

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7W14FU, TC7W14FK

Schmitt Inverter

The TC7W14 is high speed C²MOS Schmitt Inverter fabricated with silicon gate C²MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the C²MOS low power dissipation.

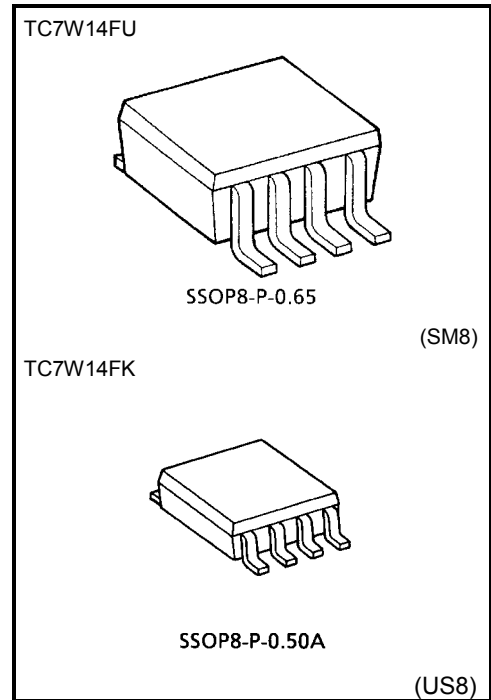
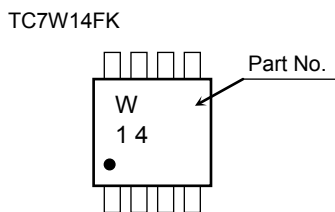
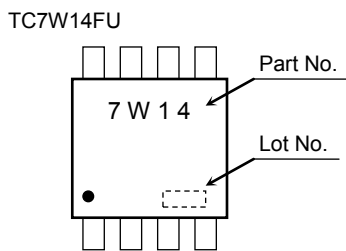
Pin configuration and function are the same as the TC7WU04 but the inputs have 25% V_{CC} hysteresis and with its Schmitt trigger function, the TC7W14 can be used as a line receivers which will receive slow input signals.

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

Features

- High speed: $t_{pd} = 11 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 1 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_H = 1.1 \text{ V}$ at $V_{CC} = 5\text{V}$
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 4\text{mA (min)}$
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2 \text{ to } 6\text{V}$

Marking



Weight
 SSOP8-P-0.65: 0.02 g (typ.)
 SSOP8-P-0.50A: 0.01 g (typ.)

Start of commercial production
 1992-02

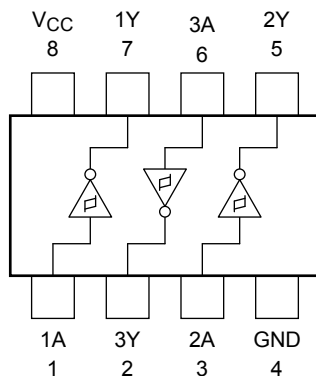
Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|------------------------------------|------------------|-------------------------------|------|
| Supply voltage range | V _{CC} | -0.5 to 7 | V |
| DC input voltage | V _{IN} | -0.5 to V _{CC} + 0.5 | 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} | ±25 | mA |
| Power dissipation | P _D | 300 (SM8) | mW |
| | | 200 (US8) | |
| Storage temperature range | T _{stg} | -65 to 150 | °C |
| Lead temperature (10 s) | T _L | 260 | °C |

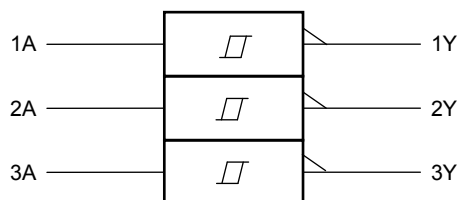
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

Pin Configuration (top view)



Logic Diagram



Truth Table

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

Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|---------------|------|
| Supply voltage | V_{CC} | 2 to 6 | V |
| Input voltage | V_{IN} | 0 to V_{CC} | V |
| Output voltage | V_{OUT} | 0 to V_{CC} | V |
| Operating temperature range | T_{opr} | -40 to 85 | °C |

Electrical Characteristics

DC Electrical Characteristics

| Characteristics | | Symbol | Test Condition | $T_a = 25^\circ\text{C}$ | | | $T_a = -40$ to 85°C | | Unit | | | | | |
|---------------------------|------------|----------|--------------------------|----------------------------|------|----------------------------|--------------------------------------|------|-----------|---------------|---|------|------|---|
| | | | | V_{CC} (V) | Min | Typ. | Max | Min | | Max | | | | |
| Threshold voltage | High level | V_P | — | 2.0 | 1.0 | 1.25 | 1.5 | 1.0 | 1.5 | V | | | | |
| | | | | 4.5 | 2.3 | 2.7 | 3.15 | 2.3 | 3.15 | | | | | |
| | | | | 6.0 | 3.0 | 3.5 | 4.2 | 3.0 | 4.2 | | | | | |
| | Low level | V_N | — | 2.0 | 0.3 | 0.65 | 0.9 | 0.3 | 0.9 | | | | | |
| | | | | 4.5 | 1.13 | 1.6 | 2.0 | 1.13 | 2.0 | | | | | |
| | | | | 6.0 | 1.5 | 2.3 | 2.6 | 1.5 | 2.6 | | | | | |
| Hysteresis voltage | | V_H | — | 2.0 | 0.3 | 0.6 | 1.0 | 0.3 | 1.0 | V | | | | |
| | | | | 4.5 | 0.6 | 1.1 | 1.4 | 0.6 | 1.4 | | | | | |
| | | | | 6.0 | 0.8 | 1.2 | 1.7 | 0.8 | 1.7 | | | | | |
| Output voltage | High level | V_{OH} | $V_{IN} = V_{IL}$ | $I_{OH} = -20 \mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V | | | |
| | | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | | |
| | | | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | | |
| | | | | $I_{OH} = -4 \text{ mA}$ | | 4.5 | 4.18 | 4.31 | — | 4.13 | | — | | |
| | | | | | | $I_{OH} = -5.2 \text{ mA}$ | | 6.0 | 5.68 | 5.80 | | — | 5.63 | — |
| | | | | | | | | — | — | — | | — | — | — |
| | Low level | V_{OL} | $V_{IN} = V_{IH}$ | $I_{OL} = 20 \mu\text{A}$ | 2.0 | — | 0 | 0.1 | — | 0.1 | | | | |
| | | | | | 4.5 | — | 0 | 0.1 | — | 0.1 | | | | |
| | | | | $I_{OL} = 4 \text{ mA}$ | | 6.0 | — | 0 | 0.1 | — | | 0.1 | | |
| | | | | | | 4.5 | — | 0.17 | 0.26 | — | | 0.33 | | |
| $I_{OL} = 5.2 \text{ mA}$ | | 6.0 | — | 0.18 | 0.26 | — | 0.33 | | | | | | | |
| | | — | — | — | — | — | — | | | | | | | |
| Input leakage current | | I_{IN} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | ± 0.1 | — | ± 1.0 | μA | | | | |
| Quiescent supply current | | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 1.0 | — | 10.0 | μA | | | | |

AC Electrical Characteristics ($C_L = 15 \text{ pF}$, $V_{CC} = 5 \text{ V}$, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | $T_a = 25^\circ\text{C}$ | | | Unit |
|------------------------|------------------------|----------------|--------------------------|------|-----|------|
| | | | Min | Typ. | Max | |
| Output transition time | t_{TLH} t_{THL} | — | — | 4 | 8 | ns |
| Propagation delay time | t_{pLH} t_{pHL} | — | — | 11 | 21 | ns |

AC Electrical Characteristics ($C_L = 50 \text{ pF}$, input $t_r = t_f = 6 \text{ ns}$)

| Characteristics | Symbol | Test Condition | $V_{CC} \text{ (V)}$ | $T_a = 25^\circ\text{C}$ | | | $T_a = -40$ to 85°C | | Unit |
|-------------------------------|------------------------|----------------|----------------------|--------------------------|------|-----|--------------------------------------|-----|------|
| | | | | Min | Typ. | Max | Min | Max | |
| Output transition time | t_{TLH} t_{THL} | — | 2.0 | — | 30 | 75 | — | 95 | ns |
| | | | 4.5 | — | 8 | 15 | — | 19 | |
| | | | 6.0 | — | 7 | 13 | — | 16 | |
| Propagation delay time | t_{pLH} t_{pHL} | — | 2.0 | — | 42 | 125 | — | 155 | ns |
| | | | 4.5 | — | 14 | 25 | — | 31 | |
| | | | 6.0 | — | 12 | 21 | — | 26 | |
| Input capacitance | C_{IN} | — | — | 5 | 10 | — | 10 | pF | |
| Power dissipation capacitance | C_{PD} | (Note) | — | 28 | — | — | — | pF | |

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

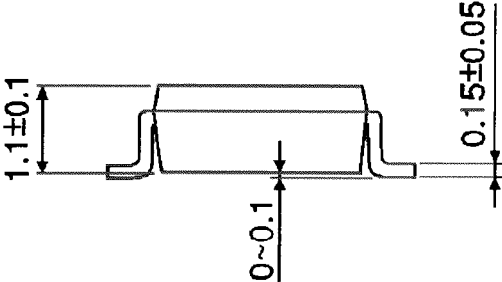
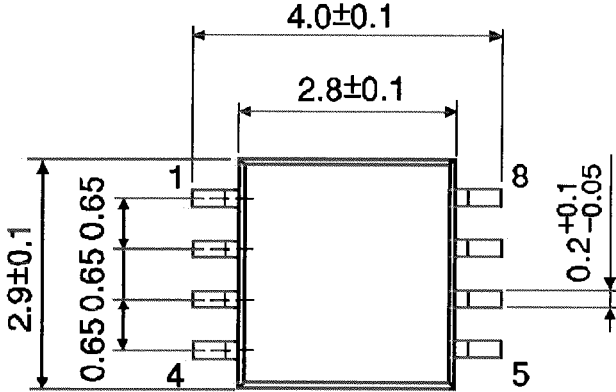
Average operating current can be obtained by the equation hereunder.

$$I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3 \text{ (per gate)}$$

Package Dimensions

SSOP8-P-0.65

Unit : mm

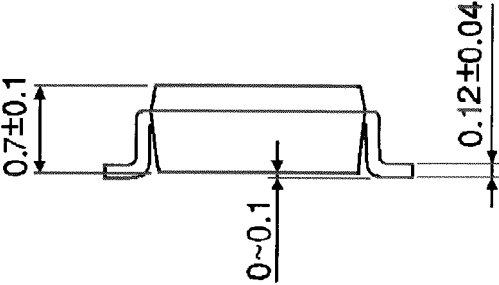
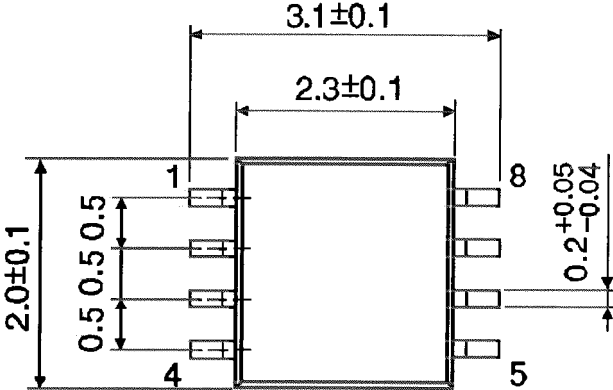


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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