

TC7WH126FU

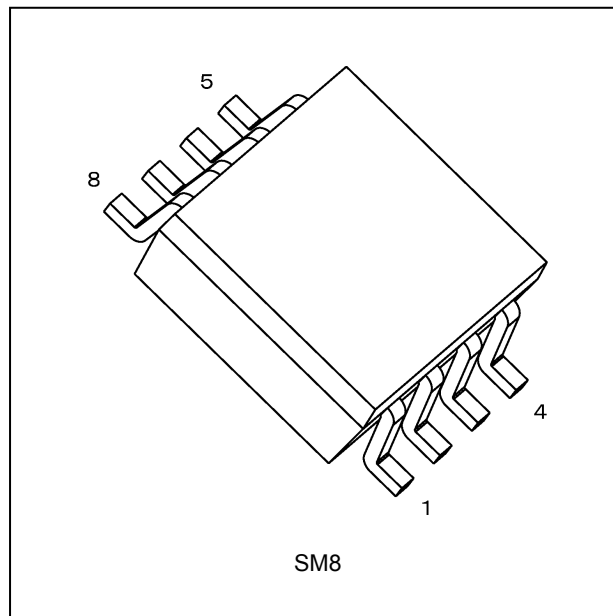
1. Functional Description

- Dual Bus Buffer with 3-State Output

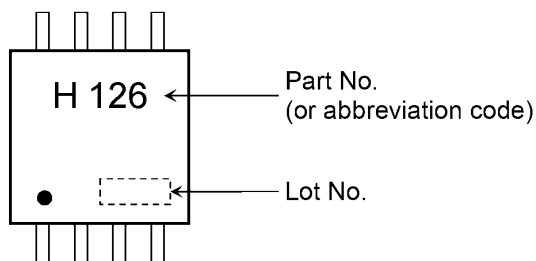
2. Features

- (1) Wide operating temperature range: $T_{opr} = -40$ to $85\text{ }^{\circ}\text{C}$
- (2) High speed operation: $t_{pd} = 3.8\text{ ns}$ (typ.) ($V_{CC} = 5.0\text{ V}$, $C_L = 15\text{ pF}$)
- (3) Low power dissipation: $I_{CC} = 2.0\text{ }\mu\text{A}$ (max) ($T_a = 25\text{ }^{\circ}\text{C}$)
- (4) High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- (5) 5.5 V tolerant inputs
- (6) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (7) Wide operating voltage range: $V_{CC} = 2.0$ to 5.5 V
- (8) Low noise: $V_{OLP} = 0.8\text{ V}$ (max)

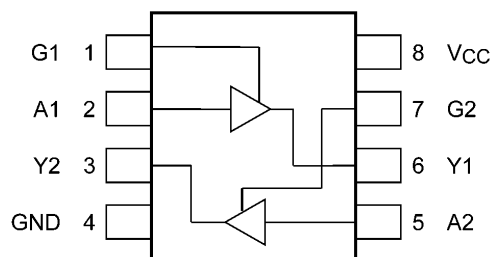
3. Packaging



4. Marking and Pin Assignment



Marking

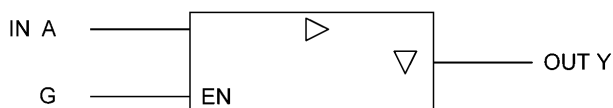


Pin Assignment (Top view)

Start of commercial production

1997-02

5. IEC Logic Symbol



6. Truth Table

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

X: Don't care
 Z: High impedance

7. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

| Characteristics | Symbol | Note | Rating | Unit |
|---------------------------------|------------------|----------|-------------------------------|------|
| Supply voltage | V _{CC} | | -0.5 to 7.0 | V |
| Input voltage | V _{IN} | | -0.5 to 7.0 | |
| DC output voltage | V _{OUT} | | -0.5 to V _{CC} + 0.5 | |
| Input diode current | I _{IK} | | -20 | mA |
| Output diode current | I _{OK} | (Note 1) | ±20 | |
| DC output current | I _{OUT} | | ±25 | |
| V _{CC} /ground current | I _{CC} | | ±50 | |
| Power dissipation | P _D | | 300 | 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: V_{OUT} < GND, V_{OUT} > V_{CC}

8. Operating Ranges (Note)

| Characteristics | Symbol | Test Condition | Rating | Unit |
|--------------------------|------------------|-------------------------------|----------------------|------|
| Supply voltage | V _{CC} | — | 2.0 to 5.5 | V |
| Input voltage | V _{IN} | — | 0 to 5.5 | |
| Output voltage | V _{OUT} | — | 0 to V _{CC} | |
| Operating temperature | T _{opr} | — | -40 to 85 | °C |
| Input rise and fall time | dt/dv | V _{CC} = 3.3 ± 0.3 V | 0 to 100 | ns/V |
| | | V _{CC} = 5.0 ± 0.5 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.

9. Electrical Characteristics

9.1. 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 | 1.5 | — | — | V |
| | | | | 3.0 to 5.5 | $V_{CC} \times 0.7$ | — | — | |
| Low-level input voltage | V_{IL} | — | | 2.0 | — | — | 0.5 | V |
| | | | | 3.0 to 5.5 | — | — | $V_{CC} \times 0.3$ | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ | $I_{OH} = -50\text{ }\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | |
| | | | | 4.5 | 4.4 | 4.5 | — | |
| | | | $I_{OH} = -4\text{ mA}$ | 3.0 | 2.58 | — | — | |
| | | | | 4.5 | 3.94 | — | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 50\text{ }\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | |
| | | | | 4.5 | — | 0.0 | 0.1 | |
| | | | $I_{OL} = 4\text{ mA}$ | 3.0 | — | — | 0.36 | |
| | | | | 4.5 | — | — | 0.36 | |
| 3-state output OFF-state leakage current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND | | 5.5 | — | — | ± 0.25 | μA |
| Input leakage current | I_{IN} | $V_{IN} = 5.5\text{ V}$ or GND | | 0 to 5.5 | — | — | ± 0.1 | μA |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | | 5.5 | — | — | 2.0 | μA |

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

| Characteristics | Symbol | Test Condition | | V_{CC} (V) | Min | Max | Unit |
|--|----------|--|-----------------------------------|--------------|---------------------|---------------------|---------------|
| High-level input voltage | V_{IH} | — | | 2.0 | 1.5 | — | V |
| | | | | 3.0 to 5.5 | $V_{CC} \times 0.7$ | — | |
| Low-level input voltage | V_{IL} | — | | 2.0 | — | 0.5 | V |
| | | | | 3.0 to 5.5 | — | $V_{CC} \times 0.3$ | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ | $I_{OH} = -50\text{ }\mu\text{A}$ | 2.0 | 1.9 | — | V |
| | | | | 3.0 | 2.9 | — | |
| | | | | 4.5 | 4.4 | — | |
| | | | $I_{OH} = -4\text{ mA}$ | 3.0 | 2.48 | — | |
| | | | | 4.5 | 3.80 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 50\text{ }\mu\text{A}$ | 2.0 | — | 0.1 | V |
| | | | | 3.0 | — | 0.1 | |
| | | | | 4.5 | — | 0.1 | |
| | | | $I_{OL} = 4\text{ mA}$ | 3.0 | — | 0.44 | |
| | | | | 4.5 | — | 0.44 | |
| 3-state output OFF-state leakage current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND | | 5.5 | — | ± 2.5 | μA |
| Input leakage current | I_{IN} | $V_{IN} = 5.5\text{ V}$ or GND | | 0 to 5.5 | — | ± 1.0 | μA |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | | 5.5 | — | 20.0 | μA |

9.3. 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) | C_L (pF) | Min | Typ. | Max | Unit |
|-------------------------------|------------------------|----------|--------------------------|---------------|------------|-----|------|------|------|
| Propagation delay time | t_{PLH}, t_{PHL} | | — | 3.3 ± 0.3 | 15 | — | 5.6 | 8.0 | ns |
| | | | | | 50 | — | 8.1 | 11.5 | |
| | | | | 5.0 ± 0.5 | 15 | — | 3.8 | 5.5 | |
| | | | | | 50 | — | 5.3 | 7.5 | |
| 3-state output enable time | t_{PZL}, t_{PZH} | | $R_L = 1\text{ k}\Omega$ | 3.3 ± 0.3 | 15 | — | 5.4 | 8.0 | ns |
| | | | | | 50 | — | 7.9 | 11.5 | |
| | | | | 5.0 ± 0.5 | 15 | — | 3.6 | 5.1 | |
| | | | | | 50 | — | 5.1 | 7.1 | |
| 3-state output disable time | t_{PLZ}, t_{PHZ} | | $R_L = 1\text{ k}\Omega$ | 3.3 ± 0.3 | 50 | — | 9.5 | 13.2 | ns |
| | | | | 5.0 ± 0.5 | 50 | — | 6.1 | 8.8 | |
| Output skew | $t_{oS LH}, t_{oS HL}$ | (Note 1) | — | 3.3 ± 0.3 | 50 | — | — | 1.5 | ns |
| | | | | 5.0 ± 0.5 | 50 | — | — | 1.0 | |
| Input capacitance | C_{IN} | | — | | | — | 4 | 10 | pF |
| Output capacitance | C_{OUT} | | — | | | — | 6 | — | pF |
| Power dissipation capacitance | C_{PD} | (Note 2) | — | | | — | 15 | — | pF |

Note 1: Parameter guaranteed by design. ($t_{oS LH} = |t_{PLHM} - t_{PLHN}|$, $t_{oS HL} = |t_{PHLM} - t_{PHLN}|$)

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.

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per 1 bit)}$$

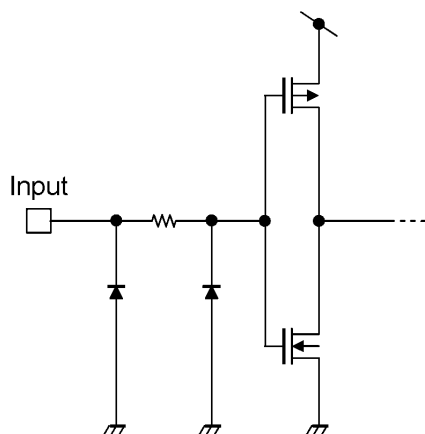
9.4. AC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

| Characteristics | Symbol | Note | Test Condition | V_{CC} (V) | C_L (pF) | Min | Max | Unit |
|-----------------------------|------------------------|----------|--------------------------|---------------|------------|-----|------|------|
| Propagation delay time | t_{PLH}, t_{PHL} | | — | 3.3 ± 0.3 | 15 | 1.0 | 9.5 | ns |
| | | | | | 50 | 1.0 | 13.0 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 6.5 | |
| | | | | | 50 | 1.0 | 8.5 | |
| 3-state output enable time | t_{PZL}, t_{PZH} | | $R_L = 1\text{ k}\Omega$ | 3.3 ± 0.3 | 15 | 1.0 | 9.5 | ns |
| | | | | | 50 | 1.0 | 13.0 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 6.0 | |
| | | | | | 50 | 1.0 | 8.0 | |
| 3-state output disable time | t_{PLZ}, t_{PHZ} | | $R_L = 1\text{ k}\Omega$ | 3.3 ± 0.3 | 50 | 1.0 | 15.0 | ns |
| | | | | 5.0 ± 0.5 | 50 | 1.0 | 10.0 | |
| Output skew | $t_{oS LH}, t_{oS HL}$ | (Note 1) | — | 3.3 ± 0.3 | 50 | — | 1.5 | ns |
| | | | | 5.0 ± 0.5 | 50 | — | 1.0 | |
| Input capacitance | C_{IN} | | — | | | — | 10 | pF |

Note 1: Parameter guaranteed by design. ($t_{oS LH} = |t_{PLHM} - t_{PLHN}|$, $t_{oS HL} = |t_{PHLM} - t_{PHLN}|$)

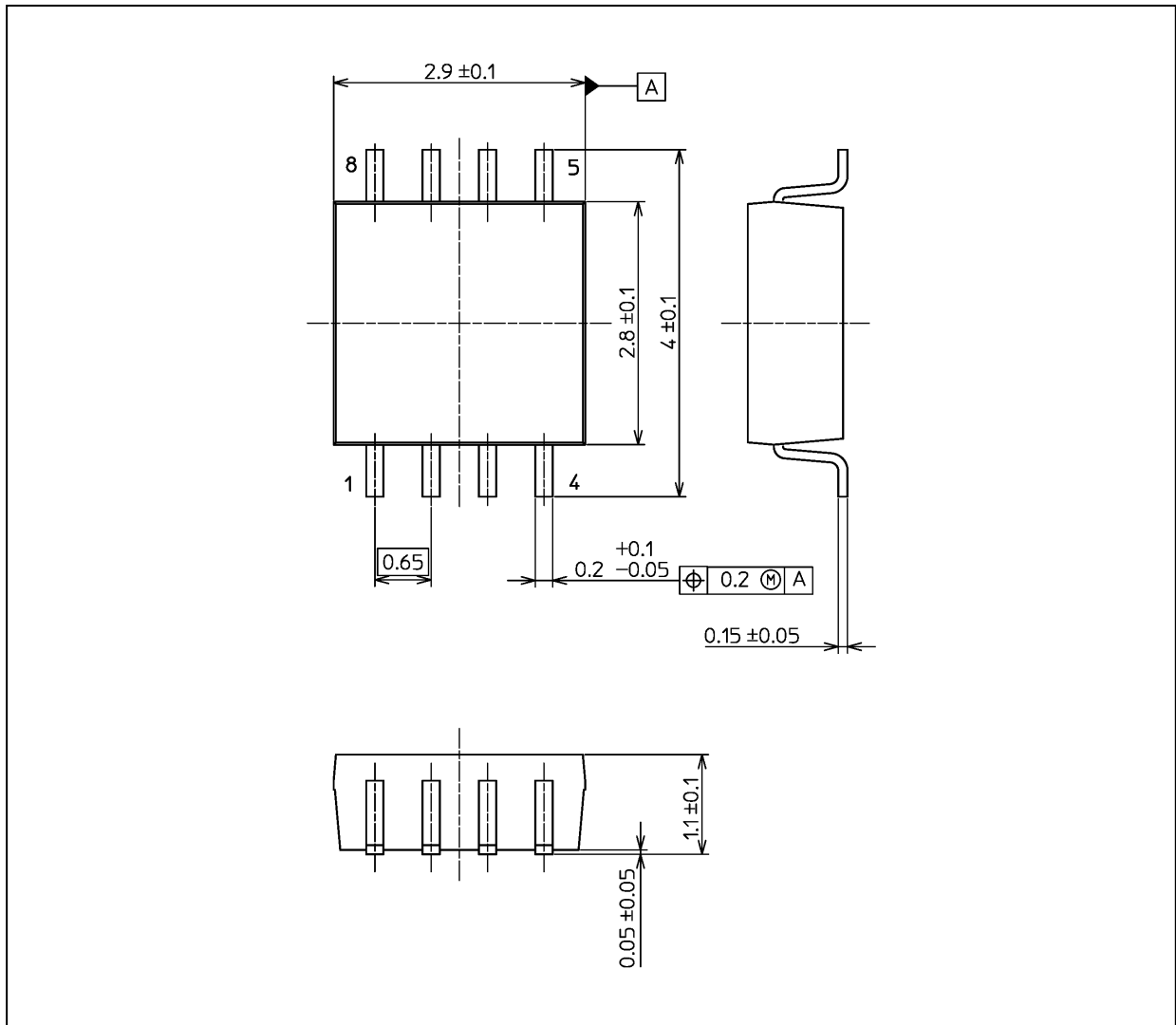
9.5. Noise Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Typ. | Limit | Unit |
|--|-----------|----------------------|--------------|------|-------|------|
| Quiet output maximum dynamic V_{OL} | V_{OLP} | $C_L = 50\text{ pF}$ | 5.0 | 0.3 | 0.8 | V |
| Quiet output minimum dynamic V_{OL} | V_{OLV} | $C_L = 50\text{ pF}$ | 5.0 | -0.3 | -0.8 | V |
| Minimum high-level dynamic input voltage | V_{IHD} | $C_L = 50\text{ pF}$ | 5.0 | — | 3.5 | V |
| Maximum low-level dynamic input voltage | V_{ILD} | $C_L = 50\text{ pF}$ | 5.0 | — | 1.5 | V |

10. Input Equivalent Circuit

Package Dimensions

Unit: mm



Weight: 21 mg (typ.)

| Package Name(s) |
|-----------------|
| JEDEC: SOT-505 |
| Nickname: SM8 |

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