

# TC7SBD384AFU

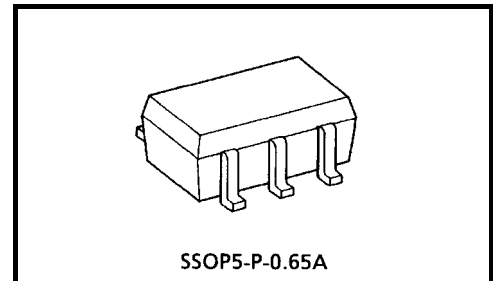
## Single Bus Switch with Level Shifting

The TC7SBD384AFU provides single bit of high-speed TTL-compatible switching. The low on resistance of the switch allows connections to be made with minimal propagation delay.

The device is organized as just 1-bit low-impedance switch with output-enable ( $\overline{OE}$ ) input. When  $\overline{OE}$  is low, the switch is on and data can flow from port A to port B, or vice versa. When  $\overline{OE}$  is high, the switch is open and a high-impedance state exists between the two ports.

The device is enable to realize the shift of signal level from 5 V to 3.3 V.

All inputs are equipped with protection circuits against static discharge.

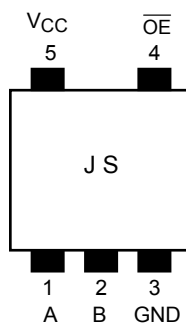


Weight: 0.006 g (typ.)

## Features

- Operating voltage:  $V_{CC} = 4.5 \sim 5.5$  V
- High speed operation:  $t_{pd} = 0.32$  ns (max)
- Low on resistance:  $R_{ON} = 5 \Omega$  (typ.)
- ESD performance: Machine model  $\geq \pm 200$  V  
Human body model  $\geq \pm 2000$  V
- TTL level input (control input)
- Low Power Dissipation:  $I_{cc} = 10 \mu A$  (max.)
- Package: USV

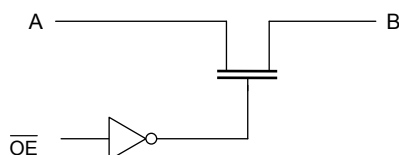
## Pin Assignment (top view)



## Truth Table

| Input | Function        |
|-------|-----------------|
| OE    |                 |
| L     | A port = B port |
| H     | Disconnect      |

## System Diagram



## Absolute Maximum Ratings (Note)

| Characteristics            | Symbol           | Rating    | Unit |
|----------------------------|------------------|-----------|------|
| Power supply range         | $V_{CC}$         | -0.5~7.0  | V    |
| DC input voltage           | $V_{IN}$         | -0.5~7.0  | V    |
| DC switch voltage          | $V_S$            | -0.5~7.0  | V    |
| Input diode current        | $I_{IK}$         | -50       | mA   |
| Continuous channel current | $I_S$            | 128       | mA   |
| Power dissipation          | $P_D$            | 200       | mW   |
| DC $V_{CC}/GND$ current    | $I_{CC}/I_{GND}$ | $\pm 100$ | mA   |
| Storage temperature        | $T_{stg}$        | -65~150   | °C   |

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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).

## Operating Ranges (Note)

| Characteristics          | Symbol    | Rating  | Unit |
|--------------------------|-----------|---------|------|
| Supply voltage           | $V_{CC}$  | 4.5~5.5 | V    |
| Input voltage            | $V_{IN}$  | 0~5.5   | V    |
| Switch voltage           | $V_S$     | 0~5.5   | V    |
| Operating temperature    | $T_{opr}$ | -40~85  | °C   |
| Input rise and fall time | $dt/dv$   | 0~10    | ns/V |

Note: The operating ranges must be maintained to ensure the normal operation of the device.

## Electrical Characteristics

## DC Characteristics (Ta = -40~85°C)

| Characteristics                           |           | Symbol           | Test Condition                                           |                         | <div>V<sub>CC</sub> (V)</div> | Min | Typ.<br>(Note 1) | Max  | Unit |
|-------------------------------------------|-----------|------------------|----------------------------------------------------------|-------------------------|-------------------------------|-----|------------------|------|------|
| Input voltage                             | “H” level | V <sub>IH</sub>  | —                                                        |                         | 4.5~5.5                       | 2.0 | —                | —    | V    |
|                                           | “L” level | V <sub>IL</sub>  | —                                                        |                         | 4.5~5.5                       | —   | —                | 0.8  |      |
| High-level output voltage<br>(Note 2)     |           | V <sub>OH</sub>  | IOH=-1μA<br>VIS = V <sub>CC</sub>                        |                         | 4.75                          | 2.3 | 2.8              | 3.2  | V    |
|                                           |           |                  |                                                          |                         | 5.0                           | 2.5 | 3.0              | 3.4  |      |
|                                           |           |                  |                                                          |                         | 5.25                          | 2.7 | 3.2              | 3.6  |      |
| Input leakage current                     |           | I <sub>IN</sub>  | VIN = 0~5.5 V                                            |                         | 4.5~5.5                       | —   | —                | ±1.0 | μA   |
| Power off leakage current                 |           | I <sub>OFF</sub> | A, B, $\overline{\text{OE}}$ = 0~5.5 V                   |                         | 0                             | —   | —                | ±1.0 | μA   |
| Off-STATE leakage current<br>(switch off) |           | I <sub>SZ</sub>  | A, B = 0~5.5 V, $\overline{\text{OE}}$ = V <sub>CC</sub> |                         | 4.5~5.5                       | —   | —                | ±1.0 | μA   |
| ON resistance<br>(Note 3)                 |           | R <sub>ON</sub>  | V <sub>IS</sub> = 0 V                                    | I <sub>IS</sub> = 64 mA | 4.5                           | —   | 5                | 9    | Ω    |
|                                           |           |                  |                                                          |                         | 4.75                          | —   | 5                | 8    |      |
|                                           |           |                  |                                                          | I <sub>IS</sub> = 30 mA | 4.5                           | —   | 5                | 9    |      |
|                                           |           |                  |                                                          |                         | 4.75                          | —   | 5                | 8    |      |
|                                           |           |                  | V <sub>IS</sub> = 2.3 V, I <sub>IS</sub> = 15 mA         |                         | 4.5                           | —   | 35               | 65   |      |
|                                           |           |                  |                                                          |                         | 4.75                          | —   | 35               | 50   |      |
| Quiescent supply current                  |           | ICC              | VIN = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0       |                         | 5.5                           | —   | —                | 10   | μA   |
| Increase in I <sub>CC</sub> per input     |           | ΔICC             | VIN = 3.4 V (one input)                                  |                         | 5.5                           | —   | —                | 2.5  | mA   |

Note 1: Typical values are at V<sub>CC</sub> = 5 V, Ta = 25°C.

Note 2: It recommends that this device uses Pull-up resistance when adding and using resistance for an output terminal. Since it causes to drop a V<sub>OH</sub> voltage level when using Pull-down resistance for an output terminal.

Note 3: Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

## AC Characteristics (Ta = -40~85°C)

| Characteristics                        |  | Symbol                               | Test Condition               |                     | Min | Max  | Unit |
|----------------------------------------|--|--------------------------------------|------------------------------|---------------------|-----|------|------|
|                                        |  |                                      |                              | V <sub>CC</sub> (V) |     |      |      |
| Propagation delay time<br>(bus to bus) |  | t <sub>pLH</sub><br>t <sub>pHL</sub> | Figure 1, Figure 2<br>(Note) | 4.5                 | —   | 0.32 | ns   |
| Output enable time                     |  | t <sub>pZL</sub><br>t <sub>pZH</sub> | Figure 1, Figure 3           | 4.5                 | —   | 4.5  | ns   |
| Output disable time                    |  | t <sub>pLZ</sub><br>t <sub>pHZ</sub> | Figure 1, Figure 3           | 4.5                 | —   | 4.5  | ns   |

Note: The propagation delay time is calculated by the RC (on-resistance and load capacitance) time constant.

## Capacitive Characteristics (Ta = 25°C)

| Characteristics               |  | Symbol           | Test Condition                                     |                     | Typ. | Unit |
|-------------------------------|--|------------------|----------------------------------------------------|---------------------|------|------|
|                               |  |                  |                                                    | V <sub>CC</sub> (V) |      |      |
| Control pin input capacitance |  | C <sub>IN</sub>  | (Note)                                             | 5.0                 | 3    | pF   |
| Switch terminal capacitance   |  | C <sub>I/O</sub> | $\overline{\text{OE}}$ = V <sub>CC</sub><br>(Note) | 5.0                 | 10   | pF   |

Note: This parameter is guaranteed by design.

AC Test Circuit

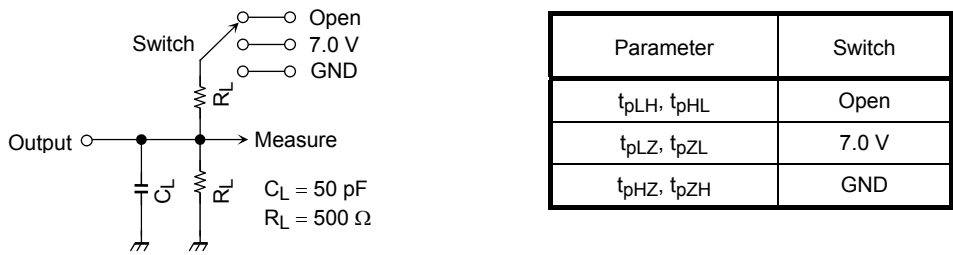


Figure 1

AC Waveform

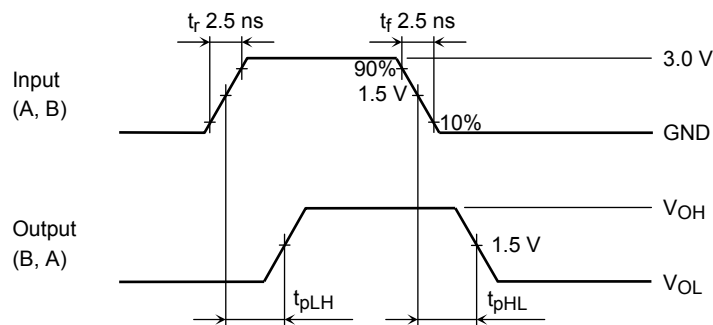


Figure 2  $t_{pLH}$ ,  $t_{pHL}$

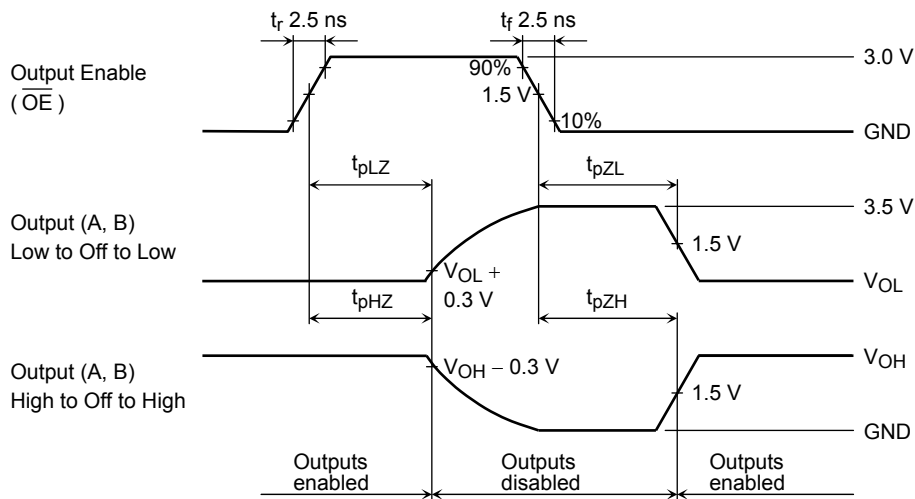


Figure 3  $t_{pLZ}$ ,  $t_{pHZ}$ ,  $t_{pZL}$ ,  $t_{pZH}$

## $V_{OH} - V_{CC}$ Characteristics (typ.)

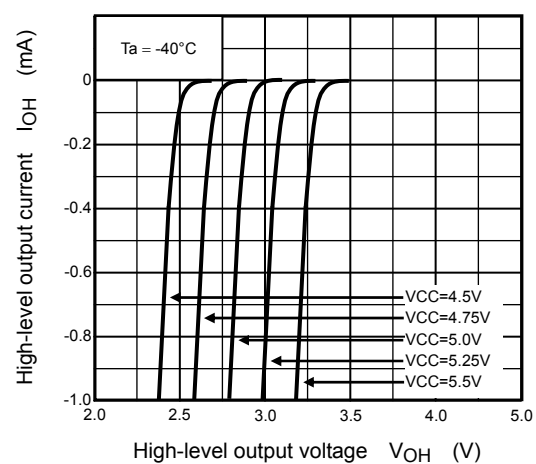
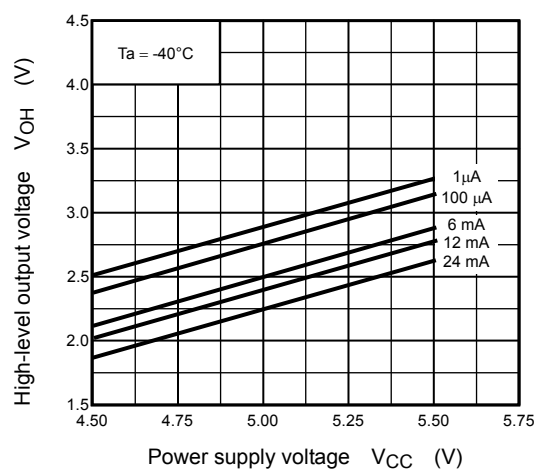
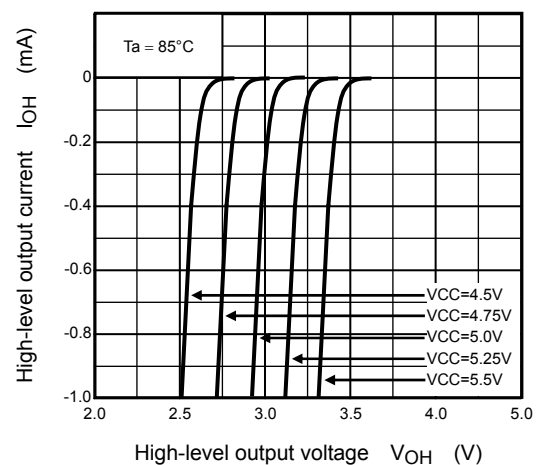
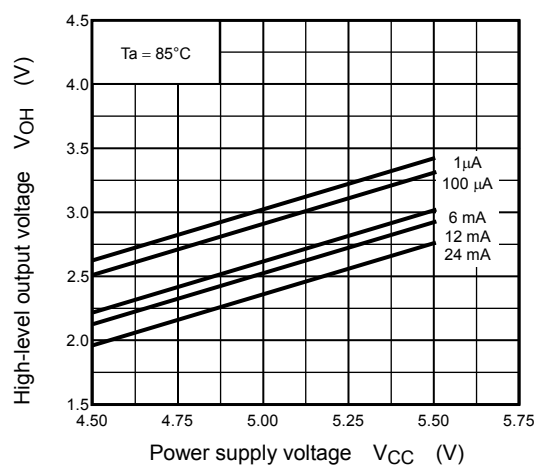
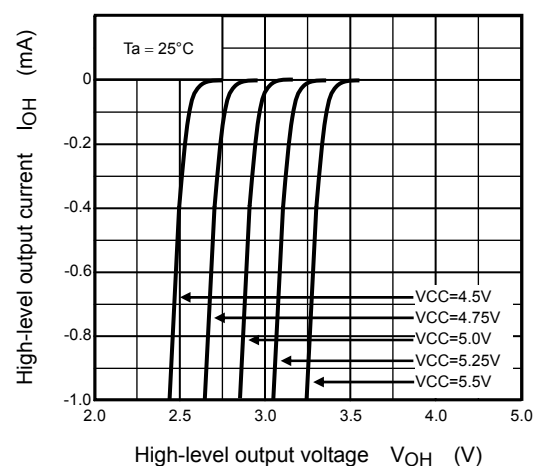
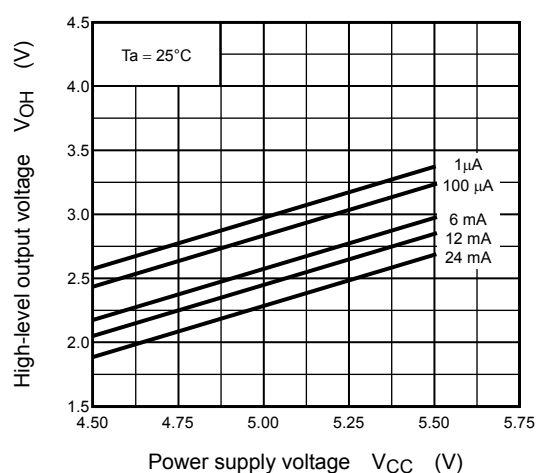
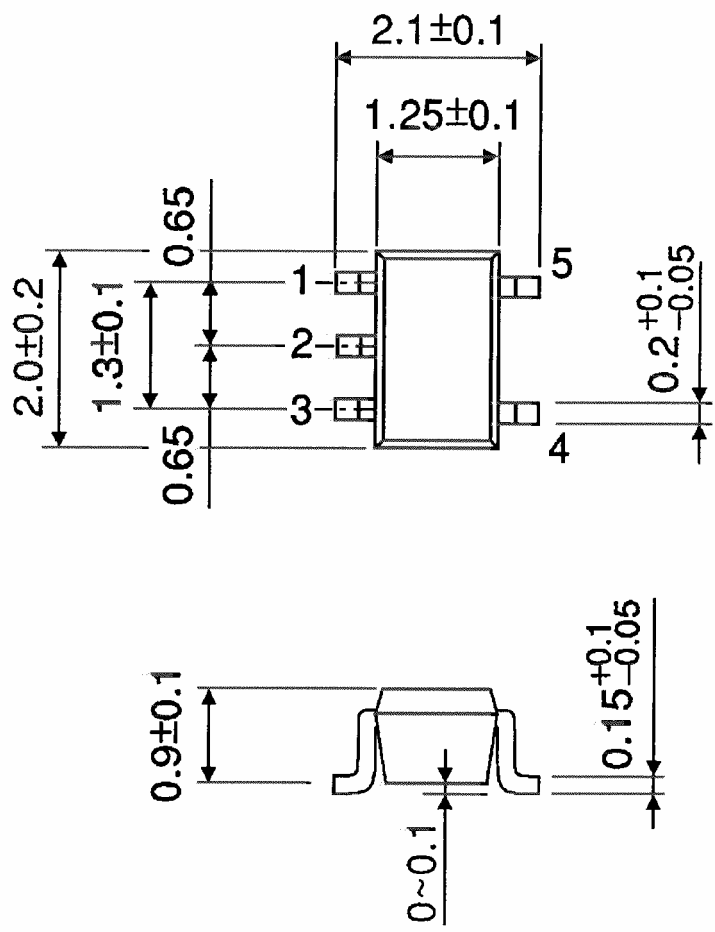


Figure 4

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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