

# TC74LCX02F, TC74LCX02FN, TC74LCX02FT

## Low-Voltage Quad 2-Input NOR Gate with 5-V Tolerant Inputs and Outputs

The TC74LCX02F/FN/FT is a high-performance CMOS 2-input NOR gate. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

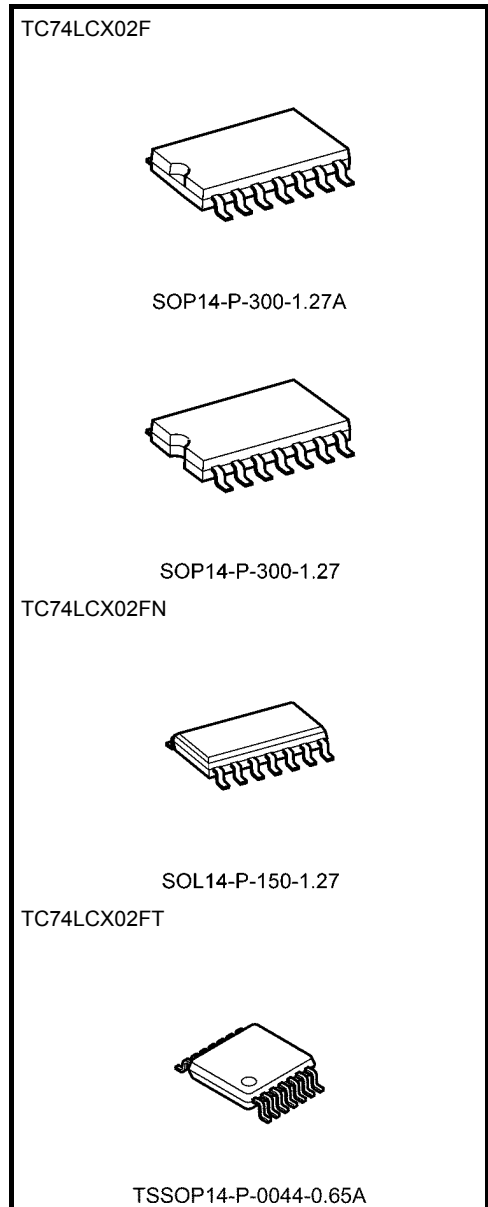
The device is designed for low-voltage (3.3 V) VCC applications, but it could be used to interface to 5-V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

### Features

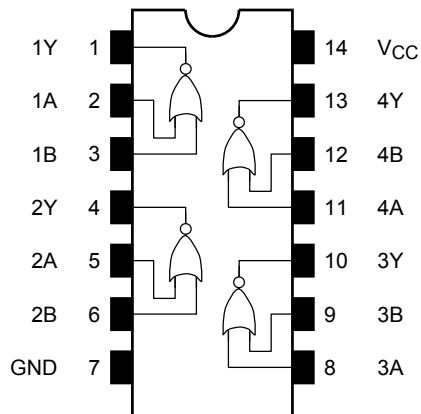
- Low-voltage operation: VCC = 2.0 to 3.6 V
- High-speed operation: t<sub>pd</sub> = 5.2 ns (max) (VCC = 3.0 to 3.6 V)
- Output current: |I<sub>OH</sub>|/I<sub>OL</sub> = 24 mA (min) (VCC = 3.0 V)
- Latch-up performance: ±500 mA
- Available in JEDEC SOP, JEITA SOP and TSSOP
- Power-down protection provided on all inputs and outputs
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 02 type

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

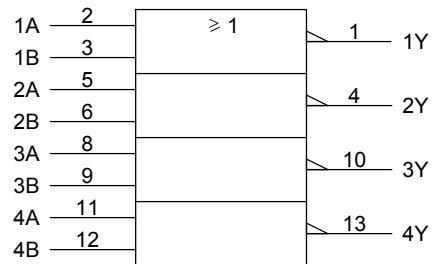


Weight	
SOP14-P-300-1.27A	: 0.18 g (typ.)
SOP14-P-300-1.27	: 0.18 g (typ.)
SOL14-P-150-1.27	: 0.12 g (typ.)
TSSOP14-P-0044-0.65A	: 0.06 g (typ.)

## Pin Assignment (top view)



## IEC Logic Symbol



## Truth Table

Inputs		Outputs
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

## Absolute Maximum Ratings (Note 1)

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 2)	V
		-0.5 to $V_{CC} + 0.5$ (Note 3)	
Input diode current	$I_{IK}$	-50	mA
Output diode current	$I_{OK}$	$\pm 50$ (Note 4)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
Power dissipation	$P_D$	180	mW
DC $V_{CC}$ /ground current	$I_{CC}/I_{GND}$	$\pm 100$	mA
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Note 2:  $V_{CC} = 0$  V

Note 3: High or low state.  $I_{OUT}$  absolute maximum rating must be observed.

Note 4:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

## Recommended Operating Conditions (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	2.0 to 3.6	V
		1.5 to 3.6 (Note 2)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 3)	V
		0 to $V_{CC}$ (Note 4)	
Output current	$I_{OH}/I_{OL}$	$\pm 24$ (Note 5)	mA
		$\pm 12$ (Note 6)	
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 10 (Note 7)	ns/V

Note 1: The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either  $V_{CC}$  or GND.

Note 2: Data retention only

Note 3:  $V_{CC} = 0$  V

Note 4: High or low state

Note 5:  $V_{CC} = 3.0$  to 3.6 V

Note 6:  $V_{CC} = 2.7$  to 3.0 V

Note 7:  $V_{IN} = 0.8$  to 2.0 V,  $V_{CC} = 3.0$  V

## Electrical Characteristics

### DC Characteristics ( $T_a = -40$ to $85^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Max	Unit		
Input voltage	H-level	$V_{IH}$	—	2.7 to 3.6	2.0	—	V	
	L-level	$V_{IL}$	—	2.7 to 3.6	—	0.8		
Output voltage	H-level	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -100 \mu\text{A}$	2.7 to 3.6	$V_{CC} - 0.2$	—	V
				$I_{OH} = -12 \text{ mA}$	2.7	2.2	—	
				$I_{OH} = -18 \text{ mA}$	3.0	2.4	—	
				$I_{OH} = -24 \text{ mA}$	3.0	2.2	—	
	L-level	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 100 \mu\text{A}$	2.7 to 3.6	—	0.2	
				$I_{OL} = 12 \text{ mA}$	2.7	—	0.4	
				$I_{OL} = 16 \text{ mA}$	3.0	—	0.4	
				$I_{OL} = 24 \text{ mA}$	3.0	—	0.55	
Input leakage current	$I_{IN}$	$V_{IN} = 0$ to 5.5 V	2.7 to 3.6	—	$\pm 5.0$	$\mu\text{A}$		
Power-off leakage current	$I_{OFF}$	$V_{IN}/V_{OUT} = 5.5$ V	0	—	10.0	$\mu\text{A}$		
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	2.7 to 3.6	—	10.0	$\mu\text{A}$		
		$V_{IN} = 3.6$ 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	—	6.0	ns
	t <sub>pHL</sub>		3.3 ± 0.3	1.5	5.2	
Output to output skew	t <sub>osLH</sub>	(Note)	2.7	—	—	ns
	t <sub>osHL</sub>		3.3 ± 0.3	—	1.0	

Note: 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> = 2.5 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)

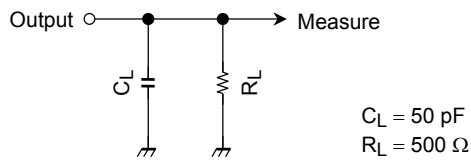
Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Typ.	Unit
Input capacitance	C <sub>IN</sub>	—	3.3	7	pF
Output capacitance	C <sub>OUT</sub>	—	0	8	pF
Power dissipation capacitance	C <sub>PD</sub>	f <sub>IN</sub> = 10 MHz	(Note) 3.3	25	pF

Note: 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:

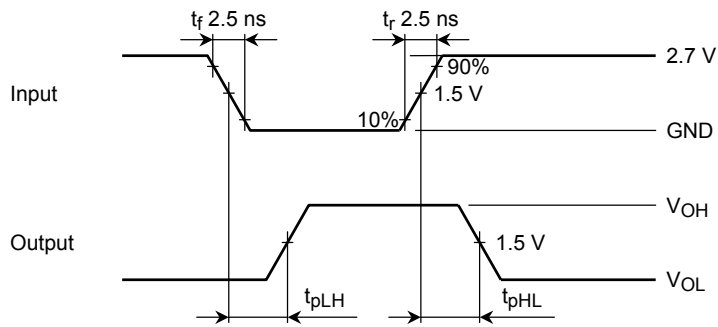
$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 4 \text{ (per gate)}$$

**AC Test Circuit**



**Figure 1**

**AC Waveform**

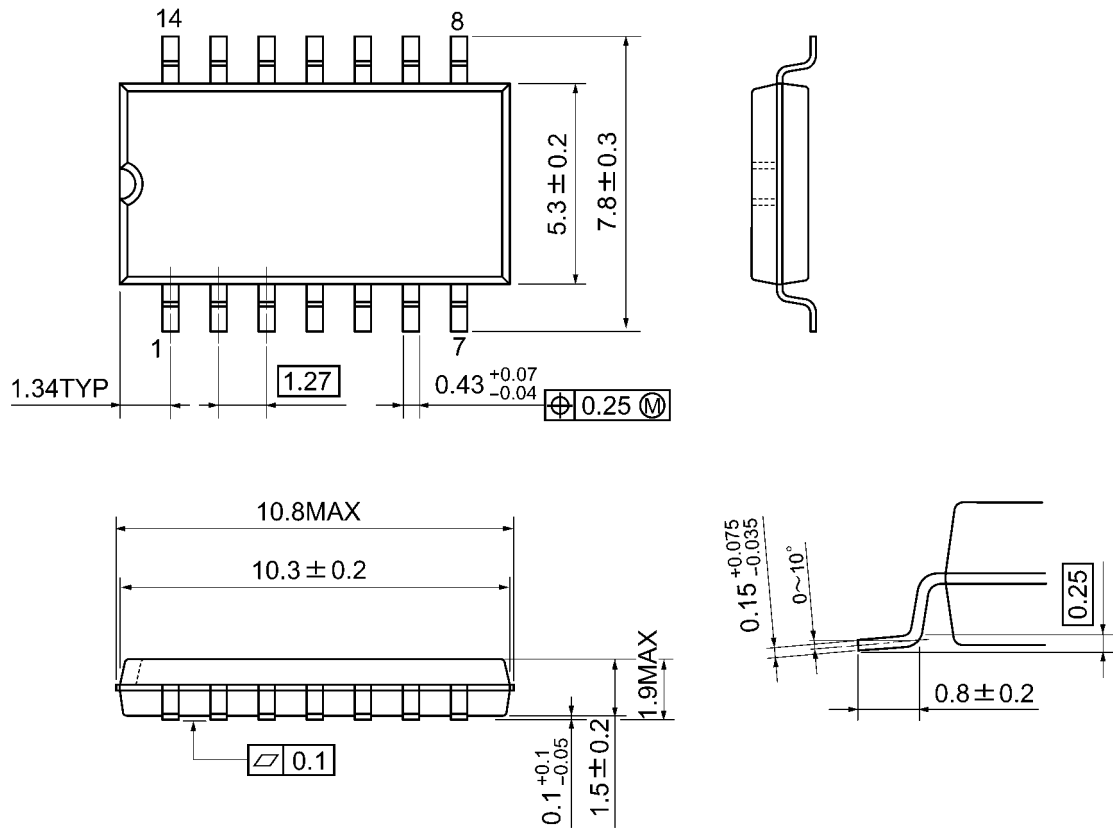


**Figure 2  $t_{pLH}$ ,  $t_{pHL}$**

**Package Dimensions**

SOP14-P-300-1.27A

Unit: mm

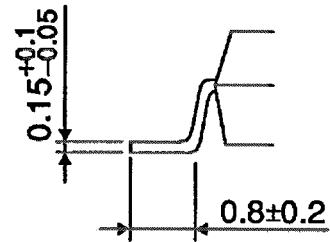
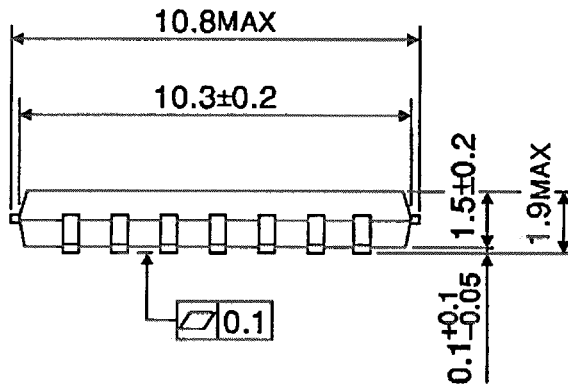
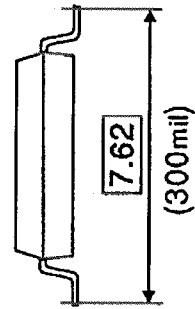
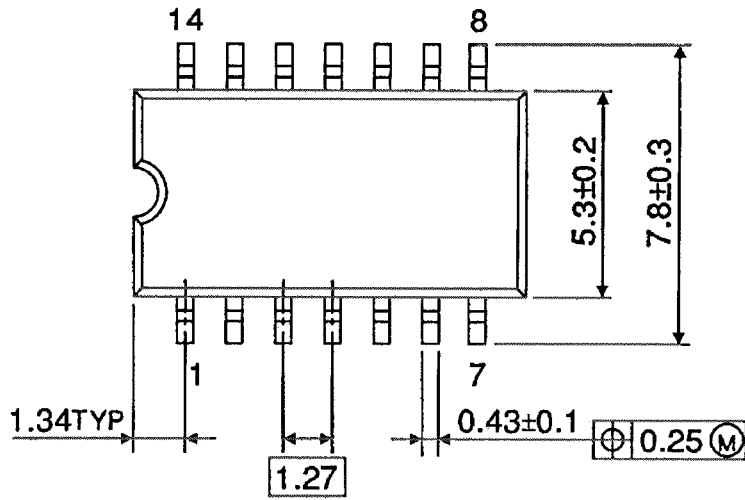


Weight: 0.18 g (typ.)

## Package Dimensions

SOP14-P-300-1.27

Unit : mm

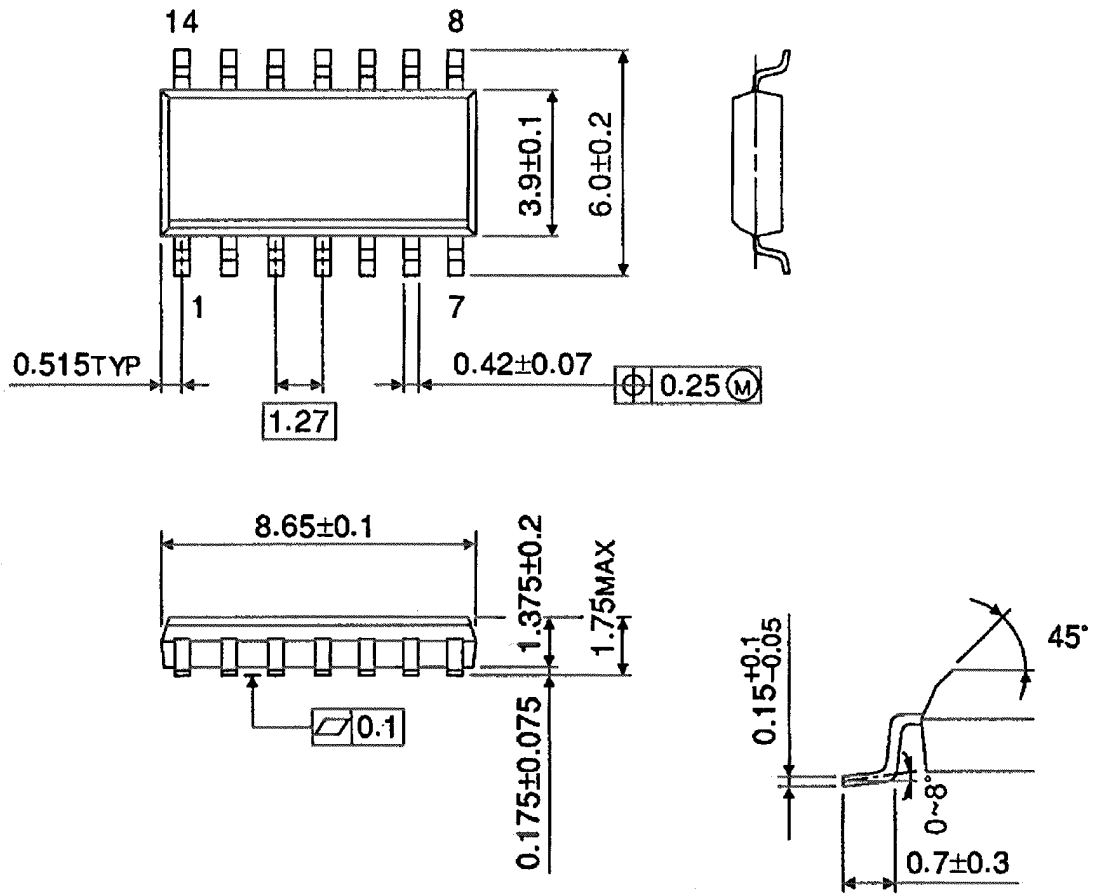


Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL14-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

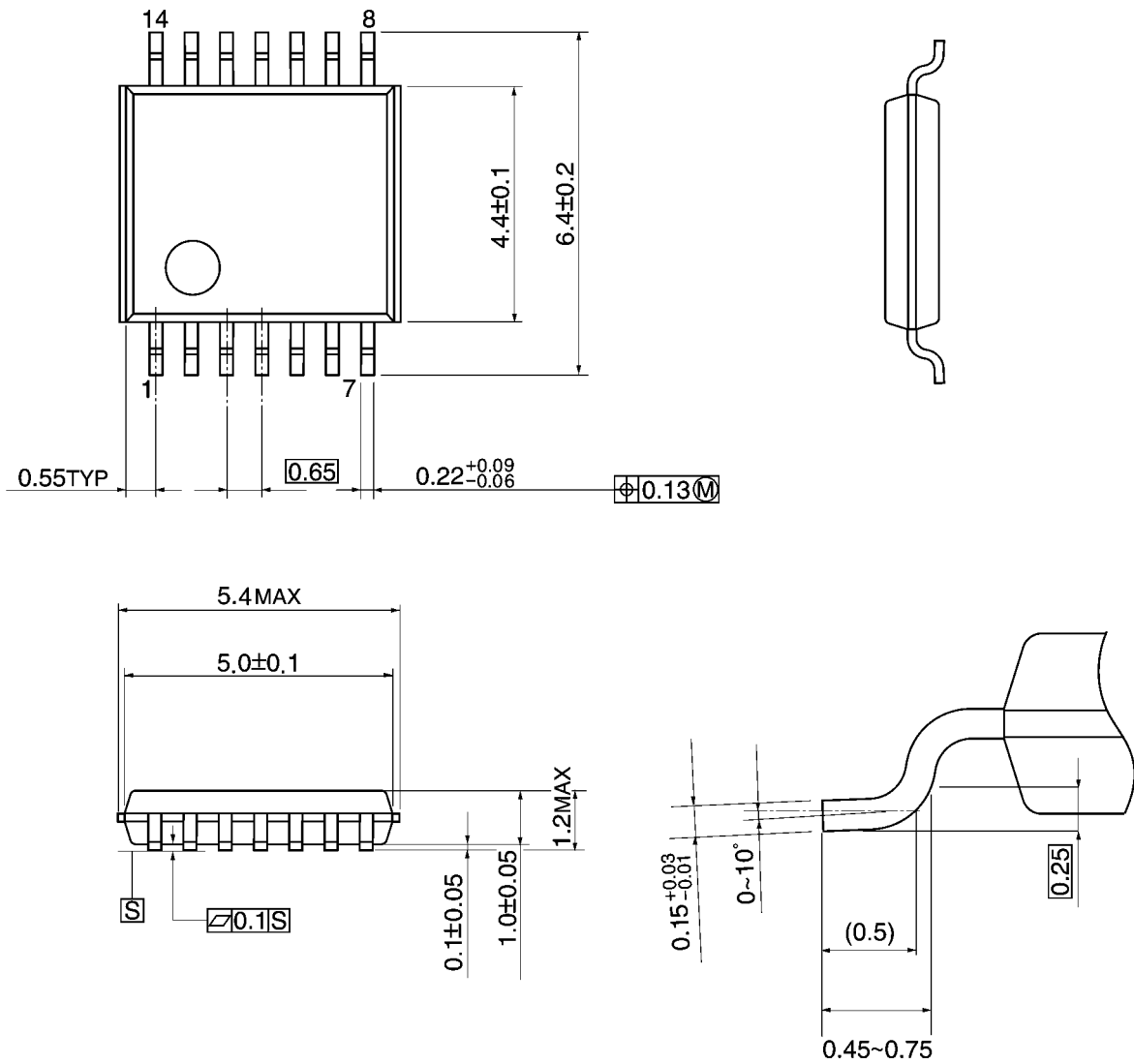
Weight: 0.12 g (typ.)



**Package Dimensions**

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

**Note: Lead (Pb)-Free Packages****SOP14-P-300-1.27A SOL14-P-150-1.27 TSSOP14-P-0044-0.65A****RESTRICTIONS ON PRODUCT USE**

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