

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHCT08AF, TC74VHCT08AFK

Quad 2-Input AND Gate

The TC74VHCT08A is an advanced high speed CMOS 2-INPUT AND GATE fabricated with silicon gate C²MOS technology.

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

The input voltage are compatible with TTL output voltage.

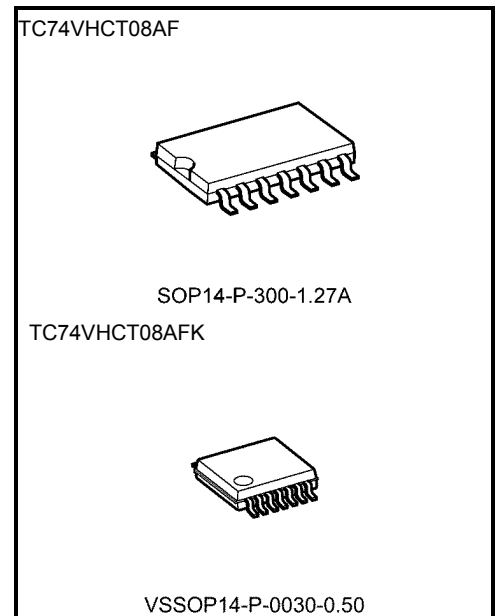
This device may be used as a level converter for interfacing 3.3 V to 5 V system.

Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output ^(Note) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

Note: VCC = 0 V

Features

- High speed: $t_{pd} = 5.0 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 2 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL inputs: $V_{IL} = 0.8 \text{ V (max)}$
 $V_{IH} = 2.0 \text{ V (min)}$
- Power down protection is provided on all inputs and outputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Low noise: $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with the 74 series (74AC/HC/F/ALS/LS etc.) 08 type.

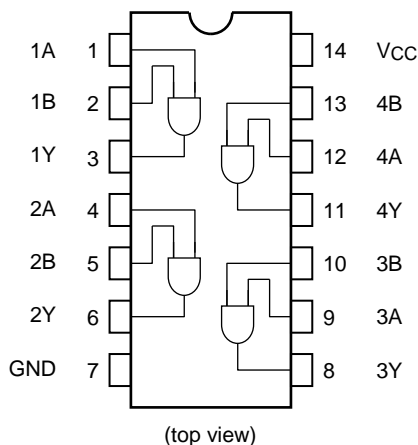


Weight

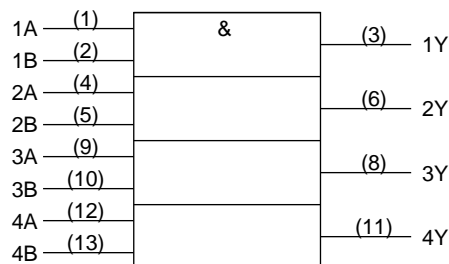
SOP14-P-300-1.27A : 0.18 g (typ.)
VSSOP14-P-0030-0.50 : 0.02 g (typ.)

Start of commercial production
1995-12

Pin Assignment



IEC Logic Symbol



Truth Table

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

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 7.0 | V |
| DC output voltage | V _{OUT} | -0.5 to 7.0 (Note 2) | V |
| | | -0.5 to V _{CC} + 0.5 (Note 3) | |
| Input diode current | I _{IK} | -20 | mA |
| Output diode current | I _{OK} | ±20 (Note 4) | mA |
| DC output current | I _{OUT} | ±25 | mA |
| DC V _{CC} /ground current | I _{CC} | ±50 | mA |
| Power dissipation | P _D | 180 | 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: V_{CC} = 0 V

Note 3: High or low state. I_{OUT} absolute maximum rating must be observed.

Note 4: V_{OUT} < GND, V_{OUT} > V_{CC}

Operating Ranges (Note 1)

| Characteristics | Symbol | Rating | Unit |
|--------------------------|------------------|-------------------------------|------|
| Supply voltage | V _{CC} | 4.5 to 5.5 | V |
| Input voltage | V _{IN} | 0 to 5.5 | V |
| Output voltage | V _{OUT} | 0 to 5.5 (Note 2) | V |
| | | 0 to V _{CC} (Note 3) | |
| Operating temperature | T _{opr} | -40 to 85 | °C |
| Input rise and fall time | dt/dV | 0 to 20 | ns/V |

Note 1: 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.

Note 2: V_{CC} = 0 V

Note 3: High or low state.

Electrical Characteristics

DC Characteristics

| Characteristics | Symbol | Test Condition | T _a = 25°C | | | T _a = -40 to 85°C | | Unit | | |
|------------------------------------|-------------------|---|--------------------------|-----|------|------------------------------|------|------|------|---|
| | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max | |
| High-level input voltage | V _{IH} | — | 4.5 to 5.5 | 2.0 | — | — | 2.0 | — | V | |
| Low-level input voltage | V _{IL} | — | 4.5 to 5.5 | — | — | 0.8 | — | 0.8 | V | |
| High-level output voltage | V _{OH} | V _{IN} = V _{IH} | I _{OH} = -50 μA | 4.5 | 4.40 | 4.50 | — | 4.40 | — | V |
| | | | I _{OH} = -8 mA | 4.5 | 3.94 | — | — | 3.80 | — | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 50 μA | 4.5 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | I _{OL} = 8 mA | 4.5 | — | — | 0.36 | — | 0.44 | |
| Input leakage current | I _{IN} | V _{IN} = 5.5 V or GND | 0 to 5.5 | — | — | ±0.1 | — | ±1.0 | μA | |
| Quiescent supply current | I _{CC} | V _{IN} = V _{CC} or GND | 5.5 | — | — | 2.0 | — | 20.0 | μA | |
| | I _{CCCT} | Per input: V _{IN} = 3.4 V Other input: V _{CC} or GND | 5.5 | — | — | 1.35 | — | 1.50 | mA | |
| Output leakage current (Power-OFF) | I _{OPD} | V _{OUT} = 5.5 V | 0 | — | — | 0.5 | — | 5.0 | μA | |

AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|-------------------------------|-----------|----------------|-----------|-----------|------|-----|------------------|-----|------|----|
| | | VCC (V) | CL (pF) | Min | Typ. | Max | Min | Max | | |
| Propagation delay time | t_{pLH} | — | 5.0 ± 0.5 | 15 | — | 5.0 | 6.9 | 1.0 | 8.0 | ns |
| | t_{pHL} | | | 50 | — | 5.5 | 7.9 | 1.0 | 9.0 | |
| Input capacitance | CIN | — | | — | 4 | 10 | — | 10 | pF | |
| Power dissipation capacitance | CPD | (Note) | | — | 18 | — | — | — | pF | |

Note: CPD 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:

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

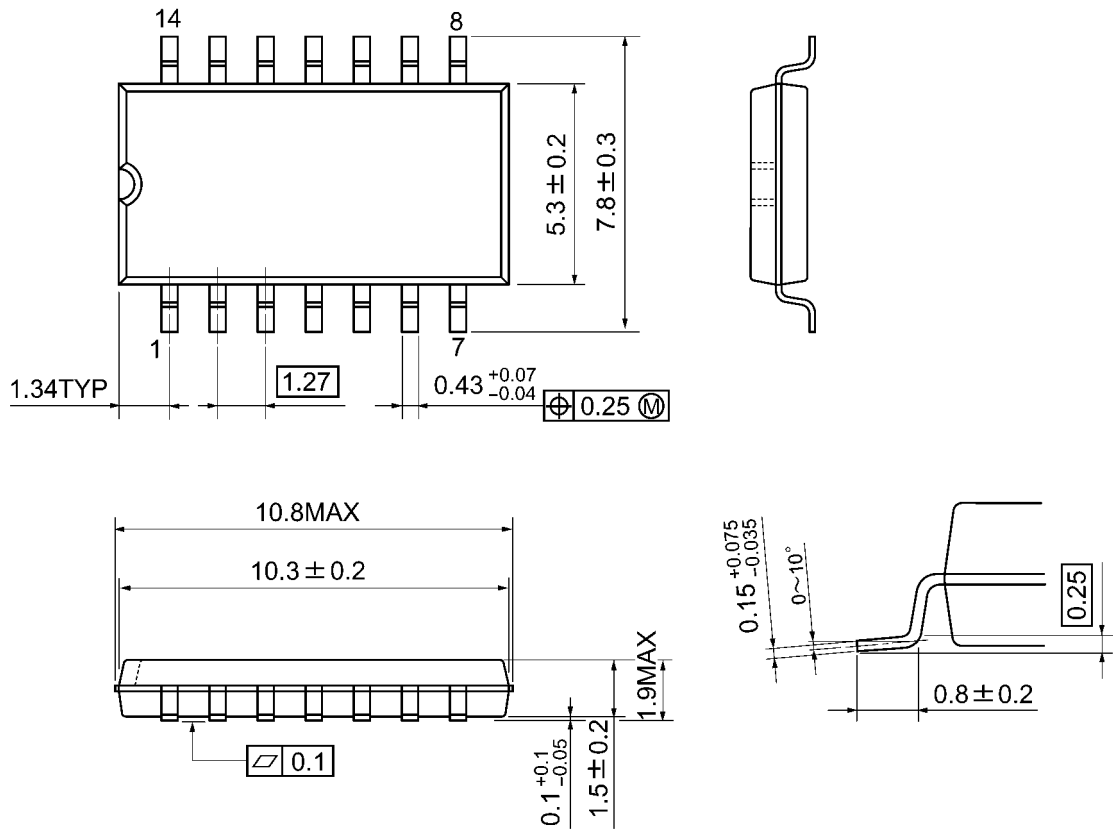
Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | | Unit |
|--|--------|----------------|-----------|------|-------|------|
| | | | VCC (V) | Typ. | Limit | |
| Quiet output maximum dynamic VOL | VOLP | CL = 50 pF | 5.0 | 0.4 | 0.8 | V |
| Quiet output minimum dynamic VOL | VOLV | CL = 50 pF | 5.0 | -0.4 | -0.8 | V |
| Minimum high level dynamic input voltage | VIHD | CL = 50 pF | 5.0 | — | 2.0 | V |
| Maximum low level dynamic input voltage | VILD | CL = 50 pF | 5.0 | — | 0.8 | V |

Package Dimensions

SOP14-P-300-1.27A

Unit: mm

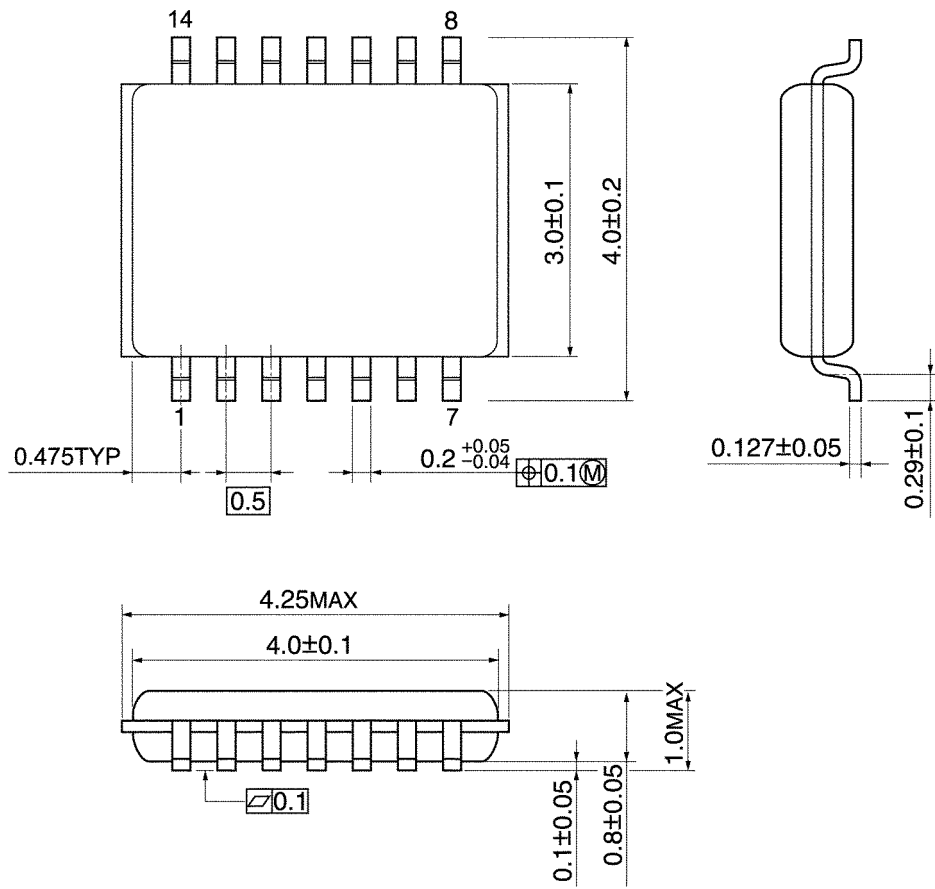


Weight: 0.18 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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