TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74LCX14F,TC74LCX14FN,TC74LCX14FT

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

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

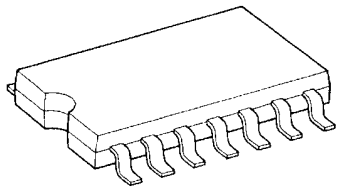
The TC74LCX14F/FN/FT is a high-performance CMOS schmitt inverter. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

The device is designed for low-voltage (3.3 V) 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.

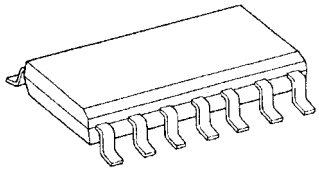
All inputs are equipped with protection circuits against static discharge.

TC74LCX14F



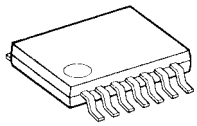
SOP14-P-300-1.27

TC74LCX14FN



SOL14-P-150-1.27

TC74LCX14FT



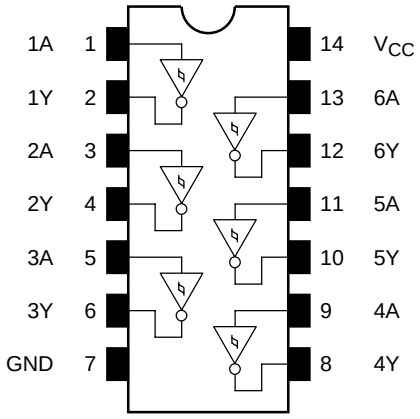
TSSOP14-P-0044-0.65

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.)

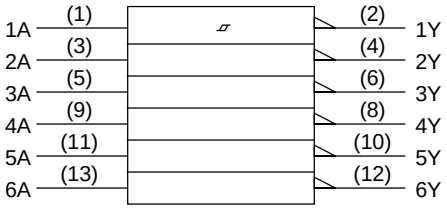
Features

- 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)
- Ouput current: $|I_{OH}|/I_{OL}$ = 24 mA (min) (V_{CC} = 3.0 V)
- Latch-up performance: ±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

Pin Assignment (top view)



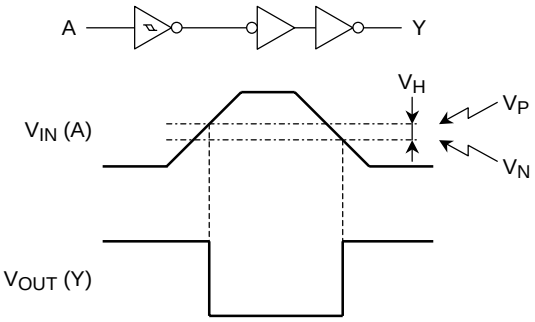
IEC Logic Symbol



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}	±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 to 150	°C

Note 1: V_{CC} = 0 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}	±24 (Note 7)	mA
		±12 (Note 8)	
Operating temperature	T_{opr}	−40 to 85	°C

Note 4: Data retention only

Note 5: V_{CC} = 0 V

Note 6: High or low state

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

Note 8: 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 Icc 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_{osLH} t_{osHL}	(Note 9)	2.7	—	—	ns
			3.3 ± 0.3	—	1.0	

Note 9: Parameter guaranteed by design.
($t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$)

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 10)	3.3	25	pF

Note 10: 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:
$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6$ (per gate)

AC Test Circuit

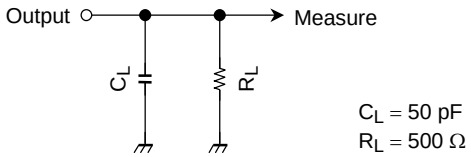


Figure 1

AC Waveform

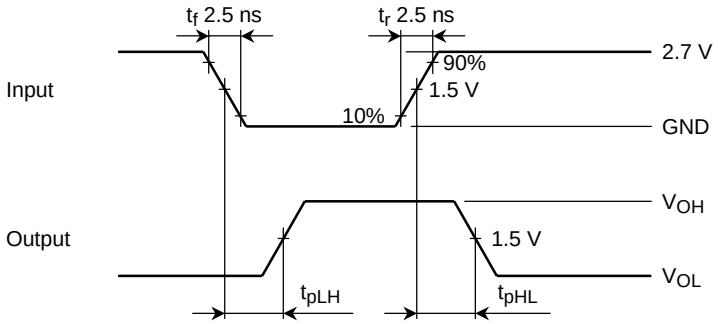
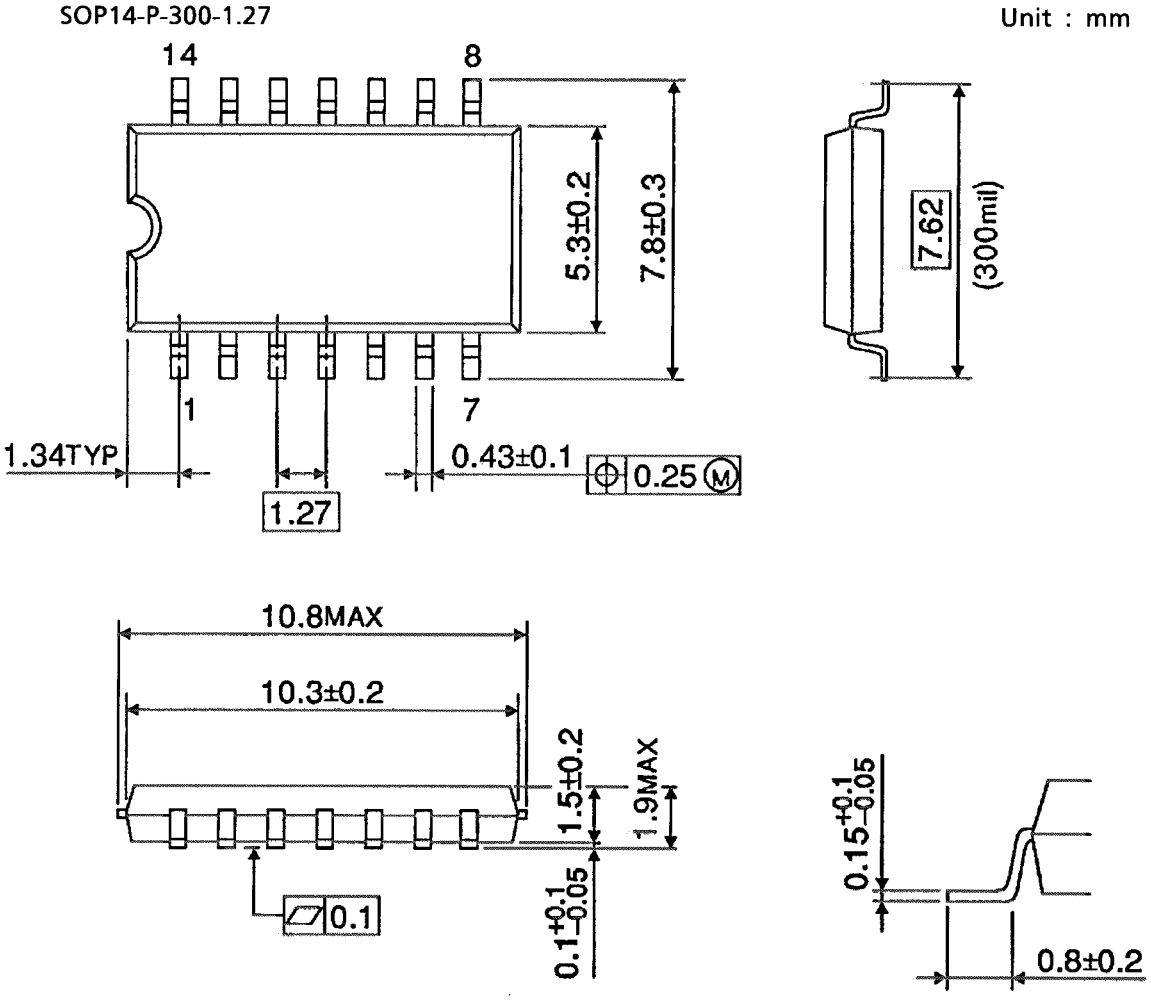


Figure 2 t_{pLH}, t_{pHL}

Package Dimensions



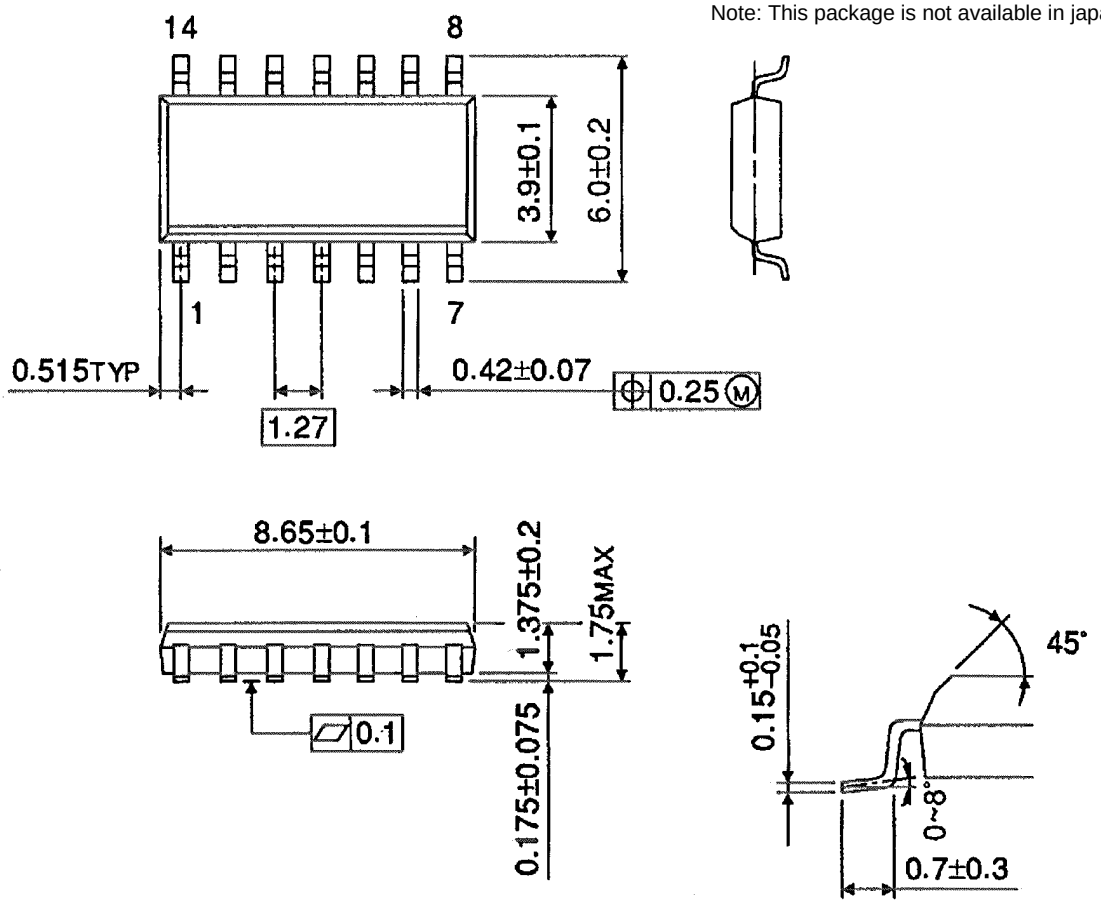
Weight: 0.18 g (typ.)

Package Dimensions

SOL14-P-150-1.27

Unit : mm

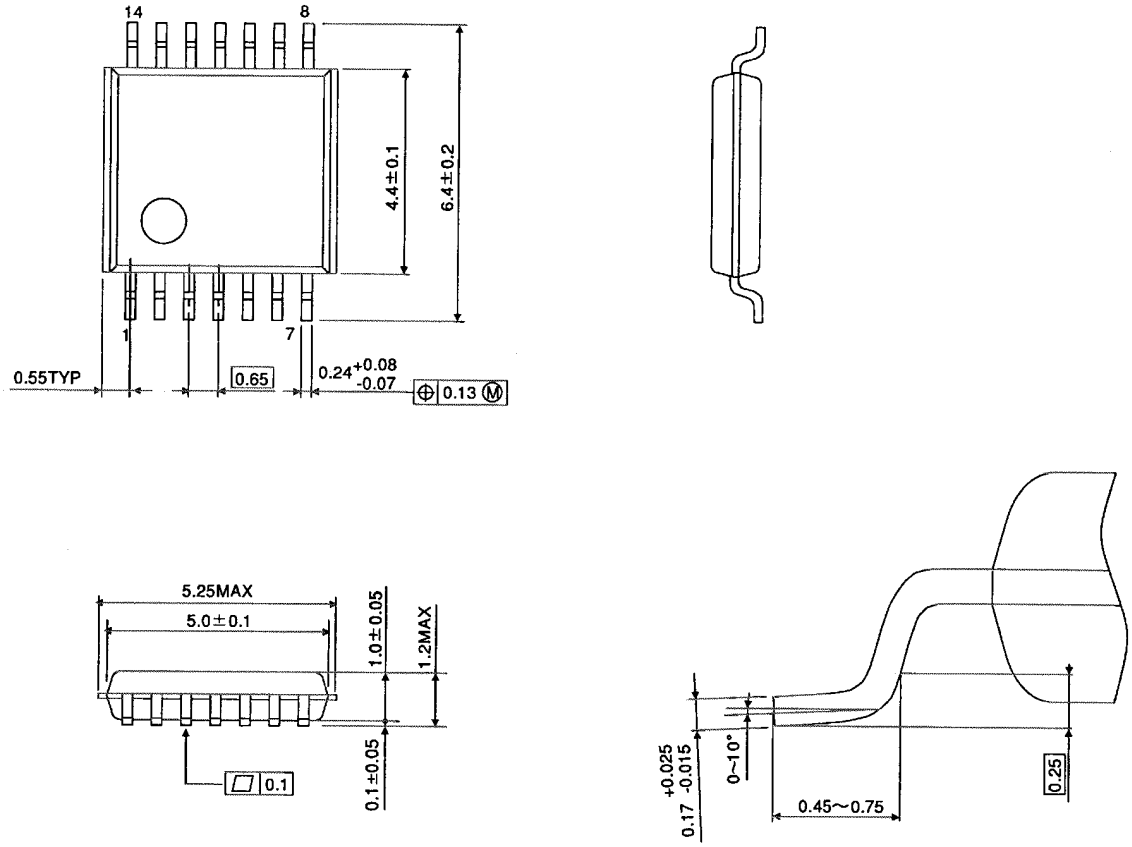
Note: This package is not available in japan.



Weight: 0.12 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65 Unit : mm



Weight: 0.06 g (typ.)

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