

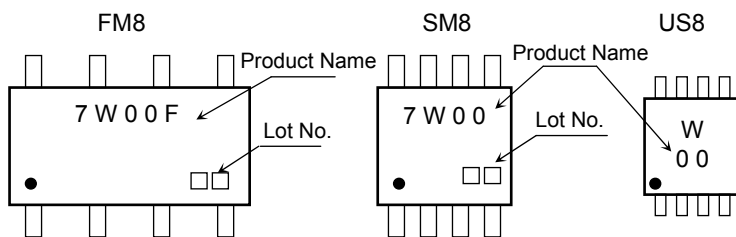
# TC7W00F, TC7W00FU, TC7W00FK

## Dual 2-Input NAND Gate

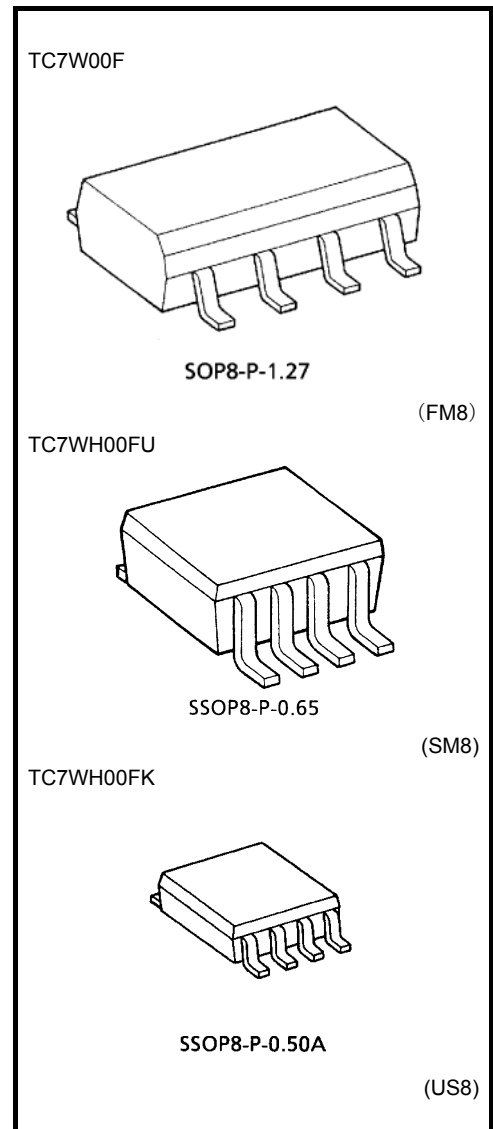
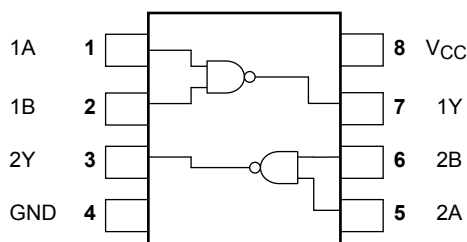
### Features

- High Speed :  $t_{pd} = 6\text{ns}$  (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 :  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Output drive capability : 10 LSTTL Loads
- Symmetrical Output Impedance :  $|I_{OH}| = I_{OL} = 4\text{mA}$  (min)
- Balanced propagation delays :  $t_{pLH} \cong t_{pHL}$
- Wide operating voltage range :  $V_{CC} = 2$  to  $6\text{V}$

### Marking



### Pin Assignment (top view)



Weight

|               |                 |
|---------------|-----------------|
| SOP8-P-1.27   | : 0.05 g (typ.) |
| SSOP8-P-0.65  | : 0.02 g (typ.) |
| SSOP8-P-0.50A | : 0.01 g (typ.) |

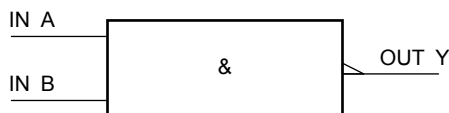
## Absolute Maximum Ratings (Ta = 25°C)

| Characteristics                    | Symbol           | Rating                        | Unit |
|------------------------------------|------------------|-------------------------------|------|
| Supply voltage                     | V <sub>CC</sub>  | -0.5 to 7.0                   | 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 (FM8, SM8)                | mW   |
|                                    |                  | 200 (US8)                     |      |
| Storage temperature                | 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).

## IEC Logic Symbol



## Truth Table

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

## Operating Ranges

| Characteristics          | Symbol                          | Rating                              | Unit |
|--------------------------|---------------------------------|-------------------------------------|------|
| Supply voltage           | V <sub>CC</sub>                 | 2.0 to 6.0                          | V    |
| Input voltage            | V <sub>IN</sub>                 | 0 to V <sub>CC</sub>                | 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 | t <sub>r</sub> , t <sub>f</sub> | 0 to 1000 (V <sub>CC</sub> = 2.0 V) | ns   |
|                          |                                 | 0 to 500 (V <sub>CC</sub> = 4.5 V)  |      |
|                          |                                 | 0 to 400 (V <sub>CC</sub> = 6.0 V)  |      |

**Electrical Characteristics**

**DC Characteristics**

| Characteristics           | 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   |
|                           |                 |   |                          | 4.5                 | 3.15 | —    | —                | 3.15 | —    |     |
|                           |                 |   |                          | 6.0                 | 4.2  | —    | —                | 4.2  | —    |     |
| Low-level input voltage   | V <sub>IL</sub> | —   |                          | 2.0                 | —    | —    | 0.5              | —    | 0.5  |     |
|                           |                 |   |                          | 4.5                 | —    | —    | 1.35             | —    | 1.35 |     |
|                           |                 |   |                          | 6.0                 | —    | —    | 1.8              | —    | 1.8  |     |
| High-level output voltage | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IH</sub><br>or V <sub>IL</sub> | I <sub>OH</sub> = -20 μA | 2.0                 | 1.9  | 2.0  | —                | 1.9  | —    | V   |
|                           |                 |   |                          | 4.5                 | 4.4  | 4.5  | —                | 4.4  | —    |     |
|                           |                 |   | I <sub>OH</sub> = -4 mA  | 4.5                 | 4.18 | 4.31 | —                | 4.13 | —    |     |
|                           |                 |   |                          | 6.0                 | 5.9  | 6.0  | —                | 5.9  | —    |     |
| Low-level output voltage  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub>                       | I <sub>OL</sub> = 20 μA  | 2.0                 | —    | 0.0  | 0.1              | —    | 0.1  |     |
|                           |                 |   |                          | 4.5                 | —    | 0.0  | 0.1              | —    | 0.1  |     |
|                           |                 |   |                          | 6.0                 | —    | 0.0  | 0.1              | —    | 0.1  |     |
|                           |                 |   | I <sub>OL</sub> = 4 mA   | 4.5                 | —    | 0.17 | 0.26             | —    | 0.33 |     |
|                           |                 |   |                          | 6.0                 | —    | 0.18 | 0.26             | —    | 0.33 |     |
| Input leakage current     | I <sub>IN</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                |                          | 6.0                 | —    | —    | ±0.1             | —    | ±1.0 | μA  |
| Quiescent supply current  | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                |                          | 6.0                 | —    | —    | 1.0              | —    | 10.0 | μA  |

## AC Characteristics (C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C)

| Characteristics        | Symbol           | Test Condition | Ta = 25°C |      |     | Unit |
|------------------------|------------------|----------------|-----------|------|-----|------|
|                        |                  |                | Min       | Typ. | Max |      |
| Output Transition Time | t <sub>TLH</sub> | —              | —         | 4    | 8   | ns   |
|                        | t <sub>THL</sub> |                |           |      |     |      |
| Propagation Delay Time | t <sub>pLH</sub> | —              | —         | 6    | 12  | ns   |
|                        | t <sub>pHL</sub> |                |           |      |     |      |

## AC Characteristics (C<sub>L</sub> = 50pF, Input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Characteristics               | Symbol                               | Test Condition | V <sub>CC</sub> (V) | Ta = 25°C |      |     | Ta = -40 to 85°C |     | Unit |
|-------------------------------|--------------------------------------|----------------|---------------------|-----------|------|-----|------------------|-----|------|
|                               |                                      |                |                     | Min       | Typ. | Max | Min              | Max |      |
| Output Transition Time        | t <sub>TLH</sub><br>t <sub>THL</sub> | —              | 2.0                 | —         | 25   | 75  | —                | 95  | ns   |
|                               |                                      |                | 4.5                 | —         | 7    | 15  | —                | 19  |      |
|                               |                                      |                | 6.0                 | —         | 6    | 13  | —                | 16  |      |
| Propagation delay time        | t <sub>pLH</sub><br>t <sub>pHL</sub> | —              | 2.0                 | —         | 25   | 75  | —                | 95  | ns   |
|                               |                                      |                | 4.5                 | —         | 9    | 15  | —                | 19  |      |
|                               |                                      |                | 6.0                 | —         | 8    | 13  | —                | 16  |      |
| Input capacitance             | C <sub>IN</sub>                      | —              | —                   | 5         | 10   | —   | 10               | pF  |      |
| Power dissipation capacitance | C <sub>PD</sub>                      | (Note 1)       | —                   | 20        | —    | —   | —                | pF  |      |

Note 1: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

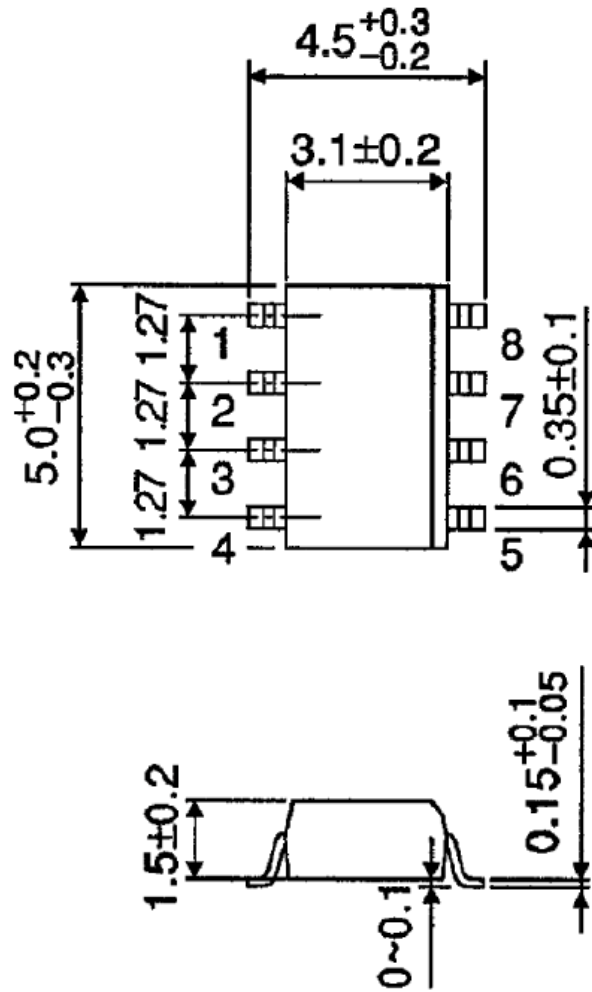
Average operating current can be obtained by the equation:

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

## Package Dimensions

SOP8-P-1.27

Unit : mm

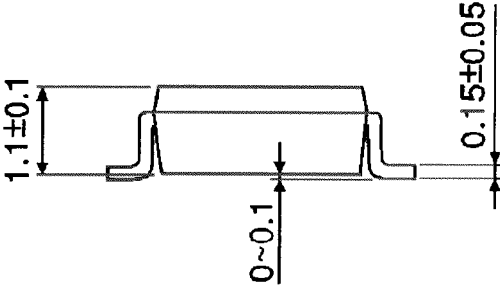
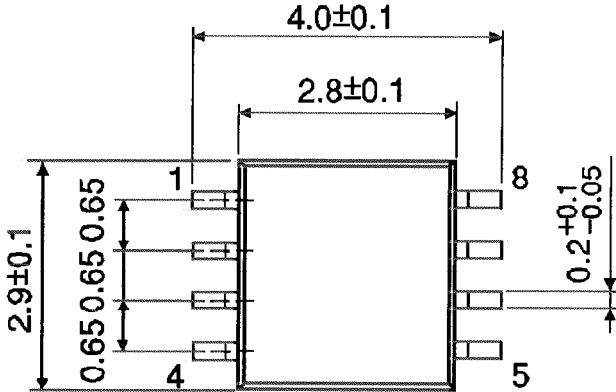


Weight: 0.05 g (typ.)

**Package Dimensions**

SSOP8-P-0.65

Unit : mm

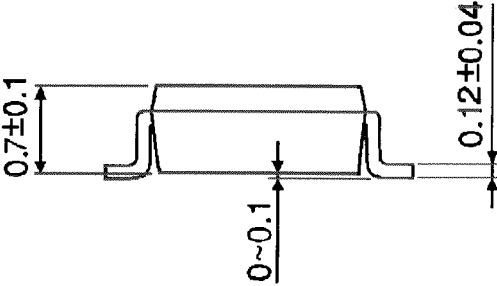
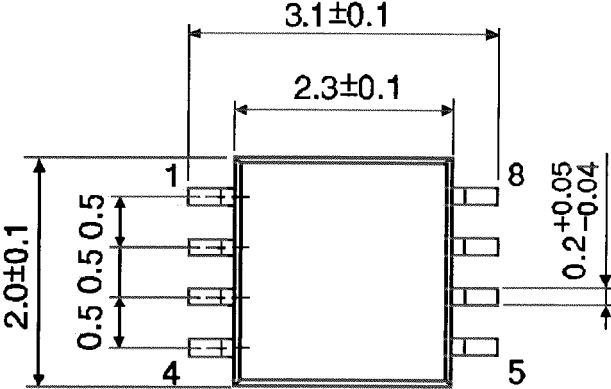


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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