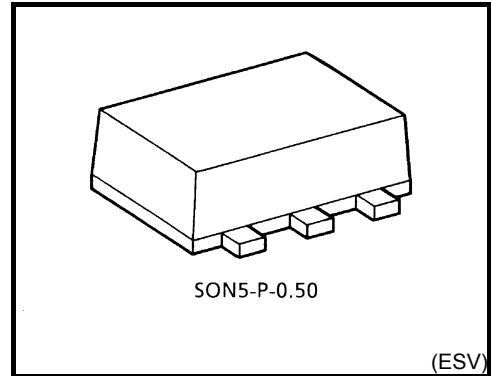


# TC7SZ17FE

## Schmitt Buffer

### Features

- High output current :  $\pm 24\text{mA}$  (min) at  $V_{CC} = 3\text{V}$
- Super high speed operation :  $t_{pd} = 3.7\text{ ns}$  (typ.)  
at  $V_{CC} = 5\text{V}$ ,  $50\text{pF}$
- Operation voltage range :  $V_{CC}(\text{opr.}) = 1.65\text{ to }5.5\text{ V}$
- 5.5-V tolerant input
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at 3.3-V  $V_{CC}$



Weight : 0.003 g (typ.)

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

| Characteristics             | Symbol    | Rating                          | Unit |
|-----------------------------|-----------|---------------------------------|------|
| Supply voltage range        | $V_{CC}$  | -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           | $P_D$     | 150                             | mW   |
| Storage temperature         | $T_{stg}$ | -65 to 150                      | °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.

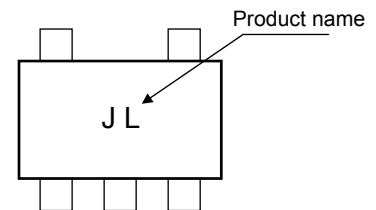
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

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

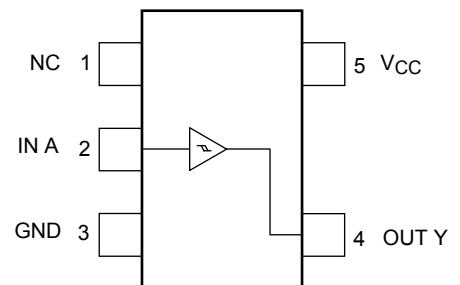
Note 2: High or Low state. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

### Marking

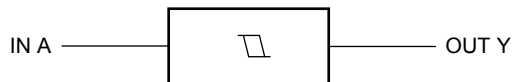


### Pin Assignment (top view)



Start of commercial production  
2008-11

## IEC Logic Symbol



## Truth Table

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

## Operating Ranges

| Characteristics       | Symbol    | Rating                 | Unit |
|-----------------------|-----------|------------------------|------|
| Supply voltage        | $V_{CC}$  | 1.65 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   |

Note 4: Data retention only

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

Note 6: High or Low State

## Electrical Characteristics

### DC Characteristics

| Characteristics    | Symbol     | Test Condition | $T_a = 25^\circ C$ |      |      | $T_a = -40 \text{ to } 85^\circ C$ |      | Unit |     |
|--------------------|------------|----------------|--------------------|------|------|------------------------------------|------|------|-----|
|                    |            |                | $V_{CC}$ (V)       | Min  | Typ. | Max                                | Min  |      | Max |
| Threshold voltage  | High-level | —              | 1.65               | 0.6  | 1.0  | 1.4                                | 0.6  | 1.4  | V   |
|                    |            |                | 1.8                | 0.7  | 1.1  | 1.5                                | 0.7  | 1.5  |     |
|                    |            |                | 2.3                | 1.0  | 1.4  | 1.8                                | 1.0  | 1.8  |     |
|                    |            |                | 3.0                | 1.3  | 1.75 | 2.2                                | 1.3  | 2.2  |     |
|                    |            |                | 4.5                | 1.9  | 2.45 | 3.1                                | 1.9  | 3.1  |     |
|                    | Low-level  | —              | 1.65               | 0.2  | 0.5  | 0.8                                | 0.2  | 0.8  |     |
|                    |            |                | 1.8                | 0.25 | 0.55 | 0.9                                | 0.25 | 0.9  |     |
|                    |            |                | 2.3                | 0.40 | 0.75 | 1.15                               | 0.40 | 1.15 |     |
|                    |            |                | 3.0                | 0.6  | 1.0  | 1.5                                | 0.6  | 1.5  |     |
|                    |            |                | 4.5                | 1.0  | 1.43 | 2.0                                | 1.0  | 2.0  |     |
| Hysteresis voltage | $V_H$      | —              | 1.65               | 0.1  | 0.48 | 0.9                                | 0.1  | 1.0  | V   |
|                    |            |                | 1.8                | 0.15 | 0.54 | 1.0                                | 0.15 | 1.0  |     |
|                    |            |                | 2.3                | 0.25 | 0.65 | 1.1                                | 0.25 | 1.1  |     |
|                    |            |                | 3.0                | 0.4  | 0.77 | 1.2                                | 0.4  | 1.2  |     |
|                    |            |                | 4.5                | 0.6  | 1.01 | 1.5                                | 0.6  | 1.5  |     |
|                    |            |                | 5.5                | 0.7  | 1.18 | 1.7                                | 0.7  | 1.7  |     |

| Characteristics           | Symbol                   | Test Condition                              | Ta = 25°C                        |                           |                         | Ta = -40 to 85°C |      | Unit |      |      |   |      |
|---------------------------|--------------------------|---|----------------------------------|---------------------------|-------------------------|------------------|------|------|------|------|---|------|
|                           |                          |   | V <sub>CC</sub> (V)              | Min                       | Typ.                    | Max              | Min  |      | Max  |      |   |      |
| Output voltage            | High-level               | V <sub>OH</sub>                             | V <sub>IN</sub> = V <sub>P</sub> | I <sub>OH</sub> = -100 μA | 1.65                    | 1.55             | 1.65 | —    | 1.55 | —    | V |      |
|                           |                          |   |                                  |                           | 1.8                     | 1.7              | 1.8  | —    | 1.7  | —    |   |      |
|                           |                          |   |                                  |                           | 2.3                     | 2.2              | 2.3  | —    | 2.2  | —    |   |      |
|                           |                          |   |                                  |                           | 3.0                     | 2.9              | 3.0  | —    | 2.9  | —    |   |      |
|                           |                          |   |                                  |                           | 4.5                     | 4.4              | 4.5  | —    | 4.4  | —    |   |      |
|                           |                          |   |                                  |                           | I <sub>OH</sub> = -4 mA | 1.65             | 1.29 | 1.52 | —    | 1.29 |   | —    |
|                           |                          |   |                                  |                           |                         | 2.3              | 1.9  | 2.15 | —    | 1.9  |   | —    |
|                           |                          |   |                                  |                           |                         | 3.0              | 2.4  | 2.8  | —    | 2.4  |   | —    |
|                           |                          |   |                                  |                           |                         | 3.0              | 2.3  | 2.68 | —    | 2.3  |   | —    |
|                           | Low-level output voltage | V <sub>OL</sub>                             | V <sub>IN</sub> = V <sub>N</sub> | I <sub>OL</sub> = 100 μA  | 1.65                    | —                | 0    | 0.1  | —    | 0.1  | V |      |
|                           |                          |   |                                  |                           | 1.8                     | —                | 0    | 0.1  | —    | 0.1  |   |      |
|                           |                          |   |                                  |                           | 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> = 4 mA  | 1.65             | —    | 0.08 | 0.24 | —    |   | 0.24 |
|                           |                          |   |                                  |                           |                         | 2.3              | —    | 0.1  | 0.3  | —    |   | 0.3  |
|                           |                          |   |                                  |                           |                         | 3.0              | —    | 0.15 | 0.4  | —    |   | 0.4  |
|                           |                          |   |                                  |                           |                         | 3.0              | —    | 0.22 | 0.55 | —    |   | 0.55 |
| I <sub>OL</sub> = 32 mA   | 4.5                      | —   | 0.22                             | 0.55                      | —                       | 0.55             |      |      |      |      |   |      |
|                           | 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    | 1.65 to 5.5                      | —                         | —                       | 2                | —    | 20   | μA   |      |   |      |

## AC Characteristics (unless otherwise specified, Input: t<sub>r</sub> = t<sub>f</sub> = 3 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, R <sub>L</sub> = 1 MΩ  | 1.8 ± 0.15          | 2.0 | 9.1  | 15.0             | 2.0 | 15.6 | ns  |
|                               |                                      |  | 2.5 ± 0.2           | 1.0 | 5.0  | 9.0              | 1.0 | 9.5  |     |
|                               |                                      |  | 3.3 ± 0.3           | 1.0 | 3.7  | 6.3              | 1.0 | 6.5  |     |
|                               |                                      |  | 5.0 ± 0.5           | 0.5 | 3.1  | 5.2              | 0.5 | 5.5  |     |
|                               |                                      | C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω | 3.3 ± 0.3           | 1.5 | 4.4  | 7.2              | 1.5 | 7.5  |     |
|                               |                                      |  | 5.0 ± 0.5           | 0.5 | 3.7  | 5.9              | 0.5 | 6.2  |     |
| Input capacitance             | C <sub>IN</sub>                      | —  | 0 to 5.5            | —   | 4    | —                | —   | pF   |     |
| Power dissipation capacitance | C <sub>PD</sub>                      | (Note 7)                                       | 3.3                 | —   | 24   | —                | —   | —    | pF  |
|                               |                                      |  | 5.5                 | —   | 30   | —                | —   | —    |     |

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.

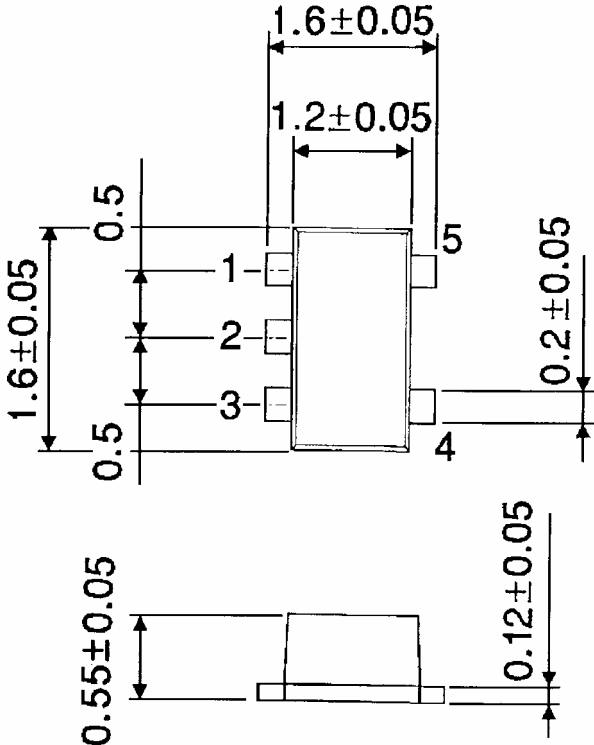
Average operating current can be obtained by the equation.

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

**Package Dimensions**

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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