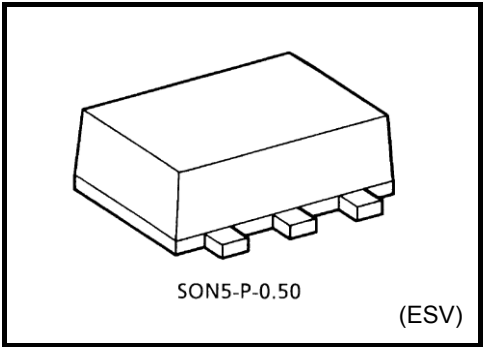


TC7SZU04FE

Inverter (Unbuffered)

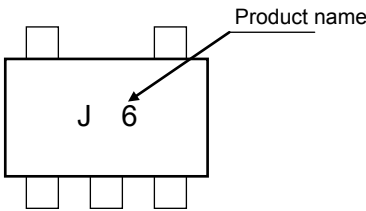
Features

- High output current:  $\pm 32\text{ mA}$  (min) at  $V_{CC} = 4.5\text{ V}$
- Low quiescent power:  $I_{CC} < 1\mu\text{A}$  (max)  
at  $V_{CC} = 5.5\text{ V}$ ,  $T_a = 25^\circ\text{C}$
- Operation voltage range:  $V_{CC\text{ (opr)}} = 1.65\text{ to }5.5\text{ V}$
- 5.5-V tolerant input



Weight : 0.003 g (typ.)

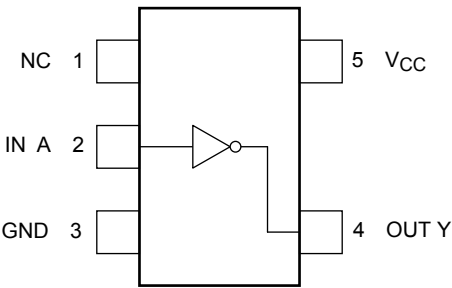
Marking



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

| Characteristics             | Symbol    | Rating                        | Unit             |
|-----------------------------|-----------|-------------------------------|------------------|
| Supply voltage              | $V_{CC}$  | $-0.5\text{ to }6$            | V                |
| DC input voltage            | $V_{IN}$  | $-0.5\text{ to }6$            | V                |
| DC output voltage           | $V_{OUT}$ | $-0.5\text{ to }V_{CC} + 0.5$ | V                |
| Input diode current         | $I_{IK}$  | $-20$                         | mA               |
| Output diode current        | $I_{OK}$  | $\pm 20$ (Note 1)             | mA               |
| DC output current           | $I_{OUT}$ | $\pm 50$                      | mA               |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$                      | mA               |
| Power dissipation           | $P_D$     | 150                           | mW               |
| Storage temperature         | $T_{stg}$ | $-65\text{ to }150$           | $^\circ\text{C}$ |

Pin Assignment (top view)

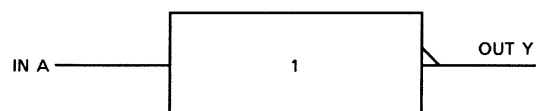


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

## IEC Logic Symbol



## Truth Table

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

## Operating Ranges

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

Note 2: Data retention only

## 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> | —  |                           | 1.65 to 1.95             | V <sub>CC</sub> × 0.85 | —    | —                      | V <sub>CC</sub> × 0.85 | —                      | V   |      |
|                           |                 |  |                           | 2.3 to 5.5               | V <sub>CC</sub> × 0.8  | —    | —                      | V <sub>CC</sub> × 0.8  | —                      |     |      |
| Low-level input voltage   | V <sub>IL</sub> | —  |                           | 1.65 to 1.95             | —                      | —    | V <sub>CC</sub> × 0.15 | —                      | V <sub>CC</sub> × 0.15 | V   |      |
|                           |                 |  |                           | 2.3 to 5.5               | —                      | —    | V <sub>CC</sub> × 0.2  | —                      | V <sub>CC</sub> × 0.2  |     |      |
| High-level output voltage | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IL</sub>        | I <sub>OH</sub> = −100 μA | 1.65                     | 1.45                   | 1.64 | —                      | 1.45                   | —                      | V   |      |
|                           |                 |  |                           | 2.3                      | 2.1                    | 2.3  | —                      | 2.1                    | —                      |     |      |
|                           |                 |  |                           | 3.0                      | 2.7                    | 3.0  | —                      | 2.7                    | —                      |     |      |
|                           |                 |  |                           | 4.5                      | 4.0                    | 4.4  | —                      | 4.0                    | —                      |     |      |
|                           |                 | V <sub>IN</sub> = GND                    | I <sub>OH</sub> = −4 mA   | 1.65                     | 1.29                   | 1.52 | —                      | 1.29                   | —                      |     |      |
|                           |                 |  |                           | I <sub>OH</sub> = −8 mA  | 2.3                    | 1.9  | 2.14                   | —                      | 1.9                    |     | —    |
|                           |                 |  |                           | I <sub>OH</sub> = −12 mA | 3.0                    | 2.4  | 2.75                   | —                      | 2.4                    |     | —    |
|                           |                 |  |                           | I <sub>OH</sub> = −16 mA | 3.0                    | 2.3  | 2.61                   | —                      | 2.3                    |     | —    |
|                           |                 |  |                           | I <sub>OH</sub> = −32 mA | 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>OL</sub> = 100 μA  | 1.65                     | —                      | 0    | 0.2                    | —                      | 0.2                    | V   |      |
|                           |                 |  |                           | 2.3                      | —                      | 0    | 0.2                    | —                      | 0.2                    |     |      |
|                           |                 |  |                           | 3.0                      | —                      | 0    | 0.3                    | —                      | 0.3                    |     |      |
|                           |                 |  |                           | 4.5                      | —                      | 0    | 0.5                    | —                      | 0.5                    |     |      |
|                           |                 | V <sub>IN</sub> = V <sub>CC</sub>        | I <sub>OL</sub> = 4 mA    | 1.65                     | —                      | 0.08 | 0.24                   | —                      | 0.24                   |     |      |
|                           |                 |  |                           | I <sub>OL</sub> = 8 mA   | 2.3                    | —    | 0.1                    | 0.3                    | —                      |     | 0.3  |
|                           |                 |  |                           | I <sub>OL</sub> = 12 mA  | 3.0                    | —    | 0.17                   | 0.4                    | —                      |     | 0.4  |
|                           |                 |  |                           | I <sub>OL</sub> = 16 mA  | 3.0                    | —    | 0.25                   | 0.55                   | —                      |     | 0.55 |
|                           |                 |  |                           | I <sub>OL</sub> = 32 mA  | 4.5                    | —    | 0.26                   | 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                     |     |      |
| Quiescent supply current  | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND | 5.5                       | —                        | —                      | 1    | —                      | 10                     | 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 ± 0.15          | 1.0 | —    | 8.5              | 1.0 | 9.0  |
|                               |                                      |   | 2.5 ± 0.2           | 0.8 | —    | 6.2              | 0.8 | 6.5  |
|                               |                                      |   | 3.3 ± 0.3           | 0.5 | —    | 4.5              | 0.5 | 4.8  |
|                               |                                      |   | 5.0 ± 0.5           | 0.5 | —    | 3.9              | 0.5 | 4.1  |
|                               |                                      | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω | 3.3 ± 0.3           | 1.0 | —    | 6.0              | 1.0 | 6.5  |
|                               |                                      |   | 5.0 ± 0.5           | 0.8 | —    | 5.0              | 0.8 | 5.5  |
| Input capacitance             | C <sub>IN</sub>                      | —   | 0 to 5.5            | —   | 5    | —                | —   | pF   |
| Power dissipation capacitance | C <sub>PD</sub>                      | (Note 3)  | 3.3                 | —   | 10   | —                | —   | pF   |
|                               |                                      |   | 5.5                 | —   | 25   | —                | —   |      |

Note 3: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

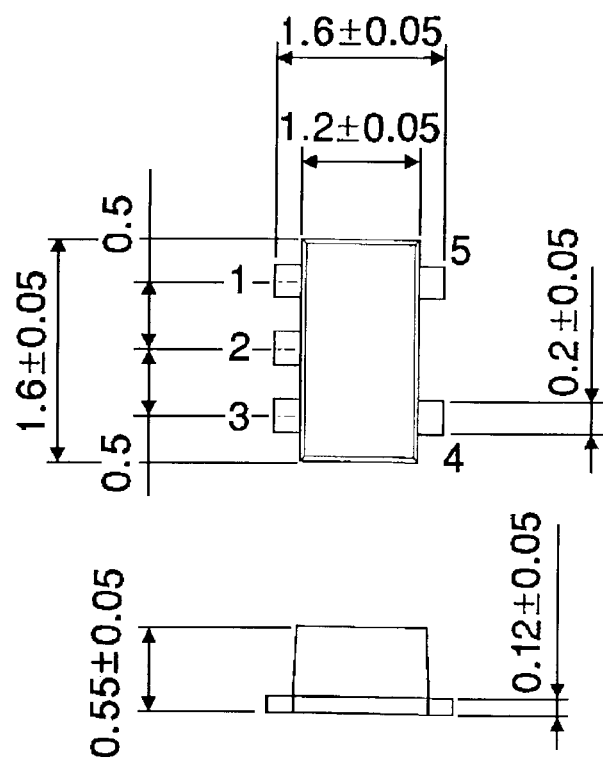
Average operating current can be obtained by the equation.

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

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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