

# TC74LCX14F, TC74LCX14FN, TC74LCX14FT

## Low-Voltage Hex Schmitt Inverter with 5-V Tolerant Inputs and Outputs

The TC74LCX14F/FN/FT is a high-performance CMOS schmitt inverter. 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.

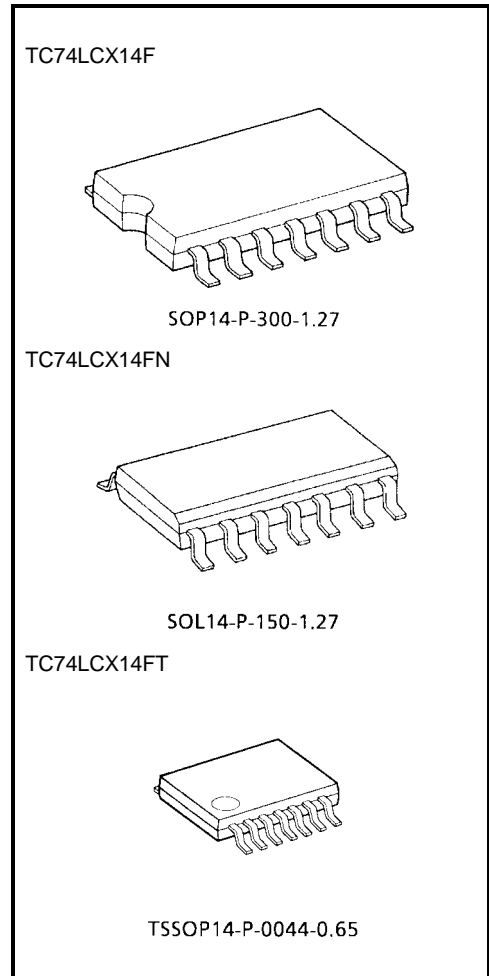
Pin configuration and function are the same as the TC74LCX04 but the inputs have hysteresis and with Schmitt trigger function, the TC74LCX14F/FN/FT can be used as a line receivers which will receive slow input signals.

All inputs are equipped with protection circuits against static discharge.

### Features

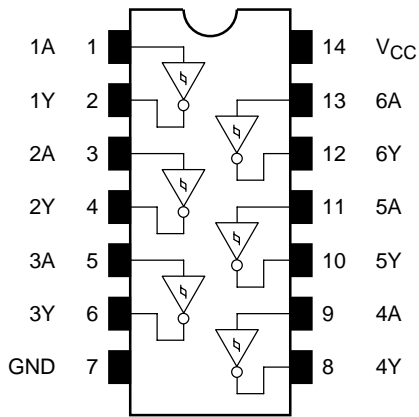
- Low-voltage operation:  $V_{CC} = 2.0$  to  $3.6$  V
- High-speed operation:  $t_{pd} = 6.5$  ns (max) ( $V_{CC} = 3.0$  to  $3.6$  V)
- Output current:  $|I_{OH}|/I_{OL} = 24$  mA (min) ( $V_{CC} = 3.0$  V)
- Latch-up performance:  $\pm 500$  mA
- Available in JEDEC SOP, JEITA SOP and TSSOP
- Power-down protection provided on all inputs and outputs
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 14 type

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

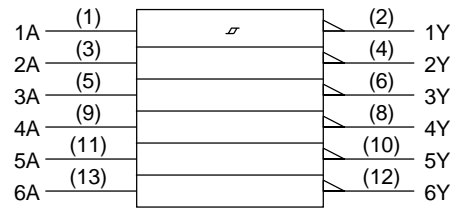


Weight  
 SOP14-P-300-1.27: 0.18 g (typ.)  
 SOL14-P-150-1.27: 0.12 g (typ.)  
 TSSOP14-P-0044-0.65: 0.06 g (typ.)

## Pin Assignment (top view)



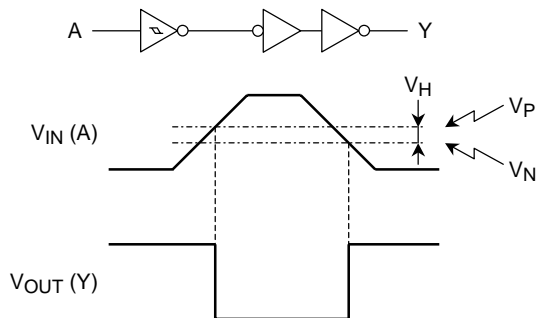
## IEC Logic Symbol



## Truth Table

Inputs	Outputs
A	Y
L	H
H	L

## System Diagram and waveform



## Maximum Ratings

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 1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	$I_{IK}$	-50	mA
Output diode current	$I_{OK}$	$\pm 50$ (Note 3)	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:  $V_{CC} = 0\text{ V}$

Note 2: High or low state.  $I_{OUT}$  absolute maximum rating must be observed.

Note 3:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

## Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	2.0 to 3.6	V
		1.5 to 3.6 (Note 4)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 5)	V
		0 to $V_{CC}$ (Note 6)	
Output current	$I_{OH}/I_{OL}$	$\pm 24$ (Note 7)	mA
		$\pm 12$ (Note 8)	
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}C$

Note 4: Data retention only

Note 5:  $V_{CC} = 0\text{ V}$

Note 6: High or low state

Note 7:  $V_{CC} = 3.0$  to  $3.6\text{ V}$

Note 8:  $V_{CC} = 2.7$  to  $3.0\text{ V}$

**Electrical Characteristics**

**DC Characteristics (Ta = -40 to 85°C)**

Characteristics		Symbol	Test Condition		V <sub>CC</sub> (V)	Min	Max	Unit
Threshold voltage	H-level	V <sub>P</sub>	—		3.0	1.2	2.2	V
	L-level	V <sub>N</sub>	—		3.0	0.6	1.5	
Hysteresis voltage		V <sub>H</sub>	—		3.0	0.4	1.2	V
Output voltage	H-level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	2.7 to 3.6	V <sub>CC</sub> - 0.2	—	V
				I <sub>OH</sub> = -12 mA	2.7	2.2	—	
				I <sub>OH</sub> = -18 mA	3.0	2.4	—	
				I <sub>OH</sub> = -24 mA	3.0	2.2	—	
	L-level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	2.7 to 3.6	—	0.2	
				I <sub>OL</sub> = 12 mA	2.7	—	0.4	
				I <sub>OL</sub> = 16 mA	3.0	—	0.4	
				I <sub>OL</sub> = 24 mA	3.0	—	0.55	
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = 0 to 5.5 V		2.7 to 3.6	—	±5.0	μA
Power-off leakage current		I <sub>OFF</sub>	V <sub>IN</sub> /V <sub>OUT</sub> = 5.5 V		0	—	10.0	μA
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		2.7 to 3.6	—	10.0	μA
			V <sub>IN</sub> = 3.6 to 5.5 V		2.7 to 3.6	—	±10.0	
Increase in I <sub>CC</sub> per input		ΔI <sub>CC</sub>	V <sub>IH</sub> = V <sub>CC</sub> - 0.6 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>	t <sub>pHL</sub>	Figure 1, Figure 2		2.7	—	7.5	ns
					3.3 ± 0.3	1.5	6.5	
Output to output skew	t <sub>osLH</sub>	t <sub>osHL</sub>	(Note 9)		2.7	—	—	ns
					3.3 ± 0.3	—	1.0	

Note 9: 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)

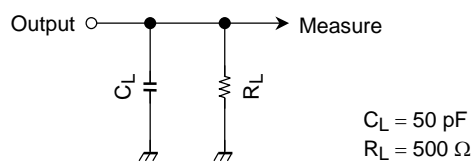
Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Typ.	Unit
Input capacitance	C <sub>IN</sub>	—	3.3	7	pF
Output capacitance	C <sub>OUT</sub>	—	0	8	pF
Power dissipation capacitance	C <sub>PD</sub>	f <sub>IN</sub> = 10 MHz (Note 10)	3.3	25	pF

Note 10: 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:

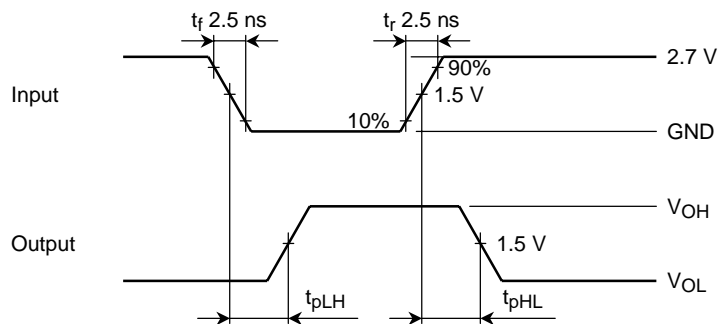
$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6 \text{ (per gate)}$$

## AC Test Circuit



**Figure 1**

## AC Waveform

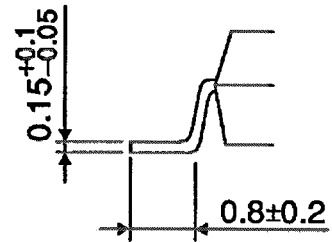
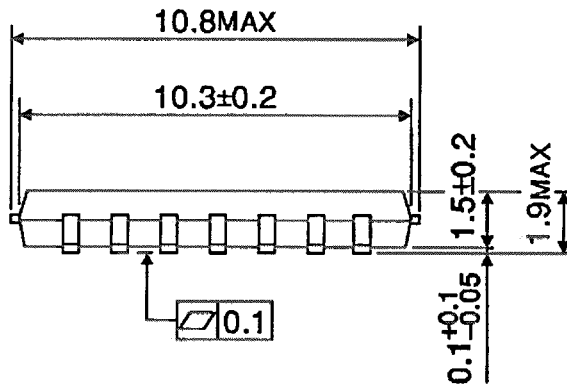
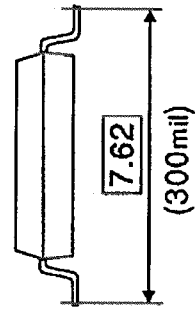
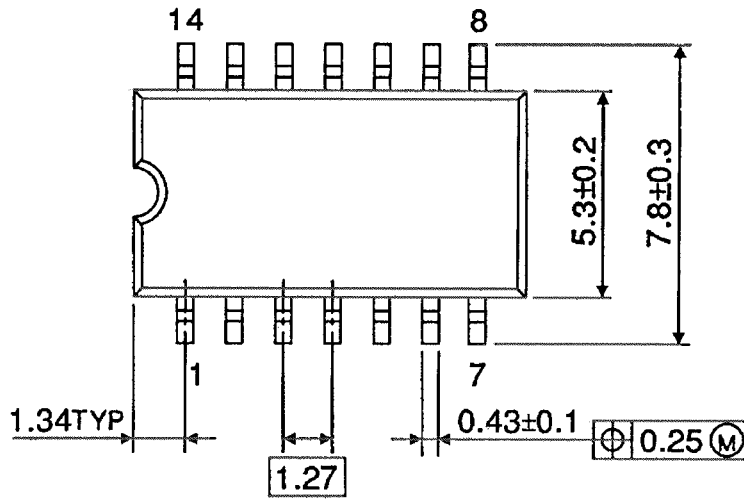


**Figure 2** t<sub>pLH</sub>, t<sub>pHL</sub>

## Package Dimensions

SOP14-P-300-1.27

Unit : mm



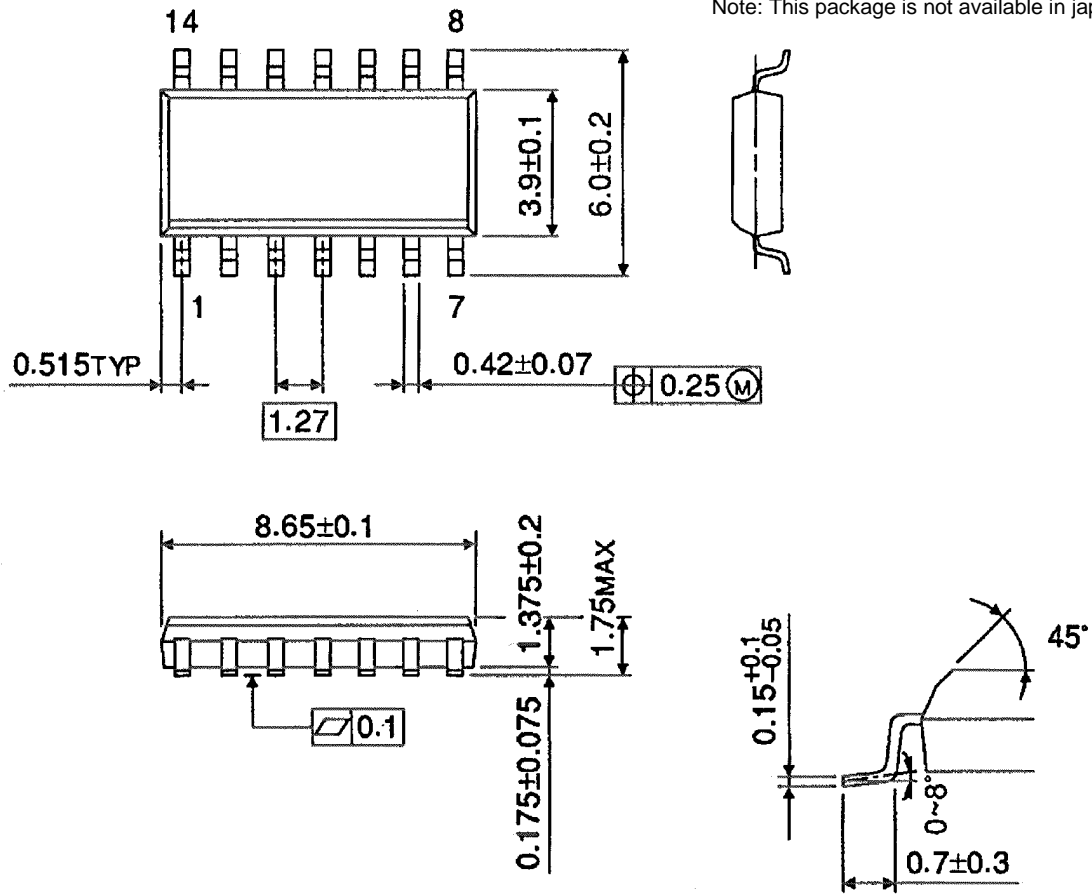
Weight: 0.18 g (typ.)

## Package Dimensions

SOL14-P-150-1.27

Unit : mm

Note: This package is not available in japan.

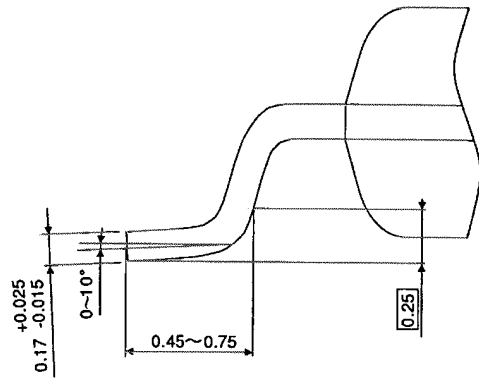
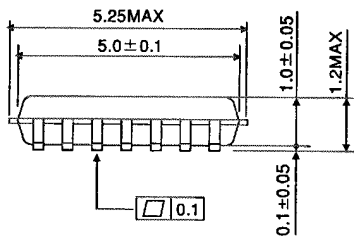
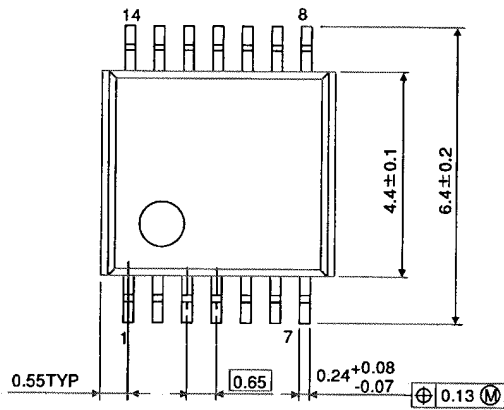


Weight: 0.12 g (typ.)

## Package Dimensions

TSSOP14-P-0044-0.65

Unit : mm



Weight: 0.06 g (typ.)



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