

# TC74LCX32F, TC74LCX32FN, TC74LCX32FT

## Low-Voltage Quad 2-Input OR Gate with 5-V Tolerant Inputs and Outputs

The TC74LCX32F/FN/FT is a high-performance CMOS 2-input OR gate. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low-power dissipation.

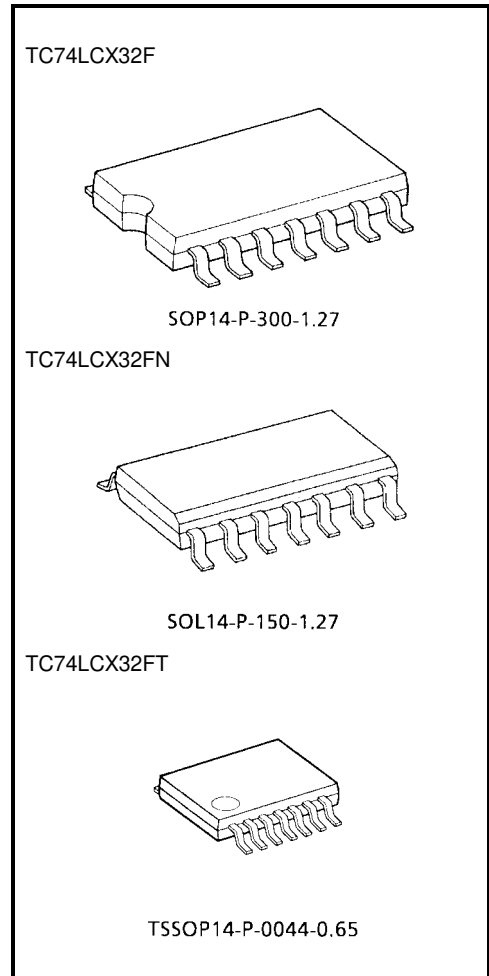
The device is designed for low-voltage (3.3 V) VCC applications, but it could be used to interface to 5-V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

### Features

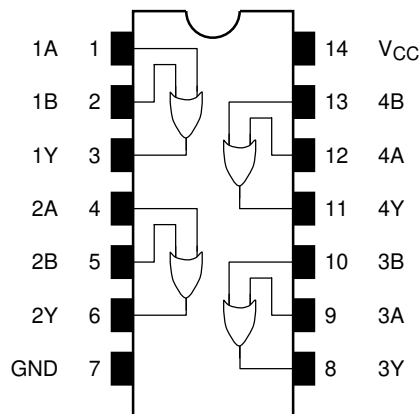
- Low-voltage operation:  $V_{CC} = 2.0$  to  $3.6$  V
- High-speed operation:  $t_{pd} = 5.5$  ns (max) ( $V_{CC} = 3.0$  to  $3.6$  V)
- Output current:  $|I_{OH}|/I_{OL} = 24$  mA (min) ( $V_{CC} = 3.0$  V)
- Latch-up performance:  $\pm 500$  mA
- Available in JEDEC SOP, JEITA SOP and TSSOP
- Power-down protection provided on all inputs and outputs
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 32 type

Note: xxxFN (JEDEC SOP) is not available in Japan.

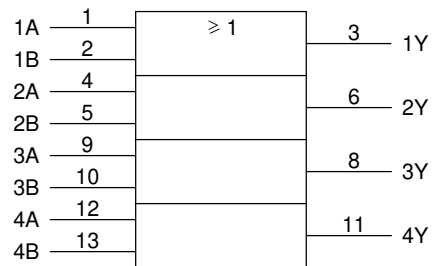


Weight  
 SOP14-P-300-1.27: 0.18 g (typ.)  
 SOL14-P-150-1.27: 0.12 g (typ.)  
 TSSOP14-P-0044-0.65: 0.06 g (typ.)

## Pin Assignment (top view)



## IEC Logic Symbol



## Truth Table

| Inputs |   | Outputs |
|--------|---|---------|
| A      | B | Y       |
| L      | L | L       |
| L      | H | H       |
| H      | L | H       |
| H      | H | H       |

## Maximum Ratings

| Characteristics             | Symbol           | Rating                             | Unit |
|-----------------------------|------------------|------------------------------------|------|
| Power supply voltage        | $V_{CC}$         | -0.5 to 7.0                        | V    |
| DC input voltage            | $V_{IN}$         | -0.5 to 7.0                        | V    |
| DC output voltage           | $V_{OUT}$        | -0.5 to 7.0 (Note 1)               | V    |
|                             |                  | -0.5 to $V_{CC} + 0.5$<br>(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 to 150                         | °C   |

Note 1:  $V_{CC} = 0$  V

Note 2: High or low state.  $I_{OUT}$  absolute maximum rating must be observed.

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

## Recommended Operating Conditions

| Characteristics          | Symbol          | Rating                 | Unit |
|--------------------------|-----------------|------------------------|------|
| Power supply voltage     | $V_{CC}$        | 2.0 to 3.6             | V    |
|                          |                 | 1.5 to 3.6 (Note 4)    |      |
| Input voltage            | $V_{IN}$        | 0 to 5.5               | V    |
| Output voltage           | $V_{OUT}$       | 0 to 5.5 (Note 5)      | V    |
|                          |                 | 0 to $V_{CC}$ (Note 6) |      |
| Output current           | $I_{OH}/I_{OL}$ | $\pm 24$ (Note 7)      | mA   |
|                          |                 | $\pm 12$ (Note 8)      |      |
| Operating temperature    | $T_{opr}$       | -40 to 85              | °C   |
| Input rise and fall time | dt/dv           | 0 to 10 (Note 9)       | ns/V |

Note 4: Data retention only

Note 5:  $V_{CC} = 0$  V

Note 6: High or low state

Note 7:  $V_{CC} = 3.0$  to 3.6 V

Note 8:  $V_{CC} = 2.7$  to 3.0 V

Note 9:  $V_{IN} = 0.8$  to 2.0 V,  $V_{CC} = 3.0$  V

## Electrical Characteristics

### DC Characteristics ( $T_a = -40$ to 85°C)

| Characteristics                |         | Symbol          | Test Condition                |                       | Min        | Max            | Unit       |         |
|--------------------------------|---------|-----------------|-------------------------------|-----------------------|------------|----------------|------------|---------|
|                                |         |                 |                               | $V_{CC}$ (V)          |            |                |            |         |
| Input voltage                  | H-level | $V_{IH}$        | —                             |                       | 2.7 to 3.6 | 2.0            | V          |         |
|                                | L-level | $V_{IL}$        | —                             |                       | 2.7 to 3.6 | —              |            |         |
| Output voltage                 | H-level | $V_{OH}$        | $V_{IN} = V_{IH}$ or $V_{IL}$ | $I_{OH} = -100 \mu A$ | 2.7 to 3.6 | $V_{CC} - 0.2$ | V          |         |
|                                |         |                 |                               | $I_{OH} = -12$ mA     | 2.7        | 2.2            |            |         |
|                                |         |                 |                               | $I_{OH} = -18$ mA     | 3.0        | 2.4            |            |         |
|                                |         |                 |                               | $I_{OH} = -24$ mA     | 3.0        | 2.2            |            |         |
|                                | L-level | $V_{OL}$        | $V_{IN} = V_{IL}$             | $I_{OL} = 100 \mu A$  | 2.7 to 3.6 | —              | 0.2        |         |
|                                |         |                 |                               | $I_{OL} = 12$ mA      | 2.7        | —              | 0.4        |         |
|                                |         |                 |                               | $I_{OL} = 16$ mA      | 3.0        | —              | 0.4        |         |
|                                |         |                 |                               | $I_{OL} = 24$ mA      | 3.0        | —              | 0.55       |         |
| Input leakage current          |         | $I_{IN}$        | $V_{IN} = 0$ to 5.5 V         |                       | 2.7 to 3.6 | —              | $\pm 5.0$  | $\mu A$ |
| Power-off leakage current      |         | $I_{OFF}$       | $V_{IN}/V_{OUT} = 5.5$ V      |                       | 0          | —              | 10.0       | $\mu A$ |
| Quiescent supply current       |         | $I_{CC}$        | $V_{IN} = V_{CC}$ or GND      |                       | 2.7 to 3.6 | —              | 10.0       | $\mu A$ |
|                                |         |                 | $V_{IN} = 3.6$ to 5.5 V       |                       | 2.7 to 3.6 | —              | $\pm 10.0$ |         |
| Increase in $I_{CC}$ per input |         | $\Delta I_{CC}$ | $V_{IH} = V_{CC} - 0.6$ V     |                       | 2.7 to 3.6 | —              | 500        |         |

## AC Characteristics (Ta = -40 to 85°C)

| Characteristics        | Symbol            | Test Condition     | V <sub>CC</sub> (V) | Min | Max | Unit |
|------------------------|-------------------|--------------------|---------------------|-----|-----|------|
|                        |                   |                    |                     |     |     |      |
| Propagation delay time | t <sub>pLH</sub>  | Figure 1, Figure 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.

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

## Dynamic Switching Characteristics

(Ta = 25°C, input: t<sub>r</sub> = t<sub>f</sub> = 2.5 ns, C<sub>L</sub> = 50 pF, R<sub>L</sub> = 500 Ω)

| Characteristics                              | 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> = 3.3 V, V <sub>IL</sub> = 0 V | 3.3                 | 0.8  | V    |
| Quiet output minimum dynamic V <sub>OL</sub> | V <sub>OLV</sub> | V <sub>IH</sub> = 3.3 V, V <sub>IL</sub> = 0 V | 3.3                 | 0.8  | V    |

## Capacitive Characteristics (Ta = 25°C)

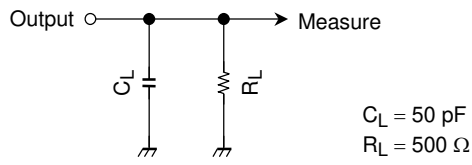
| Characteristics               | Symbol           | Test Condition                     | V <sub>CC</sub> (V) | Typ. | Unit |
|-------------------------------|------------------|------------------------------------|---------------------|------|------|
|                               |                  |                                    |                     |      |      |
| 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> = 10 MHz (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:

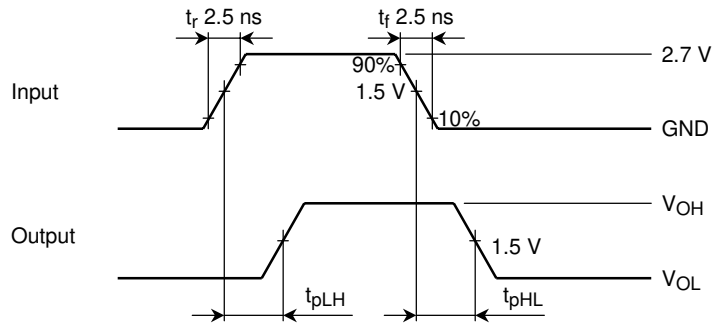
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

**AC Test Circuit**



**Figure 1**

**AC Waveform**

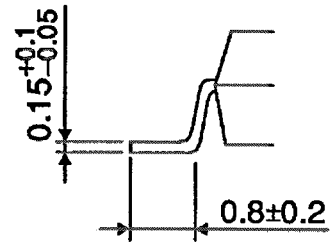
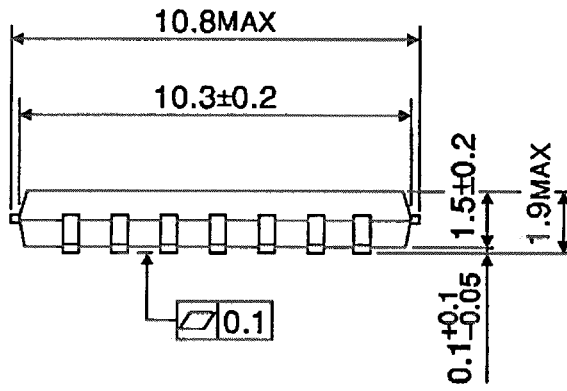
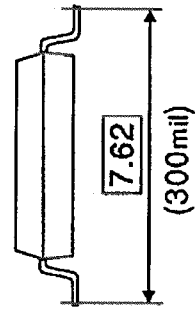
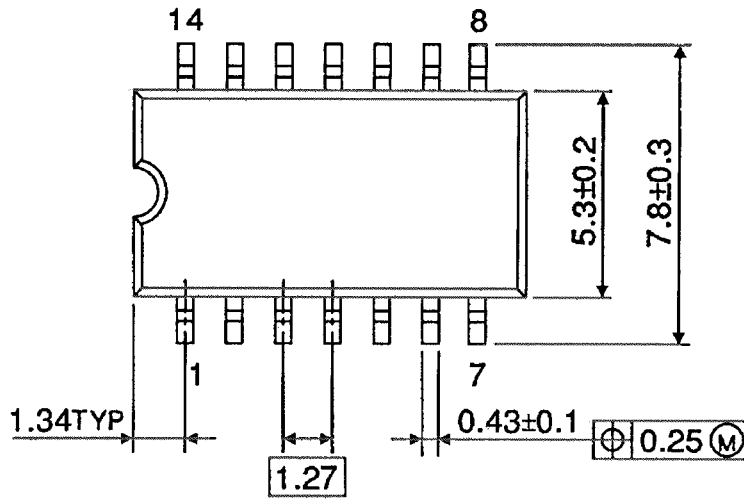


**Figure 2  $t_{pLH}$ ,  $t_{pHL}$**

**Package Dimensions**

SOP14-P-300-1.27

Unit : mm



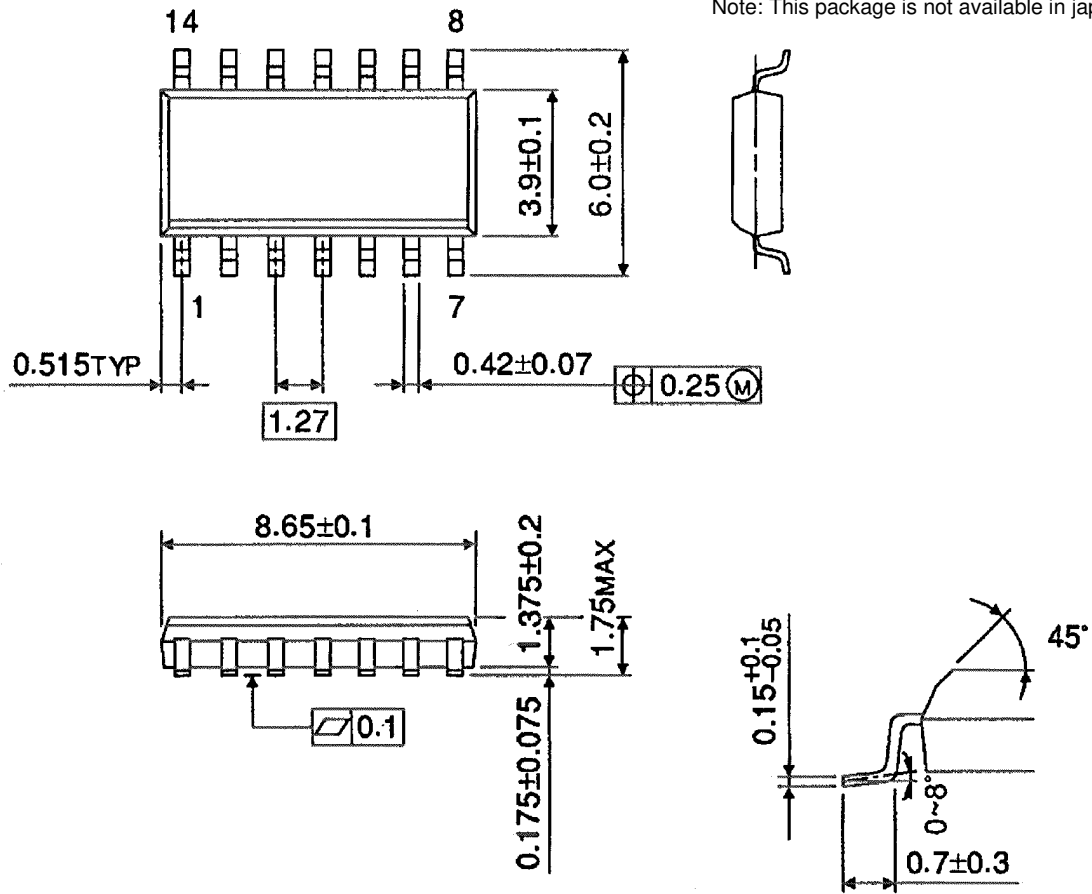
Weight: 0.18 g (typ.)

## Package Dimensions

SOL14-P-150-1.27

Unit : mm

Note: This package is not available in japan.

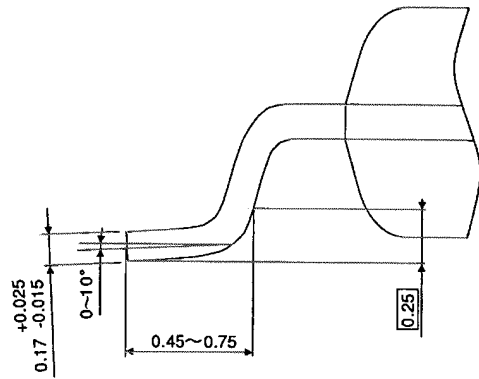
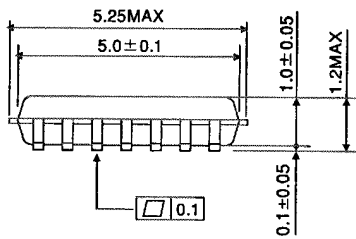
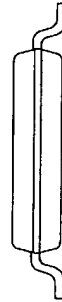
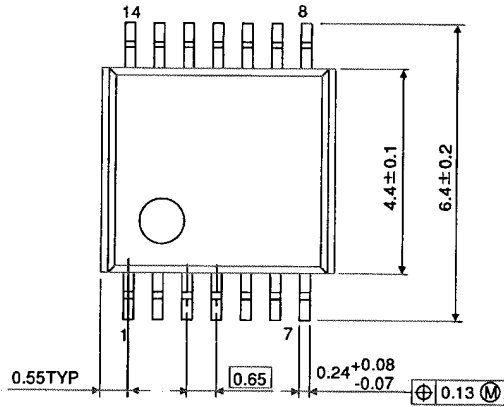


Weight: 0.12 g (typ.)

**Package Dimensions**

TSSOP14-P-0044-0.65

Unit : mm



Weight: 0.06 g (typ.)



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