

## TC74LCX02F, TC74LCX02FN, TC74LCX02FT

### LOW VOLTAGE QUAD 2-INPUT NOR GATE WITH 5V TOLERANT INPUTS AND OUTPUTS

The TC74LCX02 is a high performance CMOS 2-INPUT NOR GATE. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

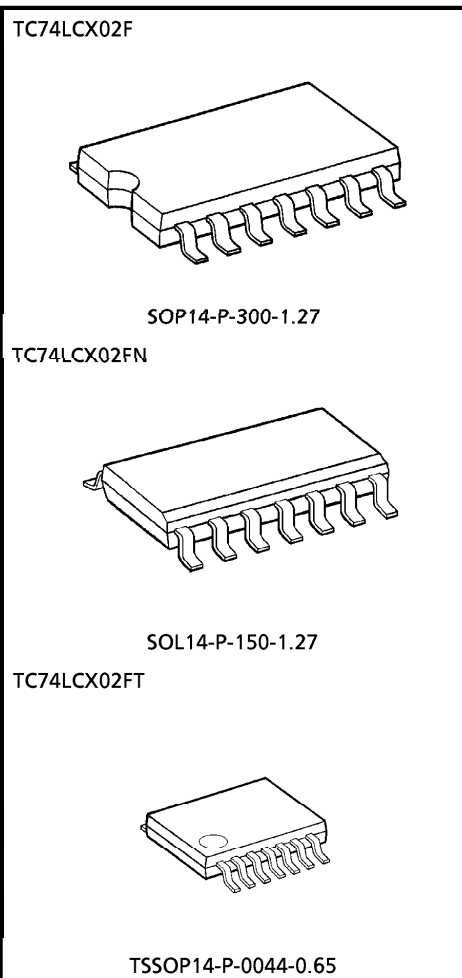
The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

#### FEATURES

- Low voltage operation :  $V_{CC} = 2.0 \sim 3.6V$
- High speed operation :  $t_{pd} = 5.2ns$  (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.) 02 type.

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

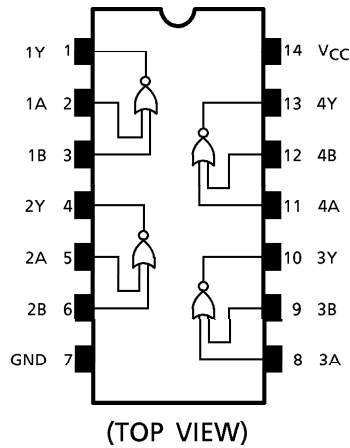


Weight	
SOP14-P-300-1.27	: 0.18g (Typ.)
SOL14-P-150-1.27	: 0.12g (Typ.)
TSSOP14-P-0044-0.65	: 0.06g (Typ.)

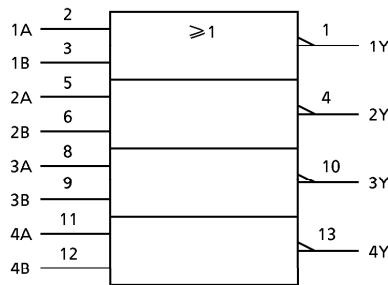
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**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



**TRUTH TABLE**

INPUTS		OUTPUTS
A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

**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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## 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 ( $T_a = -40\sim 85^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	MIN.	MAX.	UNIT	
Input Voltage	"H" Level	$V_{IH}$	2.7~3.6	2.0	—	V	
	"L" Level	$V_{IL}$	2.7~3.6	—	0.8		
Output Voltage	"H" Level	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -100\mu A$	2.7~3.6	$V_{CC} - 0.2$	V
				$I_{OH} = -12mA$	2.7	2.2	
				$I_{OH} = -18mA$	3.0	2.4	
				$I_{OH} = -24mA$	3.0	2.2	
	"L" Level	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 100\mu A$	2.7~3.6	—	0.2
				$I_{OL} = 12mA$	2.7	—	0.4
				$I_{OL} = 16mA$	3.0	—	0.4
				$I_{OL} = 24mA$	3.0	—	0.55
Input Leakage Current	$I_{IN}$	$V_{IN} = 0\sim 5.5V$	2.7~3.6	—	$\pm 5.0$	$\mu A$	
Power Off Leakage Current	$I_{OFF}$	$V_{IN}/V_{OUT} = 5.5V$	0	—	10.0	$\mu A$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	2.7~3.6	—	10.0	$\mu A$	
		$V_{IN}/V_{OUT} = 3.6\sim 5.5V$	2.7~3.6	—	$\pm 10.0$		
Increase In $I_{CC}$ Per Input	$\Delta I_{CC}$	$V_{IH} = V_{CC} - 0.6V$	2.7~3.6	—	500	$\mu A$	

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	—	6.0	ns
	t <sub>pHL</sub>		3.3 ± 0.3	1.5	5.2	
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

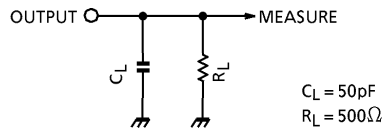
(Note 11) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

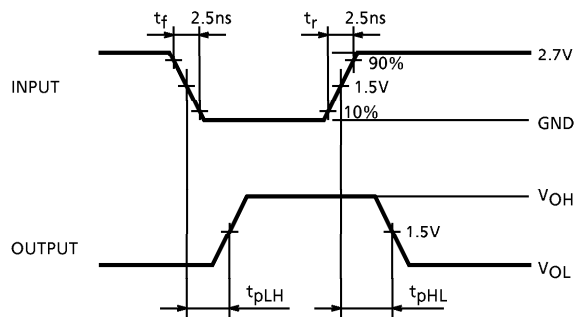
**TEST CIRCUIT**

Fig.1



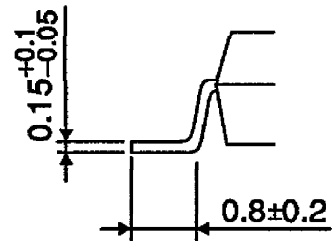
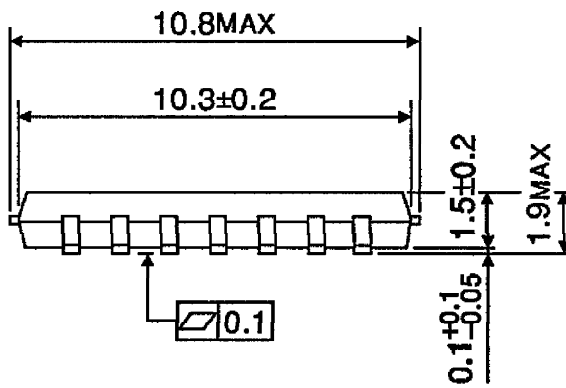
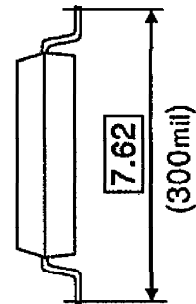
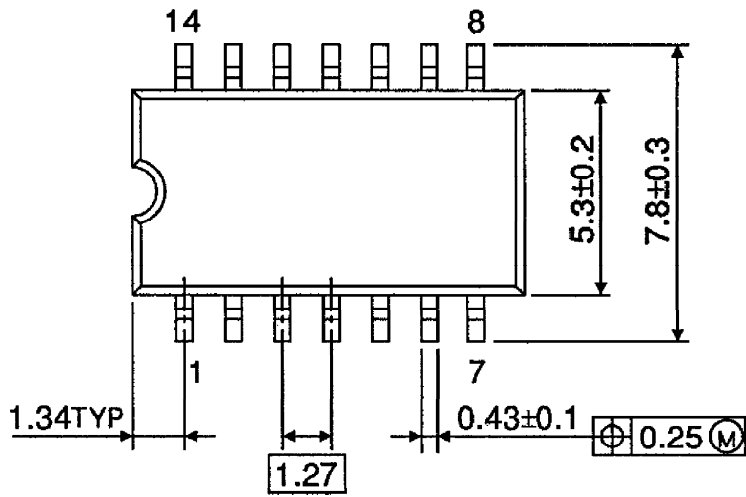
**AC WAVEFORM**

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



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

Unit : mm

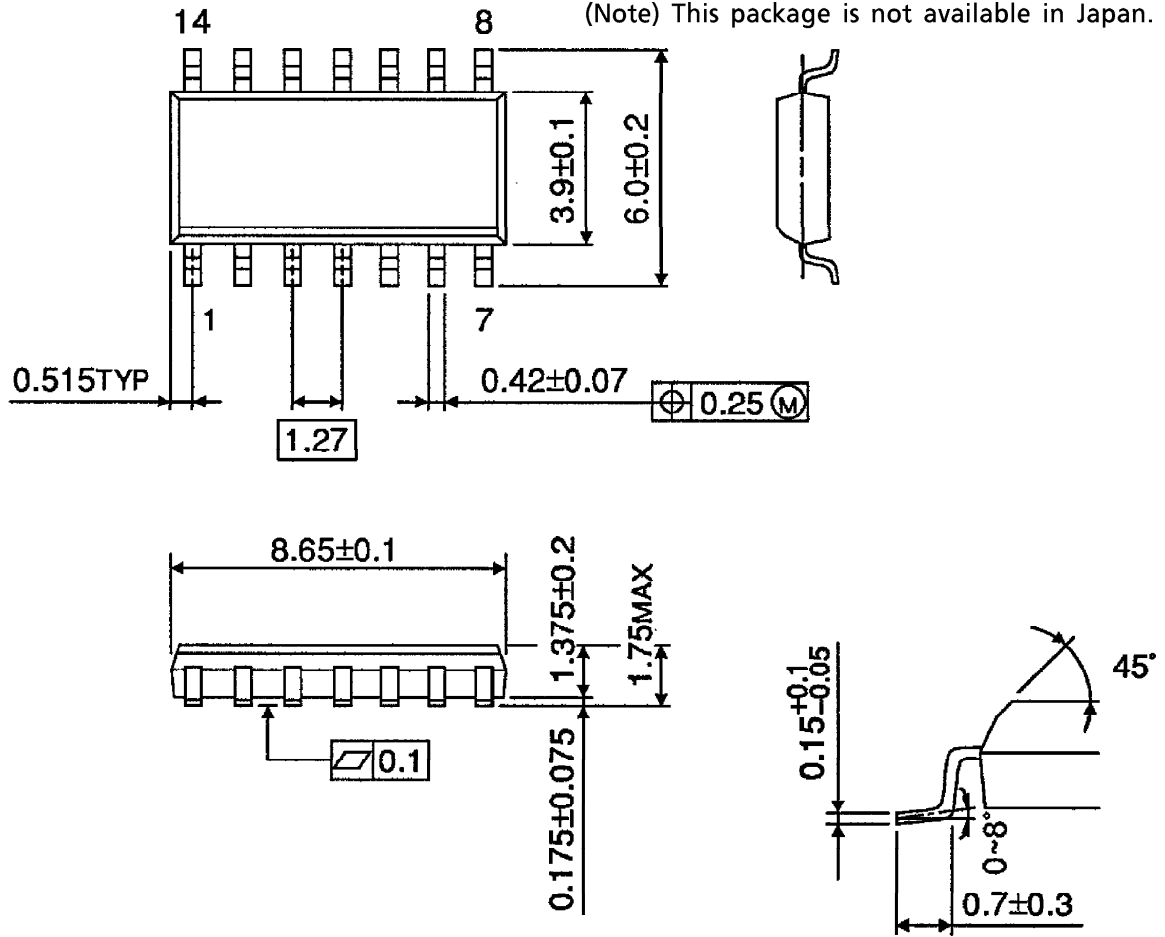


Weight : 0.18g (Typ.)

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

Unit : mm

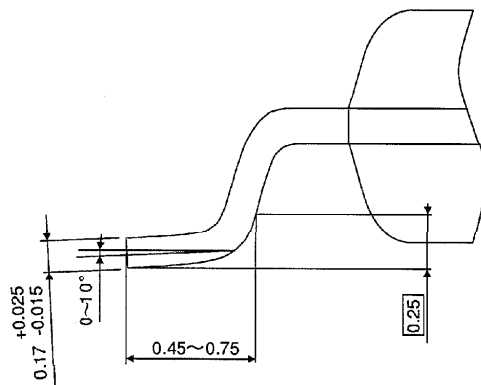
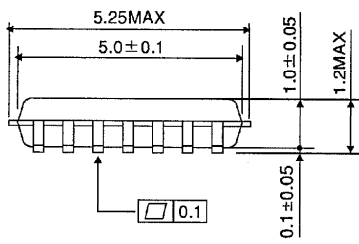
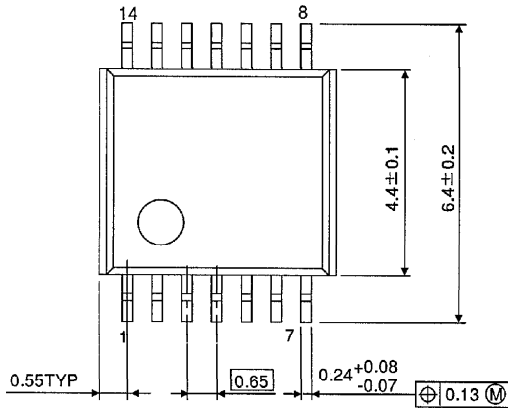
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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

Unit : mm



Weight : 0.06g (Typ.)