

# TC74LCX14F, TC74LCX14FN, TC74LCX14FT

## LOW VOLTAGE HEX SCHMITT INVERTER WITH 5V TOLERANT INPUTS AND OUTPUTS

The TC74LCX14 is a high performance CMOS SCHMITT INVERTER. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for inputs.

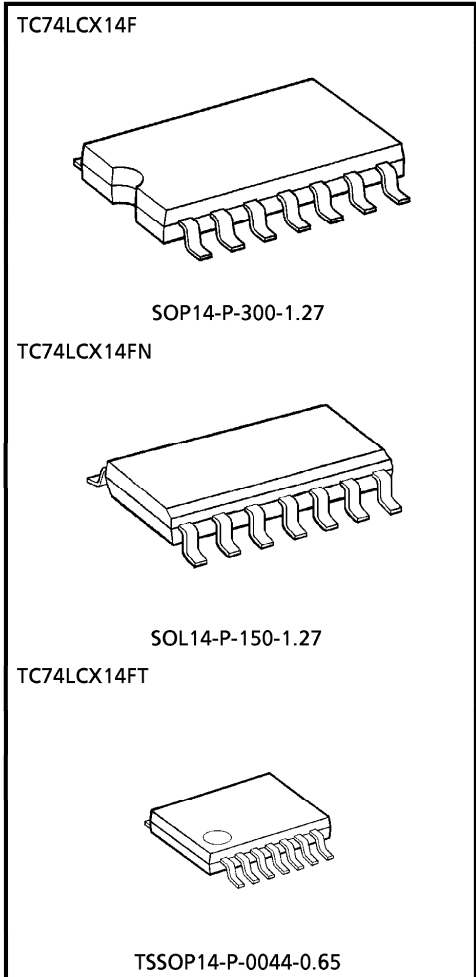
Pin configuration and function are the same as the TC74LCX04 but the inputs have hysteresis and with its schmitt trigger function, the TC74LCX14 can be used as a line receivers which will receive slow input signals.

All inputs are equipped with protection circuits against static discharge.

### FEATURES

- Low voltage operation :  $V_{CC} = 2.0 \sim 3.6V$
- High speed operation :  $t_{pd} = 6.5ns$  (Max.)  
( $V_{CC} = 3.0 \sim 3.6V$ )
- Output current :  $|I_{OH}| / I_{OL} = 24mA$  (Min.)  
( $V_{CC} = 3.0V$ )
- Latch-up performance :  $\pm 500mA$
- Available in JEDEC SOP, EIAJ SOP and TSSOP
- Power down protection is provided on all inputs and outputs.
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 14 type.

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

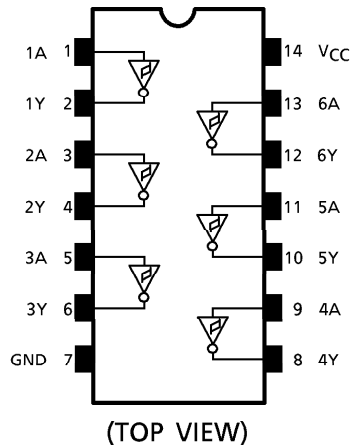


Weight  
 SOP14-P-300-1.27 : 0.18g (Typ.)  
 SOL14-P-150-1.27 : 0.12g (Typ.)  
 TSSOP14-P-0044-0.65 : 0.06g (Typ.)

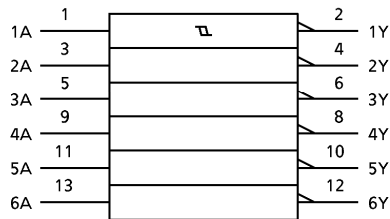
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**PIN ASSIGNMENT**



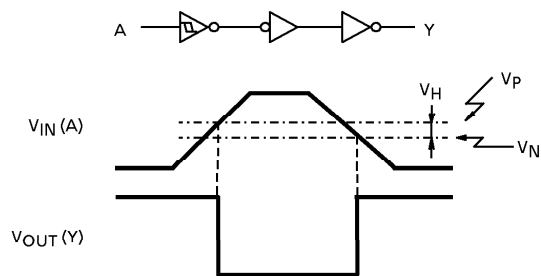
**IEC LOGIC SYMBOL**



**TRUTH TABLE**

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

**SYSTEM DIAGRAM, WAVEFORM**



**MAXIMUM RATINGS**

| PARAMETER                   | SYMBOL           | RATING                       | UNIT |
|-----------------------------|------------------|------------------------------|------|
| Power Supply Voltage        | $V_{CC}$         | -0.5~7.0                     | V    |
| DC Input Voltage            | $V_{IN}$         | -0.5~7.0                     | V    |
| DC Output Voltage           | $V_{OUT}$        | -0.5~7.0 (Note 1)            | V    |
|                             |                  | -0.5~ $V_{CC}$ +0.5 (Note 2) |      |
| Input Diode Current         | $I_{IK}$         | -50                          | mA   |
| Output Diode Current        | $I_{OK}$         | ±50 (Note 3)                 | mA   |
| DC Output Current           | $I_{OUT}$        | ±50                          | mA   |
| Power Dissipation           | $P_D$            | 180                          | mW   |
| DC $V_{CC}$ /Ground Current | $I_{CC}/I_{GND}$ | ±100                         | mA   |
| Storage Temperature         | $T_{stg}$        | -65~150                      | °C   |

(Note 1)  $V_{CC}=0V$

(Note 2) High or Low State.  $I_{OUT}$  absolute maximum rating must be observed.

(Note 3)  $V_{OUT}<GND, V_{OUT}>V_{CC}$

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

**RECOMMENDED OPERATING CONDITIONS**

| PARAMETER             | SYMBOL                            | RATING                     | UNIT |
|-----------------------|-----------------------------------|----------------------------|------|
| Supply Voltage        | V <sub>CC</sub>                   | 2.0~3.6                    | V    |
|                       |                                   | 1.5~3.6 (Note 4)           |      |
| Input Voltage         | V <sub>IN</sub>                   | 0~5.5                      | V    |
| Output Voltage        | V <sub>OUT</sub>                  | 0~5.5 (Note 5)             | V    |
|                       |                                   | 0~V <sub>CC</sub> (Note 6) |      |
| Output Current        | I <sub>OH</sub> / I <sub>OL</sub> | ± 24 (Note 7)              | mA   |
|                       |                                   | ± 12 (Note 8)              |      |
| Operating Temperature | T <sub>opr</sub>                  | - 40~85                    | °C   |

(Note 4) Data Retention Only

(Note 5) V<sub>CC</sub> = 0V

(Note 6) High or Low State

(Note 7) V<sub>CC</sub> = 3.0~3.6V

(Note 8) V<sub>CC</sub> = 2.7~3.0V

**ELECTRICAL CHARACTERISTICS**

DC CHARACTERISTICS (Ta = - 40~85°C)

| PARAMETER                             |                 | SYMBOL           | TEST CONDITION                                | V <sub>CC</sub> (V)       | MIN.    | MAX.                  | UNIT |   |
|---------------------------------------|-----------------|------------------|---|---------------------------|---------|-----------------------|------|---|
| Threshold Voltage                     | "H" Level       | V <sub>p</sub>   |   | 3.0                       | 1.2     | 2.2                   | V    |   |
|                                       | "L" Level       | V <sub>N</sub>   |   | 3.0                       | 0.6     | 1.5                   |      |   |
| Hysteresis Voltage                    |                 | V <sub>H</sub>   |   | 3.0                       | 0.4     | 1.2                   | V    |   |
| Output Voltage                        | "H" Level       | V <sub>OH</sub>  | V <sub>IN</sub> = V <sub>IL</sub>             | I <sub>OH</sub> = - 100μA | 2.7~3.6 | V <sub>CC</sub> - 0.2 | —    | V |
|                                       |                 |                  |   | I <sub>OH</sub> = - 12mA  | 2.7     | 2.2                   | —    |   |
|                                       |                 |                  |   | I <sub>OH</sub> = - 18mA  | 3.0     | 2.4                   | —    |   |
|                                       |                 |                  |   | I <sub>OH</sub> = - 24mA  | 3.0     | 2.2                   | —    |   |
|                                       | "L" Level       | V <sub>OL</sub>  | V <sub>IN</sub> = V <sub>IH</sub>             | I <sub>OL</sub> = 100μA   | 2.7~3.6 | —                     | 0.2  |   |
|                                       |                 |                  |   | I <sub>OL</sub> = 12mA    | 2.7     | —                     | 0.4  |   |
|                                       |                 |                  |   | I <sub>OL</sub> = 16mA    | 3.0     | —                     | 0.4  |   |
|                                       |                 |                  |   | I <sub>OL</sub> = 24mA    | 3.0     | —                     | 0.55 |   |
| Input Leakage Current                 |                 | I <sub>IN</sub>  | V <sub>IN</sub> = 0~5.5V                      | 2.7~3.6                   | —       | ± 5.0                 | μA   |   |
| Power Off Leakage Current             |                 | I <sub>OFF</sub> | V <sub>IN</sub> / V <sub>OUT</sub> = 5.5V     | 0                         | —       | 10.0                  | μA   |   |
| Quiescent Supply Current              | I <sub>CC</sub> |                  | V <sub>IN</sub> = V <sub>CC</sub> or GND      | 2.7~3.6                   | —       | 10.0                  | μA   |   |
|                                       |                 |                  | V <sub>IN</sub> / V <sub>OUT</sub> = 3.6~5.5V | 2.7~3.6                   | —       | ± 10.0                |      |   |
| Increase In I <sub>CC</sub> Per Input |                 | ΔI <sub>CC</sub> | V <sub>IH</sub> = V <sub>CC</sub> - 0.6V      | 2.7~3.6                   | —       | 500                   | μA   |   |

**AC CHARACTERISTICS (Ta = -40~85°C)**

| PARAMETER              | SYMBOL            | TEST CONDITION | V <sub>CC</sub> (V) | MIN. | MAX. | UNIT |
|------------------------|-------------------|----------------|---------------------|------|------|------|
|                        |                   |                |                     |      |      |      |
| Propagation Delay Time | t <sub>pLH</sub>  | (Fig.1, 2)     | 2.7                 | —    | 7.5  | ns   |
|                        | t <sub>pHL</sub>  |                | 3.3 ± 0.3           | 1.5  | 6.5  |      |
| Output To Output Skew  | t <sub>osLH</sub> | (Note 9)       | 2.7                 | —    | —    | ns   |
|                        | t <sub>osHL</sub> |                | 3.3 ± 0.3           | —    | 1.0  |      |

(Note 9) Parameter guaranteed by design.  
 (t<sub>osLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>osHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|)

**DYNAMIC SWITCHING CHARACTERISTICS (Ta = 25°C, Input t<sub>r</sub> = t<sub>f</sub> = 2.5ns, C<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω)**

| PARAMETER                                    | SYMBOL           | TEST CONDITION                               | V <sub>CC</sub> (V) | TYP | UNIT |
|--|------------------|--|---------------------|-----|------|
|  |                  |  |                     |     |      |
| Quiet Output Maximum Dynamic V <sub>OL</sub> | V <sub>OLP</sub> | V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V | 3.3                 | 0.8 | V    |
| Quiet Output Minimum Dynamic V <sub>OL</sub> | V <sub>OLV</sub> | V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V | 3.3                 | 0.8 | V    |

**CAPACITIVE CHARACTERISTICS (Ta = 25°C)**

| PARAMETER                     | SYMBOL           | TEST CONDITION                    | V <sub>CC</sub> (V) | TYP | UNIT |
|-------------------------------|------------------|-----------------------------------|---------------------|-----|------|
|                               |                  |                                   |                     |     |      |
| Input Capacitance             | C <sub>IN</sub>  | —                                 | 3.3                 | 7   | pF   |
| Output Capacitance            | C <sub>OUT</sub> |                                   | 0                   | 8   |      |
| Power Dissipation Capacitance | C <sub>PD</sub>  | f <sub>IN</sub> = 10MHz (Note 10) | 3.3                 | 25  | pF   |

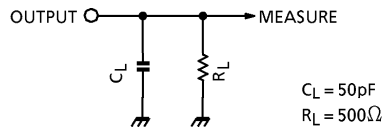
(Note 10) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

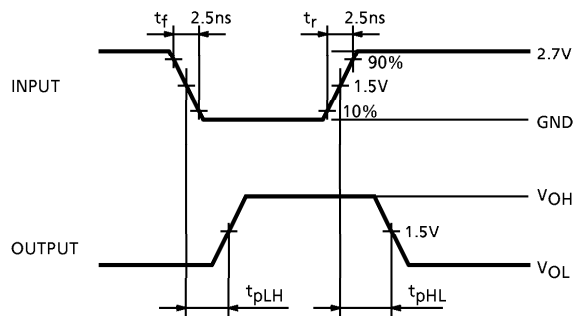
**TEST CIRCUIT**

Fig.1



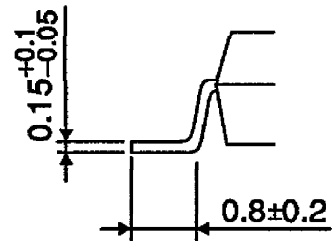
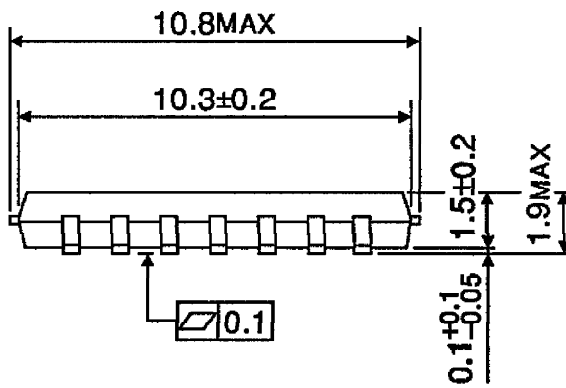
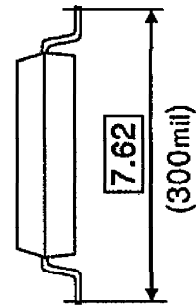
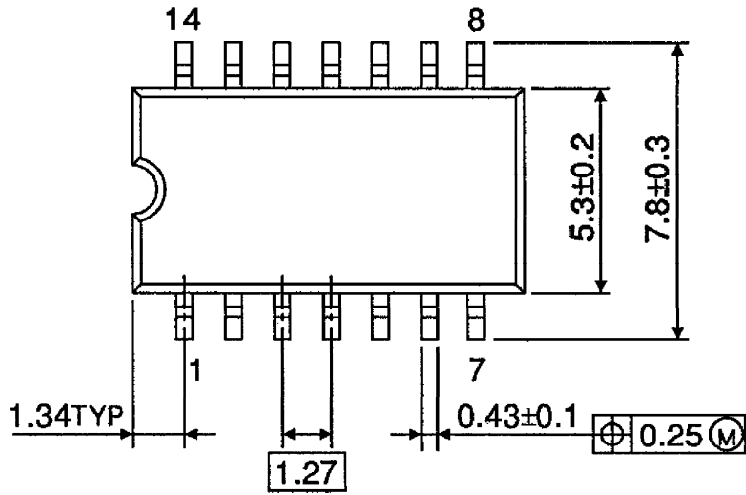
**AC WAVEFORM**

Fig.2 t<sub>pLH</sub>, t<sub>pHL</sub>



**OUTLINE DRAWING**  
SOP14-P-300-1.27

Unit : mm

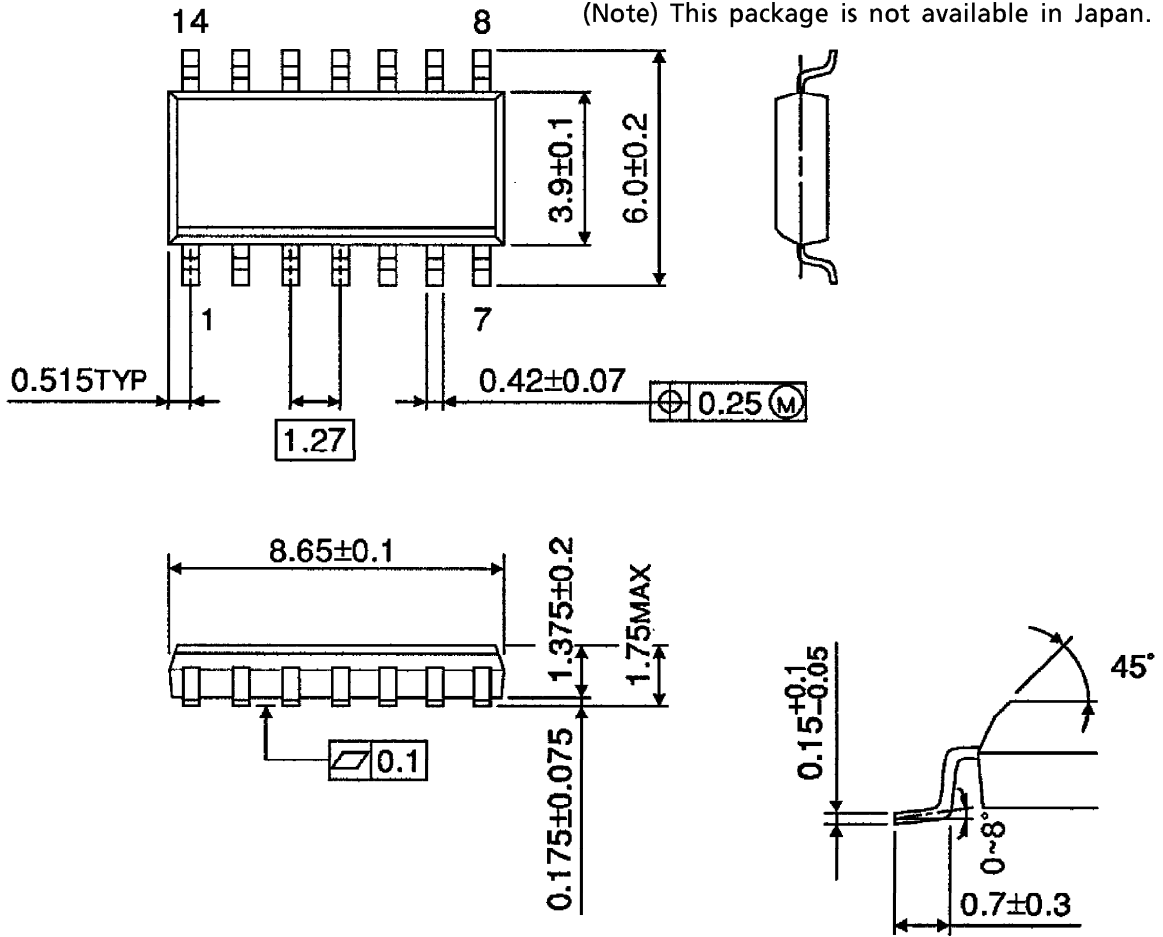


Weight : 0.18g (Typ.)

**OUTLINE DRAWING**  
SOL14-P-150-1.27

UNIT : mm

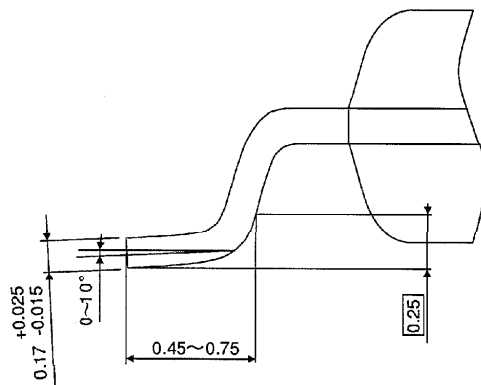
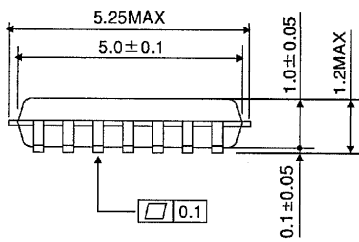
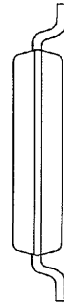
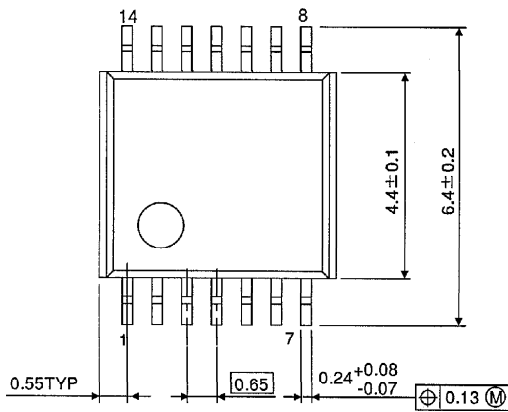
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

**OUTLINE DRAWING**  
TSSOP14-P-0044-0.65

Unit : mm



Weight : 0.06g (Typ.)



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