

TC74AC00P

1. Functional Description

- Quad 2-Input NAND Gate

2. General

The TC74AC00P is an advanced high speed CMOS 2-INPUT NAND GATE 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.

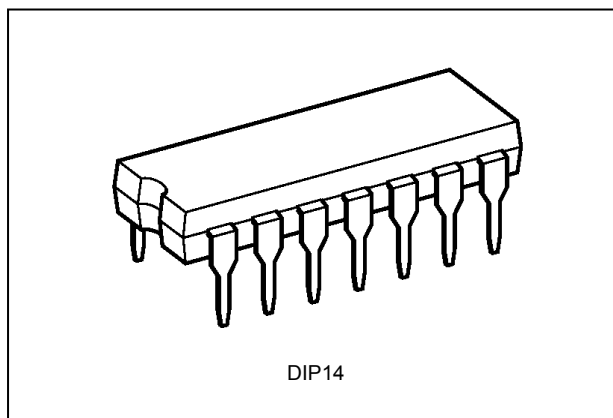
The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

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

3. Features

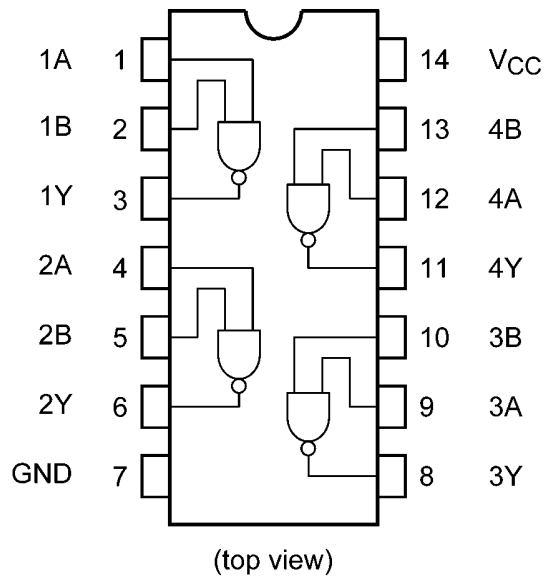
- (1) High speed: $t_{pd} = 3.8 \text{ ns (typ.)}$ $V_{CC} = 5.0 \text{ V}$
- (2) Low power dissipation: $I_{CC} = 4.0 \mu\text{A (max)}$ $T_a = 25 \text{ }^\circ\text{C}$
- (3) High noise immunity: $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (min)}$
- (4) Output current: $|I_{OH}|/I_{OL} = 24 \text{ mA (min)}$ ($V_{CC} = 4.5 \text{ V}$)
- (5) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (6) Wide operating voltage range: $V_{CC(opr)} = 2.0 \text{ V to } 5.5 \text{ V}$
- (7) Pin and function compatible with 74F00.

4. Packaging

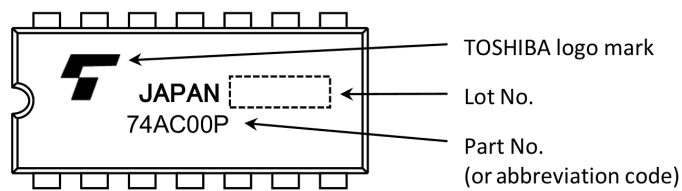


Start of commercial production
1986-05

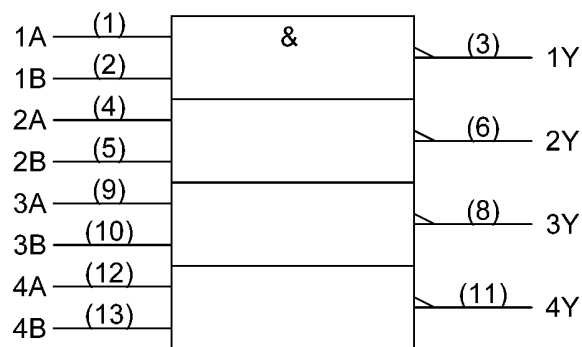
5. Pin Assignment



6. Marking



7. IEC Logic Symbol



8. Truth Table

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

9. Absolute Maximum Ratings (Note)

| Characteristics | Symbol | Note | Rating | Unit |
|--------------------------|-----------|----------|------------------------|------|
| Supply voltage | V_{CC} | | -0.5 to 7.0 | V |
| Input voltage | V_{IN} | | -0.5 to $V_{CC} + 0.5$ | V |
| 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 |
| Output current | I_{OUT} | | ± 50 | mA |
| V_{CC} /ground current | I_{CC} | | ± 100 | mA |
| Power dissipation | P_D | (Note 1) | 500 | mW |
| Storage temperature | T_{stg} | | -65 to 150 | °C |

Note: 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 1: 500 mW in the range of $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of $-10 \text{ mW}/^\circ\text{C}$ shall be applied until 300 mW.

10. 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 times | dt/dv | $V_{CC} = 3.3 \pm 0.3 \text{ V}$ | 0 to 100 | ns/V |
| | | $V_{CC} = 5.0 \pm 0.5 \text{ V}$ | 0 to 20 | |

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.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Min | Typ. | Max | Unit | |
|---------------------------|----------|-------------------------------|-----------------------------------|--------------------------|------|-----------|---------------|---|
| High-level input voltage | V_{IH} | — | 2.0 | 1.50 | — | — | V | |
| | | | 3.0 | 2.10 | — | — | | |
| | | | 5.5 | 3.85 | — | — | | |
| Low-level input voltage | V_{IL} | — | 2.0 | — | — | 0.50 | V | |
| | | | 3.0 | — | — | 0.90 | | |
| | | | 5.5 | — | — | 1.65 | | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -50\text{ }\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | |
| | | | $I_{OH} = -4\text{ mA}$ | 4.5 | 4.4 | 4.5 | — | |
| | | | | $I_{OH} = -24\text{ mA}$ | 3.0 | 2.58 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ | $I_{OL} = 50\text{ }\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | |
| | | | | 4.5 | — | 0.0 | 0.1 | |
| | | | $I_{OL} = 12\text{ mA}$ | 3.0 | — | — | 0.36 | |
| | | | | $I_{OL} = 24\text{ mA}$ | 4.5 | — | — | |
| Input leakage current | I_{IN} | $V_{IN} = V_{CC}$ or GND | 5.5 | — | — | ± 0.1 | μA | |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 5.5 | — | — | 4.0 | μA | |

11.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ to $85\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | Note | V_{CC} (V) | Min | Max | Unit | | |
|---------------------------|----------|-------------------------------|-----------------------------------|--------------|--------------------------|-----------------------------------|---------------|---|------|
| High-level input voltage | V_{IH} | — | | 2.0 | 1.50 | — | V | | |
| | | | | 3.0 | 2.10 | — | | | |
| | | | | 5.5 | 3.85 | — | | | |
| Low-level input voltage | V_{IL} | — | | 2.0 | — | 0.50 | V | | |
| | | | | 3.0 | — | 0.90 | | | |
| | | | | 5.5 | — | 1.65 | | | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -50\text{ }\mu\text{A}$ | | 2.0 | 1.9 | — | V | |
| | | | | | 3.0 | 2.9 | — | | |
| | | | $I_{OH} = -4\text{ mA}$ | | 4.5 | 4.4 | — | | |
| | | | | | $I_{OH} = -24\text{ mA}$ | 3.0 | 2.48 | | — |
| | | | | | | $I_{OH} = -75\text{ mA}$ (Note 1) | 4.5 | | 3.80 |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ | $I_{OL} = 50\text{ }\mu\text{A}$ | | 2.0 | — | 0.1 | V | |
| | | | | | 3.0 | — | 0.1 | | |
| | | | | | 4.5 | — | 0.1 | | |
| | | | $I_{OL} = 12\text{ mA}$ | | 3.0 | — | 0.44 | | |
| | | | | | $I_{OL} = 24\text{ mA}$ | 4.5 | — | | 0.44 |
| | | | | | | $I_{OL} = 75\text{ mA}$ (Note 1) | 5.5 | | — |
| Input leakage current | I_{IN} | $V_{IN} = V_{CC}$ or GND | | 5.5 | — | ± 1.0 | μA | | |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | | 5.5 | — | 40.0 | μA | | |

Note 1: This spec indicates the capability of driving $50\text{ }\Omega$ transmission lines.
One output should be tested within a 10 ms maximum duration.

11.3. AC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

| Characteristics | Symbol | Note | Test Condition | V_{CC} (V) | Min | Typ. | Max | Unit |
|-------------------------------|--------------------|----------|---|--------------|-----|------|------|------|
| Propagation delay time | t_{PLH}, t_{PHL} | | $C_L = 50\text{ pF}$ $R_L = 500\text{ }\Omega$ | 3.3 ± 0.3 | — | 6.6 | 11.2 | ns |
| | | | | 5.0 ± 0.5 | — | 4.9 | 7.0 | |
| Input capacitance | C_{IN} | | — | — | 5 | 10 | pF | |
| Power dissipation capacitance | C_{PD} | (Note 1) | — | — | 68 | — | pF | |

Note 1: 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.

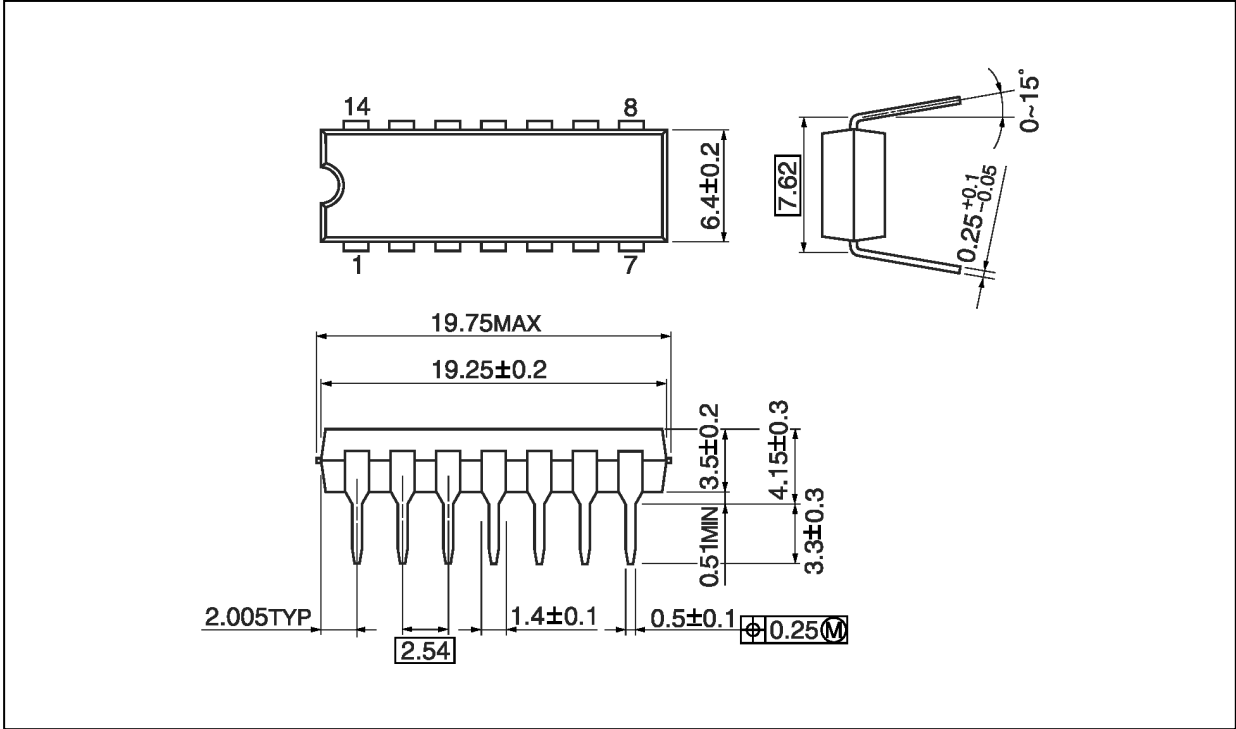
$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4 \text{ (per gate)}$$

11.4. AC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Min | Max | Unit |
|------------------------|--------------------|---|--------------|-----|------|------|
| Propagation delay time | t_{PLH}, t_{PHL} | $C_L = 50\text{ pF}$ $R_L = 500\text{ }\Omega$ | 3.3 ± 0.3 | 1.0 | 12.9 | ns |
| | | | 5.0 ± 0.5 | 1.0 | 8.0 | |
| Input capacitance | C_{IN} | — | — | — | 10 | pF |

Package Dimensions

Unit: mm



Weight: 0.96 g (typ.)

| |
|-----------------|
| Package Name(s) |
| Nickname: DIP14 |

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