

# TC74LVX02F, TC74LVX02FN, TC74LVX02FT

## Quad 2-Input NOR Gate

The TC74LVX02F/ FN/ FT is a high-speed CMOS 2-input NOR gate fabricated with silicon gate CMOS technology. Designed for use in 3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

This device is suitable for low-voltage and battery operated systems.

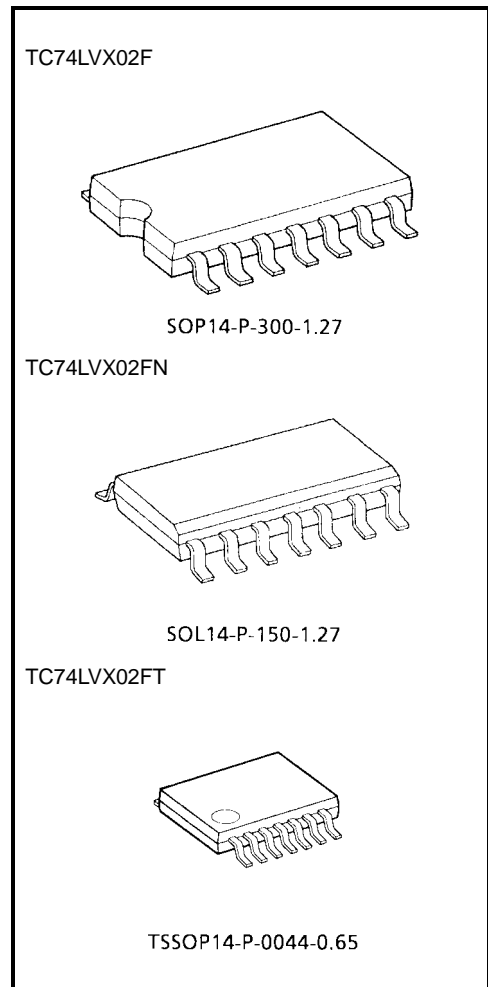
The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

An input protection circuit ensures that 0 to 5.5V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

### Features

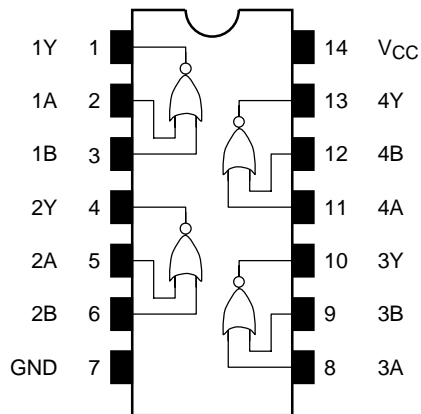
- High-speed:  $t_{pd} = 4.5 \text{ ns (typ.) (VCC = 3.3 V)}$
- Low-power dissipation:  $I_{CC} = 2 \text{ }\mu\text{A (max) (Ta = 25}^\circ\text{C)}$
- Input voltage level:  $V_{IL} = 0.8 \text{ V (max) (VCC = 3 V)}$   
 $V_{IH} = 2.0 \text{ V (min) (VCC = 3 V)}$
- Power-down protection provided on all inputs
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Low noise:  $V_{OLP} = 0.5 \text{ V (max)}$
- Pin and function compatible with 74HC02

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

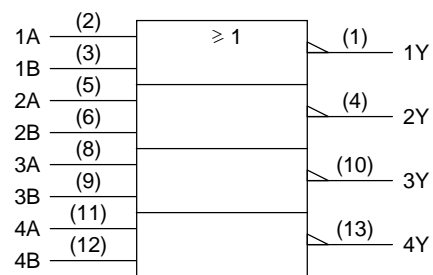


Weight  
 SOP14-P-300-1.27: 0.18 g (typ.)  
 SOL14-P-150-1.27: 0.12 g (typ.)  
 TSSOP14-P-0044-0.65: 0.06 g (typ.)

## Pin Assignment (top view)



## IEC Logic Symbol



## Truth Table

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

## Maximum Ratings

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-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 $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	180	mW
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

## Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2.0 to 3.6	V
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}C$
Input rise and fall time	$dt/dv$	0 to 100	ns/V

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit			
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max		
Input voltage	H-level	V <sub>IH</sub>	—	2.0	1.5	—	—	1.5	—	V	
				3.0	2.0	—	—	2.0	—		
				3.6	2.4	—	—	2.4	—		
	L-level	V <sub>IL</sub>	—	2.0	—	—	0.5	—	0.5		
				3.0	—	—	0.8	—	0.8		
				3.6	—	—	0.8	—	0.8		
Output voltage	H-level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				I <sub>OH</sub> = -50 μA	3.0	2.9	3.0	—	2.9	—	
				I <sub>OH</sub> = -4 mA	3.0	2.58	—	—	2.48	—	
	L-level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	2.0	—	0	0.1	—	0.1	
				I <sub>OL</sub> = 50 μA	3.0	—	0	0.1	—	0.1	
				I <sub>OL</sub> = 4 mA	3.0	—	—	0.36	—	0.44	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	3.6	—	—	±0.1	—	±1.0	μA		
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	3.6	—	—	2.0	—	20.0	μA		

### AC Characteristics (input: t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Typ.	Max		Min	Max
Propagation delay time	t <sub>pLH</sub>	—	2.7	15	—	5.9	10.7	1.0	13.5	ns
				50	—	8.4	14.2	1.0	17.0	
	t <sub>pHL</sub>		3.3 ± 0.3	15	—	4.5	6.6	1.0	8.0	
				50	—	7.0	10.1	1.0	11.5	
Output to output skew	t <sub>osLH</sub>	(Note 1)	2.7	50	—	—	1.5	—	1.5	ns
	t <sub>osHL</sub>			3.3 ± 0.3	50	—	—	1.5	—	
Input capacitance	C <sub>IN</sub>	(Note 2)	(Note 2)	—	4	10	—	10	pF	
Power dissipation capacitance	C <sub>PD</sub>	(Note 3)	(Note 3)	—	15	—	—	—	pF	

Note 1: 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>|)

Note 2: Parameter guaranteed by design.

Note 3: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

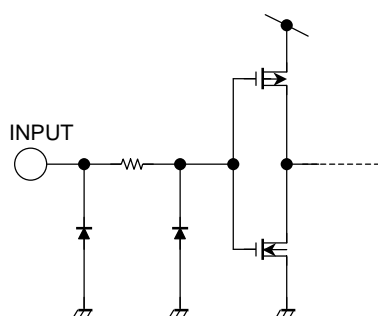
Average operating current can be obtained by the equation:

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

## Noise Characteristics (Ta = 25°C, input: tr = tf = 3 ns, CL = 50 pF)

Characteristics	Symbol	Test Condition	VCC (V)	Typ.	Limit	Unit
Quiet output maximum dynamic	V <sub>OL</sub>	V <sub>OLP</sub>	3.3	0.3	0.5	V
Quiet output minimum dynamic	V <sub>OL</sub>	V <sub>OLV</sub>	3.3	-0.3	-0.5	V
Minimum high level dynamic input voltage	V <sub>IH</sub>	V <sub>IHD</sub>	3.3	—	2.0	V
Maximum low level dynamic input voltage	V <sub>IL</sub>	V <sub>ILD</sub>	3.3	—	0.8	V

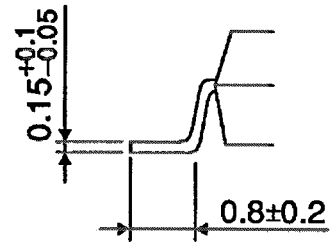
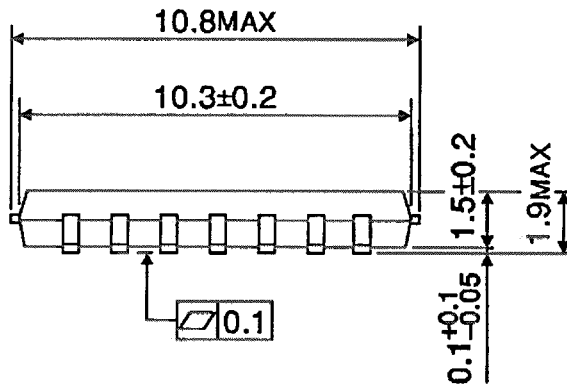
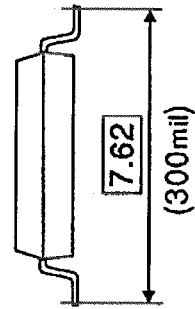
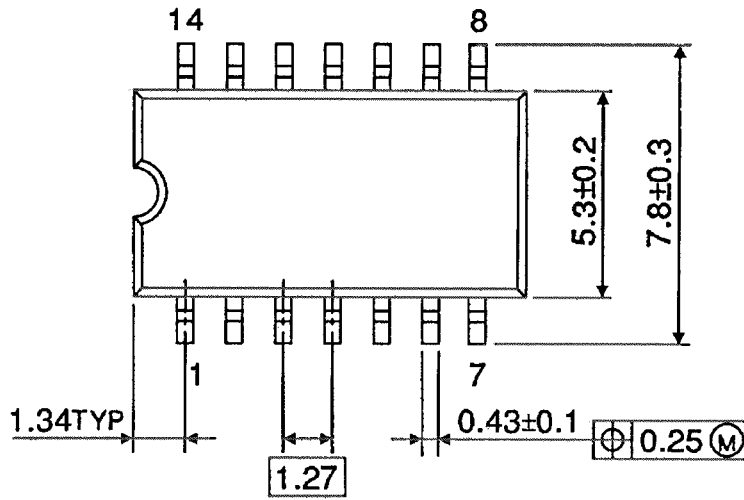
## Input Equivalent Circuit



**Package Dimensions**

SOP14-P-300-1.27

Unit : mm

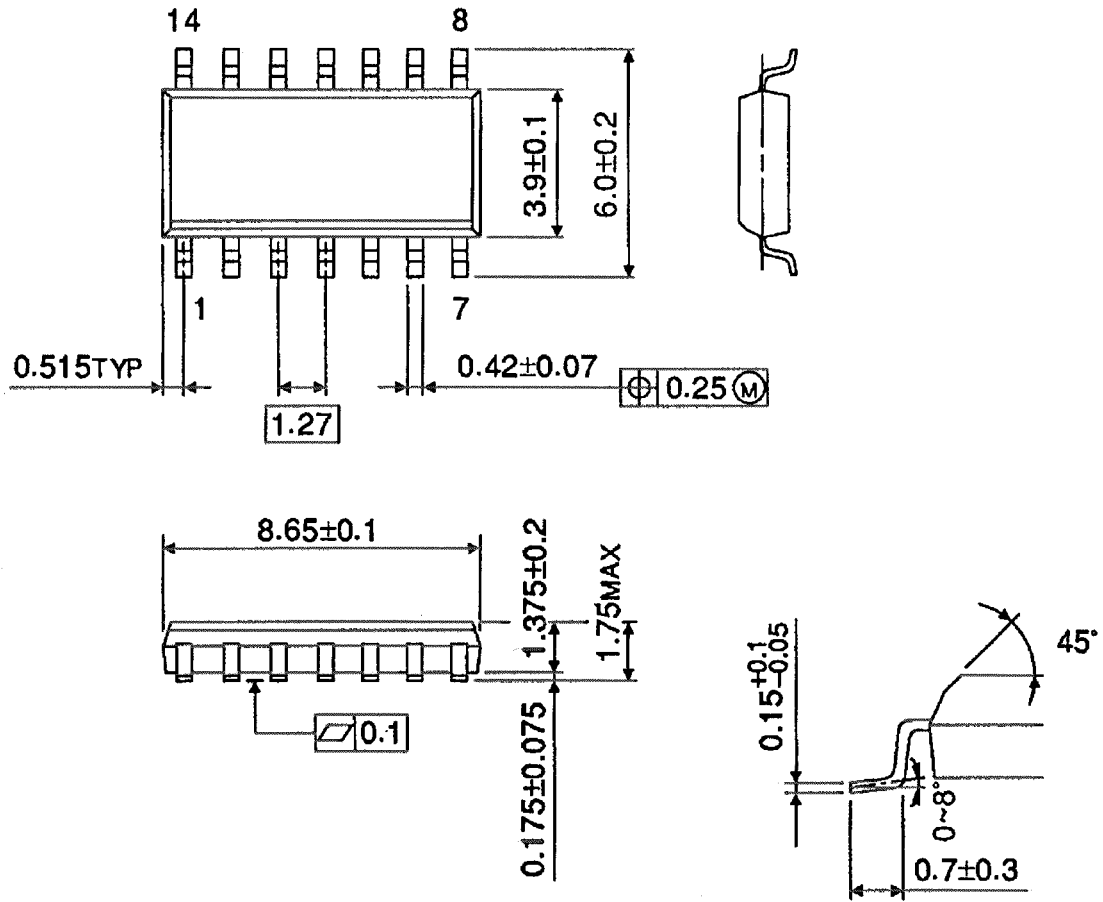


Weight: 0.18 g (typ.)

## Package Dimensions

SOL14-P-150-1.27

Unit : mm

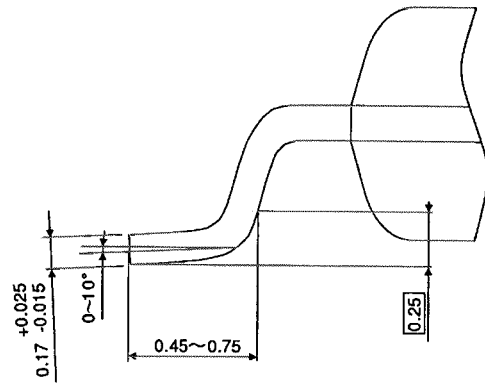
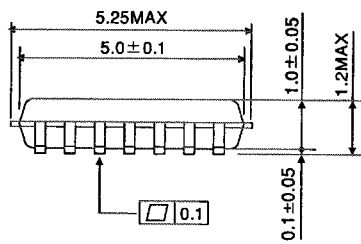
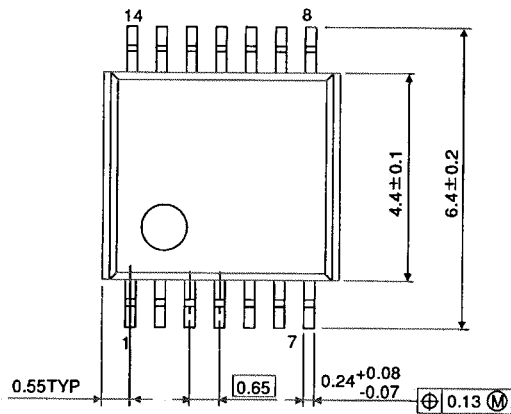


Weight: 0.12 g (typ.)

## Package Dimensions

TSSOP14-P-0044-0.65

Unit : mm



Weight: 0.06 g (typ.)

**RESTRICTIONS ON PRODUCT USE**

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.