

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7W14FU, TC7W14FK

## Schmitt Inverter

The TC7W14 is high speed C<sup>2</sup>MOS Schmitt Inverter fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the C<sup>2</sup>MOS low power dissipation.

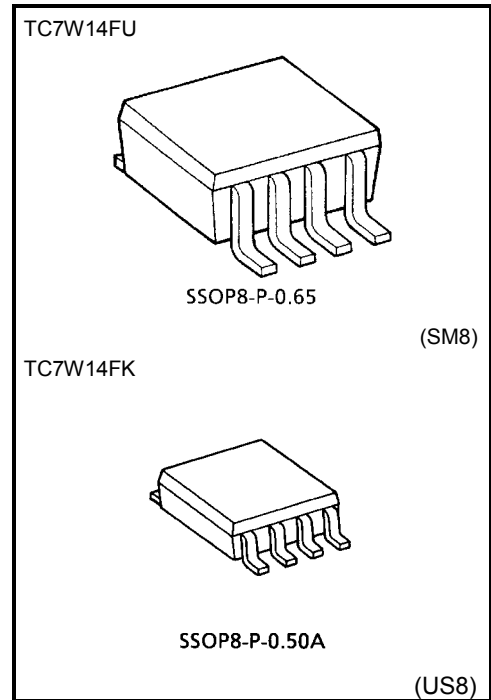
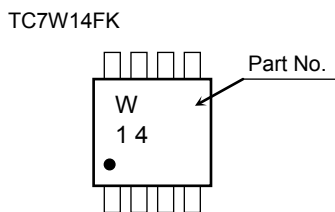
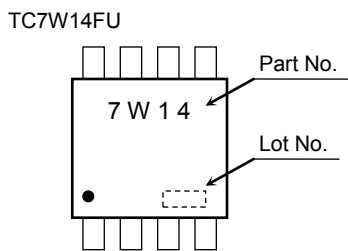
Pin configuration and function are the same as the TC7WU04 but the inputs have 25% V<sub>CC</sub> hysteresis and with its Schmitt trigger function, the TC7W14 can be used as a line receivers which will receive slow input signals.

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

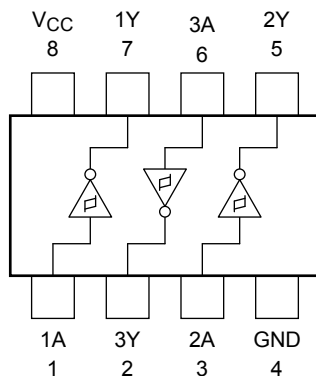
## Absolute Maximum Ratings (Ta = 25°C)

| Characteristics                    | Symbol           | Rating                        | Unit |
|------------------------------------|------------------|-------------------------------|------|
| Supply voltage range               | V <sub>CC</sub>  | -0.5 to 7                     | V    |
| DC input voltage                   | V <sub>IN</sub>  | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| DC output voltage                  | V <sub>OUT</sub> | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| Input diode current                | I <sub>IK</sub>  | ±20                           | mA   |
| Output diode current               | I <sub>OK</sub>  | ±20                           | mA   |
| DC output current                  | I <sub>OUT</sub> | ±25                           | mA   |
| DC V <sub>CC</sub> /ground current | I <sub>CC</sub>  | ±25                           | mA   |
| Power dissipation                  | P <sub>D</sub>   | 300 (SM8)                     | mW   |
|                                    |                  | 200 (US8)                     |      |
| Storage temperature range          | T <sub>stg</sub> | -65 to 150                    | °C   |
| Lead temperature (10 s)            | T <sub>L</sub>   | 260                           | °C   |

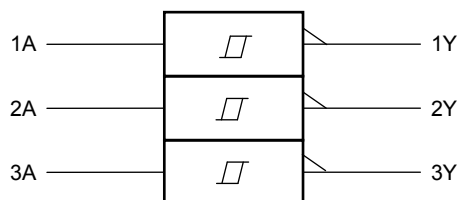
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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    |                          | Ta = 25°C          |          |                   | Ta = -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               | $V_{OH}$ | $V_{IN} = V_{IL}$ | $I_{OH} = -20 \mu A$     | 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  | —    |     |      |
|                    |                          |          |                   |                          | $I_{OH} = -4 mA$   | 4.5      | 4.18              | 4.31                | —    | 4.13 |     | —    |
|                    |                          |          |                   |                          | $I_{OH} = -5.2 mA$ | 6.0      | 5.68              | 5.80                | —    | 5.63 |     | —    |
|                    |                          |          |                   |                          | Low level          | $V_{OL}$ | $V_{IN} = V_{IH}$ | $I_{OL} = 20 \mu A$ | 2.0  | —    |     | 0    |
|                    | 4.5                      | —        | 0                 | 0.1                      |                    |          |                   |                     | —    | 0.1  |     |      |
|                    | 6.0                      | —        | 0                 | 0.1                      |                    |          |                   |                     | —    | 0.1  |     |      |
|                    | $I_{OL} = 4 mA$          | 4.5      | —                 | 0.17                     |                    |          |                   |                     | 0.26 | —    |     | 0.33 |
|                    | $I_{OL} = 5.2 mA$        | 6.0      | —                 | 0.18                     |                    |          |                   |                     | 0.26 | —    |     | 0.33 |
|                    | Input leakage current    |          | $I_{IN}$          | $V_{IN} = V_{CC}$ or GND |                    |          |                   |                     | 6.0  | —    |     | —    |
|                    | 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 | $t_{TLH}$<br>$t_{THL}$ | —              | —                        | 4    | 8   | ns   |
| Propagation delay time | $t_{pLH}$<br>$t_{pHL}$ | —              | —                        | 11   | 21  | ns   |

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

| Characteristics               | Symbol                 | Test Condition | $V_{CC}$ (V) | $T_a = 25^\circ\text{C}$ |      |     | $T_a = -40$<br>to $85^\circ\text{C}$ |     | Unit |
|-------------------------------|------------------------|----------------|--------------|--------------------------|------|-----|--------------------------------------|-----|------|
|                               |                        |                |              | Min                      | Typ. | Max | Min                                  | Max |      |
| Output transition time        | $t_{TLH}$<br>$t_{THL}$ | —              | 2.0          | —                        | 30   | 75  | —                                    | 95  | ns   |
|                               |                        |                | 4.5          | —                        | 8    | 15  | —                                    | 19  |      |
|                               |                        |                | 6.0          | —                        | 7    | 13  | —                                    | 16  |      |
| Propagation delay time        | $t_{pLH}$<br>$t_{pHL}$ | —              | 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.

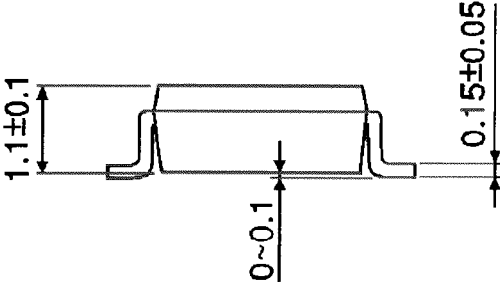
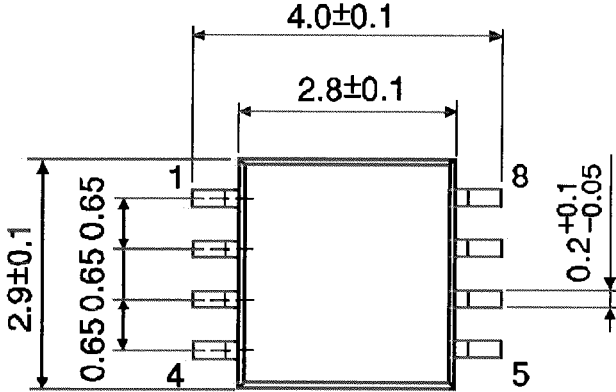
Average operating current can be obtained by the equation hereunder.

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

**Package Dimensions**

SSOP8-P-0.65

Unit : mm

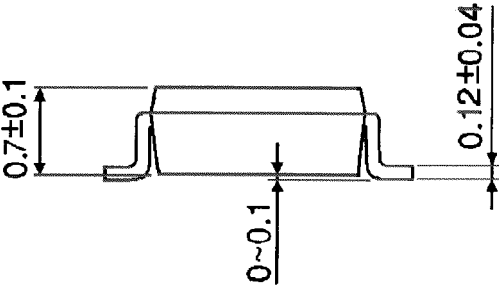
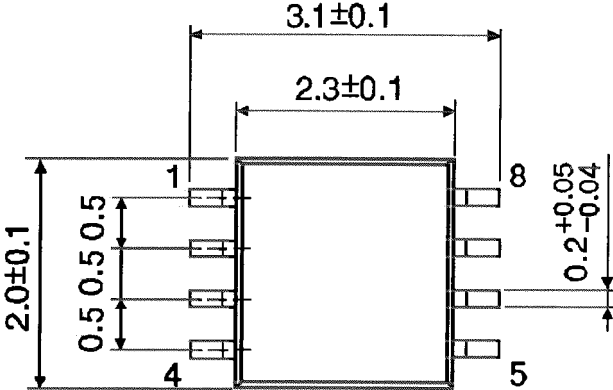


Weight: 0.02 g (typ.)

**Package Dimensions**

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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