

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74LCX86F, TC74LCX86FN, TC74LCX86FT****LOW VOLTAGE QUAD EXCLUSIVE OR GATE  
WITH 5V TOLERANT INPUTS AND OUTPUTS**

The TC74LCX86 is a high performance CMOS EXCLUSIVE OR GATE. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

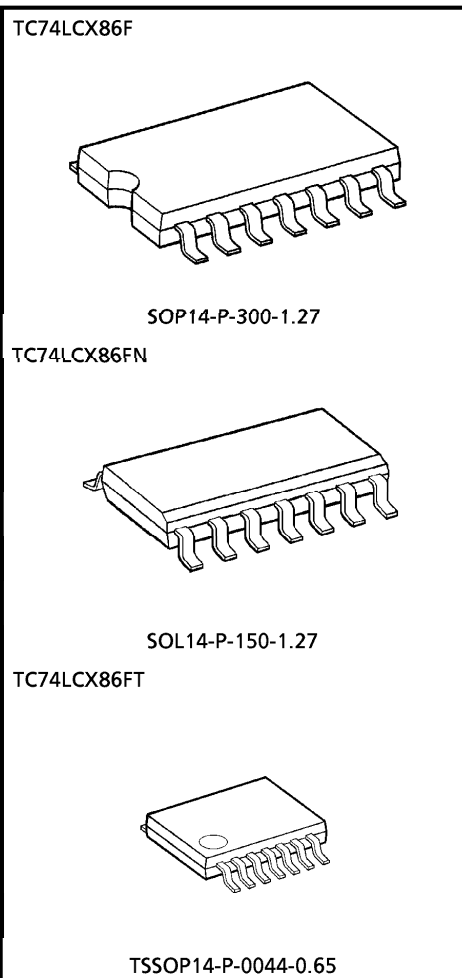
The device is designed for low-voltage (3.3V)  $V_{CC}$  applications, but it could be used to interface to 5V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

**FEATURES**

- Low voltage operation :  $V_{CC} = 2.0 \sim 3.6V$
- High speed operation :  $t_{pd} = 6.5ns$  (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.) 86 type.

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

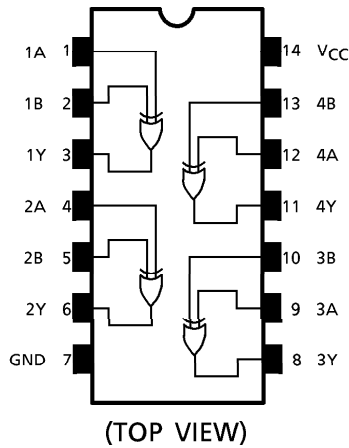


Weight  
 SOP14-P-300-1.27 : 0.18g (Typ.)  
 SOL14-P-150-1.27 : 0.12g (Typ.)  
 TSSOP14-P-0044-0.65 : 0.06g (Typ.)

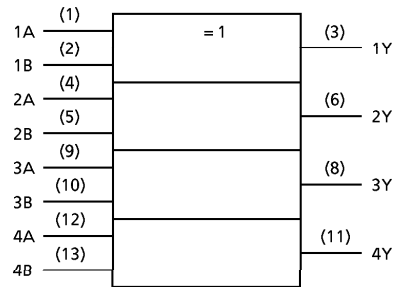
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**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



**TRUTH TABLE**

A	B	Y
L	L	L
L	H	H
H	L	H
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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- The information contained herein is subject to change without notice.

## 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	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -100\mu A$	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	$V_{OL}$	$V_{IN} = V_{IL}$ 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	—	$\pm 10.0$		
Quiescent 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	—	7.0	ns
	t <sub>pHL</sub>		3.3 ± 0.3	1.5	6.5	
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> = 2.5ns, 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

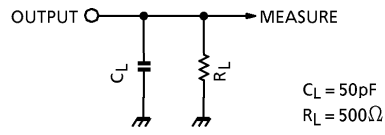
(Note 11) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

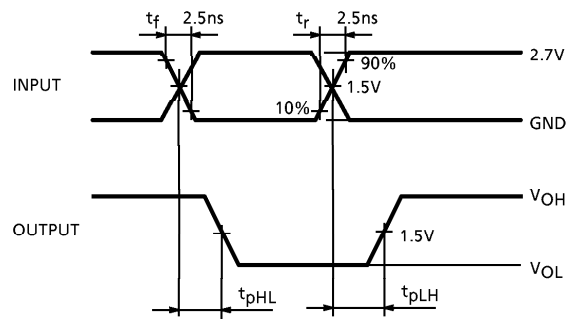
**TEST CIRCUIT**

Fig.1



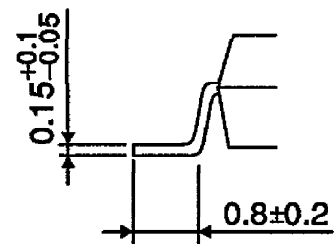
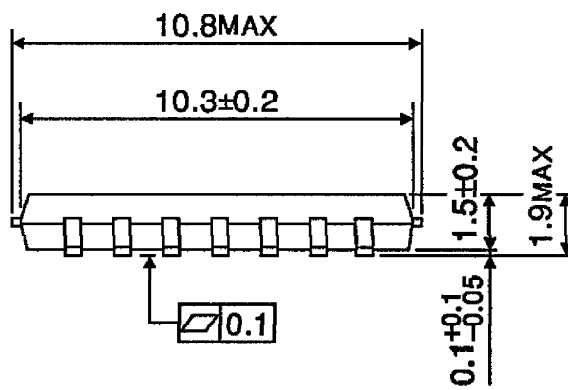
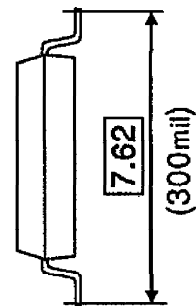
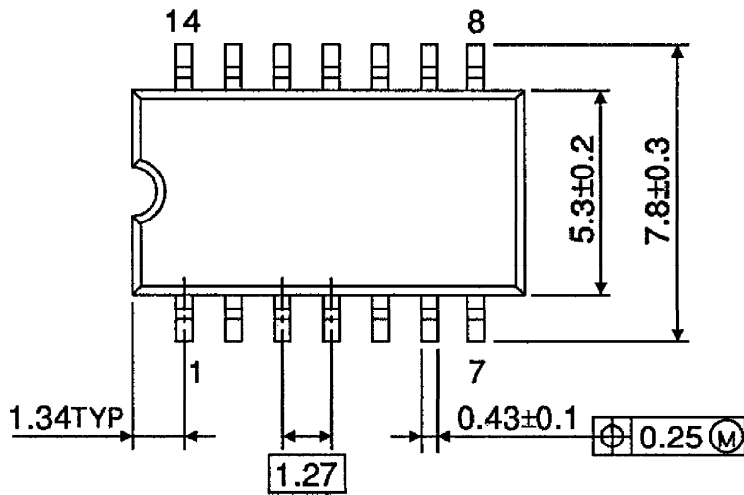
**AC WAVEFORM**

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



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

Unit : mm

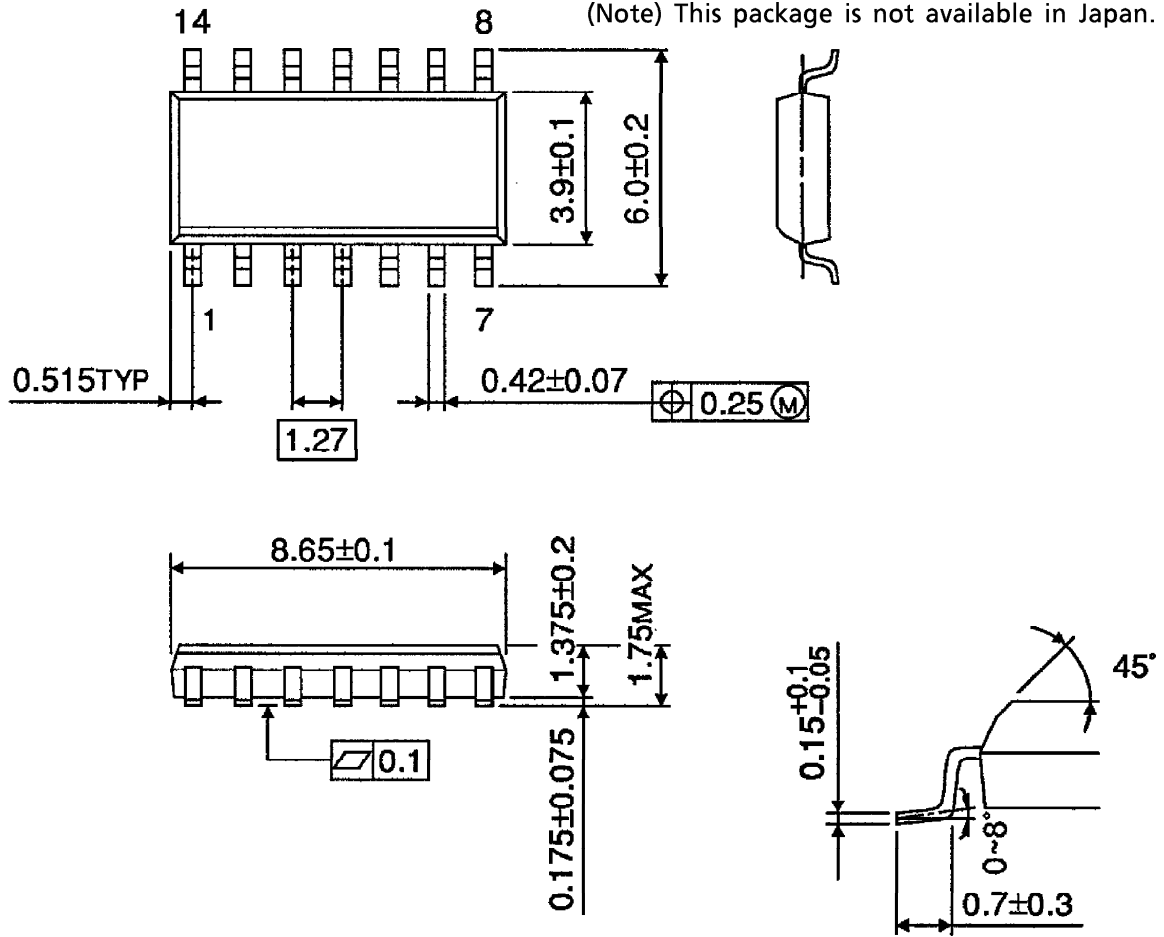


Weight : 0.18g (Typ.)

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

Unit : mm

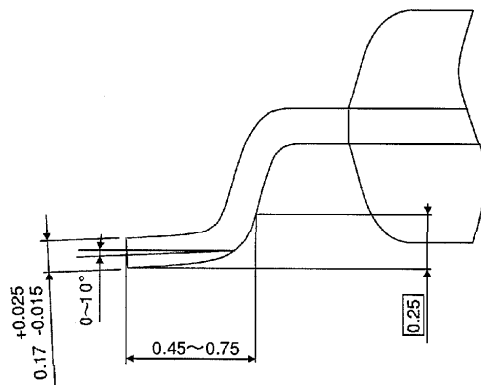
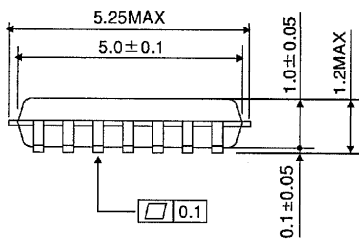
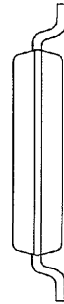
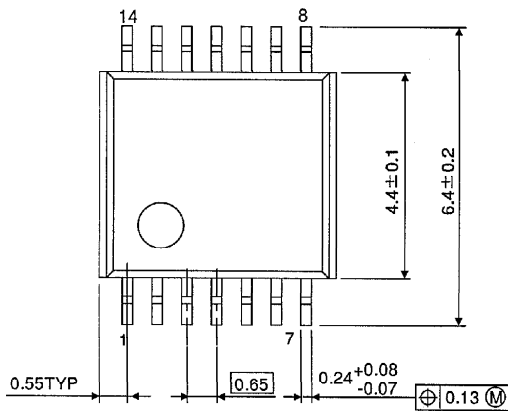
(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)

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

Unit : mm



Weight : 0.06g (Typ.)