

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

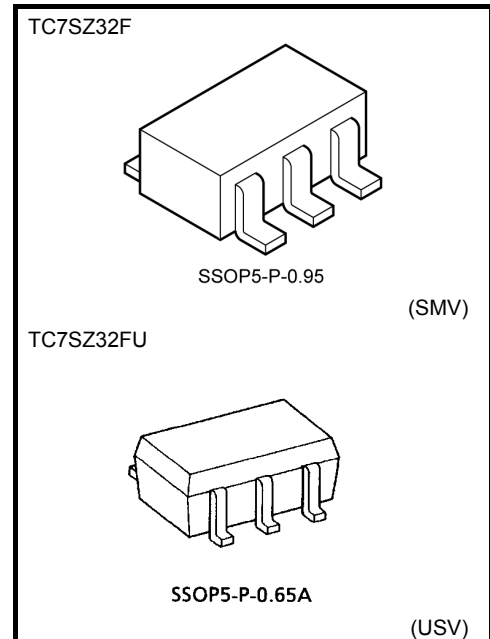
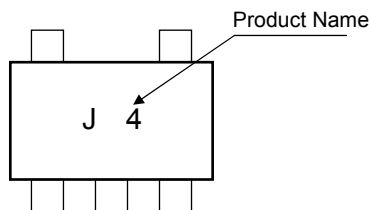
# TC7SZ32F, TC7SZ32FU

## 2-Input OR Gate

### Features

- High output current :  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation :  $t_{pd} = 2.4$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operating voltage range :  $V_{CC} = 1.8$  to 5.5 V
- 5.5-V tolerant inputs
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at 3.3- V  $V_{CC}$

### Marking

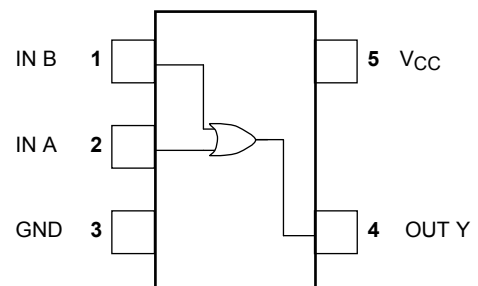


Weight:  
 SSOP5-P-0.95 : 0.016 g (typ.)  
 SSOP5-P-0.65A : 0.006 g (typ.)

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

| Characteristics             | Symbol    | Rating                          | Unit |
|-----------------------------|-----------|---------------------------------|------|
| Supply voltage              | $V_{CC}$  | -0.5 to 6                       | V    |
| DC input voltage            | $V_{IN}$  | -0.5 to 6                       | V    |
| DC output voltage           | $V_{OUT}$ | -0.5 to 6 (Note 1)              | V    |
|                             |           | -0.5 to $V_{CC} + 0.5$ (Note 2) |      |
| Input diode current         | $I_{IK}$  | -20                             | mA   |
| Output diode current        | $I_{OK}$  | -20 (Note 3)                    | mA   |
| DC output current           | $I_{OUT}$ | $\pm 50$                        | mA   |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$                        | mA   |
| Power dissipation           | $P_D$     | 200                             | mW   |
| Storage temperature         | $T_{stg}$ | -65 to 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).

Note 1:  $V_{CC} = 0$  V

Note 2: High or Low State. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

## 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           | $V_{CC}$  | 1.8 to 5.5   | V    |
|                          |           | 1.5 to 5.5 (Note 4)  |      |
| Input voltage            | $V_{IN}$  | 0 to 5.5   | V    |
| Output voltage           | $V_{OUT}$ | 0 to 5.5 (Note 5)  | V    |
|                          |           | 0 to $V_{CC}$ (Note 6)   |      |
| Operating temperature    | $T_{opr}$ | -40 to 85  | °C   |
| Input rise and fall time | dt/dv     | 0 to 20 ( $V_{CC} = 1.8\text{ V}, 2.5\text{ V} \pm 0.2\text{ V}$ ) | ns/V |
|                          |           | 0 to 10 ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ )               |      |
|                          |           | 0 to 5 ( $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ )                |      |

Note 4: Data retention only

Note 5:  $V_{CC} = 0\text{ V}$

Note 6: High or Low state

## 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>  | —   | 1.8                       | V <sub>CC</sub> × 0.88   | —    | —                      | V <sub>CC</sub> × 0.88 | —                      | V    |   |      |
|                           |                  |   | 2.3 to 5.5                | V <sub>CC</sub> × 0.75   | —    | —                      | V <sub>CC</sub> × 0.75 | —                      |      |   |      |
| Low-level input voltage   | V <sub>IL</sub>  | —   | 1.8                       | —                        | —    | V <sub>CC</sub> × 0.12 | —                      | V <sub>CC</sub> × 0.12 | V    |   |      |
|                           |                  |   | 2.3 to 5.5                | —                        | —    | V <sub>CC</sub> × 0.25 | —                      | V <sub>CC</sub> × 0.25 |      |   |      |
| 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> = -100 μA | 1.8                      | 1.7  | 1.8                    | —                      | 1.7                    | —    | V |      |
|                           |                  |   |                           | 2.3                      | 2.2  | 2.3                    | —                      | 2.2                    | —    |   |      |
|                           |                  |   |                           | 3.0                      | 2.9  | 3.0                    | —                      | 2.9                    | —    |   |      |
|                           |                  |   | I <sub>OH</sub> = -8 mA   | 4.5                      | 4.4  | 4.5                    | —                      | 4.4                    | —    |   |      |
|                           |                  |   |                           | 2.3                      | 1.9  | 2.15                   | —                      | 1.9                    | —    |   |      |
|                           |                  |   |                           | I <sub>OH</sub> = -16 mA | 3.0  | 2.4                    | 2.8                    | —                      | 2.4  |   | —    |
|                           |                  |   |                           | I <sub>OH</sub> = -24 mA | 3.0  | 2.3                    | 2.68                   | —                      | 2.3  |   | —    |
| I <sub>OH</sub> = -32 mA  | 4.5              | 3.8   | 4.2                       | —                        | 3.8  | —                      |                        |                        |      |   |      |
| Low-level output voltage  | V <sub>OL</sub>  | V <sub>IN</sub> = V <sub>IL</sub>                       | I <sub>OL</sub> = 100 μA  | 1.8                      | —    | 0                      | 0.1                    | —                      | 0.1  | V |      |
|                           |                  |   |                           | 2.3                      | —    | 0                      | 0.1                    | —                      | 0.1  |   |      |
|                           |                  |   |                           | 3.0                      | —    | 0                      | 0.1                    | —                      | 0.1  |   |      |
|                           |                  |   |                           | 4.5                      | —    | 0                      | 0.1                    | —                      | 0.1  |   |      |
|                           |                  |   | I <sub>OL</sub> = 8 mA    | 2.3                      | —    | 0.1                    | 0.3                    | —                      | 0.3  |   |      |
|                           |                  |   |                           | I <sub>OL</sub> = 16 mA  | 3.0  | —                      | 0.15                   | 0.4                    | —    |   | 0.4  |
|                           |                  |   |                           | I <sub>OL</sub> = 24 mA  | 3.0  | —                      | 0.22                   | 0.55                   | —    |   | 0.55 |
|                           |                  |   |                           | I <sub>OL</sub> = 32 mA  | 4.5  | —                      | 0.22                   | 0.55                   | —    |   | 0.55 |
| Input leakage current     | I <sub>IN</sub>  | V <sub>IN</sub> = 5.5 V or GND                          | 0 to 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> = V <sub>CC</sub> or GND                | 5.5                       | —                        | —    | 2                      | —                      | 20                     | μA   |   |      |

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

| Characteristics               | Symbol  | Test Condition                                   | Ta = 25°C           |     |      | Ta = -40 to 85°C |     | Unit |     |
|-------------------------------|---|--|---------------------|-----|------|------------------|-----|------|-----|
|                               |   |  | V <sub>CC</sub> (V) | Min | Typ. | Max              | Min |      | Max |
| Propagation delay time        | t <sub>pLH</sub><br>t <sub>pHL</sub>              | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 1 MΩ | 1.8                 | 2.0 | 4.6  | 10.0             | 2.0 | 10.5 | ns  |
|                               |   |  | 2.5 ± 0.2           | 0.8 | 3.0  | 7.0              | 0.8 | 7.5  |     |
|                               |   |  | 3.3 ± 0.3           | 0.5 | 2.4  | 4.7              | 0.5 | 5.0  |     |
|                               | 5.0 ± 0.5   | 0.5  | 1.9                 | 4.1 | 0.5  | 4.4              |     |      |     |
|                               | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω | 3.3 ± 0.3  | 1.5                 | 3.0 | 5.2  | 1.5              | 5.5 |      |     |
|                               |   | 5.0 ± 0.5  | 0.8                 | 2.4 | 4.5  | 0.8              | 4.8 |      |     |
| Input capacitance             | C <sub>IN</sub>                                   | —  | 0 to 5.5            | —   | 4    | —                | —   | pF   |     |
| Power dissipation capacitance | C <sub>PD</sub>                                   | (Note 7)   | 3.3                 | —   | 20   | —                | —   | —    | pF  |
|                               |   |  | 5.5                 | —   | 26   | —                | —   | —    |     |

Note 7: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

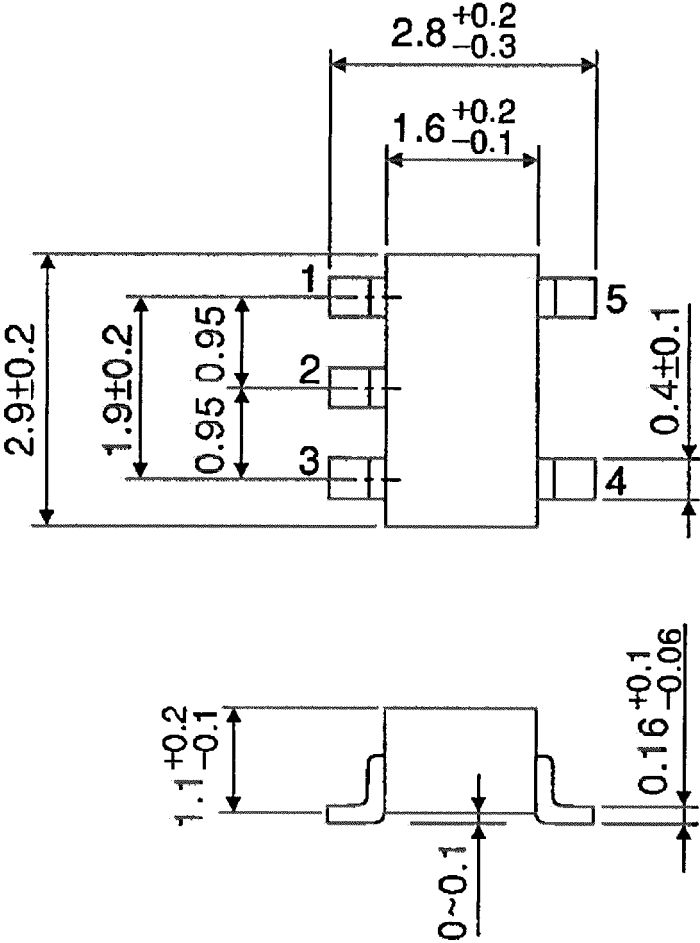
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

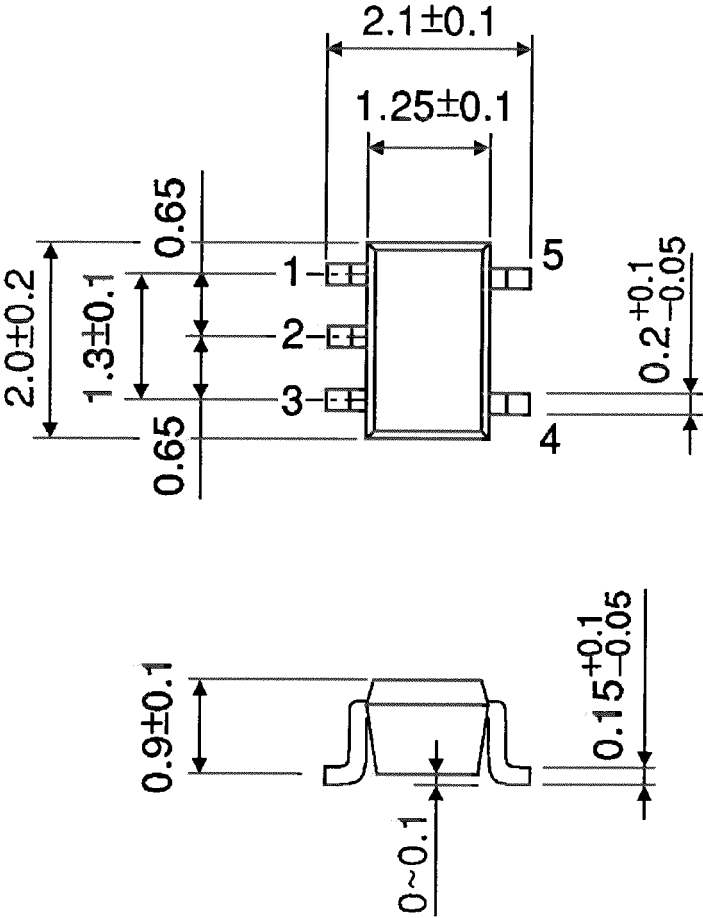


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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