TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HCU04AP,TC74HCU04AF,TC74HCU04AFN

Hex Inverter

The TC74HCU04A is a high speed CMOS INVERTER fabricated with silicon gate C^2MOS technology.

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

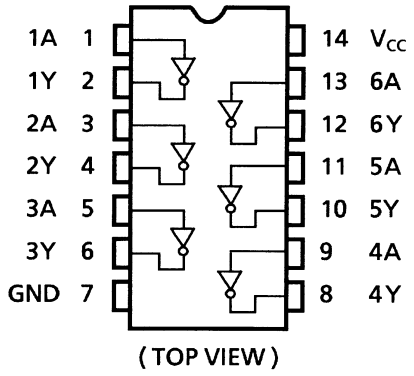
Since the internal circit is composed of a single stage inverter, it can be used in analog applications such as crystal oscllators.

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

Features

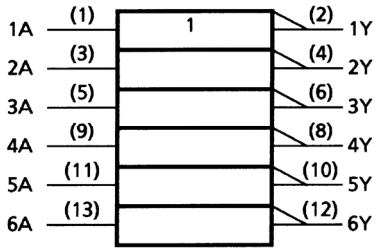
- High speed: t_{pd} = 4 ns (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 1 μA (max) at Ta = 25°C
- High noise immunity: V_{NIH} = V_{NIH} = 10% V_{CC} (min)
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}|$ = I_{OL} = 4 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2 to 6 V
- Pin and function compatible with 74LS04

Pin Assignment



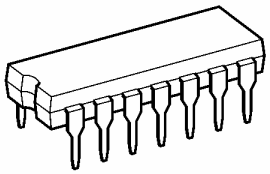
(TOP VIEW)

IEC Logic Symbol



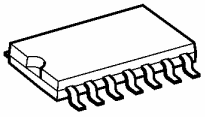
Note: xxxFN (JEDEC SOP) is not available in Japan.

TC74HCU04AP

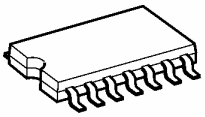


DIP14-P-300-2.54

TC74HCU04AF

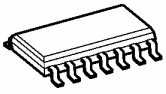


SOP14-P-300-1.27A



SOP14-P-300-1.27

TC74HCU04AFN



SOL14-P-150-1.27

Weight

DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)
SOP14-P-300-1.27	: 0.18 g (typ.)
SOL14-P-150-1.27	: 0.12 g (typ.)

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.

Note 2: 500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°C shall be applied until 300 mW.

Recommended Operating Conditions (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 6	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

Note: The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = –40 to 85°C Min	Ta = –40 to 85°C Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.7	—	—	1.7	—	V
				4.5	3.6	—	—	3.6	—	
				6.0	4.8	—	—	4.8	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.3	—	0.3	V
				4.5	—	—	0.9	—	0.9	
				6.0	—	—	1.2	—	1.2	
High-level output voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = –20 μA	2.0	1.8	2.0	—	1.9	—	V
				4.5	4.0	4.5	—	4.0	—	
				6.0	5.5	5.9	—	5.5	—	
		V_{IN} = GND	I_{OH} = –4 mA	4.5	4.18	4.31	—	4.13	—	
			I_{OH} = –5.2 mA	6.0	5.68	5.80	—	5.63	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH}	I_{OL} = 20 μA	2.0	—	0.0	0.2	—	0.2	V
				4.5	—	0.0	0.5	—	0.5	
				6.0	—	0.1	0.5	—	0.5	
		V_{IN} = V_{CC}	I_{OL} = 4 mA	4.5	—	0.17	0.26	—	0.33	
			I_{OL} = 5.2 mA	6.0	—	0.18	0.26	—	0.33	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	—	1.0	—	10.0	μA

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} t_{THL}	—	—	4	8	ns
Propagation delay time	t_{pLH} t_{pHL}	—	—	4	8	ns

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

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Output transition time	t_{TLH} t_{THL}	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time	t_{pLH} t_{pHL}	—	2.0	—	18	60	—	75	ns
			4.5	—	6	12	—	15	
			6.0	—	5	10	—	13	
Input capacitance	C_{IN}	—		—	9	15	—	15	pF
Power dissipation capacitance	C_{PD} (Note)	—		—	13	—	—	—	pF

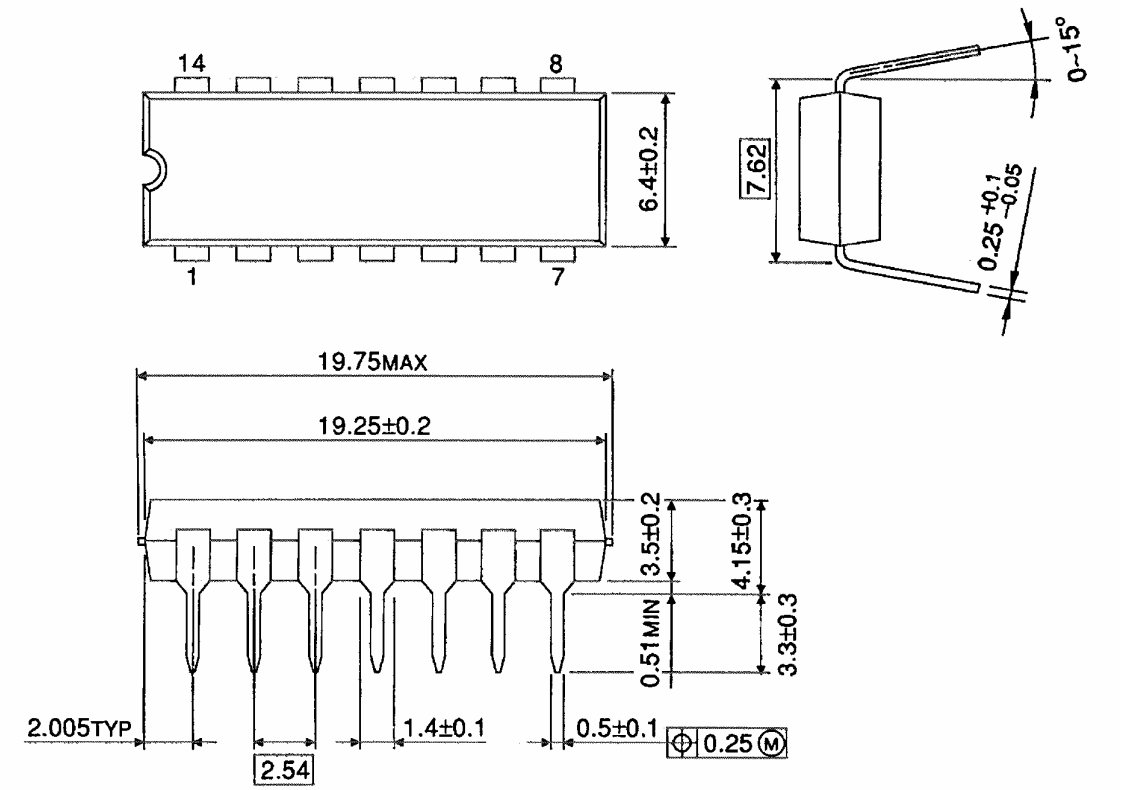
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

Package Dimensions

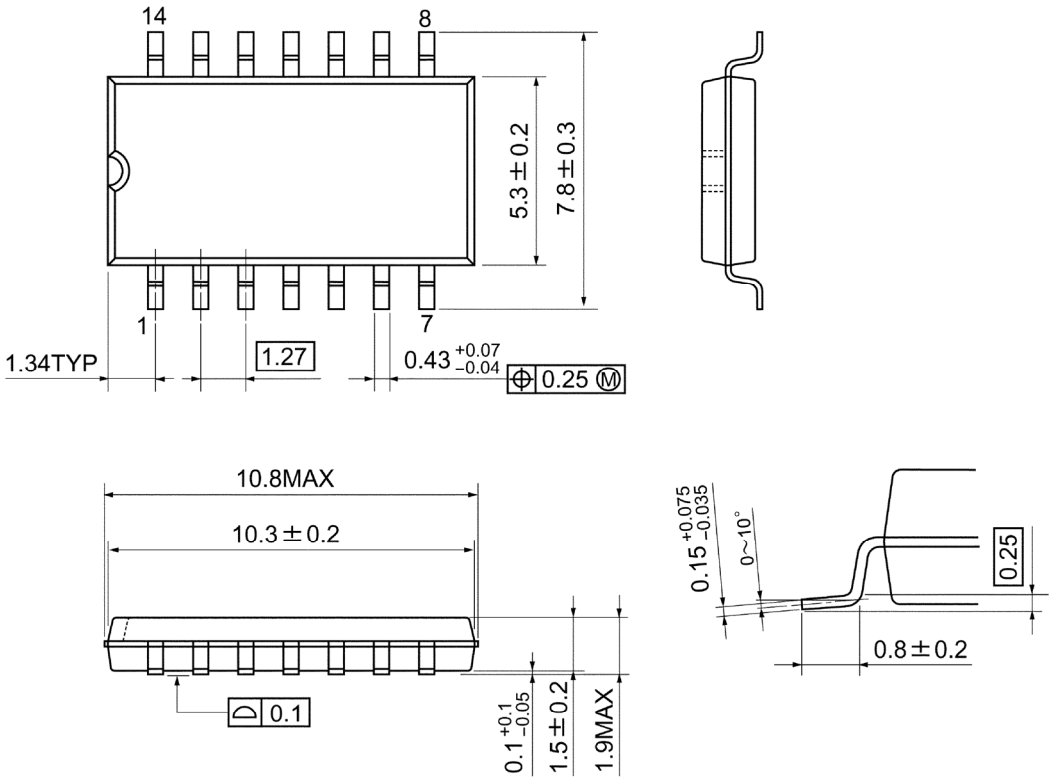
DIP14-P-300-2.54 Unit : mm



Weight: 0.96 g (typ.)

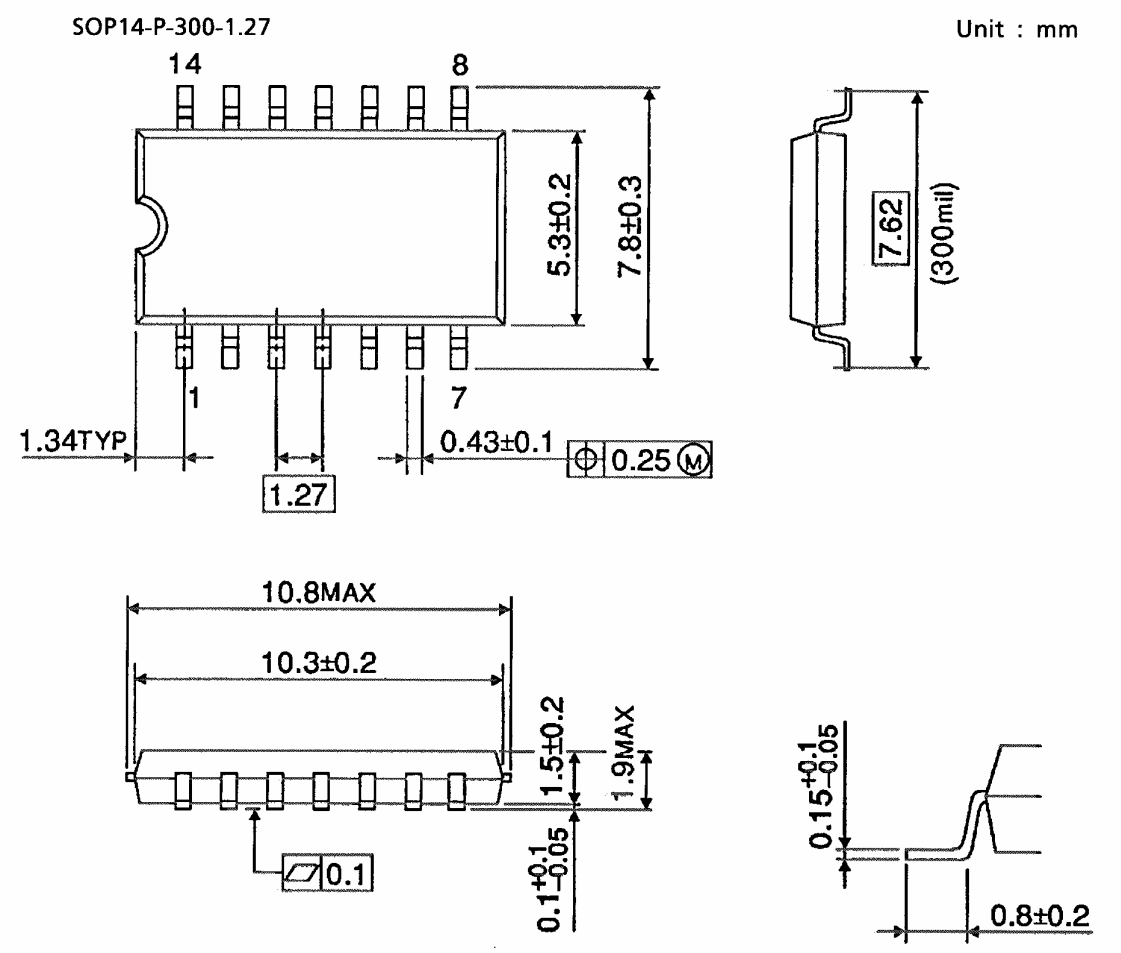
Package Dimensions

SOP14-P-300-1.27A Unit: mm



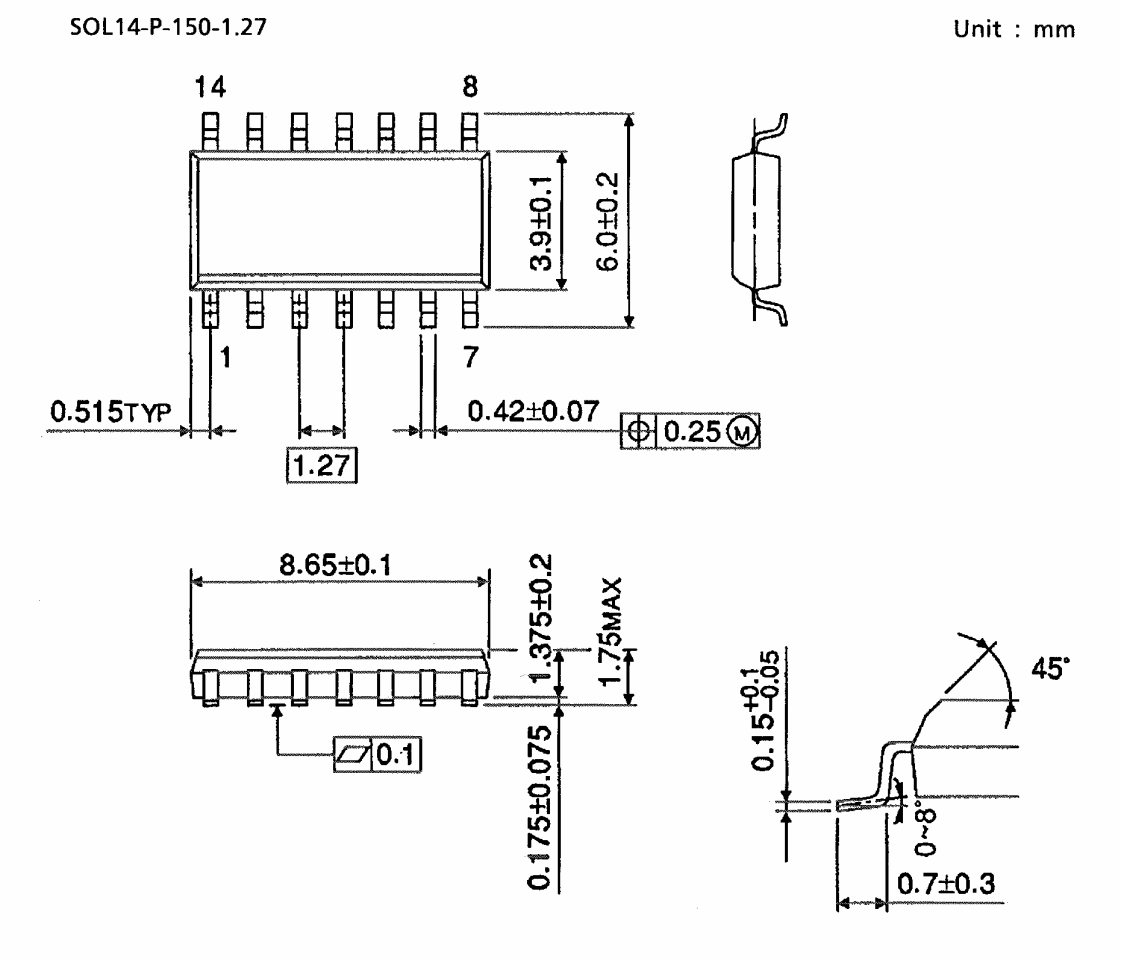
Weight: 0.18 g (typ.)

Package Dimensions



Weight: 0.18 g (typ.)

Package Dimensions (Note)



Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

Note: Lead (Pb)-Free Packages

DIP14-P-300-2.54 SOP14-P-300-1.27A SOL14-P-150-1.27

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