

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74LCX32F, TC74LCX32FN, TC74LCX32FT****LOW VOLTAGE QUAD 2-INPUT OR GATE  
WITH 5V TOLERANT INPUTS AND OUTPUTS**

The TC74LCX32 is a high performance CMOS 2-INPUT OR GATE. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

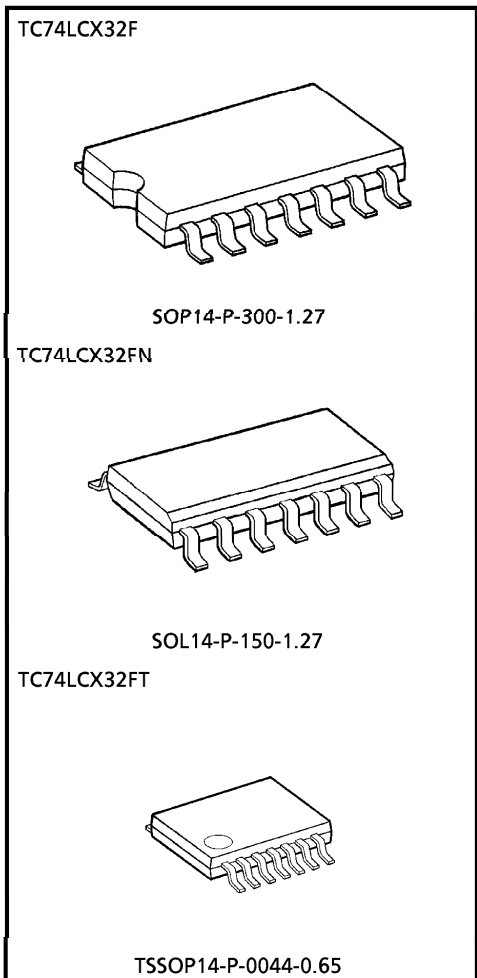
The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for inputs.

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.)  
( $V_{CC} = 3.0 \sim 3.6V$ )
- 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.) 32 type.

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

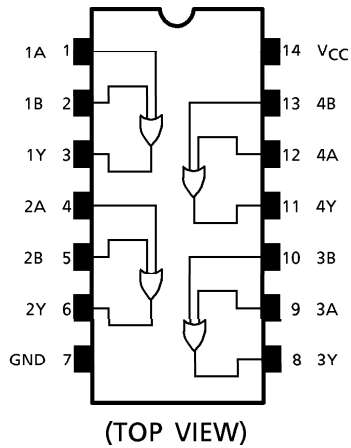
**Weight**

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

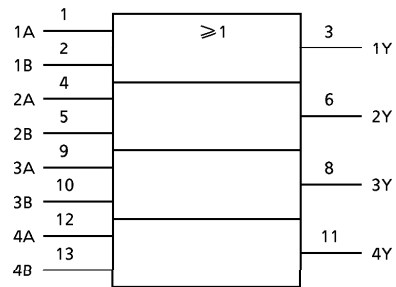
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**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



**TRUTH TABLE**

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

**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           | $V_{OUT}$        | -0.5~7.0 (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   |
| Input Rise And Fall Time | dt/dv                            | 0~10 (Note 9)              | ns/V |

- (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
- (Note 9) V<sub>IN</sub> = 0.8~2.0V, V<sub>CC</sub> = 3.0V

**ELECTRICAL CHARACTERISTICS**

DC characteristics (Ta = -40~85°C)

| PARAMETER                              |                  | 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                   |      |   |
| Output Voltage                         | "H" Level        | V <sub>OH</sub>                               | V <sub>IN</sub> = V <sub>IH</sub> or 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>IL</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                 |      |   |
| Quiescent 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                 | —    | 6.2  | ns   |
|                        | t <sub>pHL</sub>  |                | 3.3 ± 0.3           | 1.5  | 5.5  |      |
| Output To Output Skew  | t <sub>osLH</sub> | (Note 10)      | 2.7                 | —    | —    | ns   |
|                        | t <sub>osHL</sub> |                | 3.3 ± 0.3           | —    | 1.0  |      |

(Note 10) 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    |

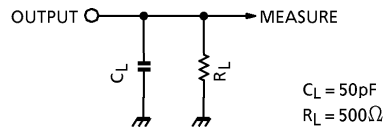
**CAPACITIVE CHARACTERISTICS** (Ta = 25°C)

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

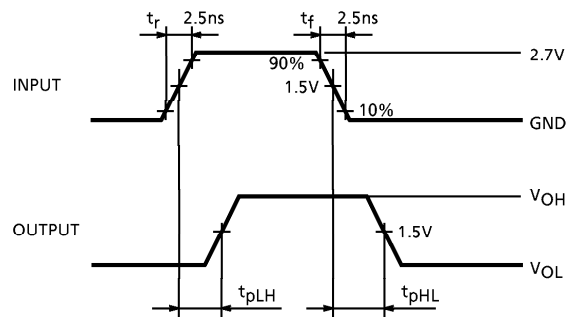
**TEST CIRCUIT**

Fig.1



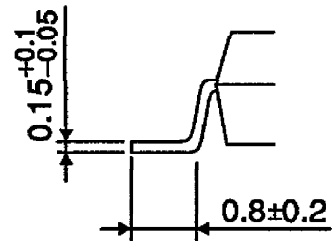
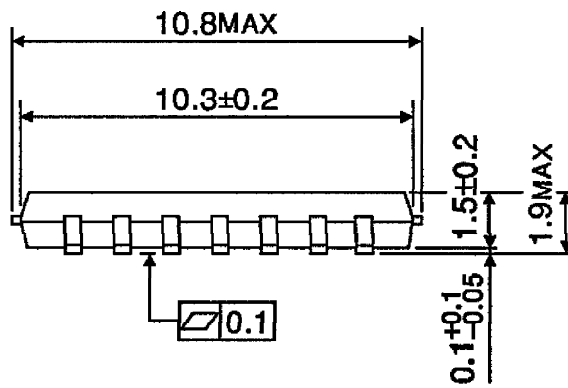
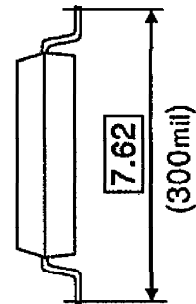
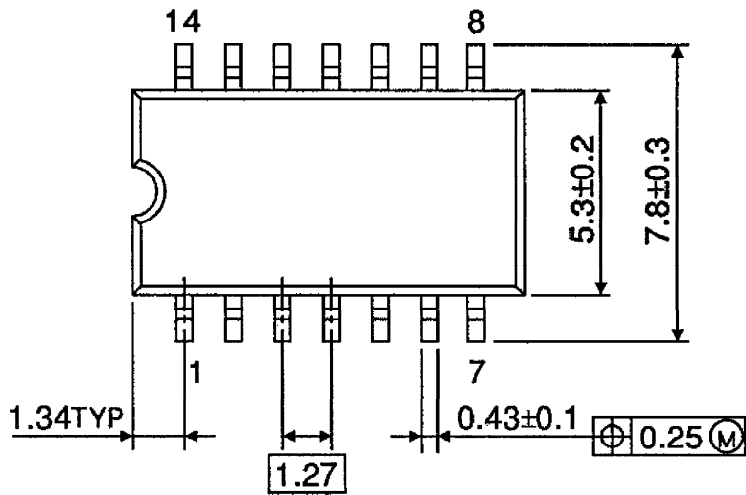
**AC WAVEFORM**

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



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

Unit : mm

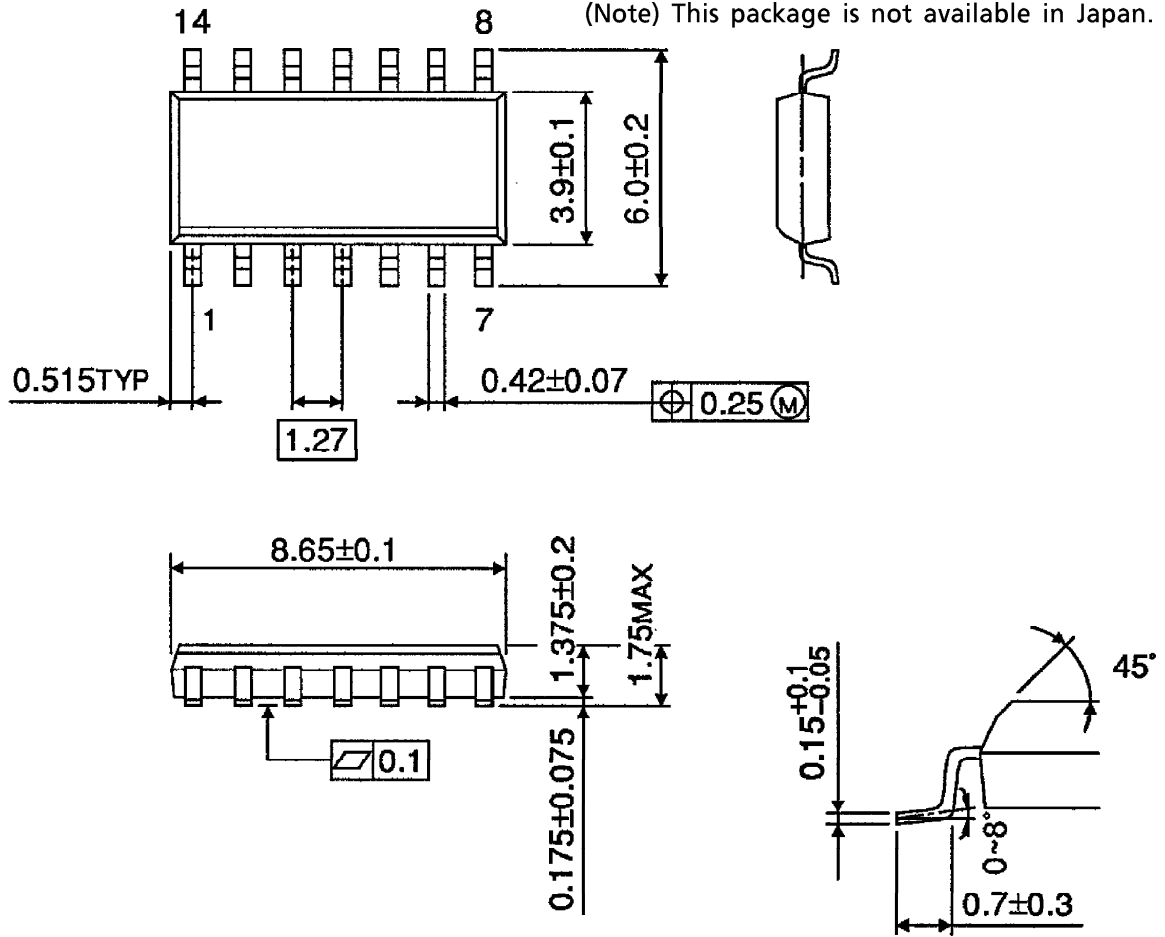


Weight : 0.18g (Typ.)

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

Unit : mm

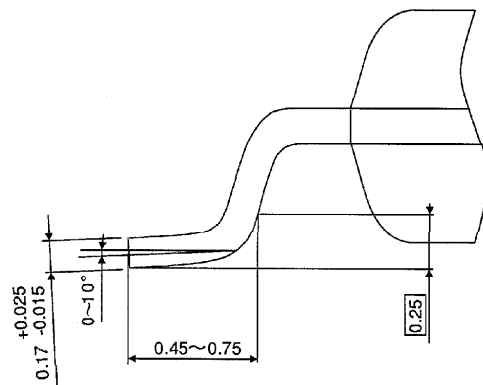
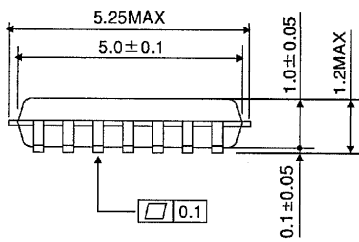
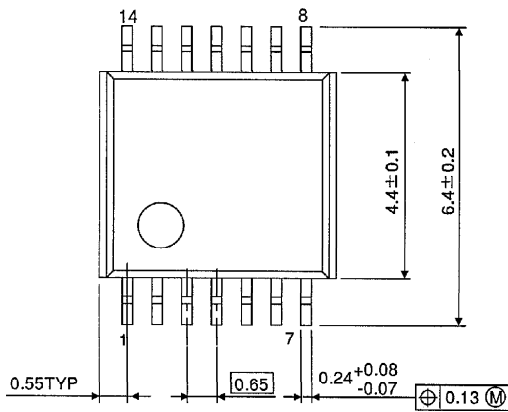
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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

Unit : mm



Weight : 0.06g (Typ.)