# TOSHIBA                                    TC7W14F/FU/FK

### TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT   SILICON MONOLITHIC
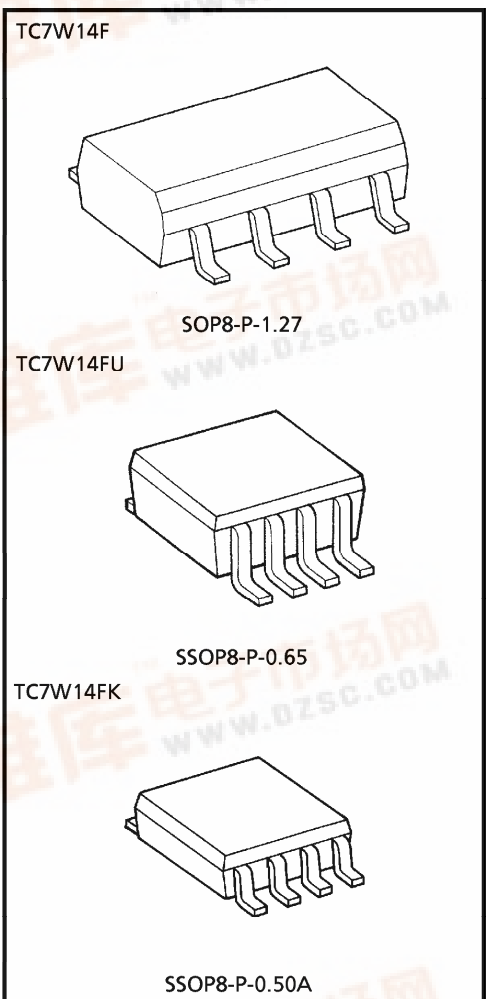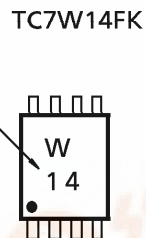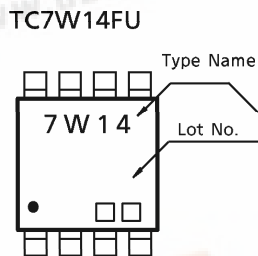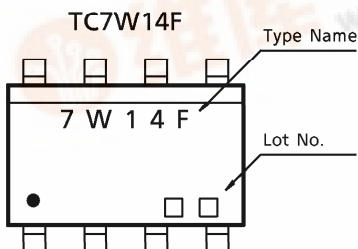
# TC7W14F, TC7W14FU, TC7W14FK

## SCHMITT INVERTER

The TC7W14 is high speed $C^2$MOS SCHMITT INVERTER fabricated with silicon gate $C^2$MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the $C^2$MOS 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.

**TC7W14F**

SOP8-P-1.27

**TC7W14FU**

SSOP8-P-0.65

**TC7W14FK**

SSOP8-P-0.50A

### FEATURES

- High Speed ....................... $t_{pd} = 11$ns (Typ.) at $V_{CC} = 5$V

- Low Power Dissipation ........... $I_{CC} = 1\mu$A (Max.) at $Ta = 25°C$

- High Noise Immunity ............. $V_H = 1.1$V at $V_{CC} = 5$V

- Output Drive Capability ........... 10 LSTTL Loads

- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL} = 4$mA

- Balanced Propagation Delays ...... $t_{pLH} \fallingdotseq t_{pHL}$

- Wide Operating Voltage Range ... $V_{CC\ (opr)} = 2\sim6$V

### MARKING

**TC7W14F**

Type Name

7 W 1 4 F

Lot No.

**TC7W14FU**

Type Name

7 W 1 4

Lot No.

**TC7W14FK**

W
1 4

**Weight**
SOP8-P-1.27    : 0.05g (Typ.)
SSOP8-P-0.65   : 0.02g (Typ.)
SSOP8-P-0.50A  : 0.01g (Typ.)

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage Range | $V_{CC}$ | $-0.5\sim7$ | V |
| DC Input Voltage | $V_{IN}$ | $-0.5\sim V_{CC}+0.5$ | V |
| DC Output Voltage | $V_{OUT}$ | $-0.5\sim V_{CC}+0.5$ | V |
| Input Diode Current | $I_{IK}$ | $\pm20$ | mA |
| Output Diode Current | $I_{OK}$ | $\pm20$ | mA |
| DC Output Current | $I_{OUT}$ | $\pm25$ | mA |
| DC $V_{CC}$/Ground Current | $I_{CC}$ | $\pm25$ | mA |
| Power Dissipation | $P_D$ | 300 (FM8, SM8) | mW |
| | | 200 (US8) | |
| Storage Temperature | $T_{stg}$ | $-65\sim150$ | °C |
| Lead Temperature (10s) | $T_L$ | 260 | °C |

### LOGIC DIAGRAM



### TRUTH TABLE

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

### PIN ASSIGNMENT (TOP VIEW)
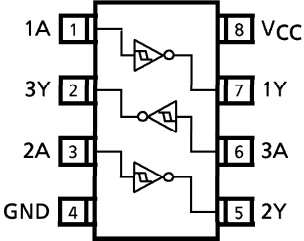


## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | $2\sim6$ | V |
| Input Voltage | $V_{IN}$ | $0\sim V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | $0\sim V_{CC}$ | V |
| Operating Temperature | $T_{opr}$ | $-40\sim85$ | °C |

## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | $V_{CC}$ | Ta = 25°C | | | Ta = −40~85°C | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Positive Threshold Voltage | $V_P$ | — | | 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 | |
| Negative Threshold Voltage | $V_N$ | — | | 2.0 | 0.3 | 0.65 | 0.9 | 0.3 | 0.9 | V |
| | | | | 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 | |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IL}$ | $I_{OH} = -20\mu A$ | 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 | — | |
| | | | $I_{OH} = -4mA$ | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | $I_{OH} = -5.2mA$ | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN} = V_{IH}$ | $I_{OL} = 20\mu A$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL} = 4mA$ | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | $I_{OL} = 5.2mA$ | 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 | $\mu A$ |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND | | 6.0 | — | — | 1.0 | — | 10.0 | |

       2001-05-31

## AC ELECTRICAL CHARACTERISTICS ($C_L$ = 15pF, $V_{CC}$ = 5V, Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | Ta = 25°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 ($C_L$ = 50pF, Input $t_r$ = $t_f$ = 6ns)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | $V_{CC}$ | Ta = 25°C MIN. | TYP. | MAX. | Ta = −40~85°C MIN. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| 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 1) | | — | 28 | — | — | — | |

(Note 1) : $C_{PD}$ is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit).

Average operating current can be obtained by the equation hereunder.

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

**PACKAGE DIMENSIONS**
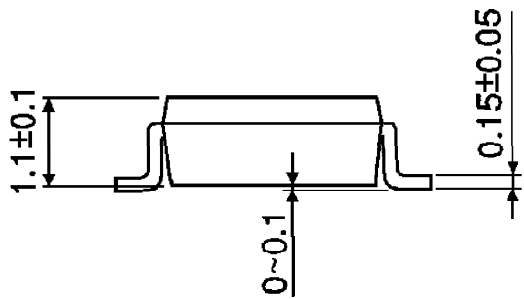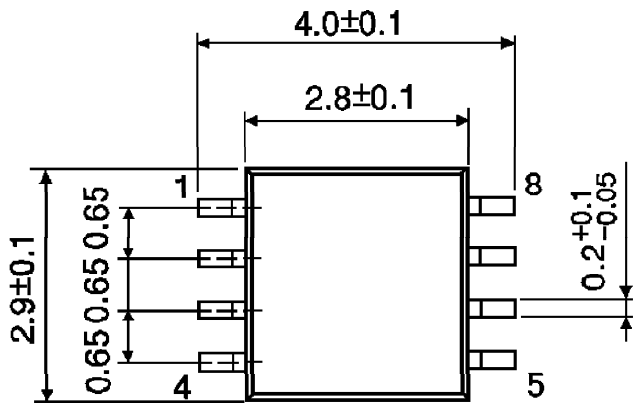    SOP8-P-1.27                                                  Unit : mm
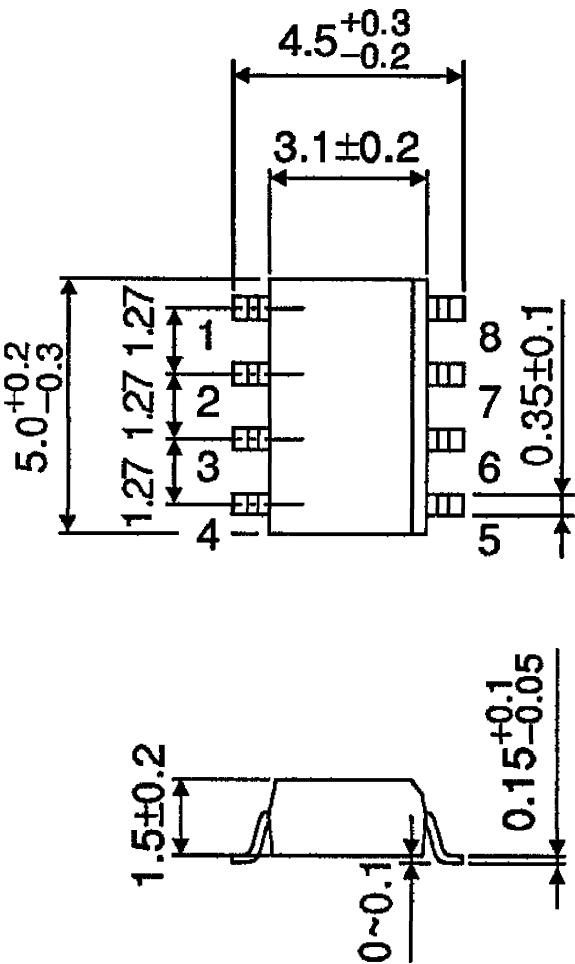


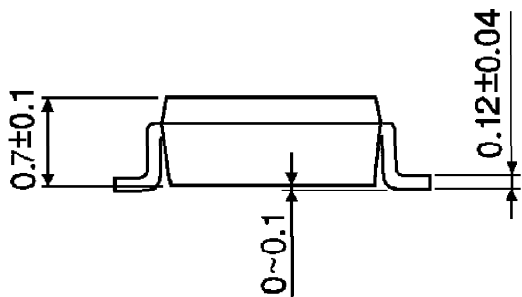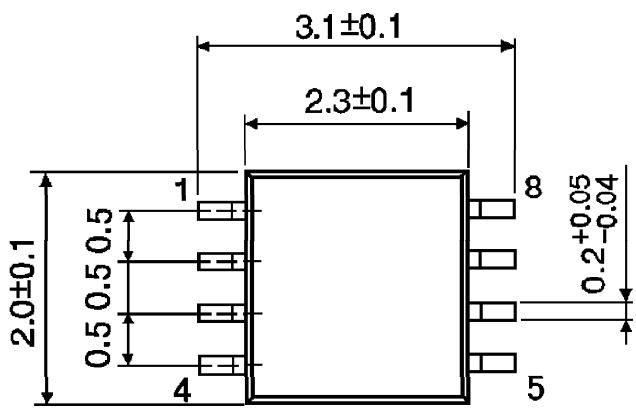Weight : 0.05g (Typ.)

**PACKAGE DIMENSIONS**

SSOP8-P-0.65

Unit : mm



Weight : 0.02g (Typ.)

**PACKAGE DIMENSIONS**
SSOP8-P-0.50A                                                                                    Unit : mm

3.1±0.1

2.3±0.1

1

8

4

5

2.0±0.1

0.5 0.5 0.5

0.5 0.5 0.5

$0.2^{+0.05}_{-0.04}$

0.7±0.1

0.12±0.04

0~0.1

Weight : 0.01g (Typ.)

## RESTRICTIONS ON PRODUCT USE