC} = 2\mu A$  (Max.) ( $T_a = 25^\circ C$ )
- Power down protection is provided on all inputs.
- Balanced propagation delays :  $t_{pLH} \approx t_{pHL}$
- Low noise :  $V_{OLP} = 0.5V$  (Max.)
- Pin and function compatible with 74HC14

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

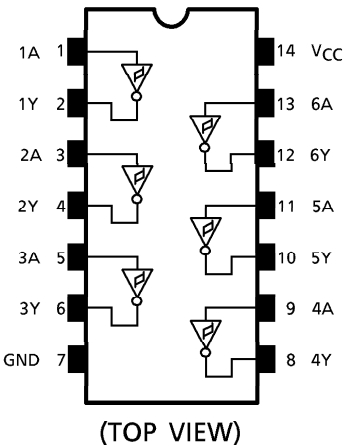


Weight  
SOP14-P-300-1.27 : 0.18g (Typ.)  
SOL14-P-150-1.27 : 0.12g (Typ.)  
TSSOP14-P-0044-0.65 : 0.06g (Typ.)

961001EBA2

● 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.

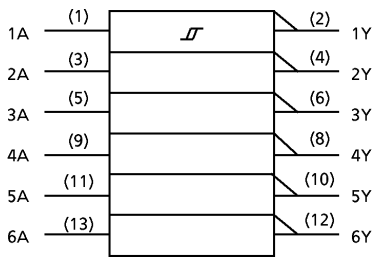
PIN ASSIGNMENT



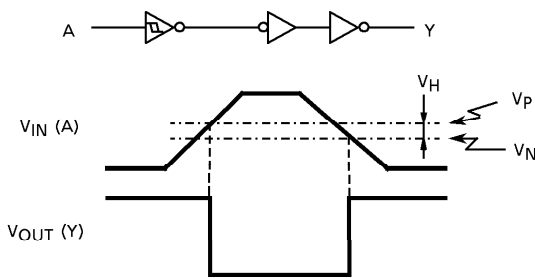
TRUTH TABLE

| INPUTS | OUTPUTS |
|--------|---------|
| A      | Y       |
| L      | H       |
| H      | L       |

IEC LOGIC SYMBOL



SYSTEM DIAGRAM, WAVEFORM



961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

## MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | RATING               | UNIT |
|-----------------------------|-----------|----------------------|------|
| Supply Voltage Range        | $V_{CC}$  | -0.5~7.0             | V    |
| DC Input Voltage            | $V_{IN}$  | -0.5~7.0             | V    |
| DC Output Voltage           | $V_{OUT}$ | -0.5~ $V_{CC} + 0.5$ | V    |
| Input Diode Current         | $I_{IK}$  | -20                  | mA   |
| Output Diode Current        | $I_{OK}$  | ±20                  | mA   |
| DC Output Current           | $I_{OUT}$ | ±25                  | mA   |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | ±50                  | mA   |
| Power Dissipation           | $P_D$     | 180                  | mW   |
| Storage Temperature         | $T_{stg}$ | -65~150              | °C   |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER             | SYMBOL    | RATING      | UNIT |
|-----------------------|-----------|-------------|------|
| Supply Voltage        | $V_{CC}$  | 2.0~3.6     | V    |
| Input Voltage         | $V_{IN}$  | 0~5.5       | V    |
| Output Voltage        | $V_{OUT}$ | 0~ $V_{CC}$ | V    |
| Operating Temperature | $T_{opr}$ | -40~85      | °C   |

## ELECTRICAL CHARACTERISTICS

## DC characteristics

| PARAMETER                |           | SYM-<br>BOL     | TEST CONDITION                           |                          | V <sub>CC</sub><br>(V) | Ta = 25°C |       |      | Ta = - 40~85°C |      | UNIT |
|--------------------------|-----------|-----------------|------------------------------------------|--------------------------|------------------------|-----------|-------|------|----------------|------|------|
|                          |           |                 |                                          |                          |                        | MIN.      | TYP.  | MAX. | MIN.           | MAX. |      |
| Threshold<br>Voltage     | "H" Level | V <sub>P</sub>  |                                          |                          | 3.0                    | —         | —     | 2.2  | —              | 2.2  | V    |
|                          | "L" Level | V <sub>N</sub>  |                                          |                          | 3.0                    | 0.9       | —     | —    | 0.9            | —    |      |
| Hysteresis Voltage       |           | V <sub>H</sub>  |                                          |                          | 3.0                    | 0.3       | —     | 1.2  | 0.3            | 1.2  | V    |
| Output<br>Voltage        | "H" Level | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IL</sub>        | I <sub>OH</sub> = - 50μA | 2.0                    | 1.9       | 2.0   | —    | 1.9            | —    | V    |
|                          |           |                 |                                          | I <sub>OH</sub> = - 50μA | 3.0                    | 2.9       | 3.0   | —    | 2.9            | —    |      |
|                          |           |                 |                                          | I <sub>OH</sub> = - 4mA  | 3.0                    | 2.58      | —     | —    | 2.48           | —    |      |
|                          | "L" Level | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub>        | I <sub>OL</sub> = 50μA   | 2.0                    | —         | 0.0   | 0.1  | —              | 0.1  |      |
|                          |           |                 |                                          | I <sub>OL</sub> = 50μA   | 3.0                    | —         | 0.0   | 0.1  | —              | 0.1  |      |
|                          |           |                 |                                          | I <sub>OL</sub> = 4mA    | 3.0                    | —         | —     | 0.36 | —              | 0.44 |      |
| Input Leakage Current    |           | I <sub>IN</sub> | V <sub>IN</sub> = 5.5V or GND            | 3.6                      | —                      | —         | ± 0.1 | —    | ± 1.0          | μA   |      |
| Quiescent Supply Current |           | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND | 3.6                      | —                      | —         | 2.0   | —    | 20.0           | μA   |      |

AC characteristics (Input  $t_r = t_f = 3\text{ns}$ )

| PARAMETER                        | SYM-BOL           | TEST<br>CONDITION |                     |                     | Ta = 25°C |      |      | Ta = - 40~85°C |      | UNIT |
|----------------------------------|-------------------|-------------------|---------------------|---------------------|-----------|------|------|----------------|------|------|
|                                  |                   |                   | V <sub>CC</sub> (V) | C <sub>L</sub> (pF) | MIN.      | TYP. | MAX. | MIN.           | MAX. |      |
| Propagation Delay<br>Time        | t <sub>pLH</sub>  |                   | 2.7                 | 15                  | —         | 8.7  | 16.3 | 1.0            | 19.5 | ns   |
|                                  |                   |                   |                     | 50                  | —         | 11.2 | 19.8 | 1.0            | 23.0 |      |
|                                  | t <sub>pHL</sub>  |                   | 3.3 ± 0.3           | 15                  | —         | 6.8  | 10.6 | 1.0            | 12.5 |      |
|                                  |                   |                   |                     | 50                  | —         | 9.3  | 14.1 | 1.0            | 16.0 |      |
| Output To Output<br>Skew         | t <sub>osLH</sub> | (Note 1)          | 2.7                 | 50                  | —         | —    | 1.5  | —              | 1.5  | ns   |
|                                  | t <sub>osHL</sub> |                   | 3.3 ± 0.3           | 50                  | —         | —    | 1.5  | —              | 1.5  |      |
| Input Capacitance                | C <sub>IN</sub>   | (Note 2)          |                     |                     | —         | 4    | 10   | —              | 10   | pF   |
| Power Dissipation<br>Capacitance | C <sub>PD</sub>   | (Note 3)          |                     |                     | —         | 21   | —    | —              | —    | pF   |

(Note 1) Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

(Note 2) Parameter guaranteed by design.

(Note 3) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

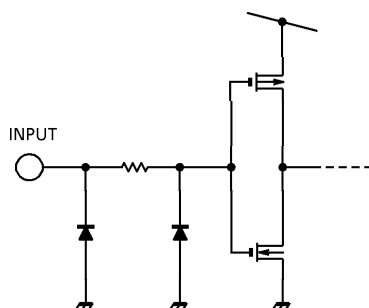
Average operating current can be obtained by the equation :

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

Noise characteristics (Ta = 25°C, Input  $t_r = t_f = 3\text{ns}$ , C<sub>L</sub> = 50pF)

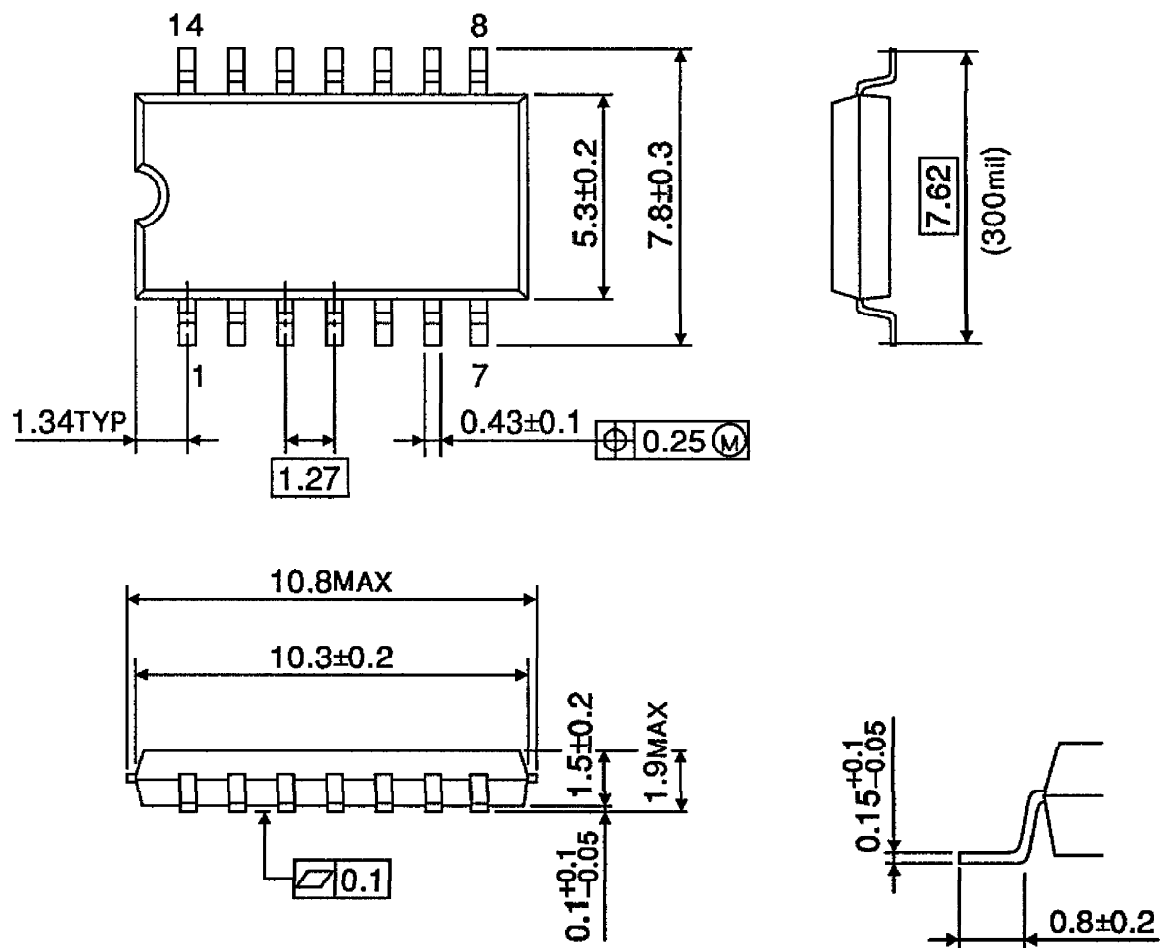
| PARAMETER                                       | SYMBOL           | TEST CONDITION | V <sub>CC</sub> (V) | TYP. | LIMIT | UNIT |
|-------------------------------------------------|------------------|----------------|---------------------|------|-------|------|
|                                                 |                  |                |                     |      |       |      |
| Quiet Output Maximum Dynamic<br>V <sub>OL</sub> | V <sub>OLP</sub> |                | 3.3                 | 0.3  | 0.5   | V    |
| Quiet Output Minimum Dynamic<br>V <sub>OL</sub> | V <sub>OLV</sub> |                | 3.3                 | −0.3 | −0.5  | V    |
| Minimum High Level Dynamic<br>Input Voltage     | V <sub>IHD</sub> |                | 3.3                 | —    | 2.2   | V    |
| Maximum Low Level Dynamic<br>Input Voltage      | V <sub>ILD</sub> |                | 3.3                 | —    | 0.9   | V    |

## INPUT EQUIVALENT CIRCUIT



OUTLINE DRAWING  
SOP14-P-300-1.27

Unit : mm



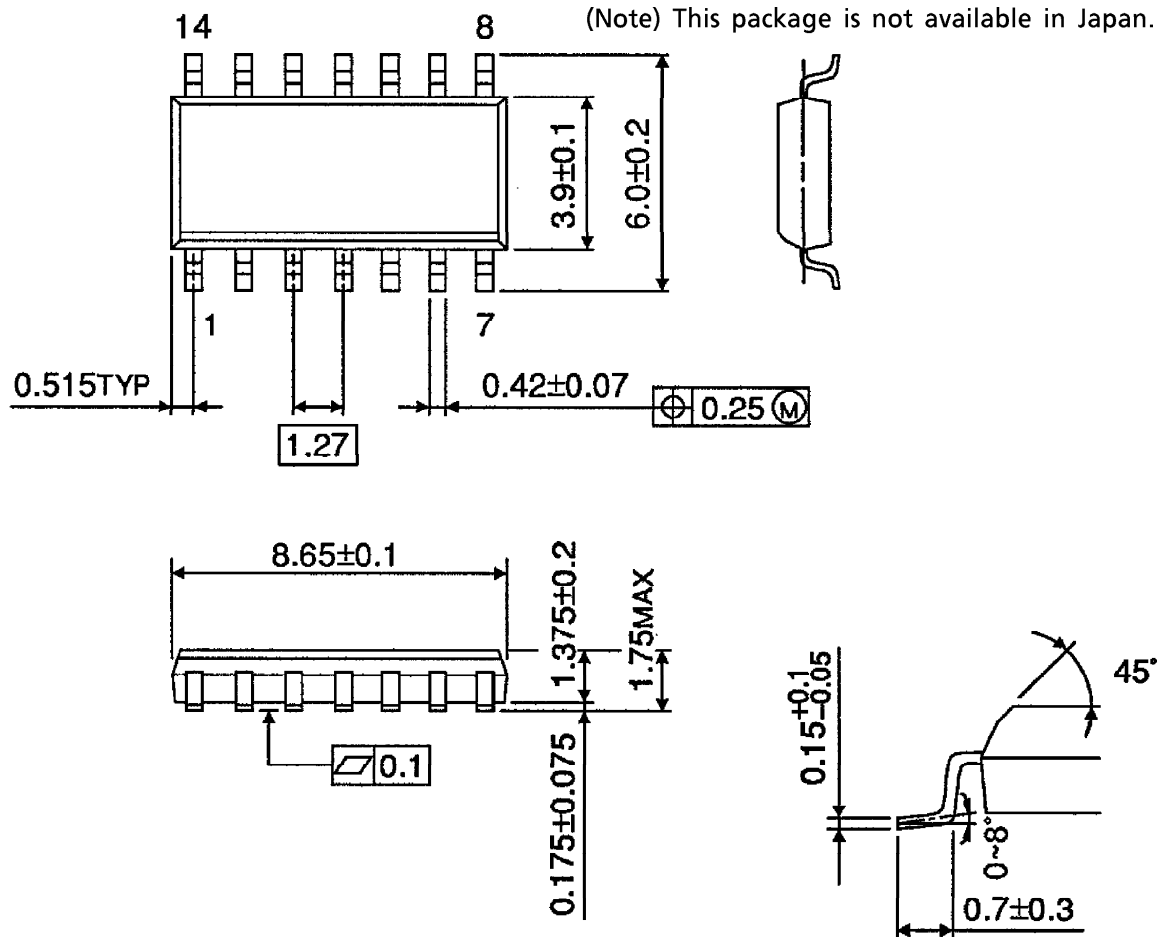
Weight : 0.18g (Typ.)

**OUTLINE DRAWING**

SOL14-P-150-1.27

Unit : mm

(Note) This package is not available in Japan.

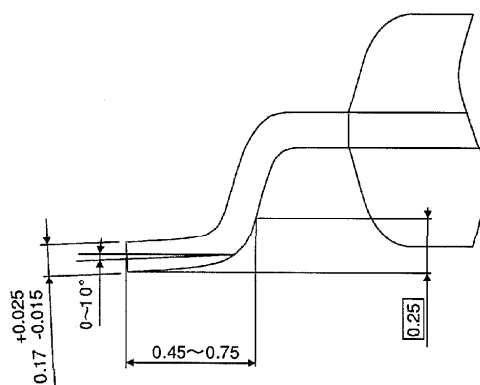
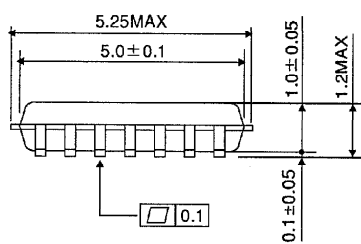
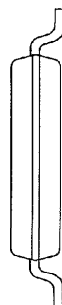
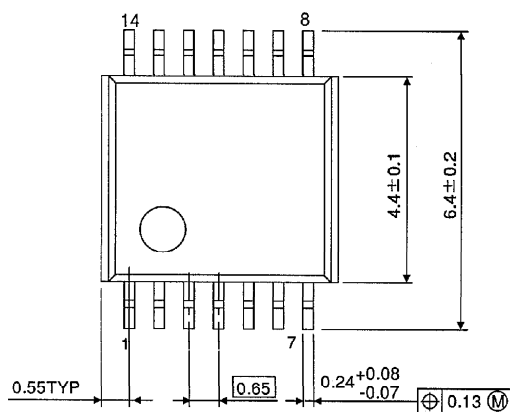


Weight : 0.12g (Typ.)

**OUTLINE DRAWING**

TSSOP14-P-0044-0.65

Unit : mm



Weight : 0.06g (Typ.)