

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74LCX05F, TC74LCX05FN, TC74LCX05FT**LOW VOLTAGE HEX INVERTER****WITH 5 V TOLERANT INPUTS AND OUTPUTS (OPEN DRAIN)**

The TC74LCX05 is a high performance CMOS INVERTER. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

Pin configuration and function are the same as the TC74LCX04, but the TC74LCX05 has high performance MOS N-channel transistor. (Open-Drain outputs)

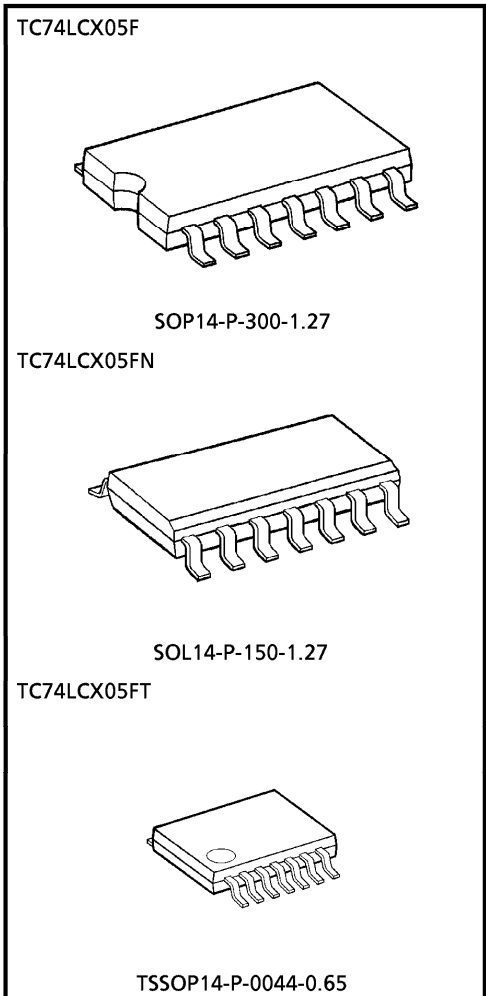
The device is designed for low-voltage (3.3 V) V_{CC} applications, but it could be used to interface to 5V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

FEATURES

- Low voltage operation : $V_{CC} = 2.0\sim 3.6\text{ V}$
- High speed operation : $t_{pZ} = 5.0\text{ ns (max)}$
($V_{CC} = 3.0\sim 3.6\text{ V}$)
- Output current : $I_{OL} = 24\text{ mA (min)}$
($V_{CC} = 3.0\text{ V}$)
- Latch-up performance : -500 mA
- Available in JEDEC SOP, EIAJ SOP and TSSOP
- Open-Drain Outputs
- 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.) 05 type.

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

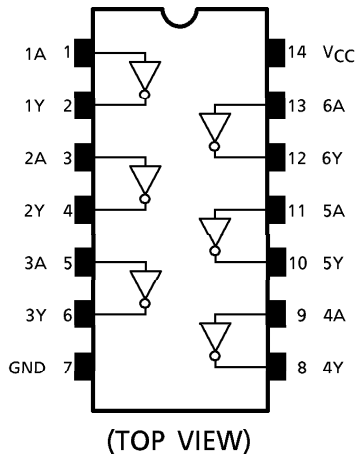
**Weight**

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.)

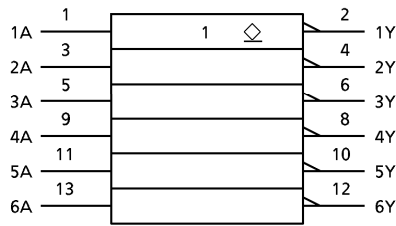
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PIN ASSIGNMENT



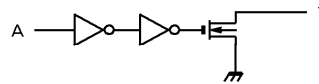
IEC LOGIC SYMBOL



TRUTH TABLE

INPUTS	OUTPUTS
A	Y
L	Z
H	L

SYSTEM DIAGRAM (per gate)



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	$^{\circ}C$

(Note 1) : Output in Off-State

(Note 2) : Low State. I_{OUT} absolute maximum rating must be observed.

(Note 3) : $V_{OUT} < GND$

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}	24 (Note 7)	mA
		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) : Output in Off-State

(Note 6) : Low State

(Note 7) : $V_{CC} = 3.0\sim 3.6\text{ V}$ (Note 8) : $V_{CC} = 2.7\sim 3.0\text{ V}$ (Note 9) : $V_{IN} = 0.8\sim 2.0\text{ V}$, $V_{CC} = 3.0\text{ V}$

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS ($T_a = -40\sim 85^\circ\text{C}$)

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	"L" Level	V_{OL}	$V_{IN} = V_{IH}$	$I_{OL} = 100\ \mu\text{A}$	2.7~3.6	—	0.2	V
				$I_{OL} = 12\ \text{mA}$	2.7	—	0.4	
				$I_{OL} = 16\ \text{mA}$	3.0	—	0.4	
				$I_{OL} = 24\ \text{mA}$	3.0	—	0.55	
Input Leakage Current	I_{IN}	$V_{IN} = 0\sim 5.5\text{ V}$	2.7~3.6	—	± 5.0	μA		
Output Off-State Current	I_{OZ}	$V_{IN} = V_{IL}$, $V_{OUT} = 0\sim 5.5\text{ V}$	2.7~3.6	—	± 5.0	μA		
Power Off Leakage Current	I_{OFF}	$V_{IN}/V_{OUT} = 5.5\text{ V}$	0	—	10.0	μA		
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC}$ or GND	2.7~3.6	—	10.0	μA		
		$V_{IN}/V_{OUT} = 3.6\sim 5.5\text{ V}$	2.7~3.6	—	± 10.0			
Increase In I_{CC} Per Input	ΔI_{CC}	$V_{IH} = V_{CC} - 0.6\text{ V}$	2.7~3.6	—	500	μA		

AC CHARACTERISTICS (Ta = -40~85°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	MIN	MAX	UNIT
Output Enable Time	t _{pZL}	(Fig.1, 2)	2.7	1.0	6.0	ns
			3.3 ± 0.3	0.8	5.0	
Output Disable Time	t _{pLZ}	(Fig.1, 2)	2.7	1.0	6.0	ns
			3.3 ± 0.3	0.8	5.0	
Output To Output Skew	t _{osZL}	(Note 10)	2.7	—	—	ns
			3.3 ± 0.3	—	1.0	

(Note 10) : Parameter guaranteed by design.
 (t_{osZL} = |t_{pZLm} - t_{pZLn}|)

DYNAMIC SWITCHING CHARACTERISTICS (Ta = 25°C, Input t_r = t_f = 2.5 ns, C_L = 50 pF, R_L = 500 Ω)

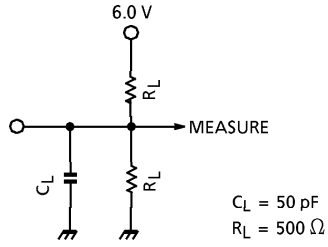
PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	TYP.	UNIT
Quiet Output Maximum Dynamic V _{OL}	V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet Output Minimum Dynamic V _{OL}	V _{OLV}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V

CAPACITIVE CHARACTERISTICS (Ta = 25°C)

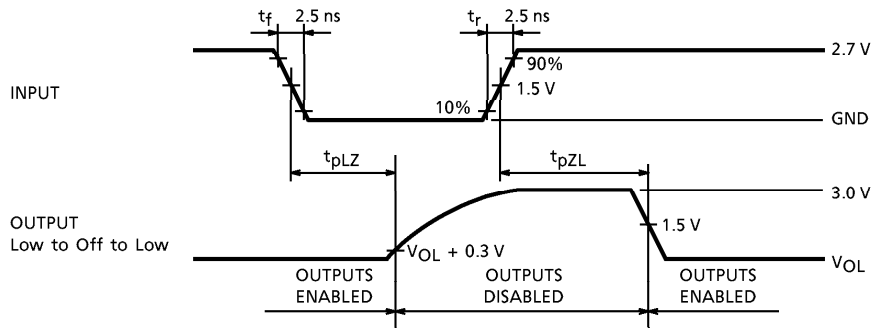
PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	TYP.	UNIT
Input Capacitance	C _{IN}	—	3.3	7	pF
Output Capacitance	C _{OUT}		3.3	8	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10 MHz (Note 11)	3.3	5	pF

(Note 11) : 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}·V_{CC}·f_{IN} + I_{CC}/6 (Per gate)

TEST CIRCUIT
Fig.1

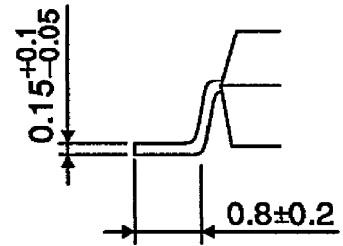
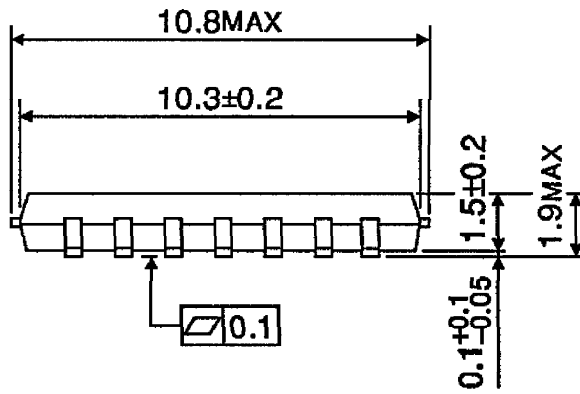
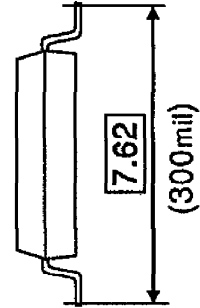
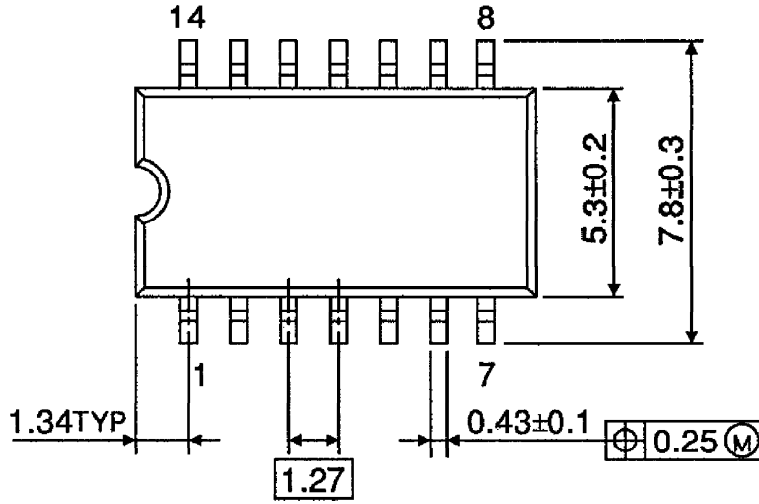


AC WAVEFORM
Fig.2 t_{pLZ} , t_{pZL}



PACKAGE DIMENSIONS
SOP14-P-300-1.27

Unit : mm

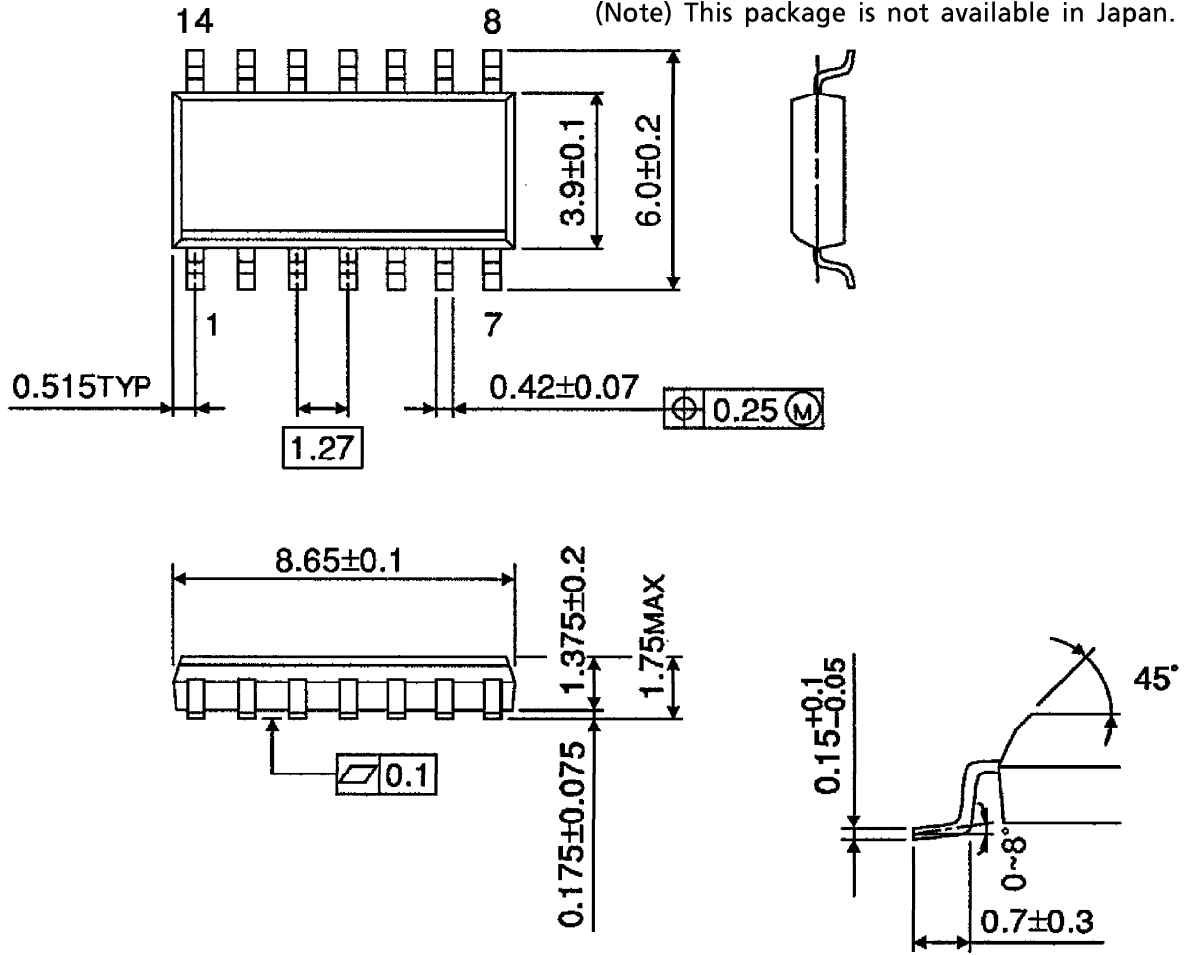


Weight : 0.18 g (Typ.)

PACKAGE DIMENSIONS
SOL14-P-150-1.27

Unit : mm

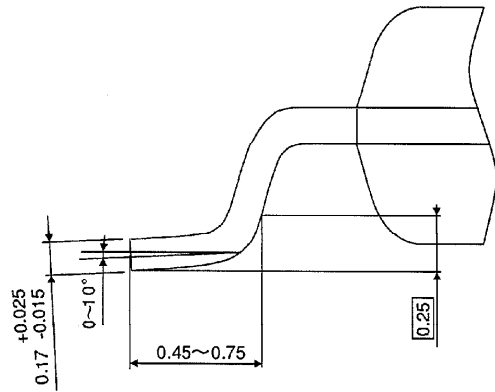
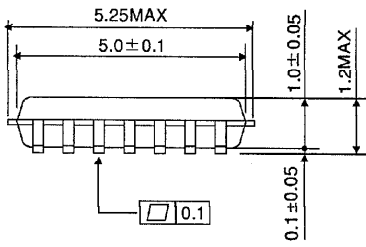
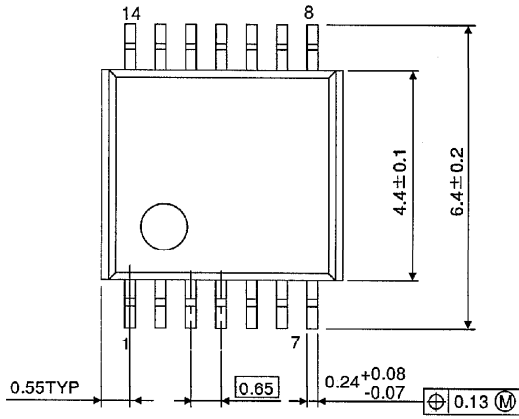
(Note) This package is not available in Japan.



Weight : 0.12 g (Typ.)

PACKAGE DIMENSIONS
TSSOP14-P-0044-0.65

Unit : mm



Weight : 0.06 g (Typ.)