

## TC74AC00P, TC74AC00F, TC74AC00FT

### Quad 2-Input NAND Gate

The TC74AC00 is an advanced high speed CMOS 2-INPUT NAND GATE fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

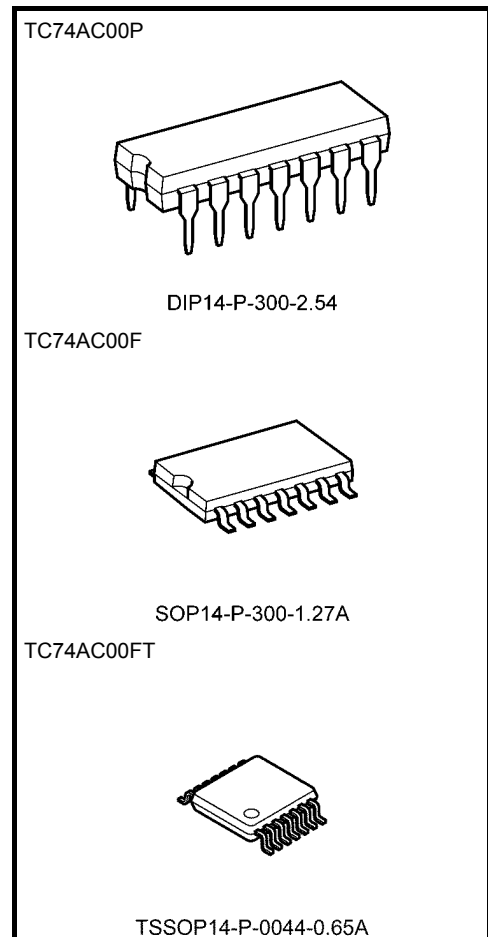
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

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:  $t_{pd} = 3.8 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Symmetrical output impedance:  
 $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$   
 Capability of driving  $50 \Omega$  transmission lines.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} \text{ (opr)} = 2 \text{ V to } 5.5 \text{ V}$
- Pin and function compatible with 74F00

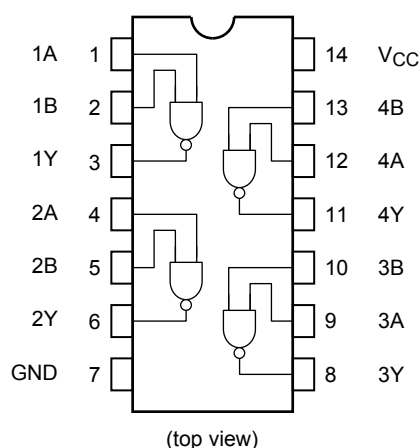


### Weight

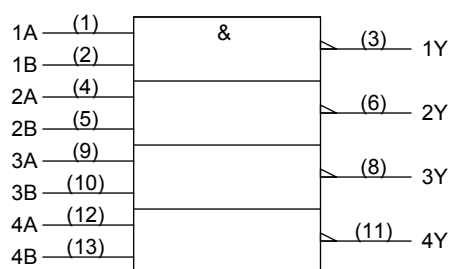
|                      |                 |
|----------------------|-----------------|
| DIP14-P-300-2.54     | : 0.96 g (typ.) |
| SOP14-P-300-1.27A    | : 0.18 g (typ.) |
| TSSOP14-P-0044-0.65A | : 0.06 g (typ.) |

Start of commercial production  
1986-05

## Pin Assignment



## 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 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 | $I_{CC}$  | ±100                               | 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  $T_a = -40^{\circ}\text{C}$  to  $65^{\circ}\text{C}$ . From  $T_a = 65^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  a derating factor of -10 mW/°C should be applied up to 300 mW.

## Operating Ranges (Note)

| Characteristics          | Symbol    | Rating  | Unit |
|--------------------------|-----------|---|------|
| Supply voltage           | $V_{CC}$  | 2.0 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 100 ( $V_{CC} = 3.3 \pm 0.3$ V)<br>0 to 20 ( $V_{CC} = 5 \pm 0.5$ V) | 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   |  | V <sub>CC</sub><br>(V) | Ta = 25°C            |             |                      | Ta =<br>-40 to 85°C  |                      | Unit |
|---------------------------|-----------------|--|--|------------------------|----------------------|-------------|----------------------|----------------------|----------------------|------|
|                           |                 |  |  |                        | Min                  | Typ.        | Max                  | Min                  | Max                  |      |
| High-level input voltage  | V <sub>IH</sub> | —  |  | 2.0<br>3.0<br>5.5      | 1.50<br>2.10<br>3.85 | —<br>—<br>— | —<br>—<br>—          | 1.50<br>2.10<br>3.85 | —<br>—<br>—          | V    |
| Low-level input voltage   | V <sub>IL</sub> | —  |  | 2.0<br>3.0<br>5.5      | —<br>—<br>—          | —<br>—<br>— | 0.50<br>0.90<br>1.65 | —<br>—<br>—          | 0.50<br>0.90<br>1.65 | V    |
| High-level output voltage | V <sub>OH</sub> | V <sub>IN</sub><br>= V <sub>IH</sub> or<br>V <sub>IL</sub> | I <sub>OH</sub> = -50 μA   | 2.0                    | 1.9                  | 2.0         | —                    | 1.9                  | —                    | V    |
|                           |                 |  |  | 3.0                    | 2.9                  | 3.0         | —                    | 2.9                  | —                    |      |
|                           |                 |  |  | 4.5                    | 4.4                  | 4.5         | —                    | 4.4                  | —                    |      |
|                           |                 |  | I <sub>OH</sub> = -4 mA<br>I <sub>OH</sub> = -24 mA<br>I <sub>OH</sub> = -75 mA (Note) | 3.0                    | 2.58                 | —           | —                    | 2.48                 | —                    |      |
|                           |                 |  |  | 4.5                    | 3.94                 | —           | —                    | 3.80                 | —                    |      |
| Low-level output voltage  | V <sub>OL</sub> | V <sub>IN</sub><br>= V <sub>IH</sub>                       | I <sub>OL</sub> = 50 μA  | 2.0                    | —                    | 0.0         | 0.1                  | —                    | 0.1                  | V    |
|                           |                 |  |  | 3.0                    | —                    | 0.0         | 0.1                  | —                    | 0.1                  |      |
|                           |                 |  |  | 4.5                    | —                    | 0.0         | 0.1                  | —                    | 0.1                  |      |
|                           |                 |  | I <sub>OL</sub> = 12 mA<br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 75 mA (Note)   | 3.0                    | —                    | —           | 0.36                 | —                    | 0.44                 |      |
|                           |                 |  |  | 4.5                    | —                    | —           | 0.36                 | —                    | 0.44                 |      |
| 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                    | —                    | —           | 4.0                  | —                    | 40.0                 | μA   |

Note: This spec indicates the capability of driving 50  $\Omega$  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 |
|-------------------------------|------------------|----------------|---------------------|-----|------|------------------|-----|------|
|                               |                  |                | V <sub>CC</sub> (V) | Min | Typ. | Max              | Min | Max  |
| Propagation delay time        | t <sub>pLH</sub> | —              | 3.3 ± 0.3           | —   | 6.6  | 11.2             | 1.0 | 12.9 |
|                               | t <sub>pHL</sub> |                | 5.0 ± 0.5           | —   | 4.9  | 7.0              | 1.0 | 8.0  |
| Input capacitance             | C <sub>IN</sub>  | —              | —                   | —   | 5    | 10               | —   | 10   |
| Power dissipation capacitance | C <sub>PD</sub>  | (Note)         | —                   | —   | 68   | —                | —   | —    |

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:

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

## Package Dimensions

DIP14-P-300-2.54

Unit : mm

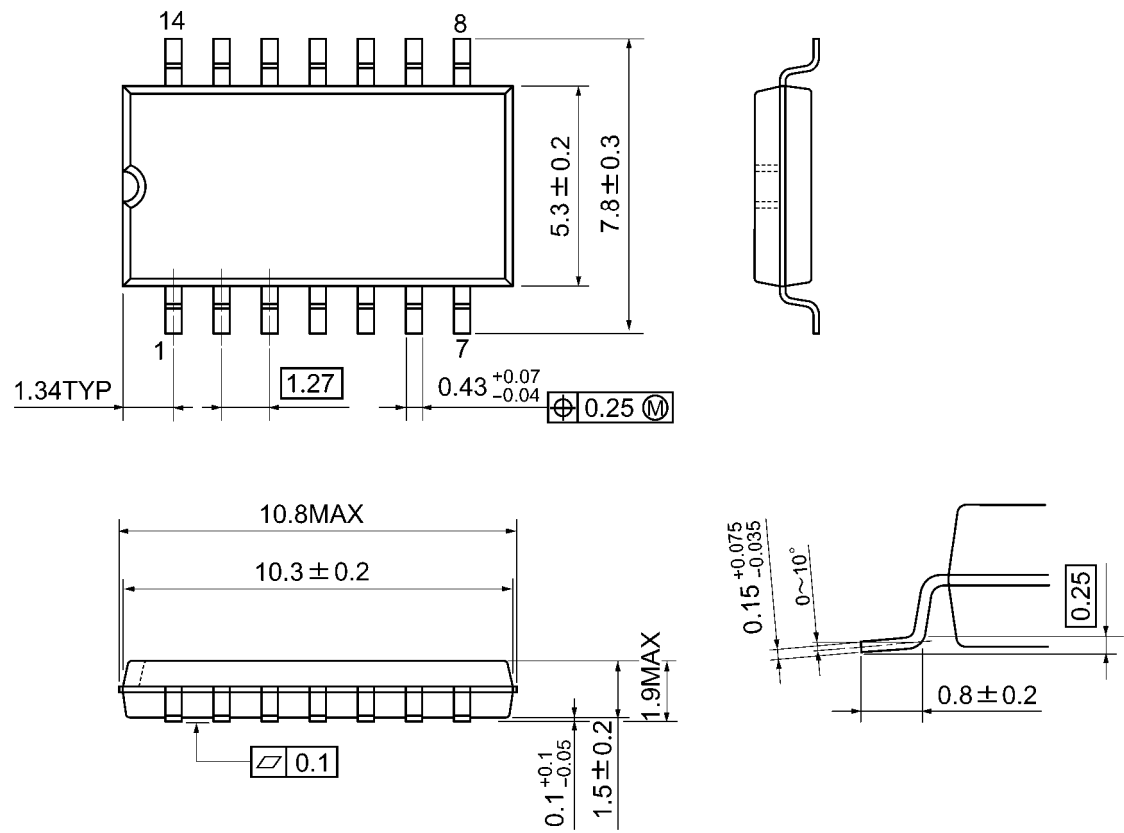


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm

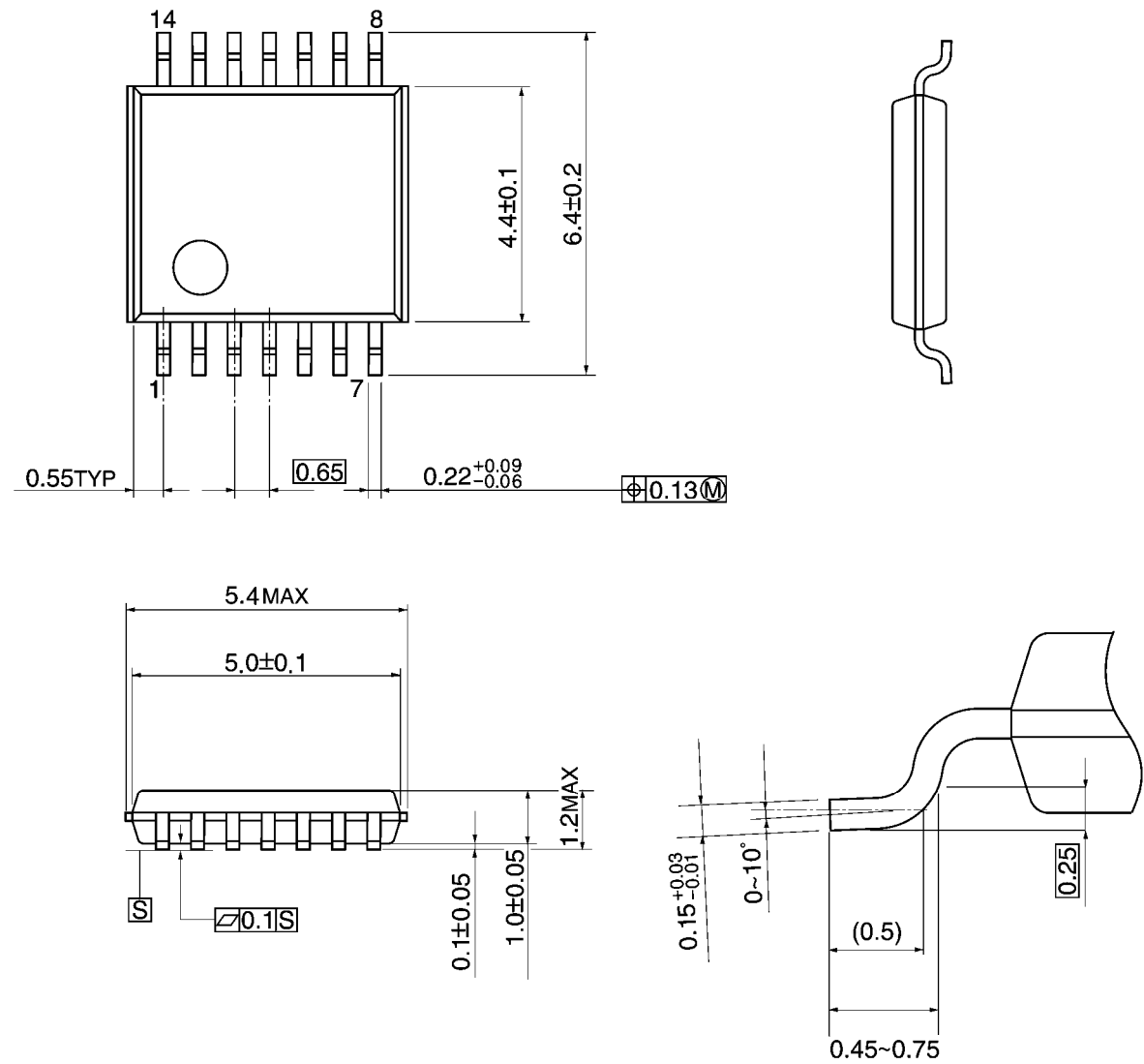


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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