

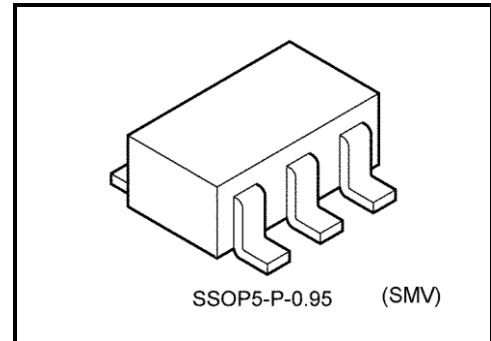
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC7SH125F

Bus Buffer with 3-STATE Output

### Features

- High speed:  $t_{pd} = 3.8 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$ ,  $15 \text{ pF}$
- Low power dissipation:  $I_{CC} = 2 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- 5.5 V tolerant input.
- Wide operating voltage range:  $V_{CC} = 2 \text{ to } 5.5 \text{ V}$

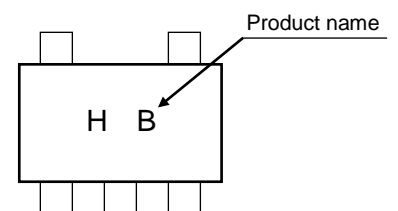


Weight : 0.016 g (typ.)

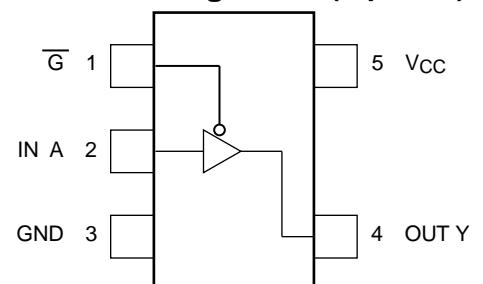
### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

| Characteristics             | Symbol    | Rating                 | Unit             |
|-----------------------------|-----------|------------------------|------------------|
| Supply voltage range        | $V_{CC}$  | -0.5 to 7.0            | V                |
| DC input voltage            | $V_{IN}$  | -0.5 to 7.0            | V                |
| DC output voltage           | $V_{OUT}$ | -0.5 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           | $I_{OUT}$ | $\pm 25$               | mA               |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$               | mA               |
| Power dissipation           | $P_D$     | 200                    | mW               |
| Storage temperature         | $T_{stg}$ | -65 to 150             | $^\circ\text{C}$ |
| Lead temperature (10 s)     | $T_L$     | 260                    | $^\circ\text{C}$ |

### Marking



### Pin Assignment (top view)



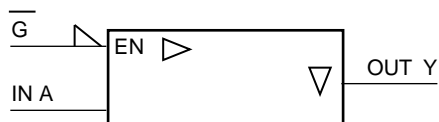
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Start of commercial production  
2004-05

## IEC Logic Symbol



## Truth Table

| $\overline{G}$ | A | Y |
|----------------|---|---|
| H              | X | Z |
| L              | L | L |
| L              | H | H |

## Operating Ranges

| Characteristics          | Symbol    | Rating                                  | Unit |
|--------------------------|-----------|---|------|
| Supply voltage           | $V_{CC}$  | 2 to 5.5                                | V    |
| 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   |
| Input rise and fall time | dt/dv     | 0 to 100 ( $V_{CC} = 3.3 V \pm 0.3 V$ ) | ns/V |
|                          |           | 0 to 20 ( $V_{CC} = 5 V \pm 0.5 V$ )    |      |

## Electrical Characteristics

### DC Characteristics

| Characteristics                  | Symbol   | Test Condition   | $T_a = 25^\circ\text{C}$   |                     |      | $T_a = -40 \text{ to } 85^\circ\text{C}$ |                     | Unit                |               |   |
|----------------------------------|----------|--|----------------------------|---------------------|------|--|---------------------|---------------------|---------------|---|
|                                  |          |  | $V_{CC}$ (V)               | Min                 | Typ. | Max                                      | Min                 |                     | Max           |   |
| High-level input voltage         | $V_{IH}$ | —  | 2.0                        | 1.5                 | —    | —  | 1.5                 | —                   | V             |   |
|                                  |          |  | 3.0 to 5.5                 | $V_{CC} \times 0.7$ | —    | —  | $V_{CC} \times 0.7$ | —                   |               |   |
| Low-level input voltage          | $V_{IL}$ | —  | 2.0                        | —                   | —    | 0.5                                      | —                   | 0.5                 | V             |   |
|                                  |          |  | 3.0 to 5.5                 | —                   | —    | $V_{CC} \times 0.3$                      | —                   | $V_{CC} \times 0.3$ |               |   |
| High-level output voltage        | $V_{OH}$ | $V_{IN} = V_{IH}$<br>or $V_{IL}$                           | $I_{OH} = -50 \mu\text{A}$ | 2.0                 | 1.9  | 2.0                                      | —                   | 1.9                 | —             | V |
|                                  |          |  |                            | 3.0                 | 2.9  | 3.0                                      | —                   | 2.9                 | —             |   |
|                                  |          |  |                            | 4.5                 | 4.4  | 4.5                                      | —                   | 4.4                 | —             |   |
|                                  |          |  | $I_{OH} = -4 \text{ mA}$   | 3.0                 | 2.58 | —  | —                   | 2.48                | —             |   |
|                                  |          |  |                            | 4.5                 | 3.94 | —  | —                   | 3.80                | —             |   |
| Low-level output voltage         | $V_{OL}$ | $V_{IN} = V_{IL}$  | $I_{OL} = 50 \mu\text{A}$  | 2.0                 | —    | 0  | 0.1                 | —                   | 0.1           | V |
|                                  |          |  |                            | 3.0                 | —    | 0  | 0.1                 | —                   | 0.1           |   |
|                                  |          |  |                            | 4.5                 | —    | 0  | 0.1                 | —                   | 0.1           |   |
|                                  |          |  | $I_{OL} = 4 \text{ mA}$    | 3.0                 | —    | —  | 0.36                | —                   | 0.44          |   |
|                                  |          |  |                            | 4.5                 | —    | —  | 0.36                | —                   | 0.44          |   |
| 3-state output off-state current | $I_{OZ}$ | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$V_{OUT} = V_{CC}$ or GND | 5.5                        | —                   | —    | $\pm 0.25$                               | —                   | $\pm 2.5$           | $\mu\text{A}$ |   |
| Input leakage current            | $I_{IN}$ | $V_{IN} = 5.5 \text{ V}$ or GND                            | 0 to 5.5                   | —                   | —    | $\pm 0.1$                                | —                   | $\pm 1.0$           | $\mu\text{A}$ |   |
| Quiescent supply current         | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND                                   | 5.5                        | —                   | —    | 2.0                                      | —                   | 20.0                | $\mu\text{A}$ |   |

## 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 |
|-------------------------------|------------------|----------------|---------|-----------|------|------|------------------|------|------|
|                               |                  | VCC (V)        | CL (pF) | Min       | Typ. | Max  | Min              | Max  |      |
| Propagation delay time        | t <sub>PLH</sub> | 3.3 ± 0.3      | 15      | —         | 5.6  | 8.0  | 1.0              | 9.5  | ns   |
|                               |                  |                | 50      | —         | 8.1  | 11.5 | 1.0              | 13.0 |      |
|                               | t <sub>PHL</sub> | 5.0 ± 0.5      | 15      | —         | 3.8  | 5.5  | 1.0              | 6.5  |      |
|                               |                  |                | 50      | —         | 5.3  | 7.5  | 1.0              | 8.5  |      |
| 3-state output enable time    | t <sub>pZL</sub> | 3.3 ± 0.3      | 15      | —         | 5.4  | 8.0  | 1.0              | 9.5  | ns   |
|                               |                  |                | 50      | —         | 7.9  | 11.5 | 1.0              | 13.0 |      |
|                               | t <sub>pZH</sub> | 5.0 ± 0.5      | 15      | —         | 3.6  | 5.1  | 1.0              | 6.0  |      |
|                               |                  |                | 50      | —         | 5.1  | 7.1  | 1.0              | 8.0  |      |
| 3-state output disable time   | t <sub>pLZ</sub> | 3.3 ± 0.3      | 50      | —         | 9.5  | 13.2 | 1.0              | 15.0 | ns   |
|                               | t <sub>pHZ</sub> | 5.0 ± 0.5      | 50      | —         | 6.1  | 8.8  | 1.0              | 10.0 |      |
| Input capacitance             | C <sub>IN</sub>  |                |         | —         | 4    | 10   | —                | 10   | pF   |
| Output capacitance            | C <sub>OUT</sub> |                |         | —         | 6    | —    | —                | —    | pF   |
| Power dissipation capacitance | C <sub>PD</sub>  | (Note 2)       |         | —         | 14   | —    | —                | —    | pF   |

Note 2: CPD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

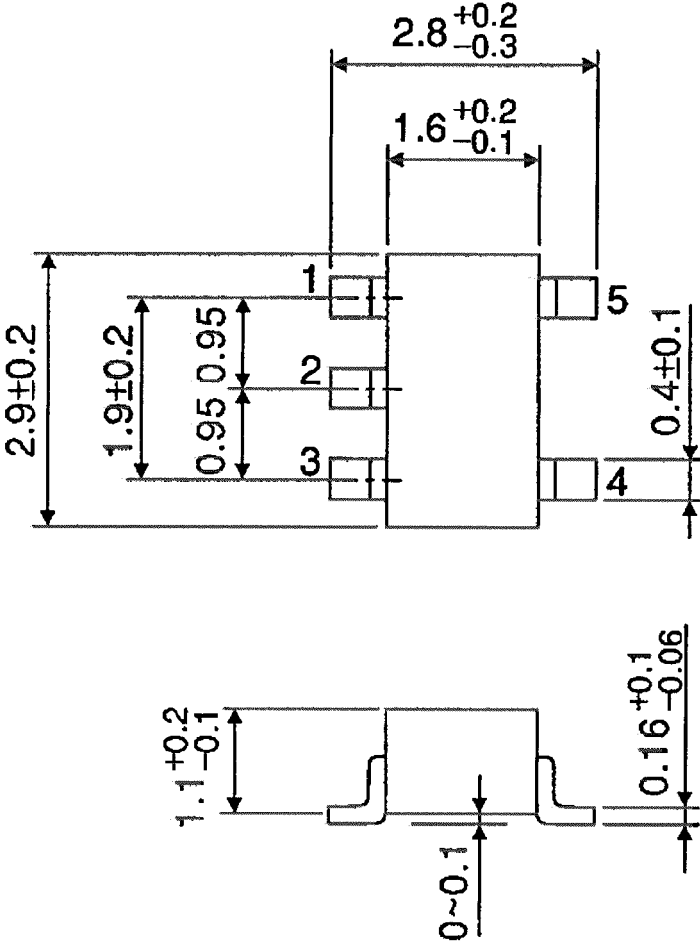
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP5-P-0.95

Unit: mm



Weight: 0.016 g (typ.)

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