

# **TC74LCX08F, TC74LCX08FN, TC74LCX08FT**

## **LOW-VOLTAGE QUAD 2-INPUT AND GATE WITH 5V TOLERANT INPUTS AND OUTPUTS**

The TC74LCX08 is a high performance CMOS 2-INPUT AND GATE. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

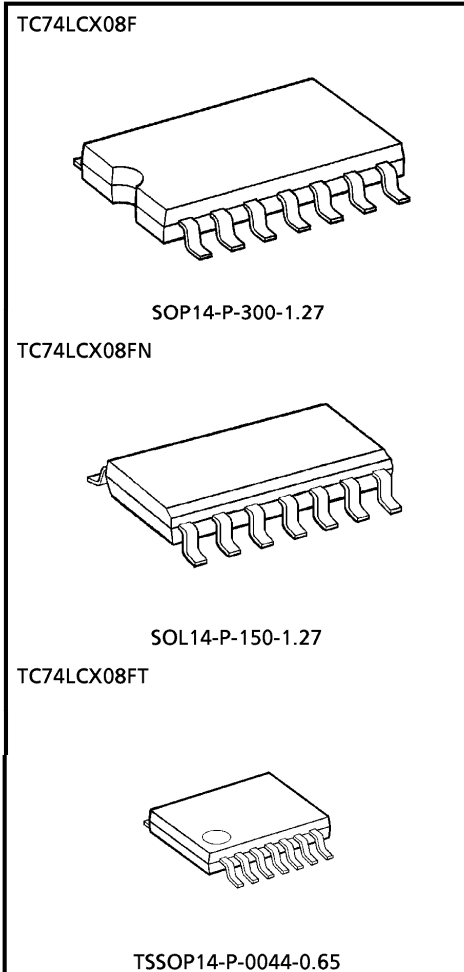
The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

### **FEATURES**

- Low voltage operation :  $V_{CC} = 2.0 \sim 3.6V$
- High speed operation :  $t_{pd} = 5.5ns$  (Max.) at  $V_{CC} = 3.0 \sim 3.6V$
- Output current :  $|I_{OH}| / |I_{OL}| = 24mA$  (Min.) at  $V_{CC} = 3.0V$
- 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.) 08 type.

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

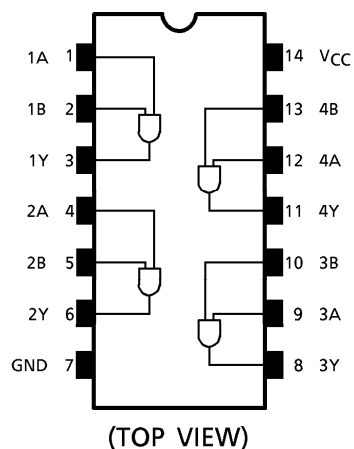


Weight  
 SOP14-P-300-1.27 : 0.18g (Typ.)  
 SOL14-P-150-1.27 : 0.12g (Typ.)  
 TSSOP14-P-0044-0.65 : 0.06g (Typ.)

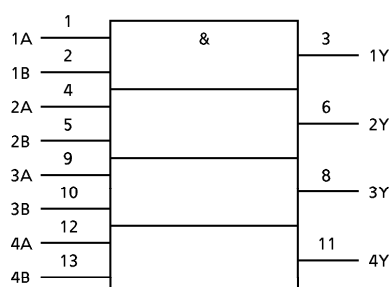
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## PIN CONNECTION



## IEC LOGIC SYMBOL



## TRUTH TABLE

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

## 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           | $V_{CC}$        | 2.0~3.6              | V    |
|                          |                 | 1.5~3.6 (Note 4)     |      |
| Input Voltage            | $V_{IN}$        | 0~5.5                | V    |
| Output Voltage           | $V_{OUT}$       | 0~5.5 (Note 5)       | V    |
|                          |                 | 0~ $V_{CC}$ (Note 6) |      |
| Output Current           | $I_{OH}/I_{OL}$ | $\pm 24$ (Note 7)    | mA   |
|                          |                 | $\pm 12$ (Note 8)    |      |
| Operating Temperature    | $T_{opr}$       | -40~85               | °C   |
| Input Rise And Fall Time | $dt/dv$         | 0~10 (Note 9)        | ns/V |

(Note 4) Data Retention Only

(Note 5)  $V_{CC} = 0V$ 

(Note 6) High or Low State

(Note 7)  $V_{CC} = 3.0\sim 3.6V$ (Note 8)  $V_{CC} = 2.7\sim 3.0V$ (Note 9)  $V_{IN} = 0.8\sim 2.0V$ ,  $V_{CC} = 3.0V$ 

## ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS ( $T_a = -40\sim 85^\circ\text{C}$ )

| CHARACTERISTIC                        |                 | SYMBOL                                        | TEST CONDITION                                       |                           | V <sub>CC</sub> (V) | MIN.                  | MAX. | UNIT |
|---------------------------------------|-----------------|-----------------------------------------------|------------------------------------------------------|---------------------------|---------------------|-----------------------|------|------|
| Input Voltage                         | "H" Level       | V <sub>IH</sub>                               |                                                      |                           | 2.7~3.6             | 2.0                   | —    | V    |
|                                       | "L" Level       | V <sub>IL</sub>                               |                                                      |                           | 2.7~3.6             | —                     | 0.8  | V    |
| Output Voltage                        | "H" Level       | V <sub>OH</sub>                               | V <sub>IN</sub> = V <sub>IH</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> or V <sub>IL</sub> | I <sub>OL</sub> = 100μA   | 2.7~3.6             | —                     | 0.2  | V    |
|                                       |                 |                                               |                                                      | 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><br>t <sub>pHL</sub>   | (Fig.1, 2)     | 2.7                 | —    | 6.2  | ns   |
|                        |                                        |                | 3.3 ± 0.3           | 1.5  | 5.5  |      |
| Output To Output Skew  | t <sub>osLH</sub><br>t <sub>osHL</sub> | (Note 10)      | 2.7                 | —    | —    | ns   |
|                        |                                        |                | 3.3 ± 0.3           | —    | 1.0  |      |

(Note 10) Parameter guaranteed by design.

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

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    | pF   |
| Power Dissipation Capacitance | C <sub>PD</sub>  | f <sub>IN</sub> = 10MHz (Note 11) | 3.3                 | 25   | pF   |

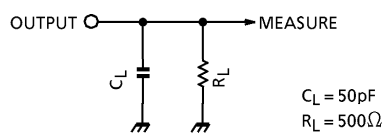
(Note 11) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 4 \text{ (Per gate)}$$

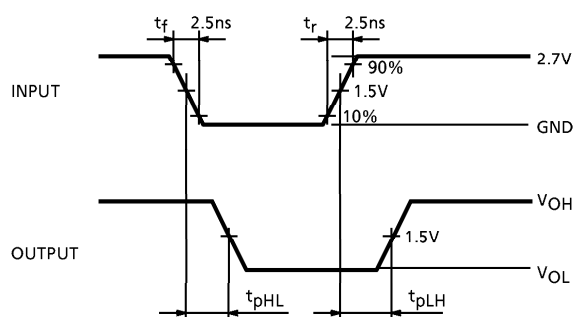
# TEST CIRCUIT

Fig.1



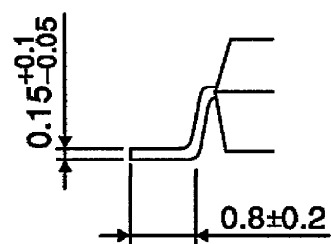
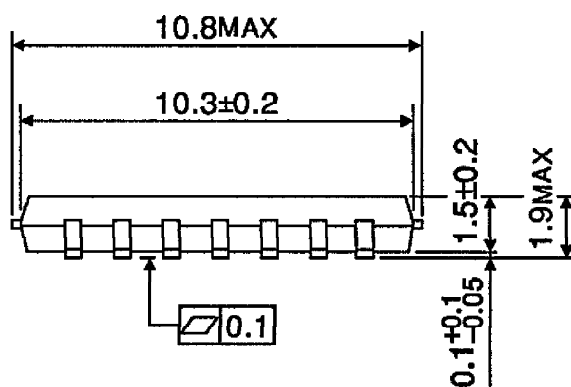
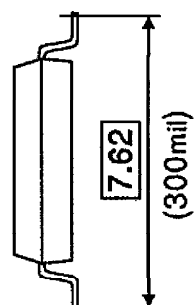
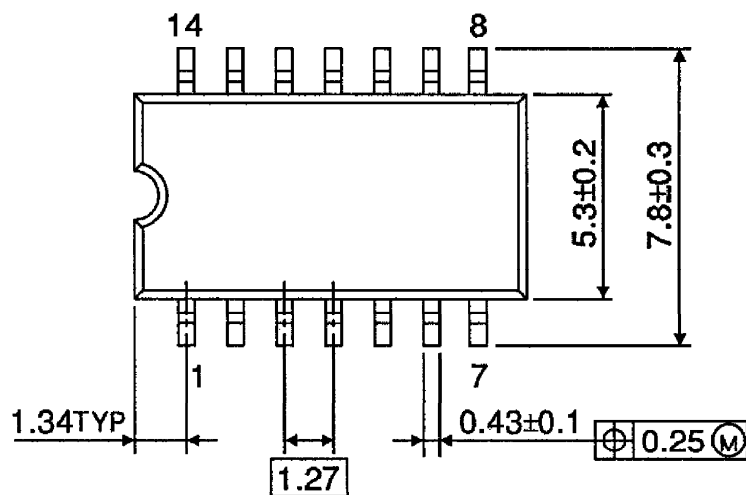
# AC WAVEFORM

Fig.2  $t_{pLH}$ ,  $t_{pHL}$



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

Unit : mm



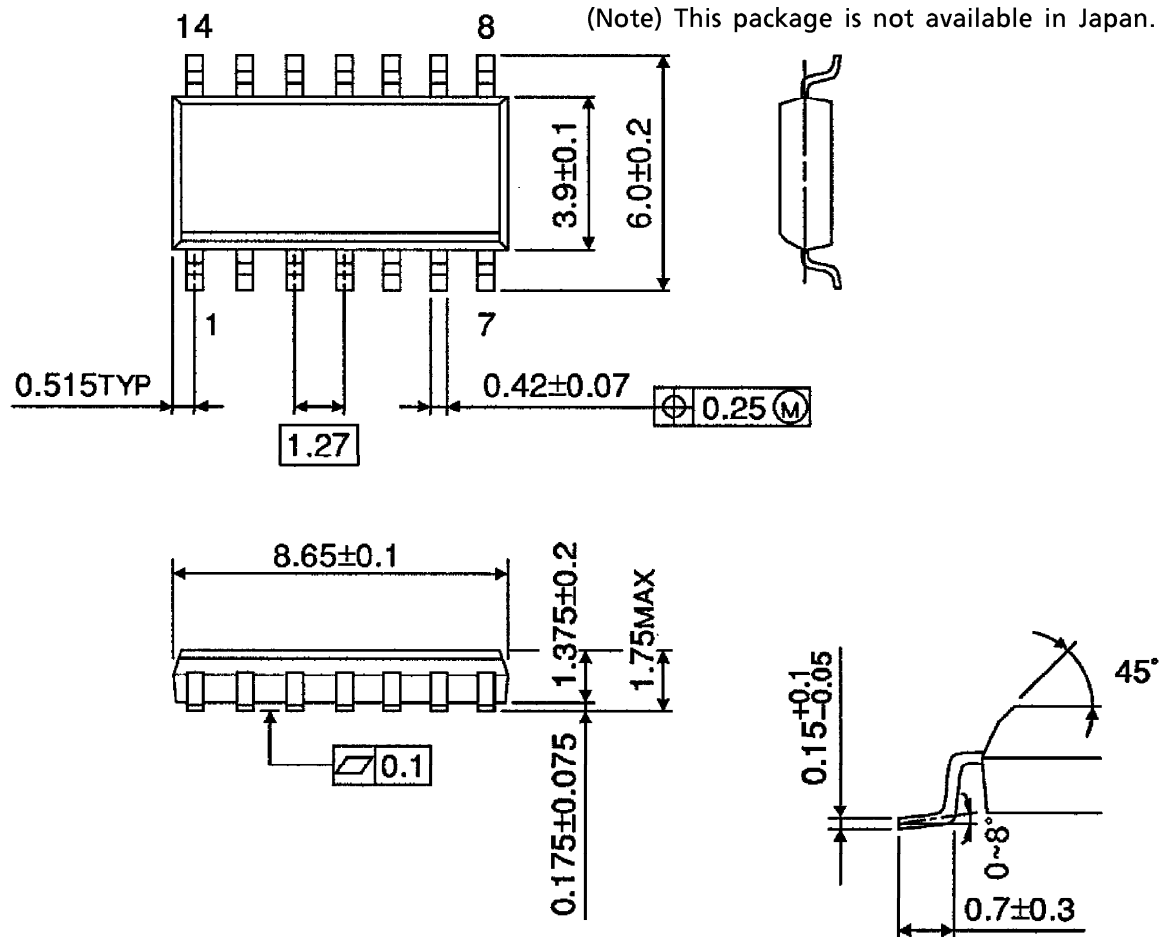
Weight : 0.18g (Typ.)

**OUTLINE DRAWING**

SOL14-P-150-1.27

Unit : mm

(Note) This package is not available in Japan.

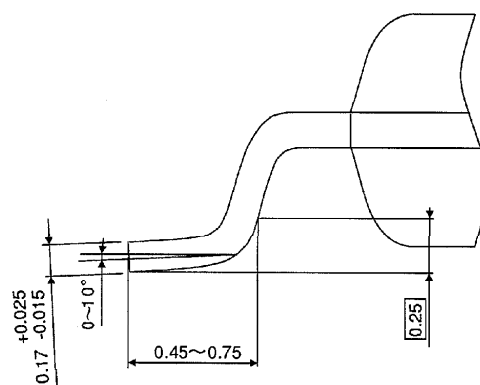
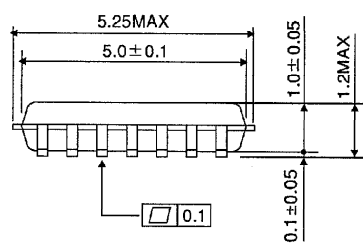
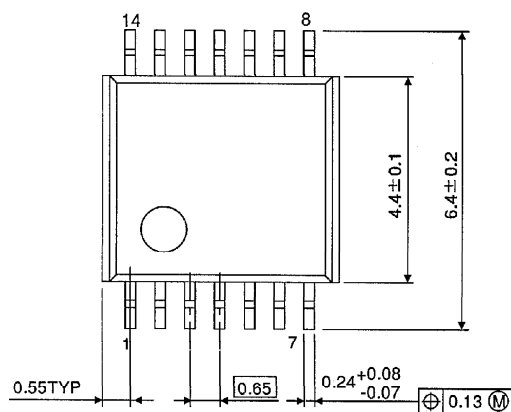


Weight : 0.12g (Typ.)

**OUTLINE DRAWING**

TSSOP14-P-0044-0.65

Unit : mm



Weight : 0.06g (Typ.)