

TC74HCU04AP,TC74HCU04AF,TC74HCU04AFT**Hex Inverter**

The TC74HCU04A is a high speed CMOS INVERTER fabricated with silicon gate C²MOS technology.

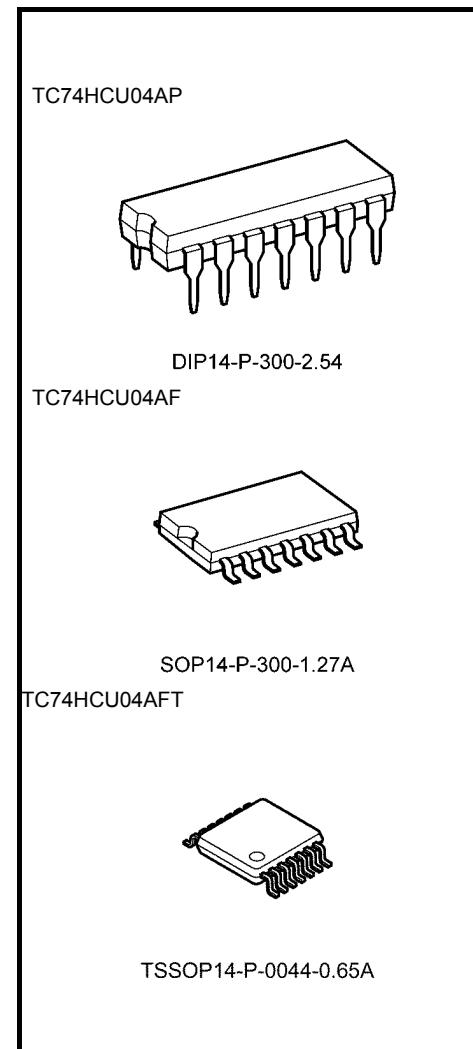
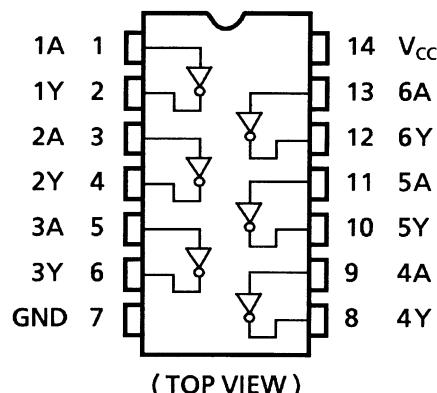
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

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

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

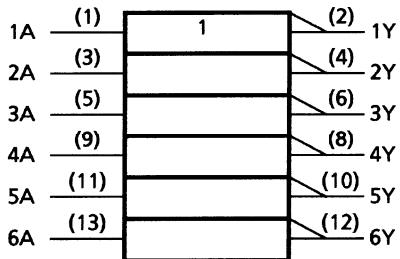
Features

- High speed: $t_{pd} = 4$ ns (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 1 \mu A$ (max) at $T_a = 25^\circ C$
- 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: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2 to 6 V
- 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.)
TSSOP14-P-0044-0.65A : 0.06 g (typ.)

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/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 Ta = -40 to 65°C. From Ta = 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} | 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 operating ranges must be maintained 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 | | | Ta = -40 to 85°C | | Unit | |
|---------------------------|-----------------|--|--|---------------------|-----------|------|------|------------------|------|------|--|
| | | | | | Min | Typ. | Max | Min | Max | | |
| 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 | — | | |
| | | V _{IN} = GND | I _{OH} = -4 mA I _{OH} = -5.2 mA | 6.0 | 5.5 | 5.9 | — | 5.5 | — | | |
| | | | | 4.5 | 4.18 | 4.31 | — | 4.13 | — | | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} | I _{OL} = 20 µA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | V | |
| | | | | 2.0 | — | 0.0 | 0.2 | — | 0.2 | | |
| | | V _{IN} = V _{CC} | I _{OL} = 4 mA I _{OL} = 5.2 mA | 4.5 | — | 0.17 | 0.26 | — | 0.33 | | |
| | | | | 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 ($C_L = 50 \text{ pF}$, input: $t_r = t_f = 6 \text{ ns}$)

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

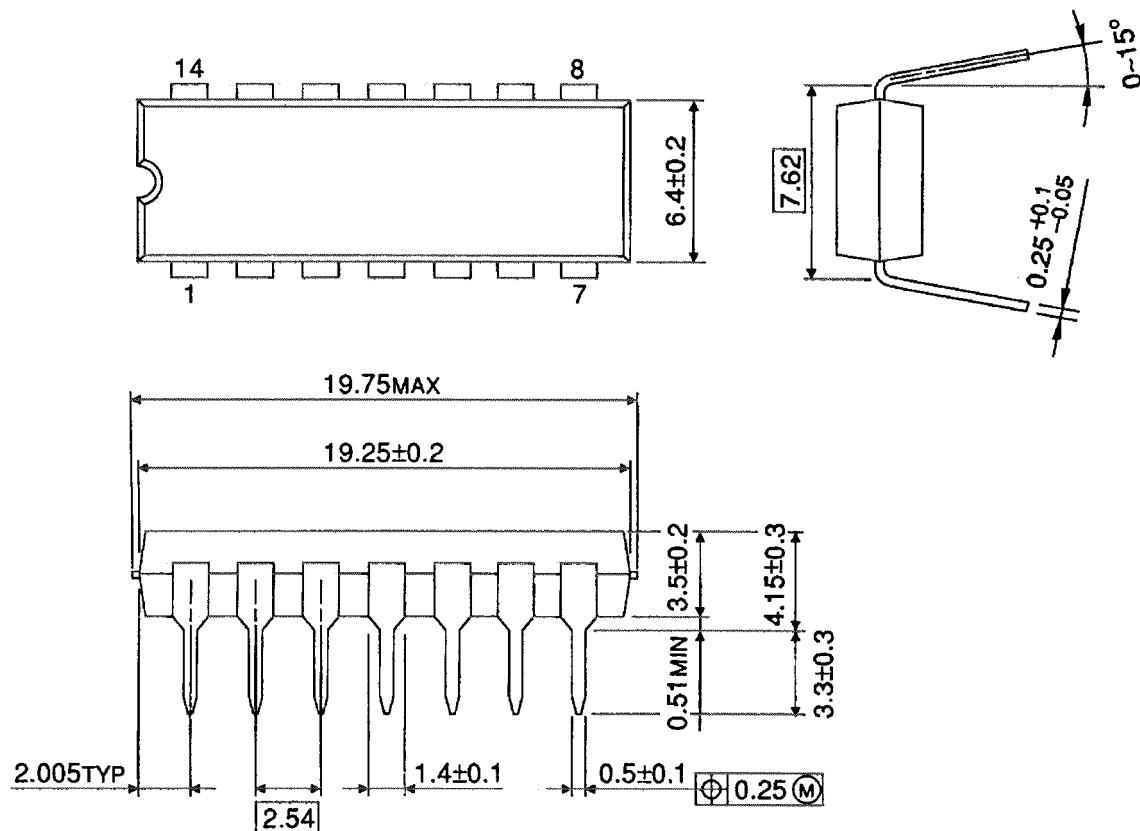
Average operating current can be obtained by the equation:

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

Package Dimensions

DIP14-P-300-2.54

Unit : mm

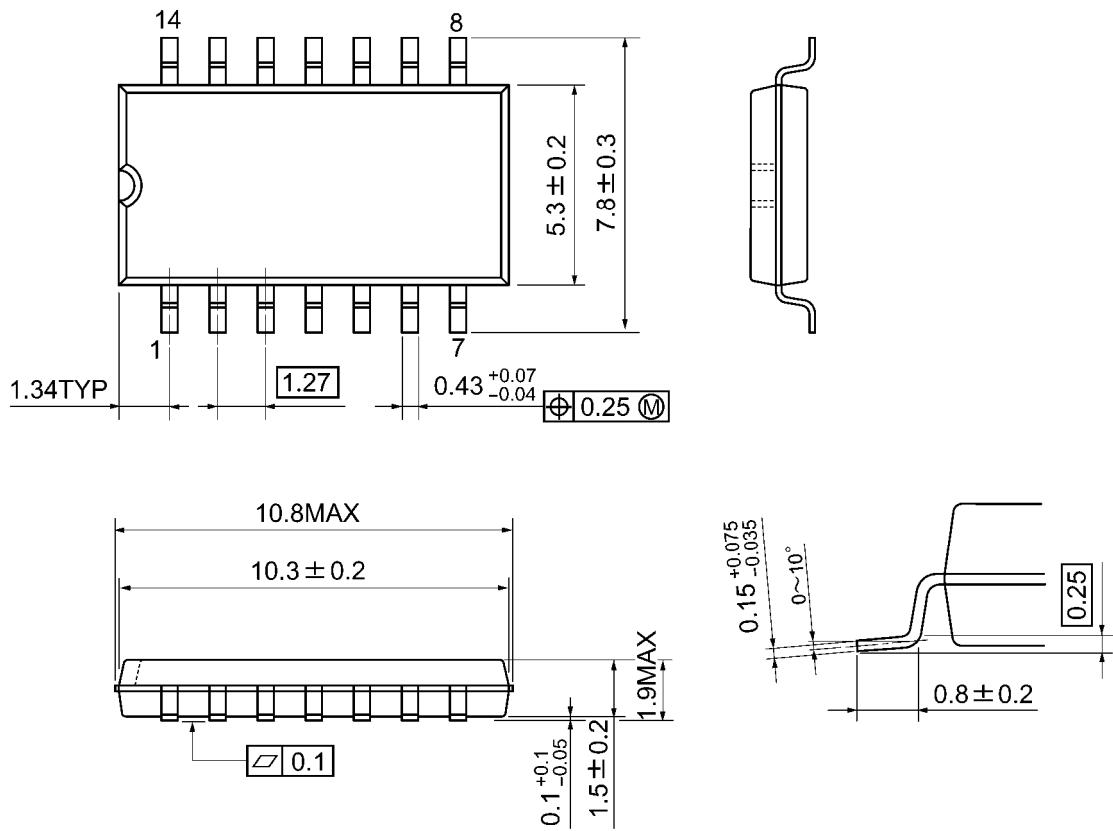


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm

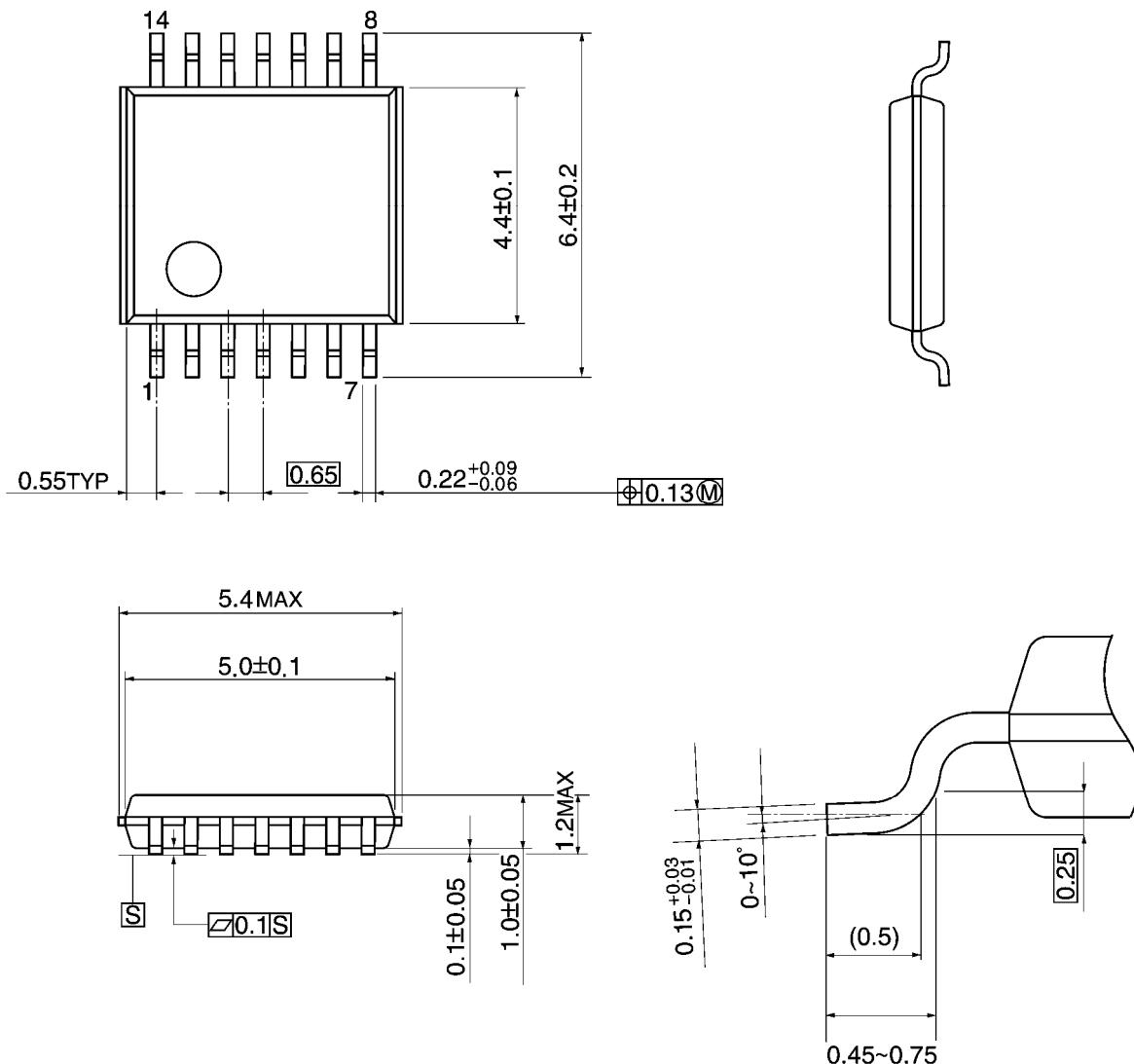


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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