

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74HCT00AP, TC74HCT00AF, TC74HCT00AFN

## Quad 2-Input NAND Gate

The TC74HCT00A is a high speed CMOS 2-INPUT NAND GATE fabricated with silicon gate C<sup>2</sup>MOS 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.

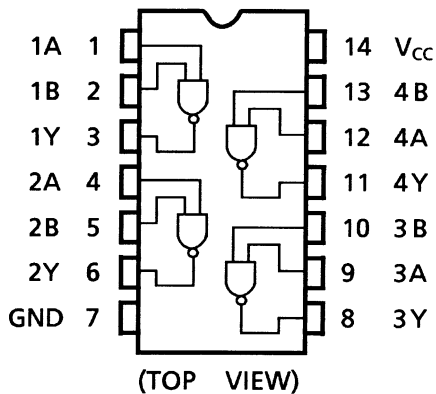
The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

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

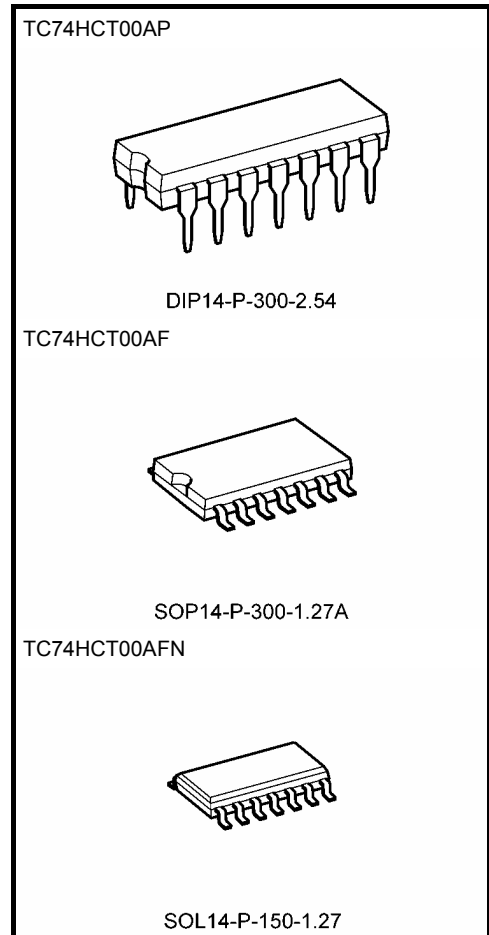
### Features

- High speed:  $t_{pd} = 10 \text{ ns (typ.)}$  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 74LS00

### Pin Assignment



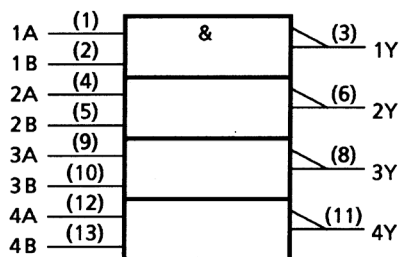
Note: xxxFN (JEDEC SOP) is not available in Japan.



Weight

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

## IEC Logic Symbol



## Truth Table

| A | B | Y |
|---|---|---|
| L | L | H |
| L | H | H |
| H | L | H |
| H | H | L |

## Absolute Maximum Ratings (Note 1)

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

## Operating Ranges (Note)

| Characteristics          | Symbol     | Rating      | Unit |
|--------------------------|------------|-------------|------|
| Supply voltage           | $V_{CC}$   | 4.5~5.5     | V    |
| Input voltage            | $V_{IN}$   | 0~ $V_{CC}$ | V    |
| Output voltage           | $V_{OUT}$  | 0~ $V_{CC}$ | V    |
| Operating temperature    | $T_{opr}$  | -40~85      | °C   |
| Input rise and fall time | $t_r, t_f$ | 0~500       | 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   | V <sub>CC</sub> (V)      | Ta = 25°C |      |      | Ta = -40~85°C |      | Unit |   |
|---------------------------|-----------------|--|--------------------------|-----------|------|------|---------------|------|------|---|
|                           |                 |  |                          | Min       | Typ. | Max  | Min           | Max  |      |   |
| High-level input voltage  | V <sub>IH</sub> | —  | 4.5~5.5                  | 2.0       | —    | —    | 2.0           | —    | V    |   |
| Low-level input voltage   | V <sub>IL</sub> | —  | 4.5~5.5                  | —         | —    | 0.8  | —             | 0.8  | V    |   |
| High-level output voltage | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                               | I <sub>OH</sub> = -20 μA | 4.5       | 4.4  | 4.5  | —             | 4.4  | —    | V |
|                           |                 |  | I <sub>OH</sub> = -4 mA  | 4.5       | 4.18 | 4.31 | —             | 4.13 | —    |   |
| Low-level output voltage  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                               | I <sub>OL</sub> = 20 μA  | 4.5       | —    | 0.0  | 0.1           | —    | 0.1  | V |
|                           |                 |  | I <sub>OL</sub> = 4 mA   | 4.5       | —    | 0.17 | 0.26          | —    | 0.33 |   |
| Input leakage current     | I <sub>IN</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 5.5                      | —         | —    | ±0.1 | —             | ±1.0 | μA   |   |
| Quiescent supply current  | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 5.5                      | —         | —    | 1.0  | —             | 10.0 | μA   |   |
|                           | I <sub>C</sub>  | Per input: V <sub>IN</sub> = 0.5 V or 2.4 V<br>Other input: V <sub>CC</sub> or GND | 5.5                      | —         | —    | 2.0  | —             | 2.9  | mA   |   |

### AC Characteristics (C<sub>L</sub> = 15 pF, V<sub>CC</sub> = 5 V, Ta = 25°C, input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Characteristics        | Symbol           | Test Condition | Min | Typ. | Max | Unit |
|------------------------|------------------|----------------|-----|------|-----|------|
| Output transition time | t <sub>TLH</sub> | —              | —   | 4    | 8   | ns   |
|                        | t <sub>THL</sub> |                |     |      |     |      |
| Propagation delay time | t <sub>pLH</sub> | —              | —   | 10   | 20  | ns   |
|                        | t <sub>pHL</sub> |                |     |      |     |      |

### AC Characteristics (C<sub>L</sub> = 50 pF, input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Characteristics               | Symbol                    | Test Condition | V <sub>CC</sub> (V) | Ta = 25°C |      |     | Ta = -40~85°C |     | Unit |
|-------------------------------|---------------------------|----------------|---------------------|-----------|------|-----|---------------|-----|------|
|                               |                           |                |                     | Min       | Typ. | Max | Min           | Max |      |
| Output transition time        | t <sub>TLH</sub>          | —              | 4.5                 | —         | 8    | 15  | —             | 19  | ns   |
|                               | t <sub>THL</sub>          |                | 5.5                 | —         | 7    | 14  | —             | 18  |      |
| Propagation delay time        | t <sub>pLH</sub>          | —              | 4.5                 | —         | 13   | 19  | —             | 24  | ns   |
|                               | t <sub>pHL</sub>          |                | 5.5                 | —         | 12   | 17  | —             | 21  |      |
| Input capacitance             | C <sub>IN</sub>           | —              | —                   | 5         | 10   | —   | 10            | pF  |      |
| Power dissipation capacitance | C <sub>PD</sub><br>(Note) | —              | —                   | 19        | —    | —   | —             | pF  |      |

Note: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

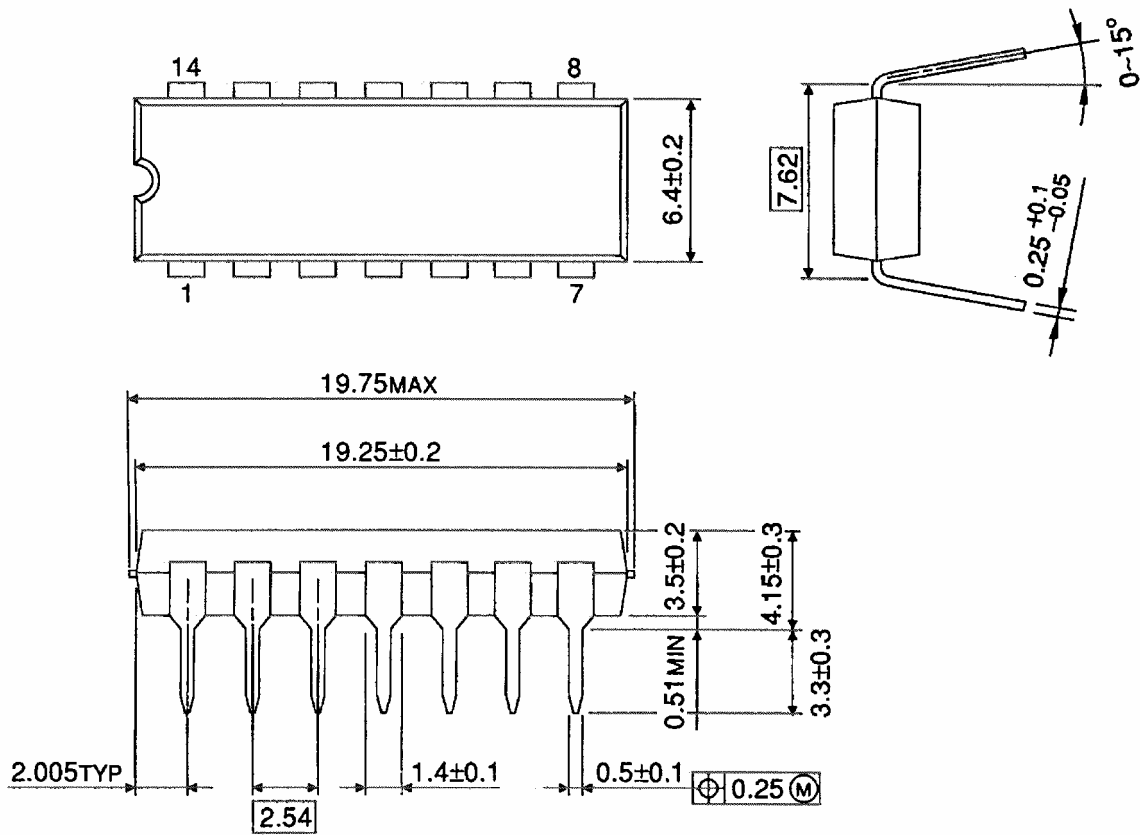
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

## Package Dimensions

DIP14-P-300-2.54

Unit : mm

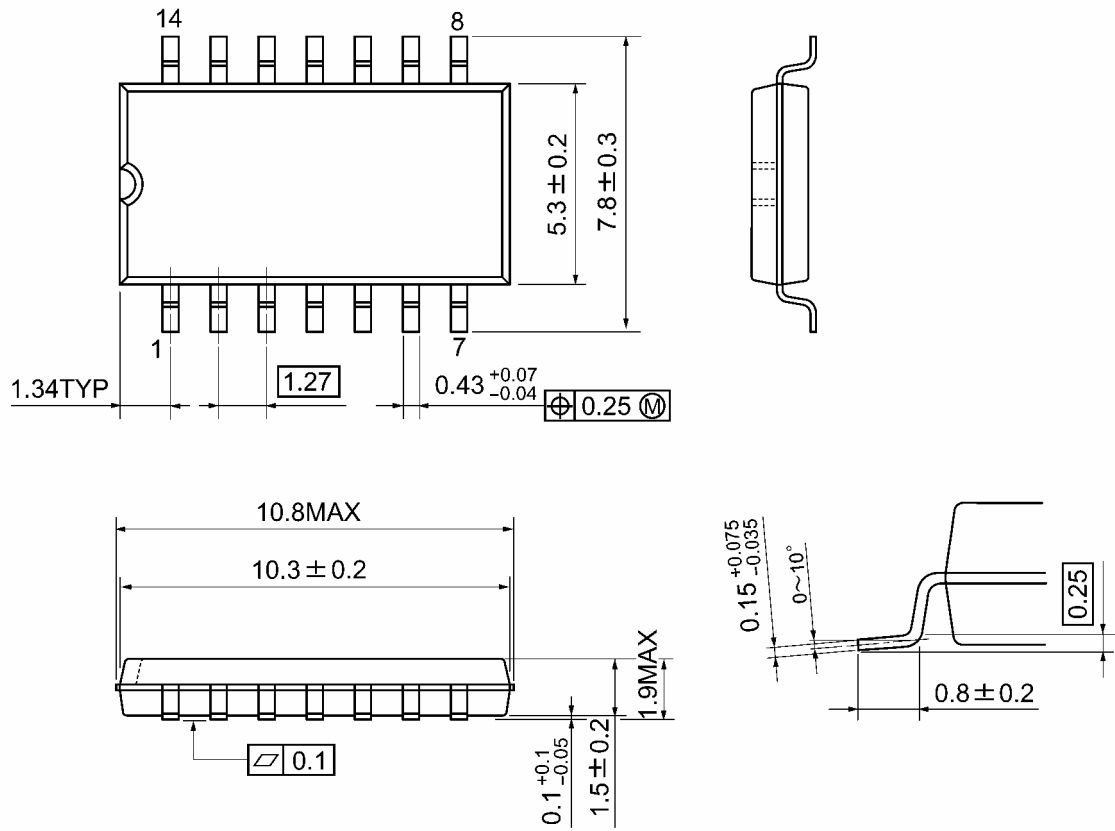


Weight: 0.96 g (typ.)

**Package Dimensions**

SOP14-P-300-1.27A

Unit: mm

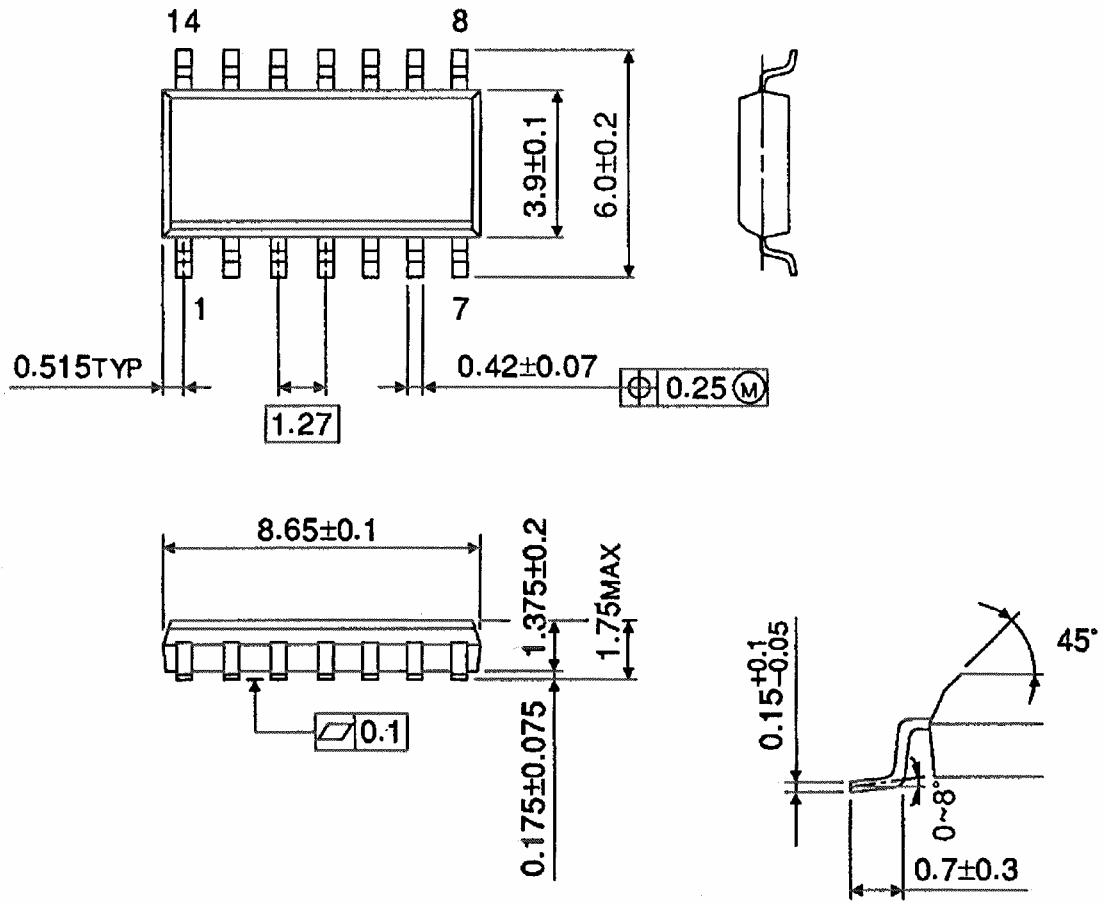


Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL14-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

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20070701-EN GENERAL

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