

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC125F, TC74VHC125FT, TC74VHC125FK TC74VHC126F, TC74VHC126FT, TC74VHC126FK

TC74VHC125F/FT/FK Quad Bus Buffer
TC74VHC126F/FT/FK Quad Bus Buffer

The TC74VHC125/126 are high speed CMOS QUAD BUS BUFFERS fabricated with silicon gate C²MOS technology.

They achieve the high speed operation similar to equivalent Bipolar Shottky TTL while maintaining the CMOS low power dissipation.

The TC74VHC125 requires the 3-state control input \bar{G} to be set high to place the output into the high impedance state, whereas the TC74VHC126 requires the control input G to be set low to place the output into high impedance.

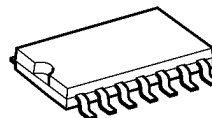
An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up.

This circuit prevents device destruction due to mismatched supply and input voltages.

Features

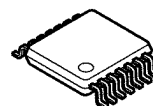
- High speed: $t_{pd} = 3.8 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC(opr)} = 2 \text{ to } 5.5 \text{ V}$
- Low noise: $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with 74ALS125/126

TC74VHC125F, TC74VHC126F



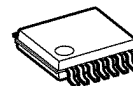
SOP14-P-300-1.27A

TC74VHC125FT, TC74VHC126FT



TSSOP14-P-0044-0.65A

TC74VHC125FK, TC74VHC126FK



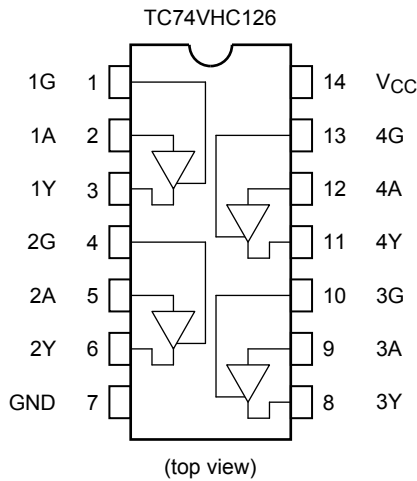
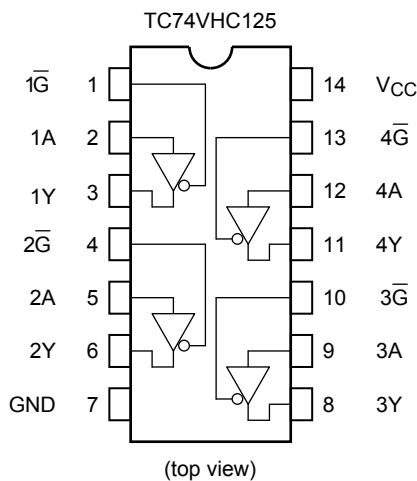
VSSOP14-P-0030-0.50

Weight

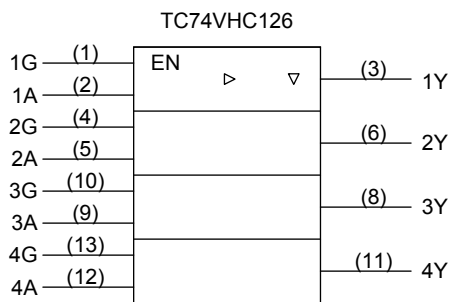
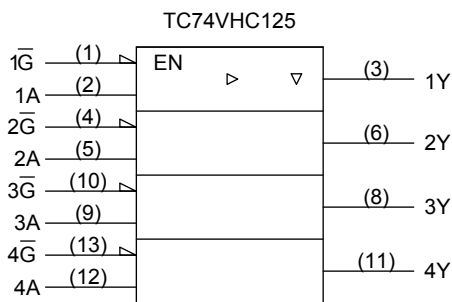
| | |
|----------------------|-----------------|
| SOP14-P-300-1.27A | : 0.18 g (typ.) |
| TSSOP14-P-0044-0.65A | : 0.06 g (typ.) |
| VSSOP14-P-0030-0.50 | : 0.02 g (typ.) |

Start of commercial production
1992-05

Pin Assignment



IEC Logic Symbol



Truth Table

TC74VHC125

| Inputs | | Output |
|----------------|---|--------|
| \overline{G} | A | Y |
| H | X | Z |
| L | L | L |
| L | H | H |

X: Don't care

Z: High impedance

TC74VHC126

| Inputs | | Output |
|--------|---|--------|
| G | A | Y |
| L | X | Z |
| H | L | L |
| H | H | H |

X: Don't care

Z: High impedance

Absolute Maximum Ratings (Note)

| 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 $V_{CC} + 0.5$ | V |
| Input diode current | I_{IK} | -20 | mA |
| Output diode current | I_{OK} | ± 20 | 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: 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.).

Operating Ranges (Note)

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------|---|------|
| Supply voltage | V_{CC} | 2.0 to 5.5 | V |
| Input voltage | V_{IN} | 0 to 5.5 | 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) 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 | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit | |
|----------------------------------|-----------------|---|--------------------------|---------------------|-------------------------------|--------|-------------------------------|-------------------------------|-------------------------------|-----|
| | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| High-level input voltage | V _{IH} | — | | 2.0 3.0 to 5.5 | 1.50 V _{CC} × 0.7 | — — | — — | 1.50 V _{CC} × 0.7 | — — | V |
| Low-level input voltage | V _{IL} | — | | 2.0 3.0 to 5.5 | — — | — — | 0.50 V _{CC} × 0.3 | — — | 0.50 V _{CC} × 0.3 | V |
| High-level output voltage | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OH} = −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 _{OH} = −4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| 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 | 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 _{OL} = 4 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| I _{OL} = 8 mA | 4.5 | — | | — | 0.36 | — | 0.44 | | | |
| 3-state output off-state current | I _{OZ} | V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND | | 5.5 | — | — | ±0.25 | — | ±2.50 | μA |
| 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 | — | — | 4.0 | — | 40.0 | 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 | t_{pLH} t_{pHL} | — | 3.3 ± 0.3 | 15 | — | 5.6 | 8.0 | 1.0 | 9.5 | ns |
| | | | | 50 | — | 8.1 | 11.5 | 1.0 | 13.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 3.8 | 5.5 | 1.0 | 6.5 | |
| | | | | 50 | — | 5.3 | 7.5 | 1.0 | 8.5 | |
| Output enable time | t_{pZL} t_{pZH} | R _L = 1 kΩ | 3.3 ± 0.3 | 15 | — | 5.4 | 8.0 | 1.0 | 9.5 | ns |
| | | | | 50 | — | 7.9 | 11.5 | 1.0 | 13.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 3.6 | 5.1 | 1.0 | 6.0 | |
| | | | | 50 | — | 5.1 | 7.1 | 1.0 | 8.0 | |
| Output disable time | t_{pLZ} t_{pHZ} | R _L = 1 kΩ | 3.3 ± 0.3 | 50 | — | 9.5 | 13.2 | 1.0 | 15.0 | ns |
| | | | 5.0 ± 0.5 | 50 | — | 6.1 | 8.8 | 1.0 | 10.0 | |
| Output to output skew | t_{osLH} t_{osHL} | (Note 1) | 3.3 ± 0.3 | 50 | — | — | 1.5 | — | 1.5 | ns |
| | | | 5.0 ± 0.5 | 50 | — | — | 1.0 | — | 1.0 | |
| Input capacitance | C _{IN} | — | | | — | 4 | 10 | — | 10 | pF |
| Output capacitance | C _{OUT} | — | | | — | 6 | — | — | — | pF |
| Power dissipation capacitance (Note 2) | C _{PD} | TC74VHC125 | | | — | 14 | — | — | — | pF |
| | | TC74VHC126 | | | — | 15 | — | — | — | |

Note 1: Parameter guaranteed by design.

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

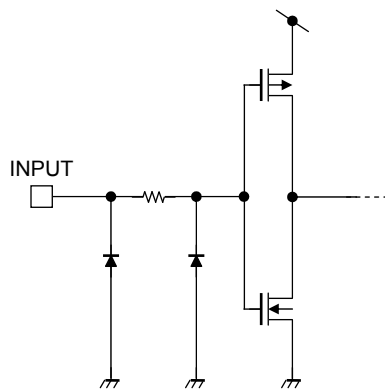
Note 2: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

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

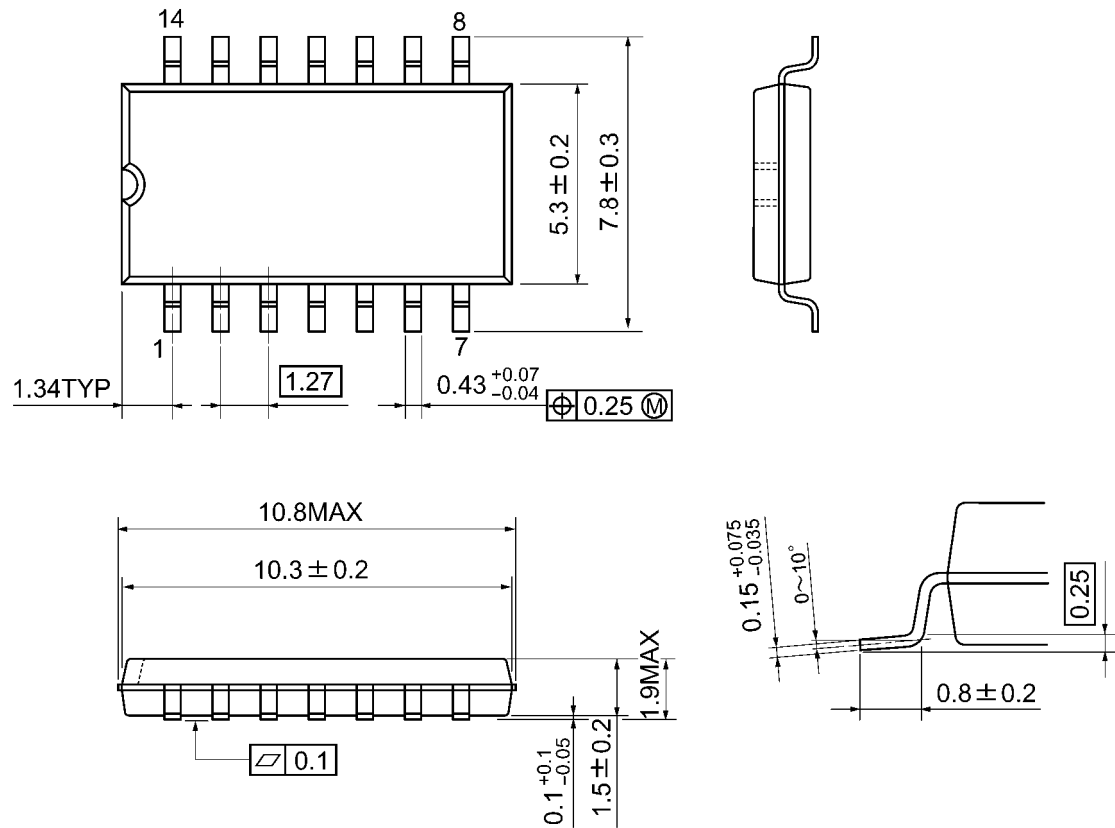
| Characteristics | Symbol | Test Condition | | Ta = 25°C | | Unit |
|--|------------------|------------------------|---------------------|-----------|-------|------|
| | | | V _{CC} (V) | Typ. | Limit | |
| Quiet output maximum dynamic V _{OL} | V _{OLP} | C _L = 50 pF | 5.0 | 0.3 | 0.8 | V |
| Quiet output minimum dynamic V _{OL} | V _{OLV} | C _L = 50 pF | 5.0 | -0.3 | -0.8 | V |
| Minimum high level dynamic input voltage | V _{IHD} | C _L = 50 pF | 5.0 | — | 3.5 | V |
| Maximum low level dynamic input voltage | V _{ILD} | C _L = 50 pF | 5.0 | — | 1.5 | V |

Input Equivalent Circuit

Package Dimensions

SOP14-P-300-1.27A

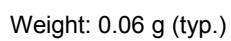
Unit: mm



Weight: 0.18 g (typ.)

TSSOP14-P-0044-0.65A

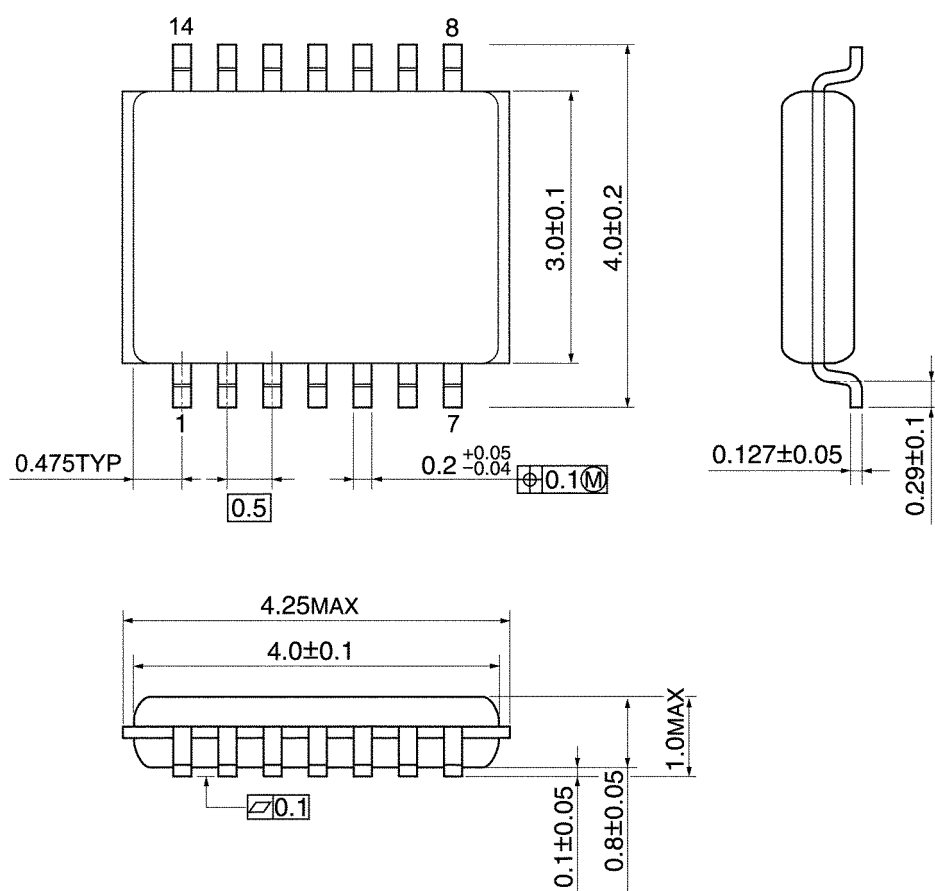
Unit: mm



Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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