

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

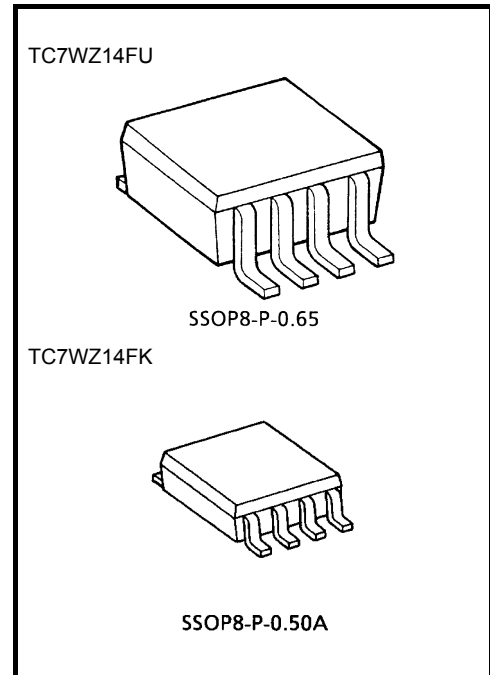
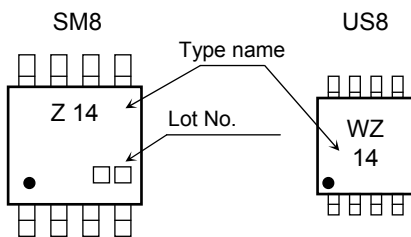
# TC7WZ14FU, TC7WZ14FK

## Triple Schmitt Inverter

### Features

- High output drive :  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation :  $t_{pd} = 3.7$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operation voltage range :  $V_{CC(opr)} = 1.65 \sim 5.5$  V
- 5.5-V tolerant inputs
- 5.5-V power down protection outputs
- Matches the performance of TC74LCX series when operated at 3.3-V  $V_{CC}$

### Marking

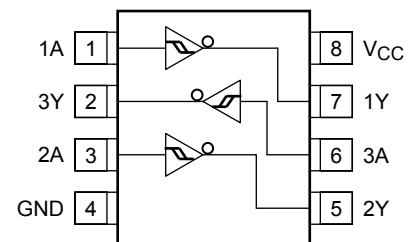


Weight  
 SSOP8-P-0.65 : 0.02 g (typ.)  
 SSOP8-P-0.50A : 0.01 g (typ.)

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

| Characteristics             | Symbol    | Rating                 | Unit |
|-----------------------------|-----------|------------------------|------|
| Supply voltage range        | $V_{CC}$  | -0.5~6                 | V    |
| DC input voltage            | $V_{IN}$  | -0.5~6                 | V    |
| DC output voltage           | $V_{OUT}$ | -0.5~6                 | V    |
| Input diode current         | $I_{IK}$  | -20                    | mA   |
| Output diode current        | $I_{OK}$  | -20                    | mA   |
| DC output current           | $I_{OUT}$ | $\pm 50$               | mA   |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$               | mA   |
| Power dissipation           | $P_D$     | 300 (SM8)<br>200 (US8) | mW   |
| Storage temperature         | $T_{stg}$ | -65~150                | °C   |
| Lead temperature (10 s)     | $T_L$     | 260                    | °C   |

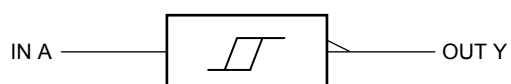
### Pin Assignment (top view)



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).

## Logic Diagram



## Truth Table

| INPUT | OUTPUT |
|-------|--------|
| A     | Y      |
| L     | H      |
| H     | L      |

## Operating Ranges

| Characteristics       | Symbol    | Rating               | Unit |
|-----------------------|-----------|----------------------|------|
| Supply voltage        | $V_{CC}$  | 1.65~5.5             | V    |
|                       |           | 1.5~5.5 (Note 1)     |      |
| Input voltage         | $V_{IN}$  | 0~5.5                | V    |
| Output voltage        | $V_{OUT}$ | 0~5.5 (Note 2)       | V    |
|                       |           | 0~ $V_{CC}$ (Note 3) |      |
| Operating temperature | $T_{opr}$ | -40~85               | °C   |

Note 1 : Data retention only

Note 2 :  $V_{CC} = 0$  V

Note 3 : High or low state

## Electrical Characteristics

### DC Characteristics

| Characteristics           |                 | Symbol                            | Test Condition                              | V <sub>CC</sub> (V)      | Ta = 25°C |      |      | Ta = -40~85°C |      | Unit |
|---------------------------|-----------------|-----------------------------------|---|--------------------------|-----------|------|------|---------------|------|------|
|                           |                 |                                   |   |                          | Min       | Typ. | Max  | Min           | Max  |      |
| Threshold voltage         | High-level      | V <sub>P</sub>                    | —   | 1.65                     | 0.6       | 1.0  | 1.4  | 0.6           | 1.4  | V    |
|                           |                 |                                   |   | 1.8                      | 0.7       | 1.1  | 1.5  | 0.7           | 1.5  |      |
|                           |                 |                                   |   | 2.3                      | 1.0       | 1.4  | 1.8  | 1.0           | 1.8  |      |
|                           |                 |                                   |   | 3.0                      | 1.3       | 1.75 | 2.2  | 1.3           | 2.2  |      |
|                           |                 |                                   |   | 4.5                      | 1.9       | 2.45 | 3.1  | 1.9           | 3.1  |      |
|                           |                 |                                   |   | 5.5                      | 2.2       | 2.9  | 3.6  | 2.2           | 3.6  |      |
|                           | Low-level       | V <sub>N</sub>                    | —   | 1.65                     | 0.2       | 0.5  | 0.8  | 0.2           | 0.8  |      |
|                           |                 |                                   |   | 1.8                      | 0.25      | 0.55 | 0.9  | 0.25          | 0.9  |      |
|                           |                 |                                   |   | 2.3                      | 0.4       | 0.75 | 1.15 | 0.4           | 1.15 |      |
|                           |                 |                                   |   | 3.0                      | 0.6       | 1.0  | 1.5  | 0.6           | 1.5  |      |
|                           |                 |                                   |   | 4.5                      | 1.0       | 1.43 | 2.0  | 1.0           | 2.0  |      |
|                           |                 |                                   |   | 5.5                      | 1.2       | 1.7  | 2.4  | 1.2           | 2.4  |      |
| Hysteresis voltage        |                 | V <sub>H</sub>                    | —   | 1.65                     | 0.1       | 0.48 | 0.9  | 0.1           | 0.9  |      |
|                           |                 |                                   |   | 1.8                      | 0.15      | 0.54 | 1.0  | 0.15          | 1.0  |      |
|                           |                 |                                   |   | 2.3                      | 0.25      | 0.65 | 1.1  | 0.25          | 1.1  |      |
|                           |                 |                                   |   | 3.0                      | 0.4       | 0.77 | 1.2  | 0.4           | 1.2  |      |
|                           |                 |                                   |   | 4.5                      | 0.6       | 1.01 | 1.5  | 0.6           | 1.5  |      |
|                           |                 |                                   |   | 5.5                      | 0.7       | 1.18 | 1.7  | 0.7           | 1.7  |      |
| High-level output voltage |                 | V <sub>OH</sub>                   | V <sub>IN</sub> = V <sub>IL</sub>           | I <sub>OH</sub> = -100μA | 1.65      | 1.55 | 1.65 | —             | 1.55 | V    |
|                           |                 |                                   |   |                          | 2.3       | 2.2  | 2.3  | —             | 2.2  |      |
|                           |                 |                                   |   |                          | 3.0       | 2.9  | 3.0  | —             | 2.9  |      |
|                           |                 |                                   |   |                          | 4.5       | 4.4  | 4.5  | —             | 4.4  |      |
|                           |                 |                                   |   | I <sub>OH</sub> = -4 mA  | 1.65      | 1.29 | 1.52 | —             | 1.29 |      |
|                           |                 |                                   |   |                          | 2.3       | 1.9  | 2.14 | —             | 1.9  |      |
|                           |                 |                                   |   |                          | 3.0       | 2.4  | 2.75 | —             | 2.4  |      |
|                           |                 |                                   |   |                          | 4.5       | 3.8  | 4.13 | —             | 3.8  |      |
| Low-level output voltage  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub> | I <sub>OH</sub> = 100 μA                    | 1.65                     | —         | 0    | 0.1  | —             | 0.1  |      |
|                           |                 |                                   |   | 2.3                      | —         | 0    | 0.1  | —             | 0.1  |      |
|                           |                 |                                   |   | 3.0                      | —         | 0    | 0.1  | —             | 0.1  |      |
|                           |                 |                                   |   | 4.5                      | —         | 0    | 0.1  | —             | 0.1  |      |
|                           |                 |                                   | I <sub>OH</sub> = 4 mA                      | 1.65                     | —         | 0.08 | 0.24 | —             | 0.24 |      |
|                           |                 |                                   |   | 2.3                      | —         | 0.1  | 0.3  | —             | 0.3  |      |
|                           |                 |                                   |   | 3.0                      | —         | 0.16 | 0.4  | —             | 0.4  |      |
|                           |                 |                                   |   | 4.5                      | —         | 0.25 | 0.55 | —             | 0.55 |      |
| Input leakage current     |                 | I <sub>IN</sub>                   | V <sub>IN</sub> = 5.5 V or GND              | 0~5.5                    | —         | —    | ±1   | —             | ±10  | μA   |
| Power off leakage current |                 | I <sub>OFF</sub>                  | V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V | 0.0                      | —         | —    | 1    | —             | 10   | μA   |
| Quiescent supply current  |                 | I <sub>CC</sub>                   | V <sub>IN</sub> = 5.5 V or GND              | 1.65~5.5                 | —         | —    | 1    | —             | 10   | μA   |

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

| Characteristics               | Symbol                 | Test Condition                                 | V <sub>CC</sub> (V) | Ta = 25°C |      |      | Ta = -40~85°C |      | Unit |
|-------------------------------|------------------------|--|---------------------|-----------|------|------|---------------|------|------|
|                               |                        |  |                     | Min       | Typ. | Max  | Min           | Max  |      |
| Propagation delay time        | $t_{pLH}$<br>$t_{pHL}$ | $C_L = 15 \text{ pF}, R_L = 1 \text{ M}\Omega$ | $1.8 \pm 0.15$      | 2.0       | 9.1  | 15.0 | 2.0           | 15.6 | ns   |
|                               |                        |  | $2.5 \pm 0.2$       | 1.0       | 5.0  | 9.0  | 1.0           | 9.5  |      |
|                               |                        |  | $3.3 \pm 0.3$       | 1.0       | 3.7  | 6.3  | 1.0           | 6.5  |      |
|                               |                        |  | $5.0 \pm 0.5$       | 0.5       | 3.1  | 5.2  | 0.5           | 5.5  |      |
|                               |                        | $C_L = 50 \text{ pF}, R_L = 500 \Omega$        | $3.3 \pm 0.3$       | 1.5       | 4.4  | 7.2  | 1.5           | 7.5  |      |
|                               |                        |  | $5.0 \pm 0.5$       | 0.8       | 3.7  | 5.9  | 0.8           | 6.2  |      |
| Input capacitance             | C <sub>IN</sub>        | —  | 0~5.5               | —         | 3.0  | —    | —             | —    | pF   |
| Power dissipation capacitance | C <sub>PD</sub>        | (Note 4)                                       | 3.3                 | —         | 33   | —    | —             | —    | pF   |
|                               |                        |  | 5.5                 | —         | 43   | —    | —             | —    |      |

Note 4: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

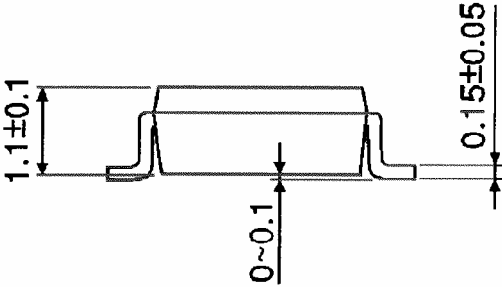
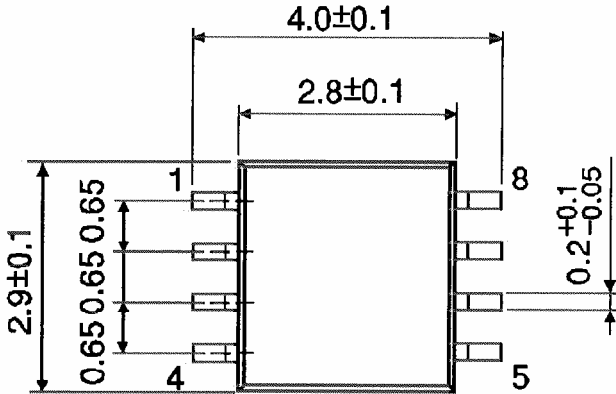
Average operating current can be obtained by the equation:

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

**Package Dimensions**

SSOP8-P-0.65

Unit : mm

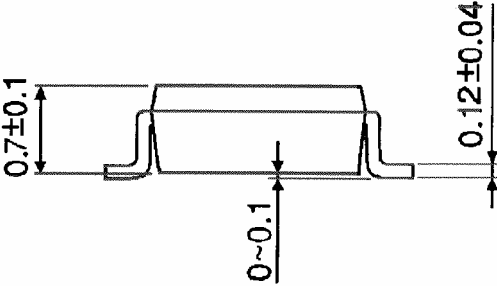
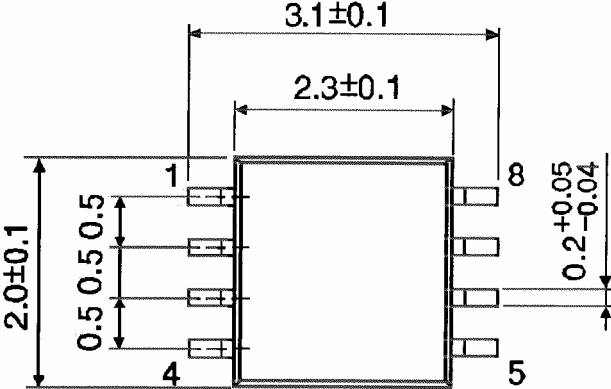


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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20070701-EN GENERAL

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