

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

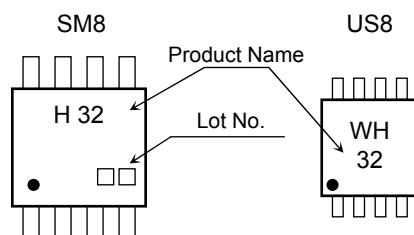
# TC7WH32FU, TC7WH32FK

Dual 2-Input OR Gate

## Features

- High speed operation :  $t_{pd} = 3.8\text{ns}$  (typ.)  
at  $V_{CC} = 5\text{V}$ ,  $C_L = 15\text{pF}$
- Low power dissipation :  $I_{CC} = 2\mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity :  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Operating voltage range :  $V_{CC} = 2$  to  $5.5\text{V}$
- Balanced propagation delays :  $t_{pLH} \approx t_{pHL}$
- 5.5-V tolerant inputs
- Identical pin assignment and function with TC7W32

## Marking



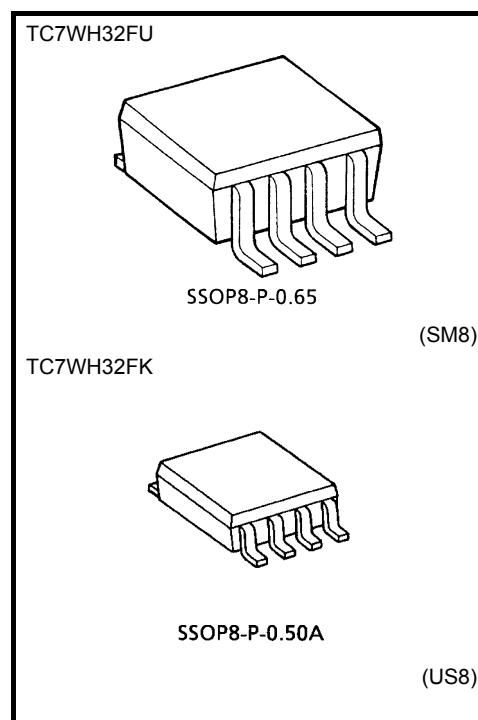
## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| Characteristics          | Symbol    | Rating                 | Unit             |
|--------------------------|-----------|------------------------|------------------|
| Supply voltage           | $V_{CC}$  | -0.5 to 7.0            | V                |
| DC input voltage         | $V_{IN}$  | -0.5 to 7.0            | V                |
| DC output voltage        | $V_{OUT}$ | -0.5 to $V_{CC} + 0.5$ | V                |
| Input diode current      | $I_{IK}$  | -20                    | mA               |
| Output diode current     | $I_{OK}$  | $\pm 20$ (Note 1)      | mA               |
| DC output current        | $I_{OUT}$ | $\pm 25$               | mA               |
| DC $V_{CC}$ /GND current | $I_{CC}$  | $\pm 50$               | mA               |
| Power dissipation        | $P_D$     | 300 (SM8)<br>200 (US8) | mW               |
| Storage temperature      | $T_{stg}$ | -65 to 150             | $^\circ\text{C}$ |
| Lead Temperature (10s)   | $T_L$     | 260                    | $^\circ\text{C}$ |

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.

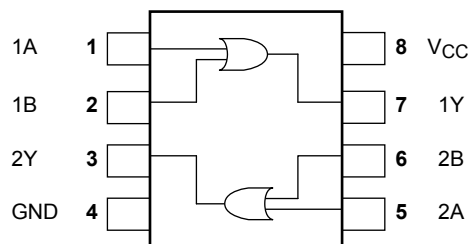
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1:  $V_{OUT} < \text{GND}$ ,  $V_{OUT} > V_{CC}$



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

## Pin Assignment (top view)



IEC Logic Symbol



Truth Table

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

Operating Ranges

| Characteristics          | Symbol           | Rating                                     | Unit |
|--------------------------|------------------|--------------------------------------------|------|
| Supply voltage           | V <sub>CC</sub>  | 2.0 to 5.5                                 | V    |
| Input voltage            | V <sub>IN</sub>  | 0 to 5.5                                   | V    |
| Output voltage           | V <sub>OUT</sub> | 0 to V <sub>CC</sub>                       | V    |
| Operating temperature    | T <sub>opr</sub> | −40 to 85                                  | °C   |
| Input rise and fall time | dt/dv            | 0 to 100 (V <sub>CC</sub> = 3.3 V ± 0.3 V) | ns/V |
|                          |                  | 0 to 20 (V <sub>CC</sub> = 5.0 V ± 0.5 V)  |      |

**Electrical Characteristics**
**DC Characteristics**

| Characteristic            | Symbol          | Test Condition                                       |                          | Ta = 25°C           |                       |      | Ta = -40 to 85°C      |                       | Unit                  |     |
|---------------------------|-----------------|------------------------------------------------------|--------------------------|---------------------|-----------------------|------|-----------------------|-----------------------|-----------------------|-----|
|                           |                 |                                                      |                          | V <sub>CC</sub> (V) | Min                   | Typ. | Max                   | Min                   |                       | Max |
| High-level input voltage  | V <sub>IH</sub> | —                                                    |                          | 2.0                 | 1.5                   | —    | —                     | 1.5                   | —                     | V   |
|                           |                 |                                                      |                          | 3.0 to 5.5          | V <sub>CC</sub> × 0.7 | —    | —                     | V <sub>CC</sub> × 0.7 | —                     |     |
| Low-level input voltage   | V <sub>IL</sub> | —                                                    |                          | 2.0                 | —                     | —    | 0.5                   | —                     | 0.5                   | V   |
|                           |                 |                                                      |                          | 3.0 to 5.5          | —                     | —    | V <sub>CC</sub> × 0.3 | —                     | V <sub>CC</sub> × 0.3 |     |
| high-level output voltage | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -50 μA | 2.0                 | 1.9                   | 2.0  | —                     | 1.9                   | —                     | V   |
|                           |                 |                                                      |                          | 3.0                 | 2.9                   | 3.0  | —                     | 2.9                   | —                     |     |
|                           |                 |                                                      |                          | 4.5                 | 4.4                   | 4.5  | —                     | 4.4                   | —                     |     |
|                           |                 |                                                      | I <sub>OH</sub> = -4 mA  | 3.0                 | 2.58                  | —    | —                     | 2.48                  | —                     |     |
|                           |                 |                                                      | I <sub>OH</sub> = -8 mA  | 4.5                 | 3.94                  | —    | —                     | 3.80                  | —                     |     |
| Low-level output voltage  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IL</sub>                    | I <sub>OL</sub> = 50 μA  | 2.0                 | —                     | 0.0  | 0.1                   | —                     | 0.1                   |     |
|                           |                 |                                                      |                          | 3.0                 | —                     | 0.0  | 0.1                   | —                     | 0.1                   |     |
|                           |                 |                                                      |                          | 4.5                 | —                     | 0.0  | 0.1                   | —                     | 0.1                   |     |
|                           |                 |                                                      | I <sub>OL</sub> = 4 mA   | 3.0                 | —                     | —    | 0.36                  | —                     | 0.44                  |     |
|                           |                 |                                                      | I <sub>OL</sub> = 8 mA   | 4.5                 | —                     | —    | 0.36                  | —                     | 0.44                  |     |
| Input leakage current     | I <sub>IN</sub> | V <sub>IN</sub> = 5.5 V or GND                       |                          | 0 to 5.5            | —                     | —    | ±0.1                  | —                     | ±1.0                  | μA  |
| Quiescent supply current  | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND             |                          | 5.5                 | —                     | —    | 2.0                   | —                     | 20.0                  | μA  |

**AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3 \text{ ns}$ )**

| Characteristic                | Symbol                               | Test Condition      |                     | Ta = 25°C |      |      | Ta = -40 to 85°C |      | Unit |
|-------------------------------|--------------------------------------|---------------------|---------------------|-----------|------|------|------------------|------|------|
|                               |                                      | V <sub>CC</sub> (V) | C <sub>L</sub> (pF) | Min       | Typ. | Max  | Min              | Max  |      |
| Propagation delay time        | t <sub>pLH</sub><br>t <sub>pHL</sub> | 3.3 ± 0.3           | 15                  | —         | 5.5  | 7.9  | 1.0              | 9.5  | ns   |
|                               |                                      |                     | 50                  | —         | 8.0  | 11.4 | 1.0              | 13.0 |      |
|                               |                                      | 5.0 ± 0.5           | 15                  | —         | 3.8  | 5.5  | 1.0              | 6.5  |      |
|                               |                                      |                     | 50                  | —         | 5.3  | 7.5  | 1.0              | 8.5  |      |
| Input capacitance             | C <sub>IN</sub>                      | —                   |                     | —         | 4    | 10   | —                | 10   | pF   |
| Power dissipation capacitance | C <sub>PD</sub>                      | (Note 2)            |                     | —         | 14   | —    | —                | —    | pF   |

Note 2: 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:

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

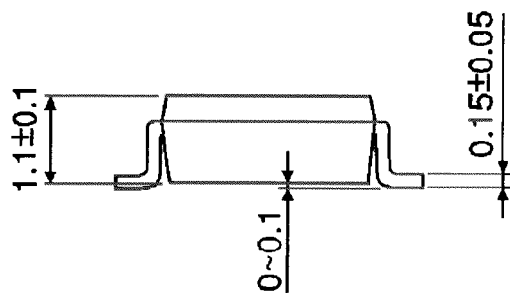
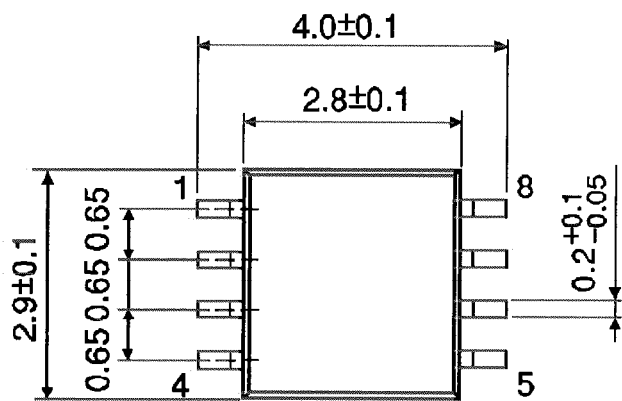
**Noise Characteristics (Ta = 25°C, input:  $t_r = t_f = 3 \text{ ns}$ )**

| Characteristics                              | Symbol           | Test Condition         | V <sub>CC</sub> (V) | Typ. | Limit | Unit |
|----------------------------------------------|------------------|------------------------|---------------------|------|-------|------|
|                                              |                  |                        |                     |      |       |      |
| Quiet output maximum dynamic V <sub>OL</sub> | V <sub>OLP</sub> | C <sub>L</sub> = 50 pF | 5.0                 | 0.3  | 0.8   | V    |
| Quiet output minimum dynamic V <sub>OL</sub> | V <sub>OLV</sub> | C <sub>L</sub> = 50 pF | 5.0                 | -0.3 | -0.8  | V    |
| Minimum high level dynamic input voltage     | V <sub>IHD</sub> | C <sub>L</sub> = 50 pF | 5.0                 | —    | 3.5   | V    |
| Maximum low level dynamic input voltage      | V <sub>ILD</sub> | C <sub>L</sub> = 50 pF | 5.0                 | —    | 1.5   | V    |

Package Dimensions

SSOP8-P-0.65

Unit : mm

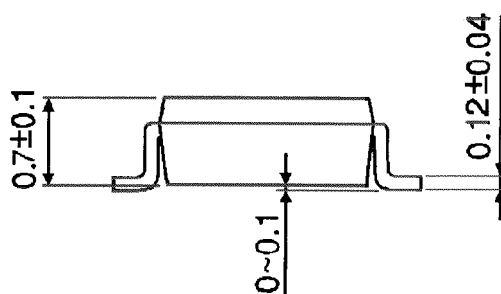
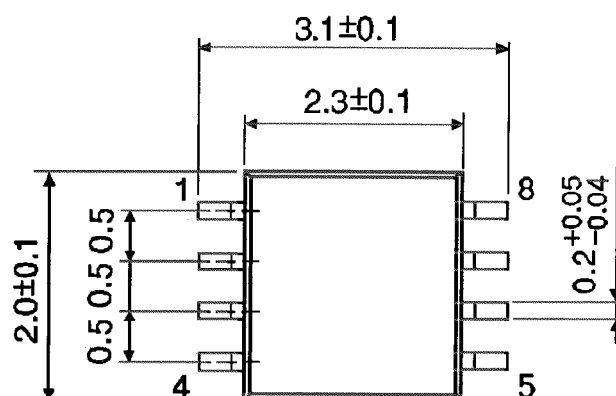


Weight: 0.02 g (typ.)

## Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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