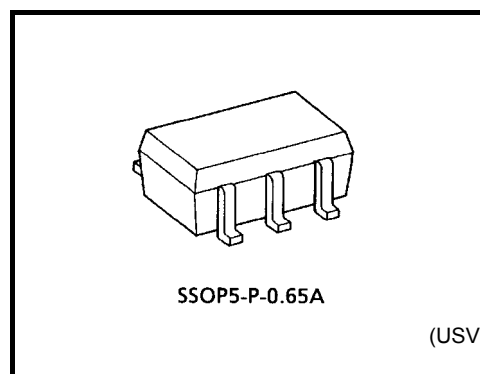


## TC7SG08FU

### 2 Input AND Gate

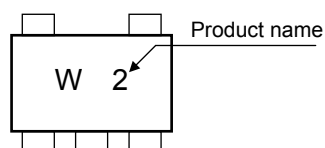
#### Features

- High-level output current:  $I_{OH}/I_{OL} = \pm 8 \text{ mA (min)}$   
at  $V_{CC} = 3.0 \text{ V}$
- High-speed operation:  $t_{pd} = 2.5 \text{ ns (typ.)}$   
at  $V_{CC} = 3.3 \text{ V}, 15 \text{ pF}$
- Operating voltage range:  $V_{CC} = 0.9 \sim 3.6 \text{ V}$
- 5.5-V tolerant inputs.
- 3.6-V power down protection output.

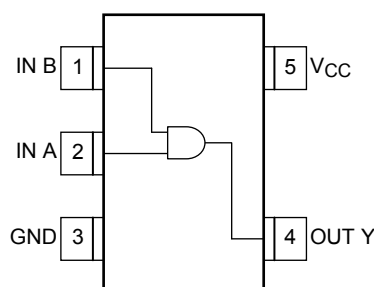


Weight: 0.006 g (typ.)

#### Marking



#### Pin Assignment (top view)



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

| Characteristics             | Symbol    | Value                             | Unit             |
|-----------------------------|-----------|-----------------------------------|------------------|
| Power supply voltage        | $V_{CC}$  | $-0.5 \sim 4.6$                   | V                |
| DC input voltage            | $V_{IN}$  | $-0.5 \sim 7.0$                   | V                |
| DC output voltage           | $V_{OUT}$ | $-0.5 \sim 4.6$ (Note 1)          | V                |
|                             |           | $-0.5 \sim V_{CC} + 0.5$ (Note 2) |                  |
| Input diode current         | $I_{IK}$  | $-20$                             | mA               |
| Output diode current        | $I_{OK}$  | $-20$ (Note 3)                    | mA               |
| DC output current           | $I_{OUT}$ | $\pm 25$                          | mA               |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$                          | mA               |
| Power dissipation           | $P_D$     | 200                               | mW               |
| Storage temperature         | $T_{stg}$ | $-65 \sim 150$                    | $^\circ\text{C}$ |

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:  $V_{CC} = 0 \text{ V}$

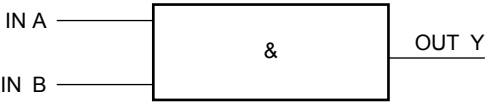
Note 2: High or Low State.  $I_{OUT}$  absolute maximum rating must be observed.

Note 3:  $V_{OUT} < \text{GND}$

Truth Table

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

IEC Logic Symbol



Operating Ranges

| Characteristics          | Symbol                           | Value                      | Unit |
|--------------------------|----------------------------------|----------------------------|------|
| Power supply voltage     | V <sub>CC</sub>                  | 0.9~3.6                    | V    |
| Input voltage            | V <sub>IN</sub>                  | 0~5.5                      | V    |
| Output voltage           | V <sub>OUT</sub>                 | 0~3.6 (Note 4)             | V    |
|                          |                                  | 0~V <sub>CC</sub> (Note 5) |      |
| Output Current           | I <sub>OH</sub> /I <sub>OL</sub> | ±8.0 (Note 6)              | mA   |
|                          |                                  | ±4.0 (Note 7)              |      |
|                          |                                  | ±3.0 (Note 8)              |      |
|                          |                                  | ±1.7 (Note 9)              |      |
|                          |                                  | ±0.3 (Note 10)             |      |
|                          |                                  | ±0.02 (Note 11)            |      |
| Operating temperature    | T <sub>opr</sub>                 | −40~85                     | °C   |
| Input rise and fall time | dt/dV                            | 0~10 (Note 12)             | ns/V |

- Note 4: V<sub>CC</sub> = 0V
- Note 5: High or Low state.
- Note 6: V<sub>CC</sub> = 3.0~3.6 V
- Note 7: V<sub>CC</sub> = 2.3~2.7 V
- Note 8: V<sub>CC</sub> = 1.65~1.95 V
- Note 9: V<sub>CC</sub> = 1.4~1.6 V
- Note 10: V<sub>CC</sub> = 1.1~1.3 V
- Note 11: V<sub>CC</sub> = 0.9 V
- Note 12: V<sub>IN</sub> = 0.8~2.0 V, V<sub>CC</sub> = 3.0 V

## DC Electrical Characteristics

| Characteristics           | Symbol           | Test Condition                                        |                            | Ta = 25°C           |                        |      |                        | Ta = -40~85°C          |                        | Unit |
|---------------------------|------------------|-------------------------------------------------------|----------------------------|---------------------|------------------------|------|------------------------|------------------------|------------------------|------|
|                           |                  |                                                       |                            | V <sub>CC</sub> (V) | Min                    | Typ. | Max                    | Min                    | Max                    |      |
| High-level input voltage  | V <sub>IH</sub>  | —                                                     |                            | 0.9                 | V <sub>CC</sub>        | —    | —                      | V <sub>CC</sub>        | —                      | V    |
|                           |                  |                                                       |                            | 1.1~1.3             | V <sub>CC</sub> × 0.7  | —    | —                      | V <sub>CC</sub> × 0.7  | —                      |      |
|                           |                  |                                                       |                            | 1.4~1.6             | V <sub>CC</sub> × 0.65 | —    | —                      | V <sub>CC</sub> × 0.65 | —                      |      |
|                           |                  |                                                       |                            | 1.65~1.95           | V <sub>CC</sub> × 0.65 | —    | —                      | V <sub>CC</sub> × 0.65 | —                      |      |
|                           |                  |                                                       |                            | 2.3~2.7             | 1.7                    | —    | —                      | 1.7                    | —                      |      |
|                           |                  |                                                       |                            | 3.0~3.6             | 2.0                    | —    | —                      | 2.0                    | —                      |      |
| Low-level input voltage   | V <sub>IL</sub>  | —                                                     |                            | 0.9                 | —                      | —    | GND                    | —                      | GND                    | V    |
|                           |                  |                                                       |                            | 1.1~1.3             | —                      | —    | V <sub>CC</sub> × 0.3  | —                      | V <sub>CC</sub> × 0.3  |      |
|                           |                  |                                                       |                            | 1.4~1.6             | —                      | —    | V <sub>CC</sub> × 0.35 | —                      | V <sub>CC</sub> × 0.35 |      |
|                           |                  |                                                       |                            | 1.65~1.95           | —                      | —    | V <sub>CC</sub> × 0.35 | —                      | V <sub>CC</sub> × 0.35 |      |
|                           |                  |                                                       |                            | 2.3~2.7             | —                      | —    | 0.7                    | —                      | 0.7                    |      |
|                           |                  |                                                       |                            | 3.0~3.6             | —                      | —    | 0.8                    | —                      | 0.8                    |      |
| High-level output voltage | V <sub>OH</sub>  | V <sub>IN</sub> = V <sub>IH</sub>                     | I <sub>OH</sub> = -0.02 mA | 0.9                 | 0.75                   | —    | —                      | 0.75                   | —                      | V    |
|                           |                  |                                                       | I <sub>OH</sub> = -0.3 mA  | 1.1~1.3             | V <sub>CC</sub> × 0.75 | —    | —                      | V <sub>CC</sub> × 0.75 | —                      |      |
|                           |                  |                                                       | I <sub>OH</sub> = -1.7 mA  | 1.4~1.6             | V <sub>CC</sub> × 0.75 | —    | —                      | V <sub>CC</sub> × 0.75 | —                      |      |
|                           |                  |                                                       | I <sub>OH</sub> = -3.0 mA  | 1.65~1.95           | V <sub>CC</sub> -0.45  | —    | —                      | V <sub>CC</sub> -0.45  | —                      |      |
|                           |                  |                                                       | I <sub>OH</sub> = -4.0 mA  | 2.3~2.7             | 2.0                    | —    | —                      | 2.0                    | —                      |      |
|                           |                  |                                                       | I <sub>OH</sub> = -8.0 mA  | 3.0~3.6             | 2.48                   | —    | —                      | 2.48                   | —                      |      |
| Low-level output voltage  | V <sub>OL</sub>  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  | I <sub>OL</sub> = 0.02 mA  | 0.9                 | —                      | —    | 0.1                    | —                      | 0.1                    | V    |
|                           |                  |                                                       | I <sub>OL</sub> = 0.3 mA   | 1.1~1.3             | —                      | —    | V <sub>CC</sub> × 0.25 | —                      | V <sub>CC</sub> × 0.25 |      |
|                           |                  |                                                       | I <sub>OL</sub> = 1.7 mA   | 1.4~1.6             | —                      | —    | V <sub>CC</sub> × 0.25 | —                      | V <sub>CC</sub> × 0.25 |      |
|                           |                  |                                                       | I <sub>OL</sub> = 3.0 mA   | 1.65~1.95           | —                      | —    | 0.45                   | —                      | 0.45                   |      |
|                           |                  |                                                       | I <sub>OL</sub> = 4.0 mA   | 2.3~2.7             | —                      | —    | 0.4                    | —                      | 0.4                    |      |
|                           |                  |                                                       | I <sub>OL</sub> = 8.0 mA   | 3.0~3.6             | —                      | —    | 0.4                    | —                      | 0.4                    |      |
| Input leakage current     | I <sub>IN</sub>  | V <sub>IN</sub> = 0~5.5V                              |                            | 0~3.6               | —                      | —    | ±0.1                   | —                      | ±1.0                   | μA   |
| Power off leakage current | I <sub>OFF</sub> | V <sub>IN</sub> = 0~5.5V<br>V <sub>OUT</sub> = 0~3.6V |                            | 0                   | —                      | —    | 1.0                    | —                      | 10.0                   | μA   |
| Quiescent supply current  | I <sub>CC</sub>  | V <sub>IN</sub> = V <sub>CC</sub> or GND              |                            | 3.6                 | —                      | —    | 1.0                    | —                      | 10.0                   | μA   |

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

| Characteristics               | Symbol                 | Test Condition                                     | Ta = 25°C           |     |      | Ta = -40~85°C |     | Unit |
|-------------------------------|------------------------|----------------------------------------------------|---------------------|-----|------|---------------|-----|------|
|                               |                        |                                                    | V <sub>CC</sub> (V) | Min | Typ. | Max           | Min | Max  |
| Propagation delay time        | $t_{PLH}$<br>$t_{PHL}$ | $C_L = 10\text{ pF}$ ,<br>$R_L = 1\text{ M}\Omega$ | 0.9                 | —   | 26.9 | —             | —   | —    |
|                               |                        |                                                    | 1.1~1.3             | —   | 10.9 | 20.7          | 1.0 | 38.6 |
|                               |                        |                                                    | 1.4~1.6             | —   | 5.9  | 9.6           | 1.0 | 11.3 |
|                               |                        |                                                    | 1.65~1.95           | —   | 4.5  | 7.0           | 1.0 | 7.5  |
|                               |                        |                                                    | 2.3~2.7             | —   | 2.9  | 4.4           | 1.0 | 4.9  |
|                               |                        |                                                    | 3.0~3.6             | —   | 2.2  | 3.5           | 1.0 | 4.1  |
|                               |                        | $C_L = 15\text{ pF}$ ,<br>$R_L = 1\text{ M}\Omega$ | 0.9                 | —   | 30.0 | —             | —   | —    |
|                               |                        |                                                    | 1.1~1.3             | —   | 12.0 | 24.2          | 1.0 | 42.0 |
|                               |                        |                                                    | 1.4~1.6             | —   | 6.5  | 10.5          | 1.0 | 12.6 |
|                               |                        |                                                    | 1.65~1.95           | —   | 5.0  | 7.7           | 1.0 | 8.0  |
|                               |                        |                                                    | 2.3~2.7             | —   | 3.2  | 4.9           | 1.0 | 5.6  |
|                               |                        |                                                    | 3.0~3.6             | —   | 2.5  | 3.8           | 1.0 | 4.4  |
|                               |                        | $C_L = 30\text{ pF}$ ,<br>$R_L = 1\text{ M}\Omega$ | 0.9                 | —   | 45.0 | —             | —   | —    |
|                               |                        |                                                    | 1.1~1.3             | —   | 18.0 | 33.4          | 1.0 | 63.2 |
|                               |                        |                                                    | 1.4~1.6             | —   | 8.9  | 14.8          | 1.0 | 17.9 |
|                               |                        |                                                    | 1.65~1.95           | —   | 6.9  | 10.3          | 1.0 | 10.8 |
|                               |                        |                                                    | 2.3~2.7             | —   | 4.4  | 6.4           | 1.0 | 6.8  |
|                               |                        |                                                    | 3.0~3.6             | —   | 3.5  | 4.9           | 1.0 | 5.4  |
| Input capacitance             | $C_{IN}$               | —                                                  | 3.6                 | —   | 3    | —             | —   | pF   |
| Power dissipation capacitance | $C_{PD}$               | (Note 13)                                          | 0.9~3.6             | —   | 6    | —             | —   | pF   |

Note 13:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

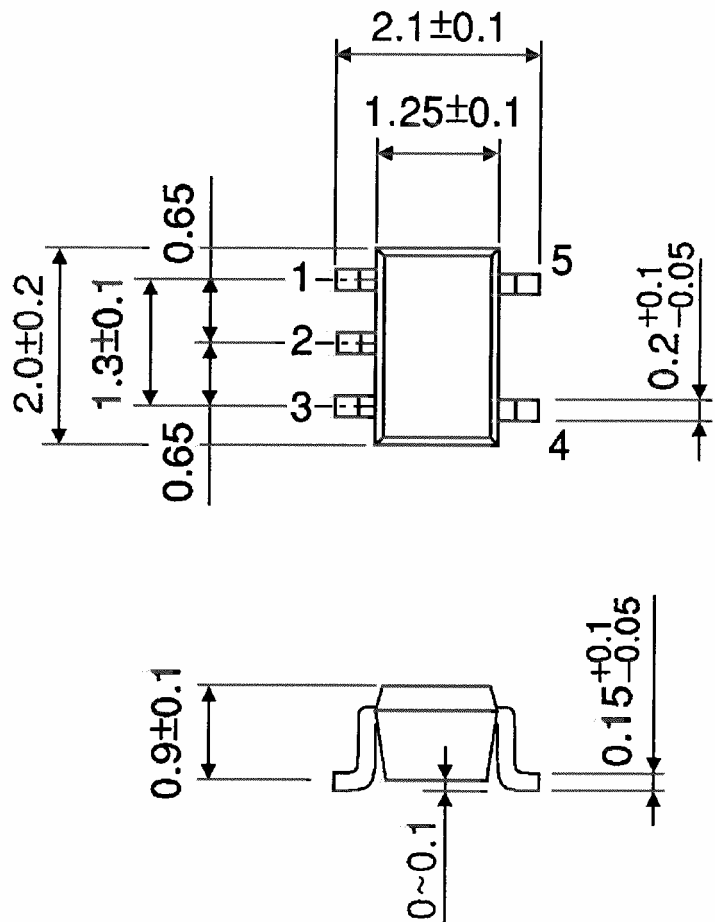
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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