

TC74LCX14F, TC74LCX14FN, TC74LCX14FT, TC74LCX14FK

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

The TC74LCX14 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) V_{CC} applications, but it could be used to interface to 5-V supply environment for inputs.

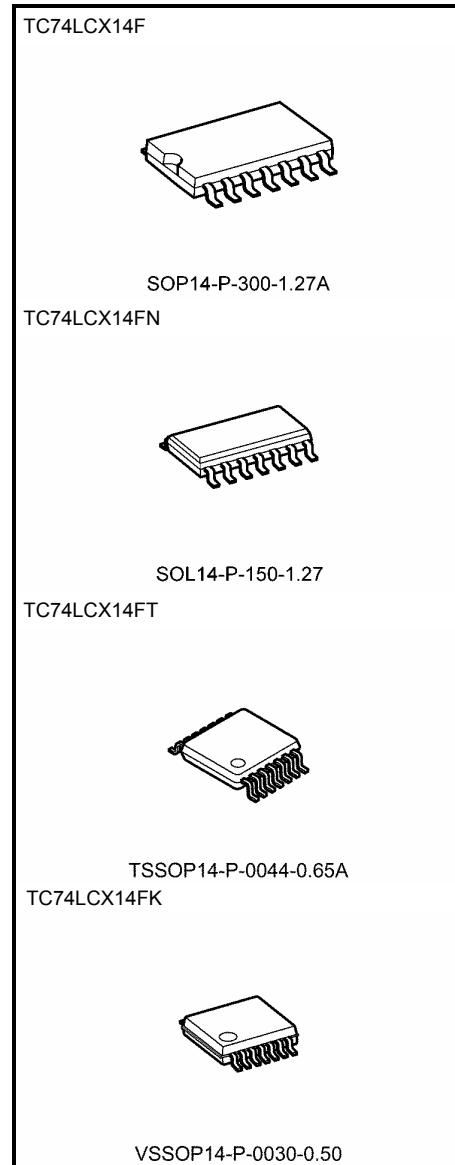
Pin configuration and function are the same as the TC74LCX04 but the inputs have hysteresis and with Schmitt trigger function, the TC74LCX14F/FN/FT can be used as a line receivers which will receive slow input signals.

All inputs are equipped with protection circuits against static discharge.

Features

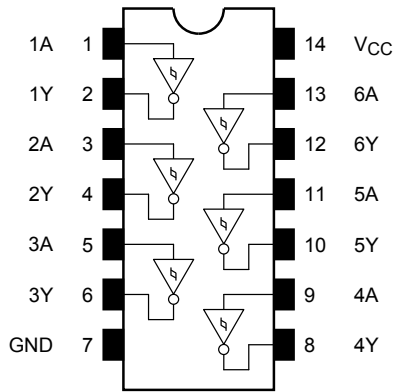
- Low-voltage operation: $V_{CC} = 2.0$ to 3.6 V
- High-speed operation: $t_{pd} = 6.5$ ns (max) ($V_{CC} = 3.0$ to 3.6 V)
- Output current: $|I_{OH}|/I_{OL} = 24$ mA (min) ($V_{CC} = 3.0$ V)
- Latch-up performance: -500 mA
- Available in JEDEC SOP, JEITA SOP, TSSOP and VSSOP (US)
- Power-down protection 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.

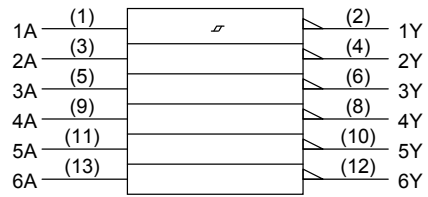


Weight	
SOP14-P-300-1.27A	: 0.18 g (typ.)
SOL14-P-150-1.27	: 0.12 g (typ.)
TSSOP14-P-0044-0.65A	: 0.06 g (typ.)
VSSOP14-P-0030-0.50	: 0.02 g (typ.)

Pin Assignment (top view)



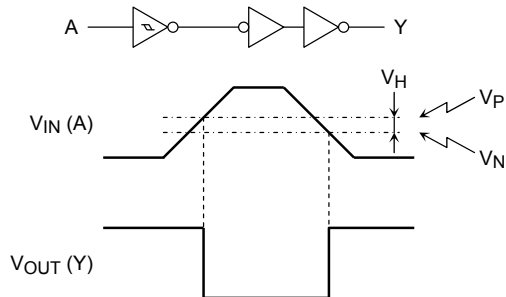
IEC Logic Symbol



Truth Table

Inputs	Outputs
A	Y
L	H
H	L

System Diagram and waveform



Absolute Maximum Ratings (Note 1)

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 2)	V
		-0.5 to $V_{CC} + 0.5$ (Note 3)	
Input diode current	I_{IK}	-50	mA
Output diode current	I_{OK}	± 50 (Note 4)	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 to 150	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: $V_{CC} = 0$ V

Note 3: High or low state. I_{OUT} absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	2.0 to 3.6	V
		1.5 to 3.6 (Note 2)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 3)	V
		0 to V_{CC} (Note 4)	
Output current	I_{OH}/I_{OL}	± 24 (Note 5)	mA
		± 12 (Note 6)	
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$

Note 1: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either V_{CC} or GND .

Note 2: Data retention only

Note 3: $V_{CC} = 0$ V

Note 4: High or low state

Note 5: $V_{CC} = 3.0$ to 3.6 V

Note 6: $V_{CC} = 2.7$ to 3.0 V

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristics		Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit	
Threshold voltage	H-level	V _P	—	3.0	1.2	2.2	V	
	L-level	V _N	—	3.0	0.6	1.5		
Hysteresis voltage		V _H	—	3.0	0.4	1.2	V	
Output voltage	H-level	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -100 μA	2.7 to 3.6	V _{CC} - 0.2	—	V
				I _{OH} = -12 mA	2.7	2.2	—	
				I _{OH} = -18 mA	3.0	2.4	—	
				I _{OH} = -24 mA	3.0	2.2	—	
	L-level	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 100 μA	2.7 to 3.6	—	0.2	
				I _{OL} = 12 mA	2.7	—	0.4	
				I _{OL} = 16 mA	3.0	—	0.4	
				I _{OL} = 24 mA	3.0	—	0.55	
Input leakage current		I _{IN}	V _{IN} = 0 to 5.5 V	2.7 to 3.6	—	±5.0	μA	
Power-off leakage current		I _{OFF}	V _{IN} /V _{OUT} = 5.5 V	0	—	10.0	μA	
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND	2.7 to 3.6	—	10.0	μA	
			V _{IN} = 3.6 to 5.5 V	2.7 to 3.6	—	±10.0		
Increase in I _{CC} per input		ΔI _{CC}	V _{IH} = V _{CC} - 0.6 V	2.7 to 3.6	—	500		

AC Characteristics (Ta = -40 to 85°C)

Characteristics		Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit
Propagation delay time	t _{pLH}	t _{pHL}	Figure 1, Figure 2	2.7	—	7.5	ns
				3.3 ± 0.3	1.5	6.5	
Output to output skew	t _{oS LH}	t _{oS HL}	(Note)	2.7	—	—	ns
				3.3 ± 0.3	—	1.0	

Note: Parameter guaranteed by design.
 (t_{oS LH} = |t_{pLHm} - t_{pLHn}|, t_{oS HL} = |t_{pHLm} - t_{pHLn}|)

Dynamic Switching Characteristics (Ta = 25°C, input: t_r = t_f = 2.5 ns, C_L = 50 pF, R_L = 500 Ω)

Characteristics		Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Quiet output maximum dynamic V _{OL}		V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet output minimum dynamic V _{OL}		V _{OLV}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V

Capacitive Characteristics (Ta = 25°C)

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

Note: C_{PD} 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

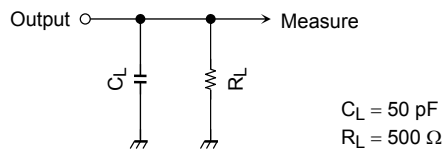


Figure 1

AC Waveform

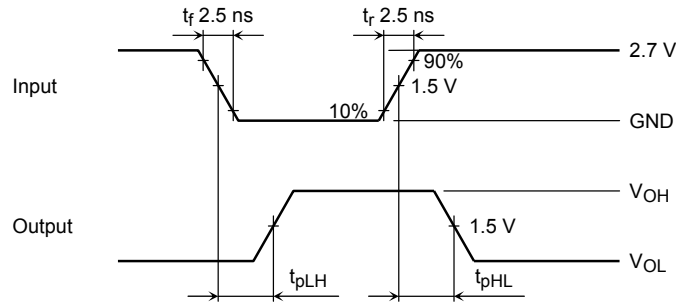
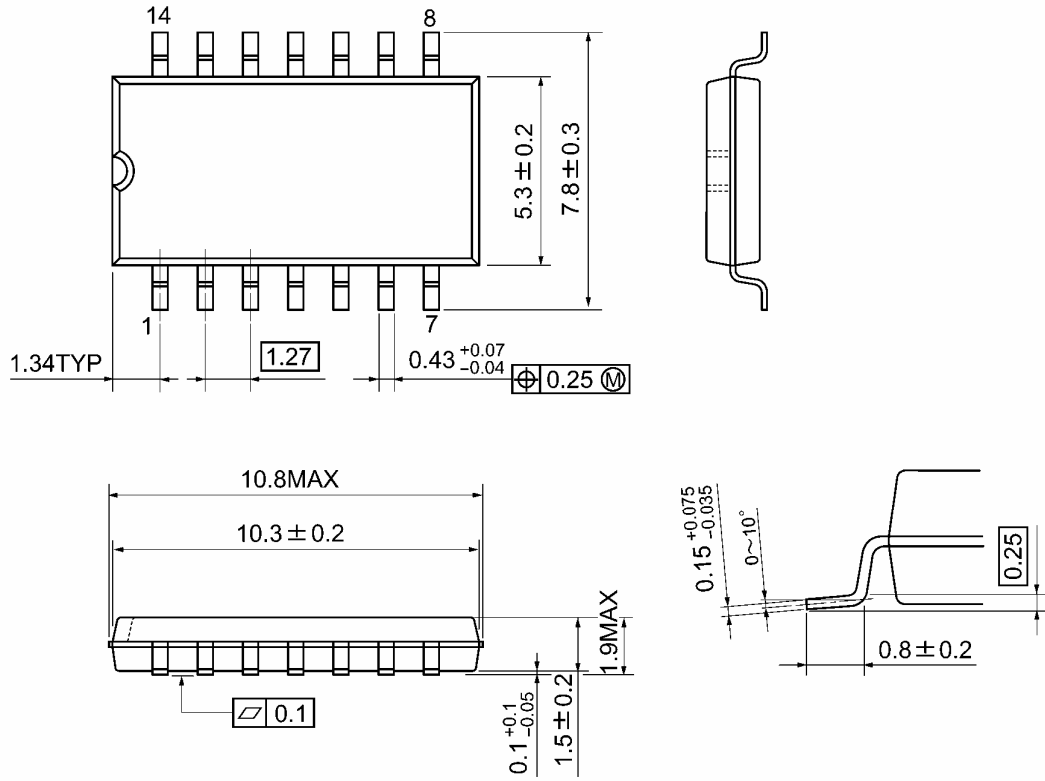


Figure 2 t_{pLH}, t_{pHL}

Package Dimensions

SOP14-P-300-1.27A

Unit: mm

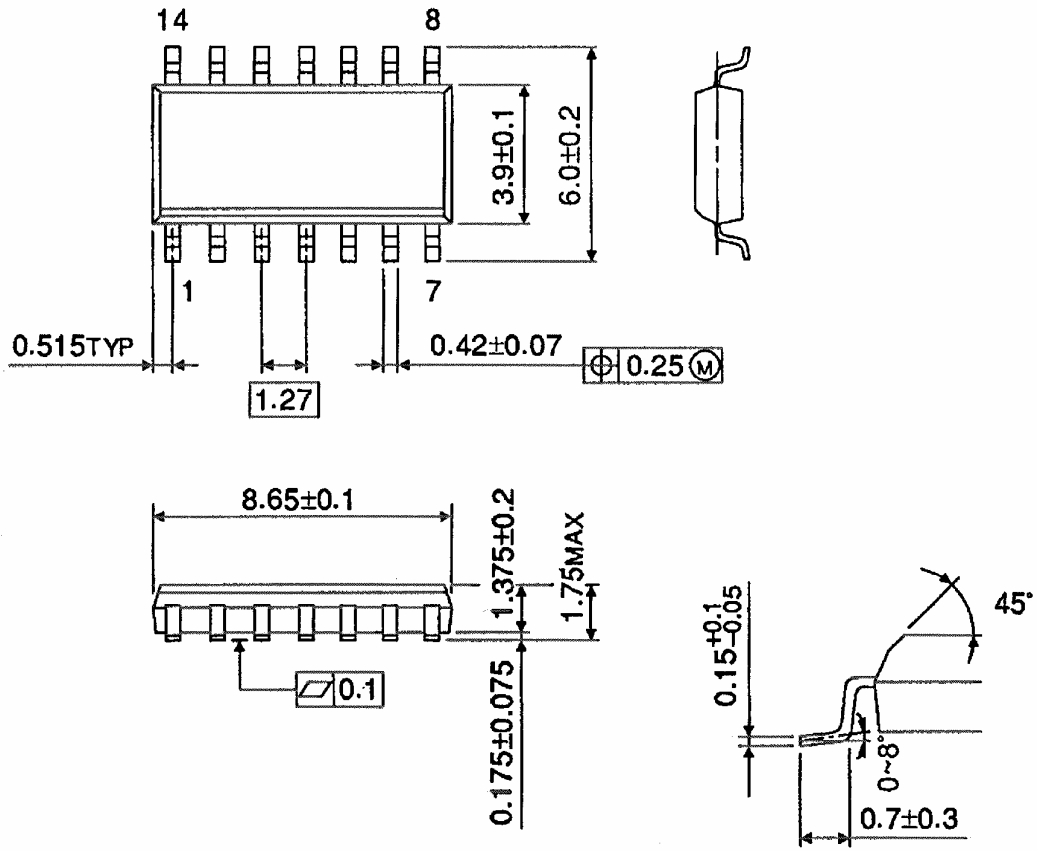


Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL14-P-150-1.27

Unit : mm



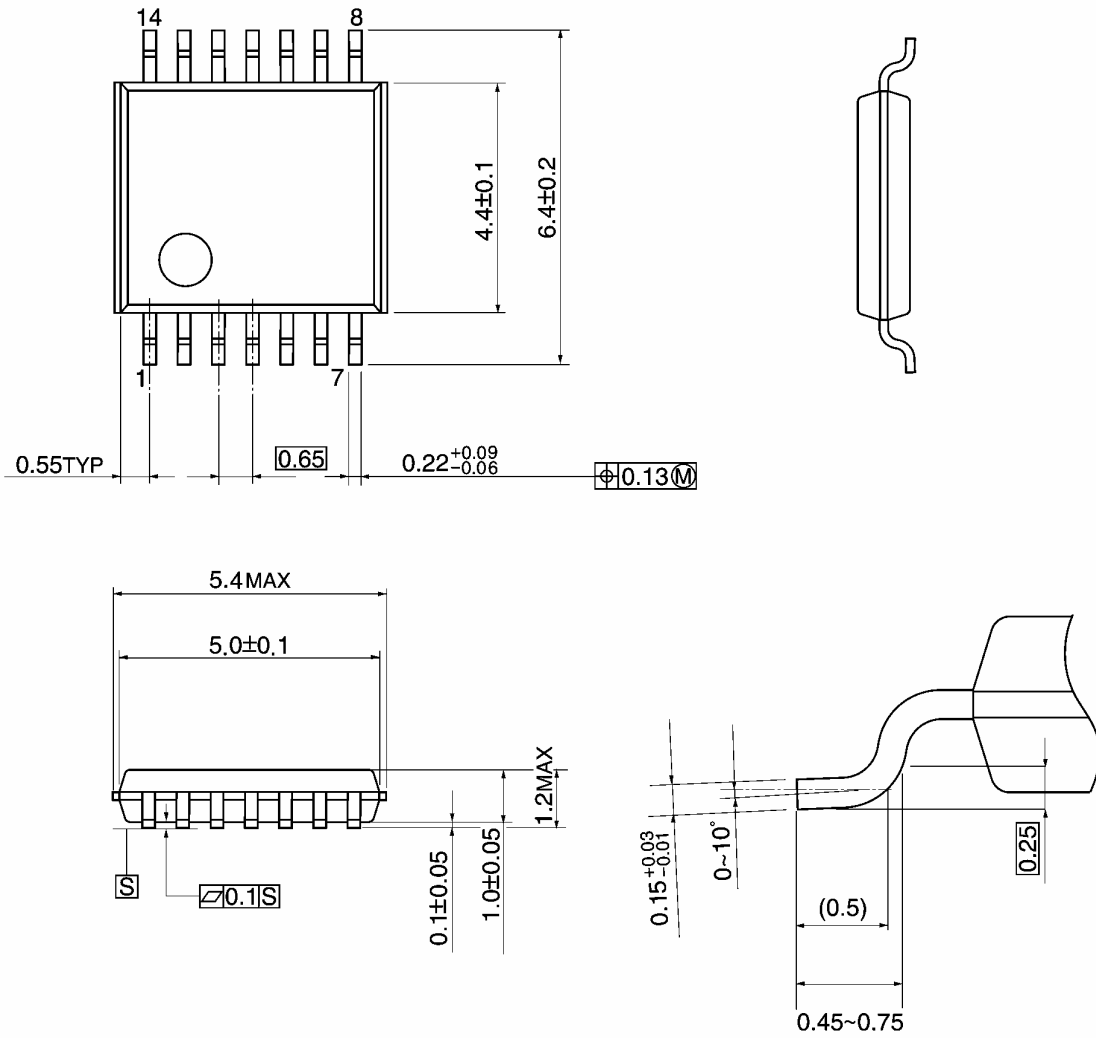
Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm

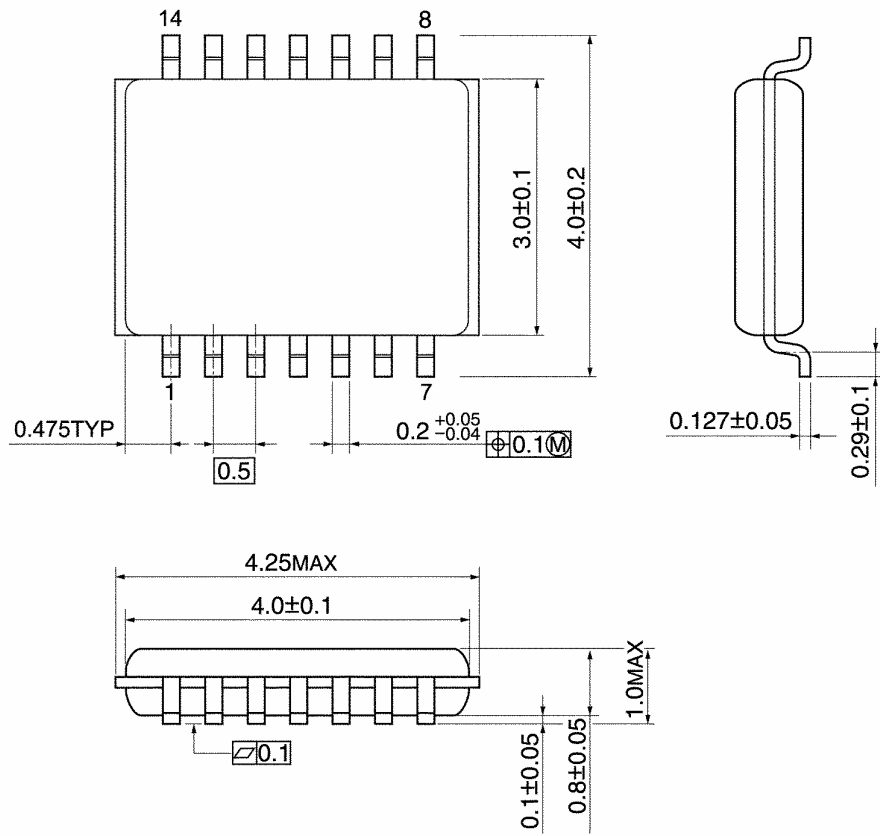


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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20070701-EN GENERAL

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