

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HCT04AP, TC74HCT04AF

Hex Inverter

The TC74HCT04A is a high speed CMOS INVERTER fabricated with silicon gate C²MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

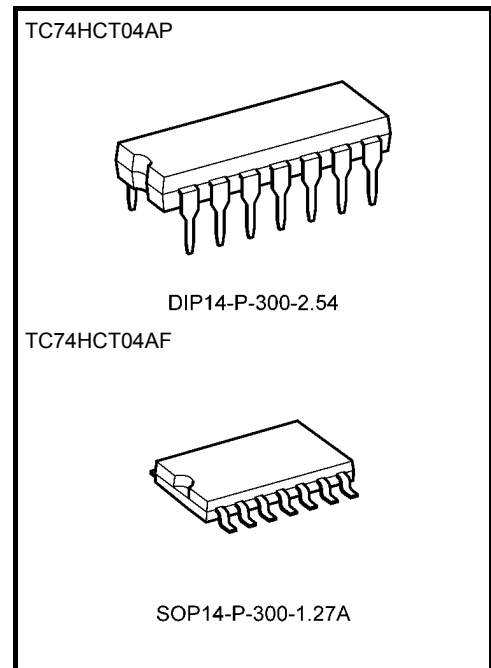
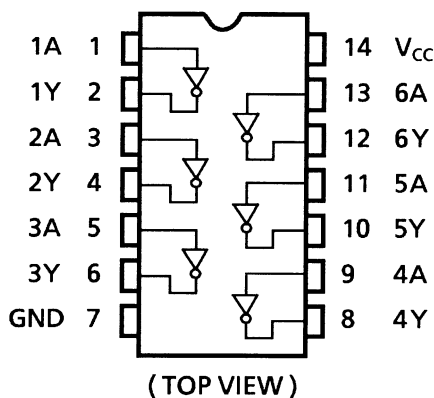
The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

Features

- High speed: $t_{pd} = 8 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 1 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs: $V_{IH} = 2 \text{ V (min)}$
 $V_{IL} = 0.8 \text{ V (max)}$
- Wide interfacing ability: LSTTL, NMOS, CMOS
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 4 \text{ mA (min)}$
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74LS04

Pin Assignment

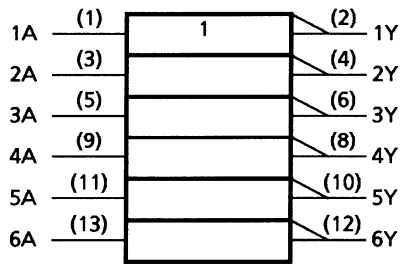


Weight

DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)

Start of commercial production
1987-11

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7	V
DC input voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Input diode current	I_{IK}	± 20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	-65 to 150	°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: 500 mW in the range of $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of -10 mW/°C shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5 to 5.5	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	t_r, t_f	0 to 500	ns

Note: 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.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	Max
High-level input voltage	V _{IH}	—		4.5 to 5.5	2.0	—	—	2.0	V
Low-level input voltage	V _{IL}	—		4.5 to 5.5	—	—	0.8	—	0.8
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -20 μA	4.5	4.4	4.5	—	4.4	—
			I _{OH} = -4 mA	4.5	4.18	4.31	—	4.13	—
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 μA	4.5	—	0.0	0.1	—	0.1
			I _{OL} = 4 mA	4.5	—	0.17	0.26	—	0.33
Input leakage current	I _{IN}	V _{IN} = V _{CC} or GND		5.5	—	—	±0.1	—	±1.0
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	1.0	—	10.0
	I _C	Per input: V _{IN} = 0.5 V or 2.4 V Other input: V _{CC} or GND		5.5	—	—	2.0	—	2.9

AC Characteristics (C_L = 15 pF, V_{CC} = 5 V, Ta = 25°C, input: t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	t _{TLH}	—	—	6	12	ns
	t _{THL}					
Propagation delay time	t _{pLH}	—	—	8	15	ns
	t _{pHL}					

AC Characteristics (C_L = 50 pF, input: t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Ta = 25°C			Ta = −40 to 85°C		Unit
				Min	Typ.	Max	Min	Max	
Output transition time	t _{TLH}	—	4.5	—	8	15	—	19	ns
	t _{THL}		5.5	—	7	13	—	16	
Propagation delay time	t _{pLH}	—	4.5	—	11	18	—	23	ns
	t _{pHL}		5.5	—	9	16	—	20	
Input capacitance	C _{IN}	—		—	5	10	—	10	pF
Power dissipation capacitance	C _{PD} (Note)	—		—	20	—	—	—	pF

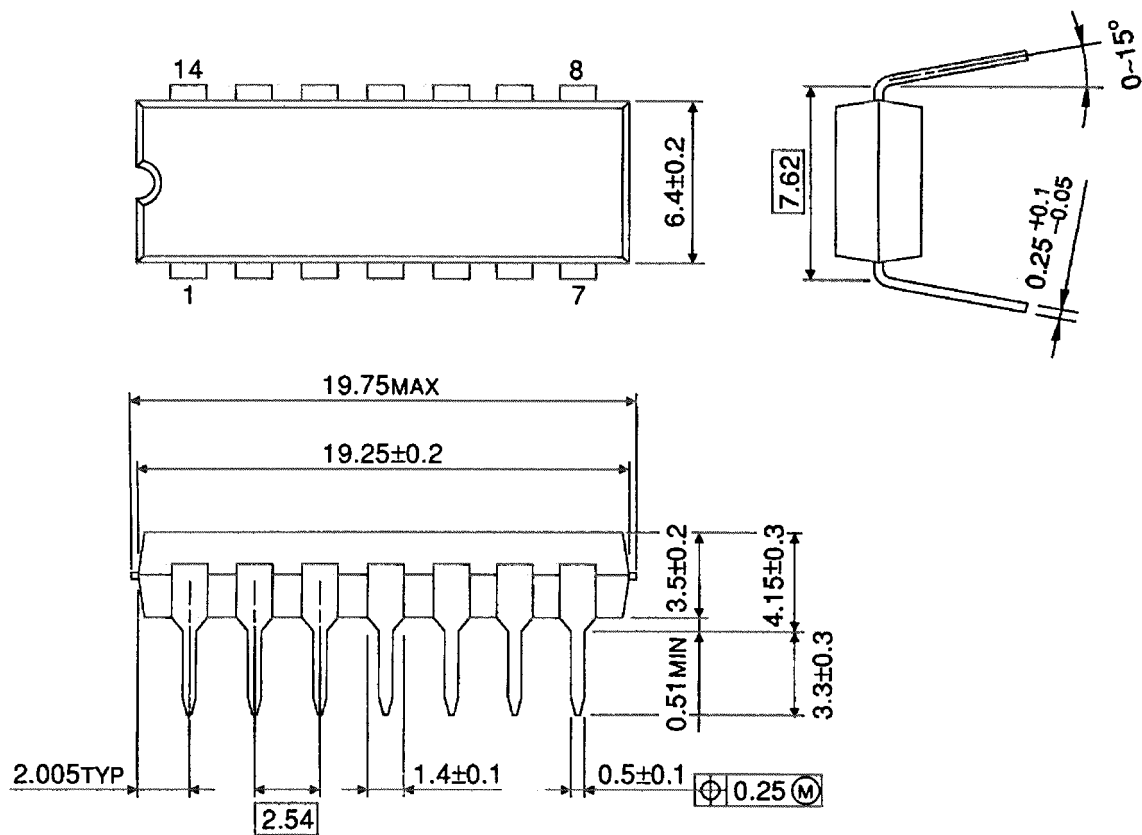
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

DIP14-P-300-2.54

Unit : mm

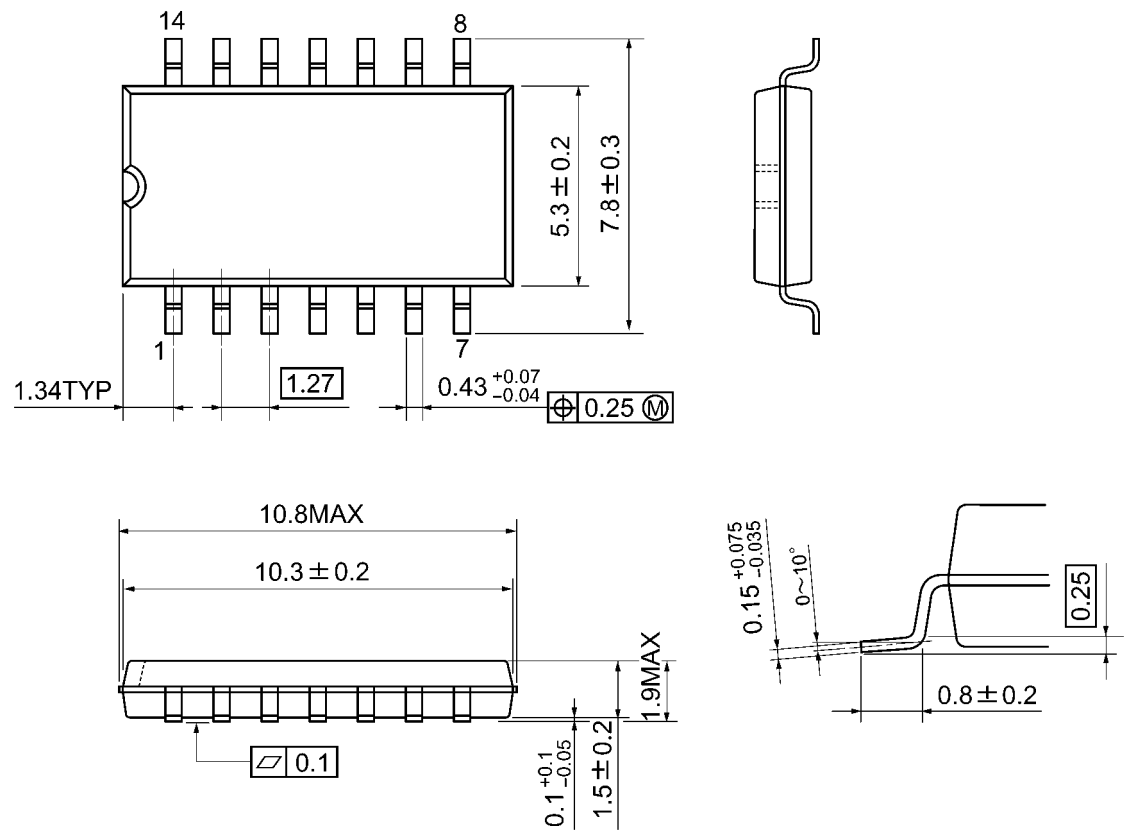


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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