

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHCT9125AFT,TC74VHCT9125AFK TC74VHCT9126AFT,TC74VHCT9126AFK

TC74VHCT9125AFT/FK 5-bit Universal Schmitt Buffer with 3-State Outputs

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The TC74VHCT9125A/9126A are an ultra-high-speed 5-bit Schmitt buffer fabricated using silicon-gate CMOS technology. The TC74VHCT9125A/9126A combines low power consumption of CMOS with Schottky TTL speeds.

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.

Y1 to Y4 outputs can be put in the high-impedance state by placing a logic HIGH on the Enable (\bar{G}) input. The CONT input determines the logical inversion of data. A logic LOW on the CONT input configures the TC74VHCT9125A/9126A as an inverter; a logic HIGH on the CONT input configures the TC74VHCT9125A/9126A as a buffer.

TC74VHCT9125A Y5 output is an inverting type, and the TC74VHCT9126A Y5 output is a non-inverting type.

All the inputs have hysteresis between the positive-going and negative-going thresholds. Thus the TC74VHCT9125A/9126A are capable of squaring up transitions of slowly changing input signals and provides an improved noise immunity.

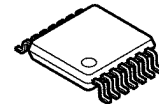
Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (Note) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, etc.

Note: Output in off-state

Features

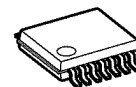
- High speed: $t_{pd} = 6.6 \text{ ns (typ.)}$ ($V_{CC} = 5 \text{ V}$)
- Low supply current: $I_{CC} = 2 \mu\text{A (max)}$ ($T_a = 25^\circ\text{C}$)
- Compatible with TTL inputs
 $V_{IL} = 0.5 \text{ V (max)}$
 $V_{IH} = 2.1 \text{ V (min)}$
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Input terminals are at the opposite side of Output terminals

TC74VHCT9125AFT, TC74VHCT9126AFT



TSSOP14-P-0044-0.65A

TC74VHCT9125AFK, TC74VHCT9126AFK



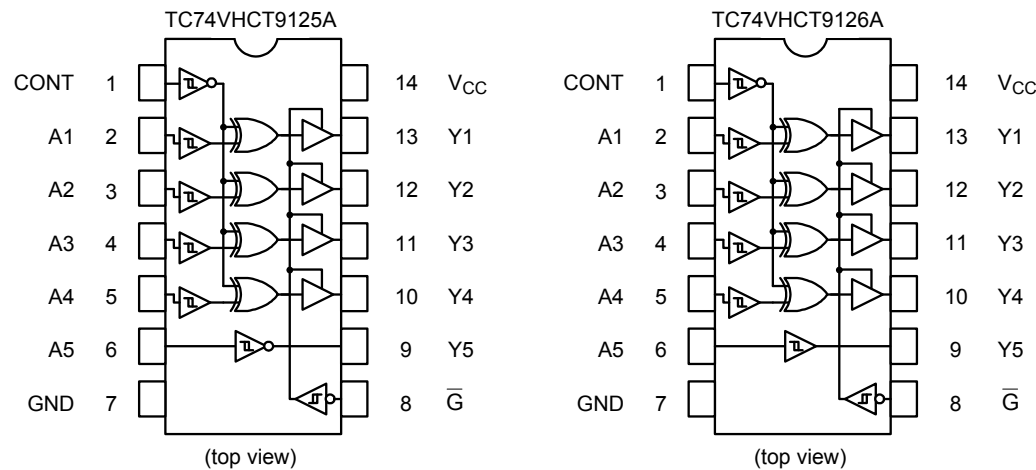
VSSOP14-P-0030-0.50

Weight

TSSOP14-P-0044-0.65A : 0.06 g (typ.)

VSSOP14-P-0030-0.50 : 0.02 g (typ.)

Pin Assignment



Truth Table

| Inputs | | | Outputs |
|-----------|------|------|---------|
| \bar{G} | CONT | A1~4 | Y1~4 |
| H | X | X | Z |
| L | L | L | H |
| L | L | H | L |
| L | H | L | L |
| L | H | H | H |

| Inputs | Outputs | |
|--------|----------|----------|
| A5 | Y5(9125) | Y5(9126) |
| L | H | L |
| H | L | H |

X : Don't care

Z : High impedance

Absolute Maximum Ratings (Note1)

| 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: Output in off-state

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 (Note1)

| 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 |

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: Output in off-state

Note 3: High or low state.

Electrical Characteristics
DC Characteristics

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40~85°C | | Unit | |
|----------------------------------|--------|---|--------------------------|-----------|------|-------|---------------|------|------|-----|
| | | | | VCC (V) | Min | Typ | Max | Min | | Max |
| Positive threshold voltage | VP | — | 4.5 | — | — | 1.90 | — | 1.90 | V | |
| | | | 5.5 | — | — | 2.10 | — | 2.10 | | |
| Negative threshold voltage | VN | — | 4.5 | 0.50 | — | — | 0.50 | — | V | |
| | | | 5.5 | 0.60 | — | — | 0.60 | — | | |
| Hysteresis voltage | VH | — | 4.5 | 0.40 | — | 1.40 | 0.40 | 1.40 | V | |
| | | | 5.5 | 0.40 | — | 1.50 | 0.40 | 1.50 | | |
| High-level output voltage | VOH | VIN = VIH or VIL | I _{OH} = -50 μA | 4.5 | 4.4 | 4.5 | — | 4.4 | — | V |
| | | | I _{OH} = -8 mA | 4.5 | 3.94 | — | — | 3.80 | — | |
| Low-level output voltage | VOL | VIN = VIH or VIL | I _{OL} = 50 μA | 4.5 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | I _{OL} = 8 mA | 4.5 | — | — | 0.36 | — | 0.44 | |
| 3-state output off-state current | IOZ | VIN = VIH or VIL VOUT = VCC or GND | 5.5 | — | — | ±0.25 | — | ±2.5 | μA | |
| Input leakage current | IIN | VIN = 5.5 V or GND | 0 to 5.5 | — | — | ±0.1 | — | ±1.0 | μA | |
| Quiescent supply current | ICC | VIN = VCC or GND | 5.5 | — | — | 2.0 | — | 20.0 | μA | |
| | ICCT | Per input: VIN = 3.4 V Other input: VCC or GND | 5.5 | — | — | 1.35 | — | 1.50 | mA | |
| Output leakage current | IOPD | VOUT = 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 |
|---|--------------------------|---------------------------|---------------------|---------------------|-----------|------|------|------------------|------|------|
| | | | V _{CC} (V) | C _L (pF) | Min | Typ. | Max | Min | Max | |
| Propagation delay time (A1 to 4 - Y1 to 4) | t_{pLH} | — | 5.0 ± 0.5 | 15 | — | 6.6 | 8.5 | 1.0 | 10.0 | ns |
| | t_{pHL} | | | 50 | — | 8.1 | 11.5 | 1.0 | 13.0 | |
| Propagation delay time (CONT-Y1 to 4) | t_{pLH} | — | 5.0 ± 0.5 | 15 | — | 8.0 | 10.5 | 1.0 | 12.0 | ns |
| | t_{pHL} | | | 50 | — | 9.9 | 14.5 | 1.0 | 17.0 | |
| Propagation delay time (A5 – Y5) | t_{pLH} | — | 5.0 ± 0.5 | 15 | — | 6.0 | 8.0 | 1.0 | 9.5 | ns |
| | t_{pHL} | | | 50 | — | 7.9 | 10.5 | 1.0 | 12.0 | |
| 3-state output enable time | t_{pZL} | $R_L = 1 \text{ k}\Omega$ | 5.0 ± 0.5 | 15 | — | 6.4 | 8.5 | 1.0 | 10.0 | ns |
| | t_{pZH} | | | 50 | — | 8.4 | 12.5 | 1.0 | 14.5 | |
| 3-state output disable time | t_{pLZ} t_{pHZ} | $R_L = 1 \text{ k}\Omega$ | 5.0 ± 0.5 | 50 | — | 6.7 | 11.5 | 1.0 | 13.0 | ns |
| Output to output skew | t_{osLH} t_{osHL} | (Note 1) | 5.0 ± 0.5 | 50 | — | — | 1.0 | — | 1.0 | ns |
| Input capacitance | C _{IN} | — | — | — | — | 4 | 10 | — | 10 | pF |
| Output capacitance | C _{OUT} | — | — | — | — | 9 | — | — | — | pF |
| Power dissipation capacitance (Note 2) | CPD | $f_{IN} = 1 \text{ MHz}$ | — | — | — | 14 | — | — | — | pF |

Note 1: Parameter guaranteed by design.

$$t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|$$

Note 2: 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:

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 5 \text{ (per bit)}$$

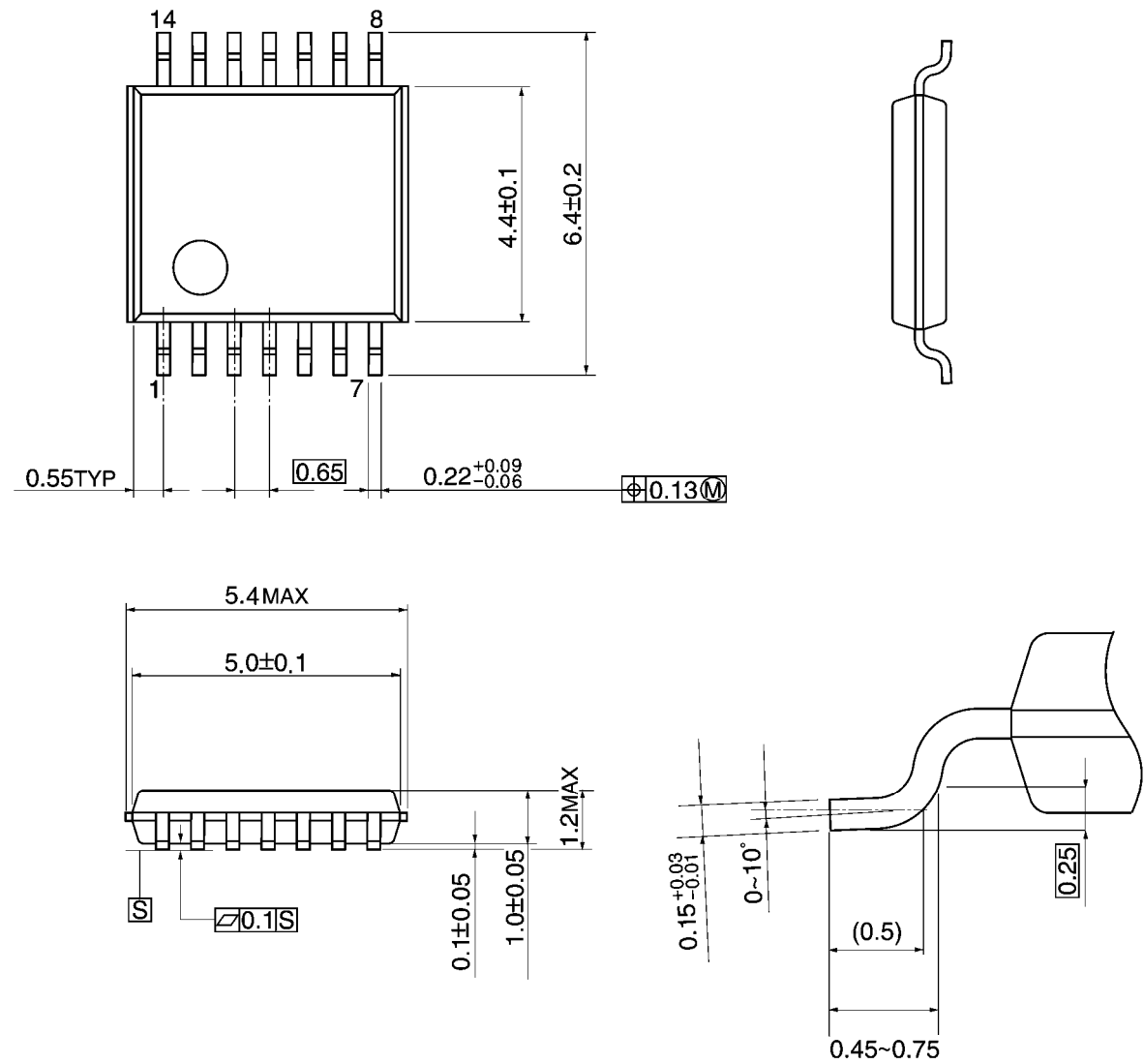
Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | Unit |
|--|------------------|------------------------|---------------------|------------|------|
| | | | V _{CC} (V) | Typ. Limit | |
| Quiet output maximum dynamic V _{OL} | V _{OLP} | C _L = 50 pF | 5.0 | 0.6 0.8 | V |
| Quiet output minimum dynamic V _{OL} | V _{OLV} | C _L = 50 pF | 5.0 | -0.2 -0.8 | V |
| Minimum high level dynamic input voltage | V _{IHD} | C _L = 50 pF | 5.0 | — 2.1 | V |
| Maximum low level dynamic input voltage | V _{ILD} | C _L = 50 pF | 5.0 | — 0.5 | V |

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm

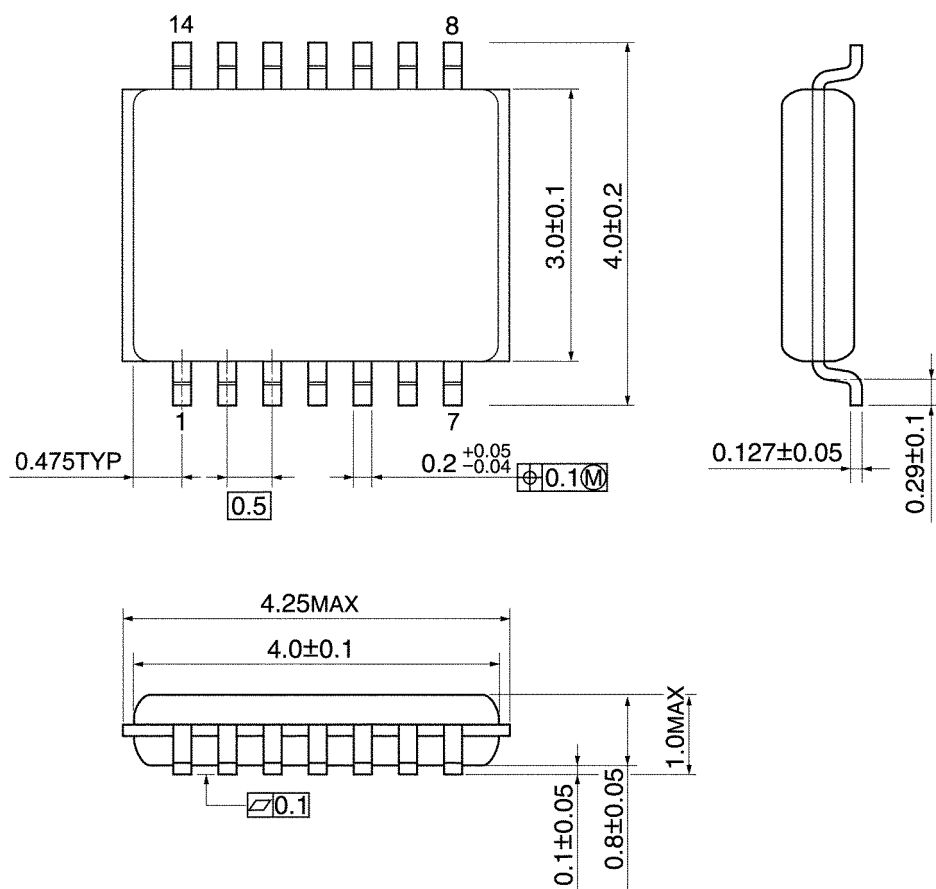


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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