

**TOSHIBA**

**TC74LCX02F/FN/FT**

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**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.

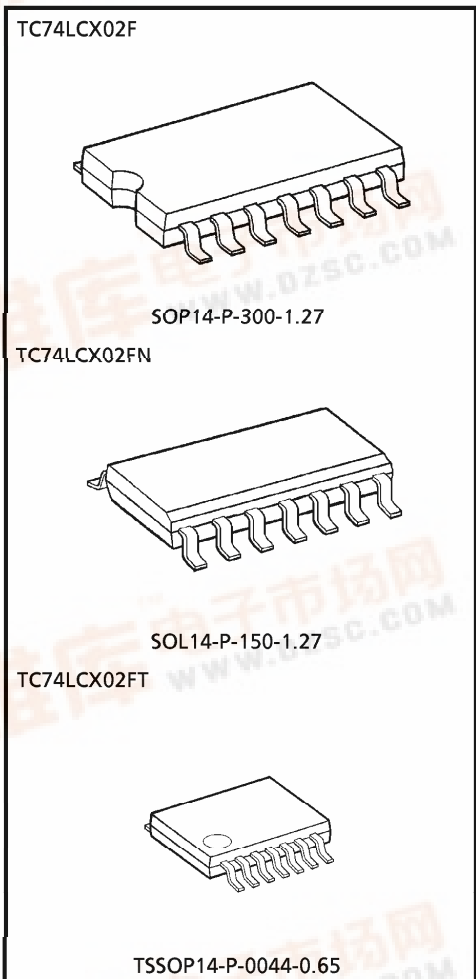
The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

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

**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.



**Weight**

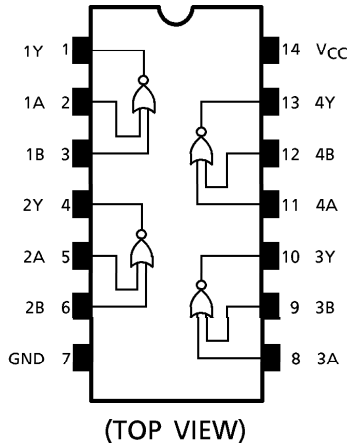
- SOP14-P-300-1.27 : 0.18g (Typ.)
- SOL14-P-150-1.27 : 0.12g (Typ.)
- TSSOP14-P-0044-0.65 : 0.06g (Typ.)

961001EBA2

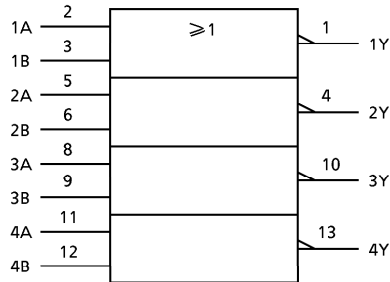
● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product 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 products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.



**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)  $V_{OUT} < GND, V_{OUT} > V_{CC}$

961001EBA2'

● The products described in this document are subject to foreign exchange and foreign trade control 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.

**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>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>IH</sub> or 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		
Increase 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	—	6.0	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

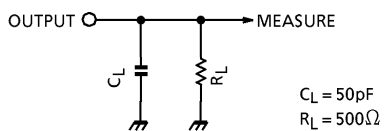
(Note 11) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

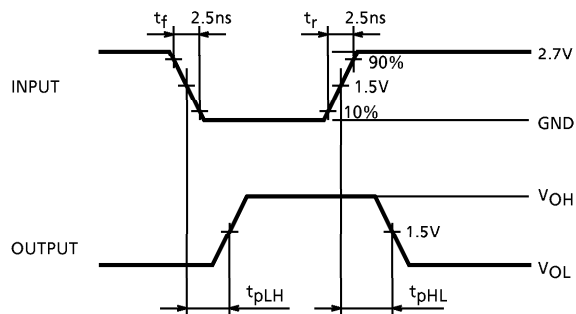
**TEST CIRCUIT**

Fig.1



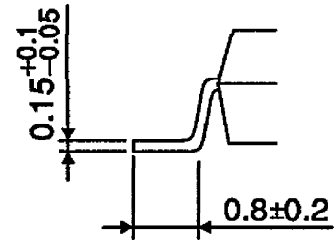
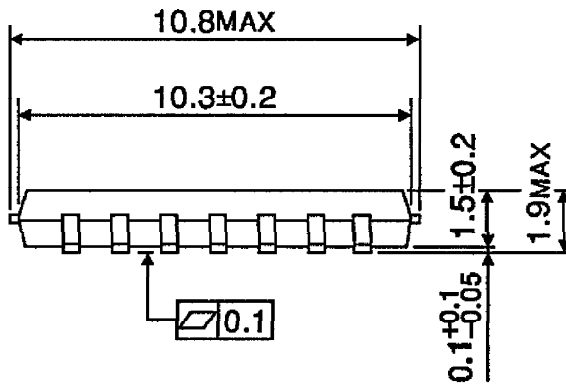
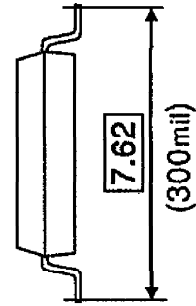
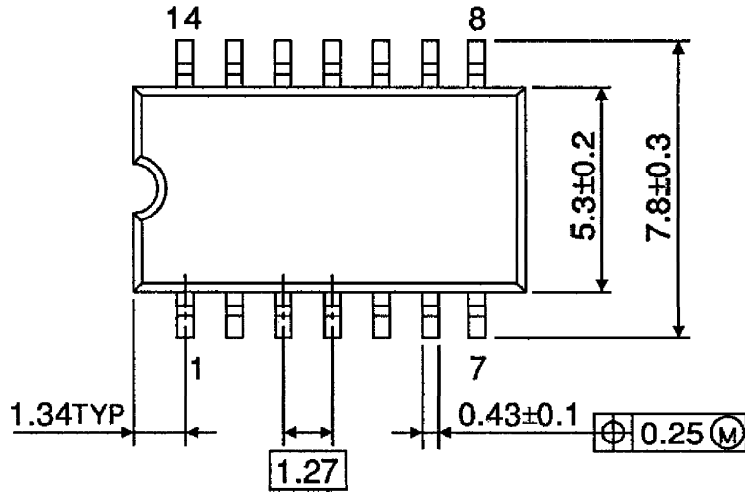
**AC WAVEFORM**

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



OUTLINE DRAWING  
SOP14-P-300-1.27

Unit : mm

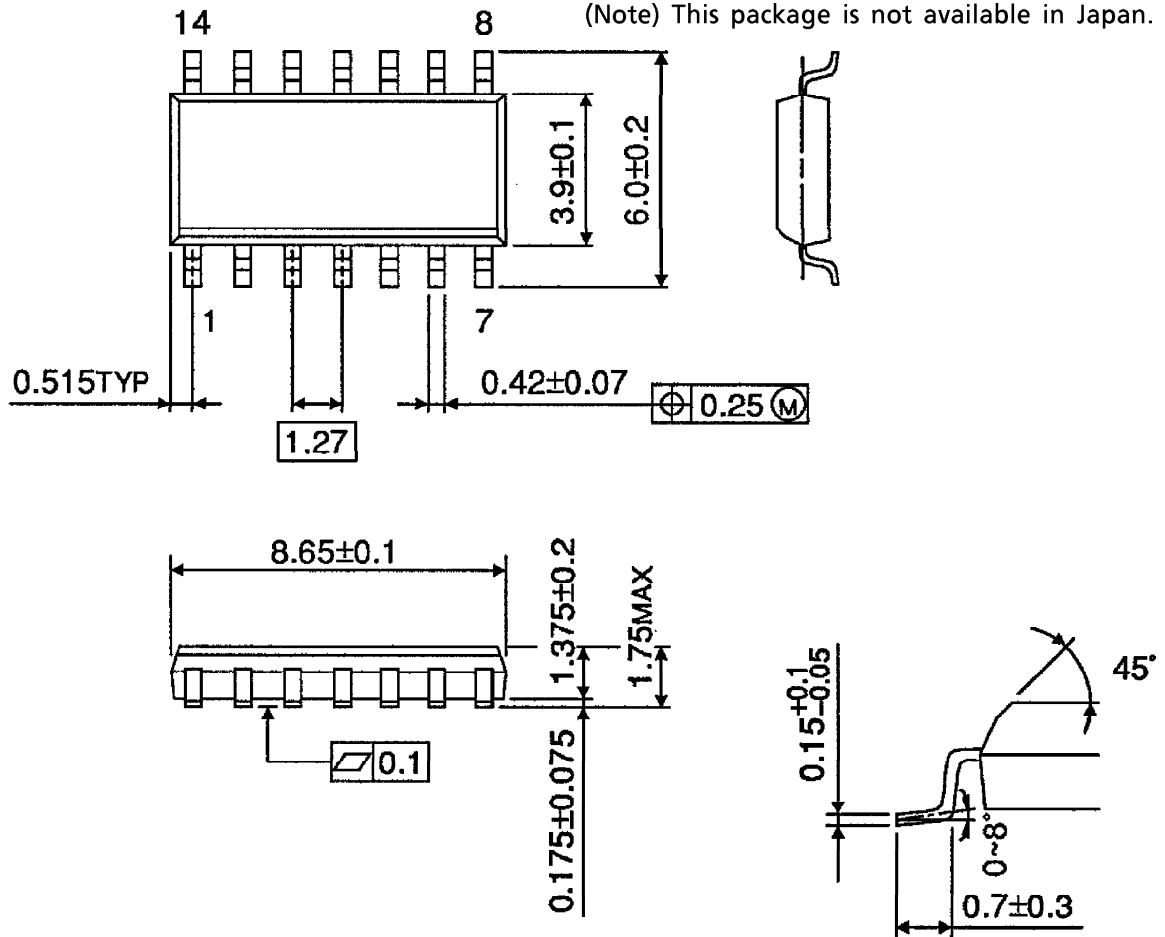


Weight : 0.18g (Typ.)

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

Unit : mm

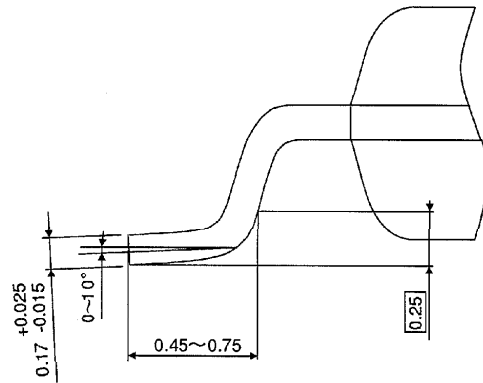
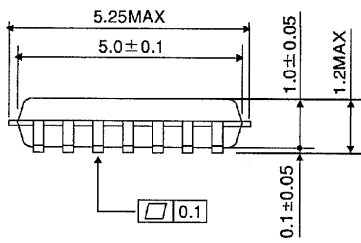
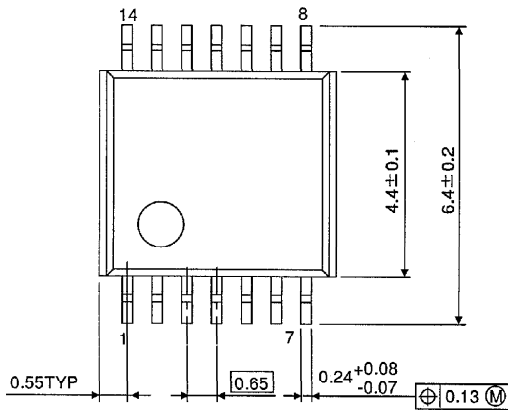
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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

Unit : mm



Weight : 0.06g (Typ.)