

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74ACT04P, TC74ACT04F, TC74ACT04FT

Hex Inverter

The TC74ACT04 is an advanced high speed CMOS INVERTER fabricated with silicon gate and double-layer metal wiring C²MOS technology.

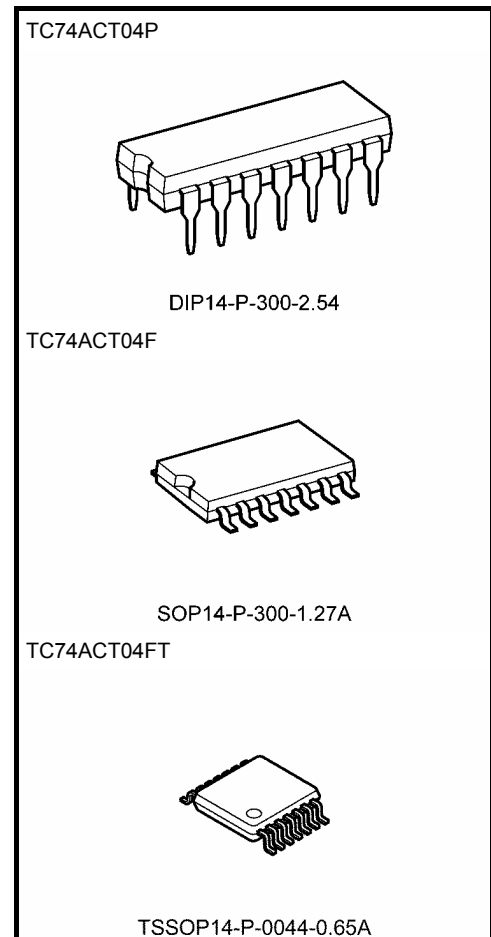
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

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.

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

Features

- High speed: $t_{pd} = 4.6 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs: $V_{IL} = 0.8 \text{ V (max)}$
 $V_{IH} = 2.0 \text{ V (min)}$
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$
Capability of driving 50Ω transmission lines.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74F04

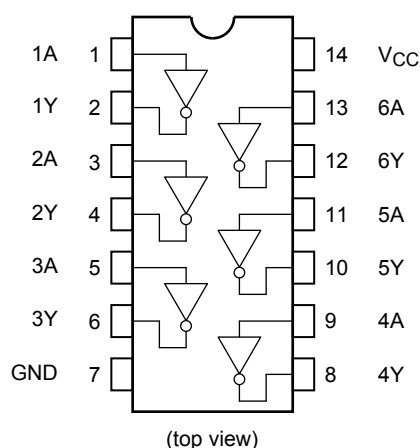


Weight

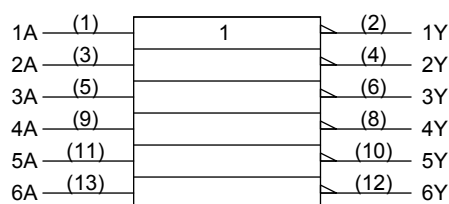
DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)
TSSOP14-P-0044-0.65A	: 0.06 g (typ.)

Start of commercial production
1988-10

Pin Assignment



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 7.0	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}	± 50	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 150	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP/TSSOP)	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 should be applied up to 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	dt/dV	0 to 10	ns/V

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	
					VCC (V)	Min	Typ.	Max	Min		Max
High-level input voltage	VIH	—			4.5 to 5.5	2.0	—	—	2.0	—	V
Low-level input voltage	VIL	—			4.5 to 5.5	—	—	0.8	—	0.8	V
High-level output voltage	VOH	VIN = VIL	I _{OH} = -50 μA	4.5	4.4	4.5	—	4.4	—	V	
			I _{OH} = -24 mA	4.5	3.94	—	—	3.80	—		
			I _{OH} = -75 mA (Note)	5.5	—	—	—	3.85	—		
Low-level output voltage	VOL	VIN = VIH	I _{OL} = 50 μA	4.5	—	0.0	0.1	—	0.1	V	
			I _{OL} = 24 mA	4.5	—	—	0.36	—	0.44		
			I _{OL} = 75 mA (Note)	5.5	—	—	—	—	1.65		
Input leakage current	IIN	VIN = VCC or GND			5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	ICC	VIN = VCC or GND			5.5	—	—	4.0	—	40.0	μA
	IC	Per input: VIN = 3.4 V Other input: VCC or GND			5.5	—	—	1.35	—	1.5	mA

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

AC Characteristics ($C_L = 50 \text{ pF}$, $R_L = 500 \Omega$, input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	t _{pLH} t _{pHL}	—	5.0 ± 0.5	—	5.5	7.9	1.0	9.0	ns
Input capacitance	C _{IN}	—		—	5	10	—	10	pF
Power dissipation capacitance	C _{PD}	(Note)		—	19	—	—	—	pF

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

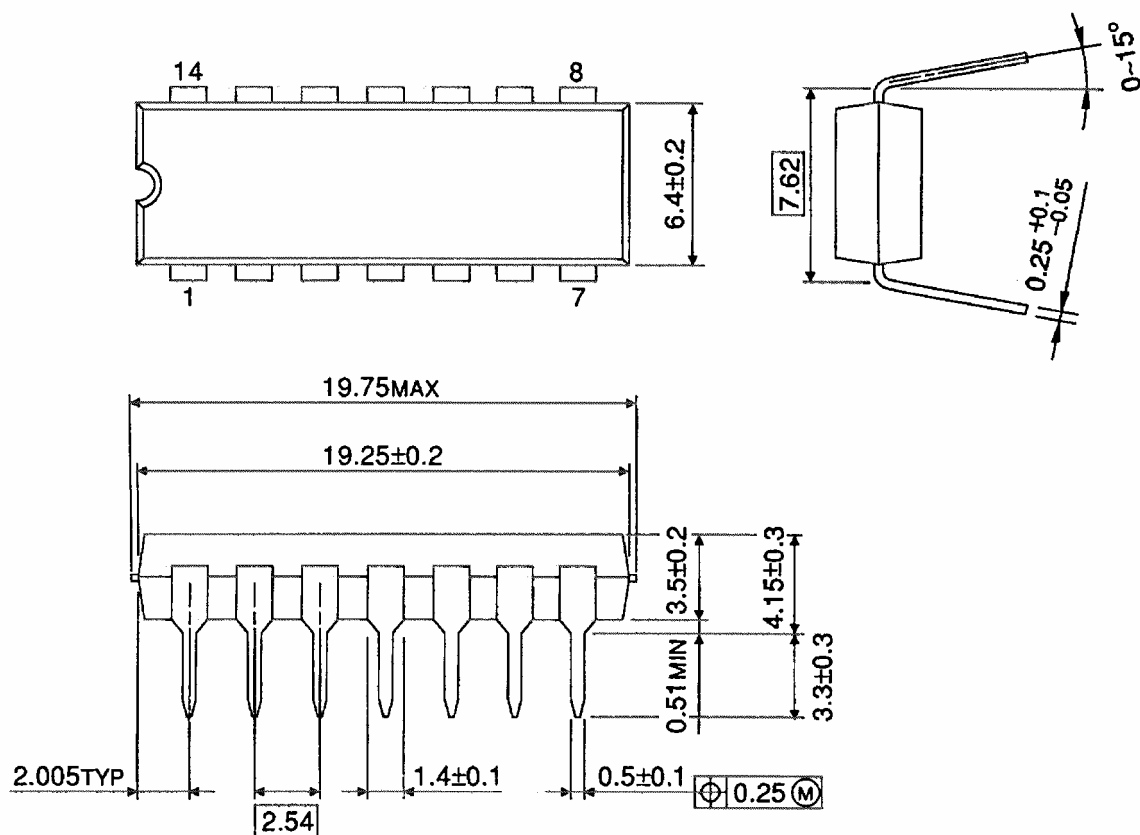
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP14-P-300-2.54

Unit : mm

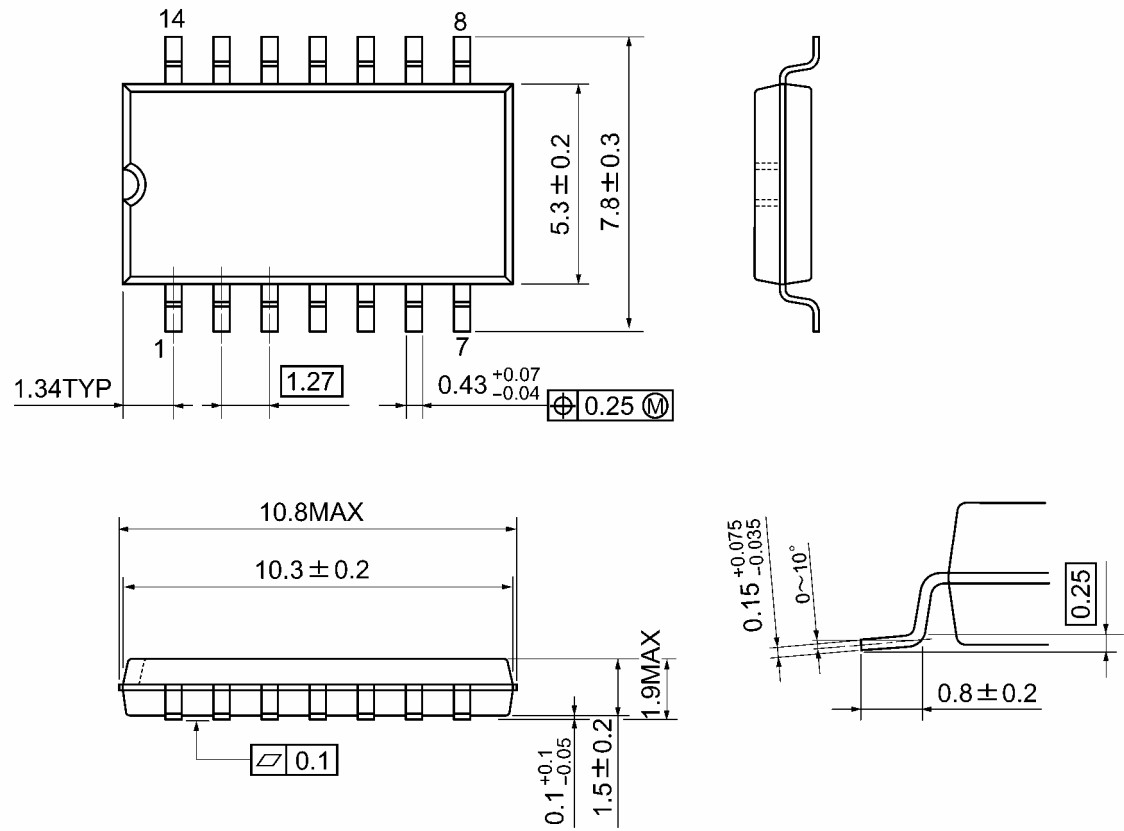


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm

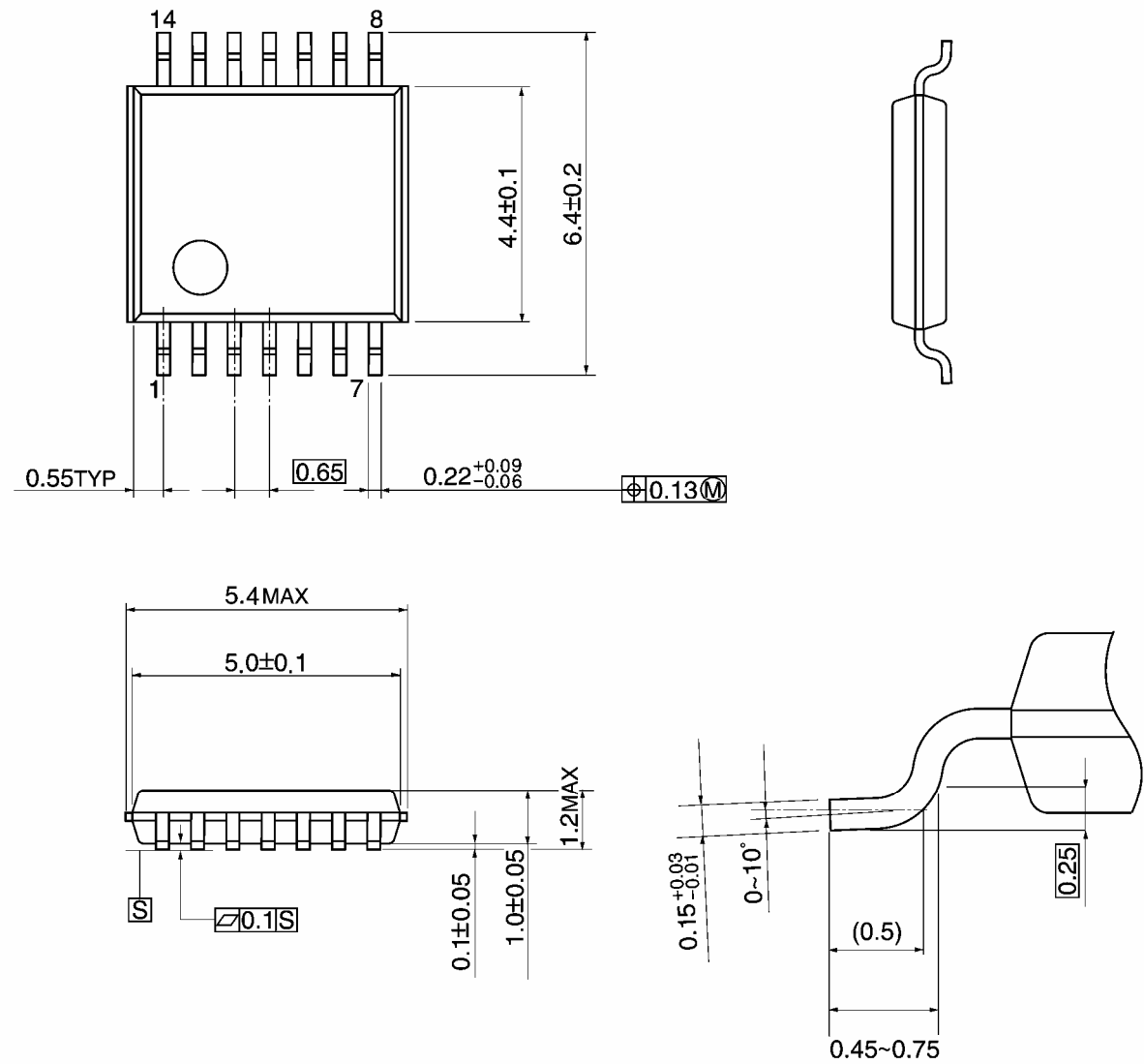


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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