

# TC7SBD384AFU

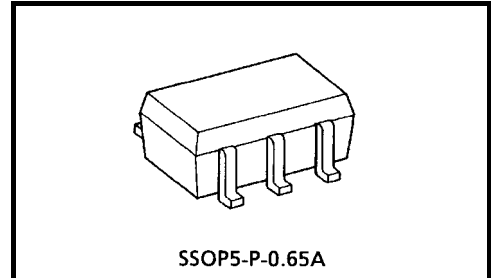
## Single Bus Switch with Level Shifting

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 able to realize the shift of signal level from 5 V to 3.3 V.

All inputs are equipped with protection circuits against static discharge.

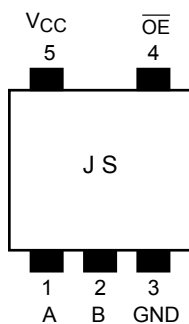


Weight: 0.006 g (typ.)

### 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

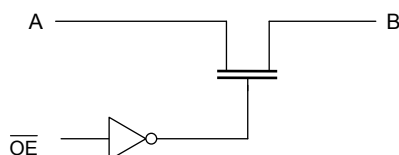
### Pin Assignment (top view)



## 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	$^{\circ}C$

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	$^{\circ}C$
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	V <sub>CC</sub> (V)	Min	Typ. (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 (Note 2)		V <sub>OH</sub>	I <sub>OH</sub> =-1μA V <sub>IS</sub> = 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>	V <sub>IN</sub> = 0~5.5 V	4.5~5.5	—	—	±1.0	μA	
Power off leakage current		I <sub>OFF</sub>	A, B, $\overline{OE}$ = 0~5.5 V	0	—	—	±1.0	μA	
Off-STATE leakage current (switch off)		I <sub>SZ</sub>	A, B = 0~5.5 V, $\overline{OE}$ = V <sub>CC</sub>	4.5~5.5	—	—	±1.0	μA	
ON resistance (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		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0	5.5	—	—	10	μA	
Increase in I <sub>CC</sub> per input		ΔI <sub>CC</sub>	V <sub>IN</sub> = 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	V <sub>CC</sub> (V)	Min	Max	Unit
Propagation delay time (bus to bus)		t <sub>pLH</sub> t <sub>pHL</sub>	Figure 1, Figure 2 (Note)	4.5	—	0.32	ns
Output enable time		t <sub>pZL</sub> t <sub>pZH</sub>	Figure 1, Figure 3	4.5	—	4.5	ns
Output disable time		t <sub>pLZ</sub> t <sub>pHZ</sub>	Figure 1, Figure 3	4.5	—	4.5	ns

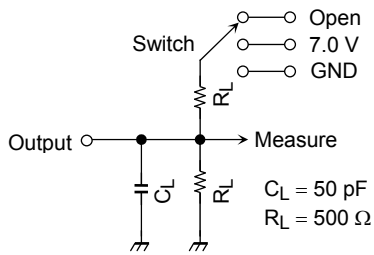
Note: The propagation delay time is calculated by the RC (on-resistance and load capacitance) time constant.

### Capacitive Characteristics (Ta = 25°C)

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

Note: This parameter is guaranteed by design.

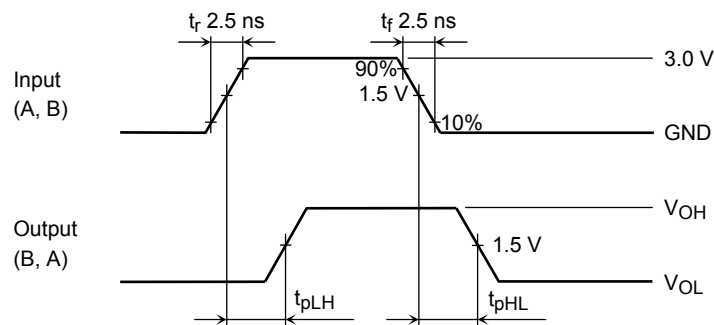
**AC Test Circuit**



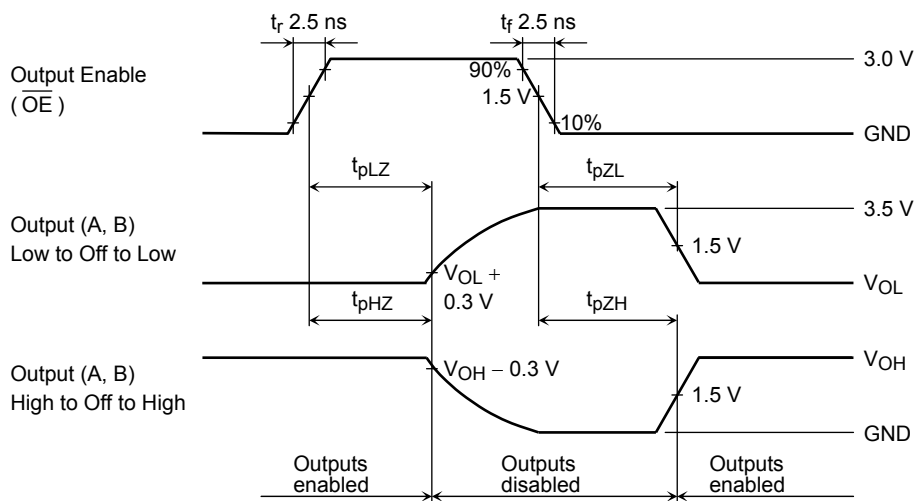
Parameter	Switch
$t_{pLH}$ , $t_{pHL}$	Open
$t_{pLZ}$ , $t_{pZL}$	7.0 V
$t_{pHZ}$ , $t_{pZH}$	GND

**Figure 1**

**AC Waveform**

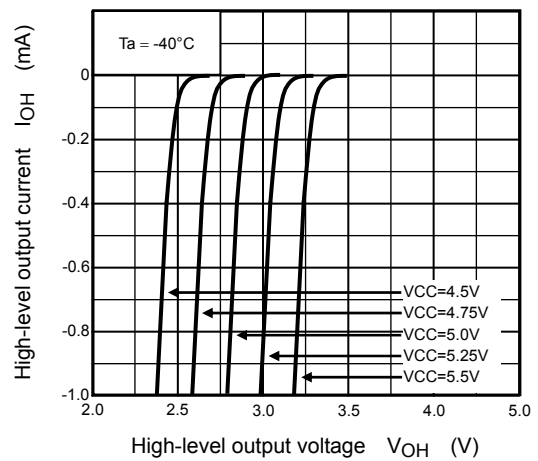
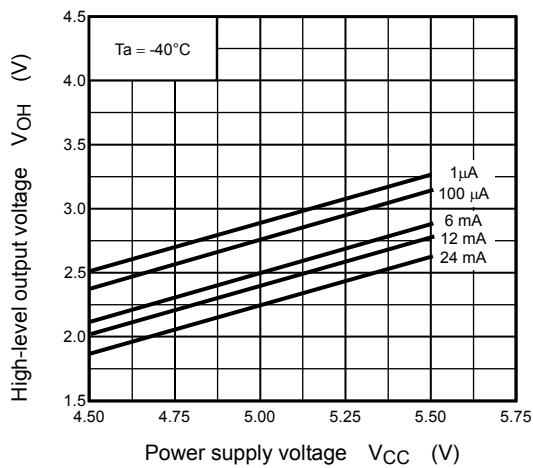
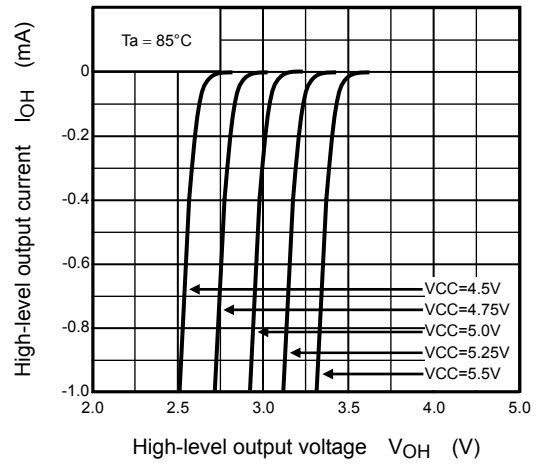
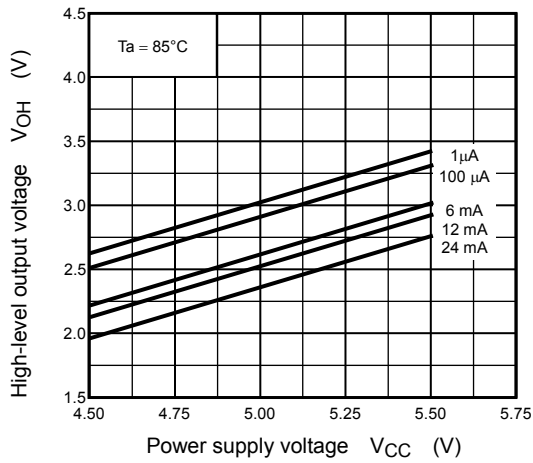
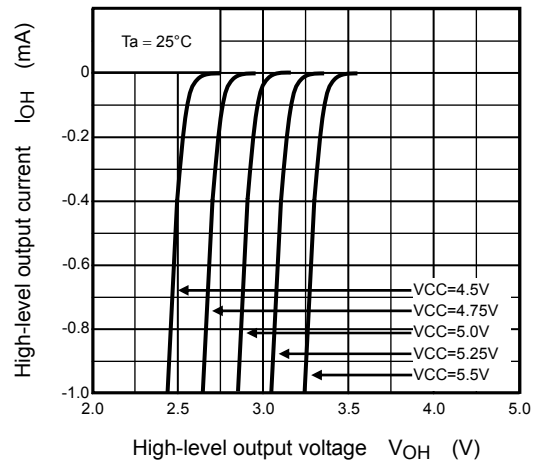
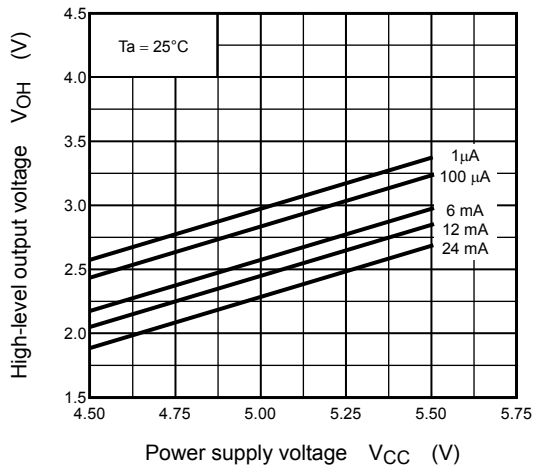


**Figure 2  $t_{pLH}$ ,  $t_{pHL}$**



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

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

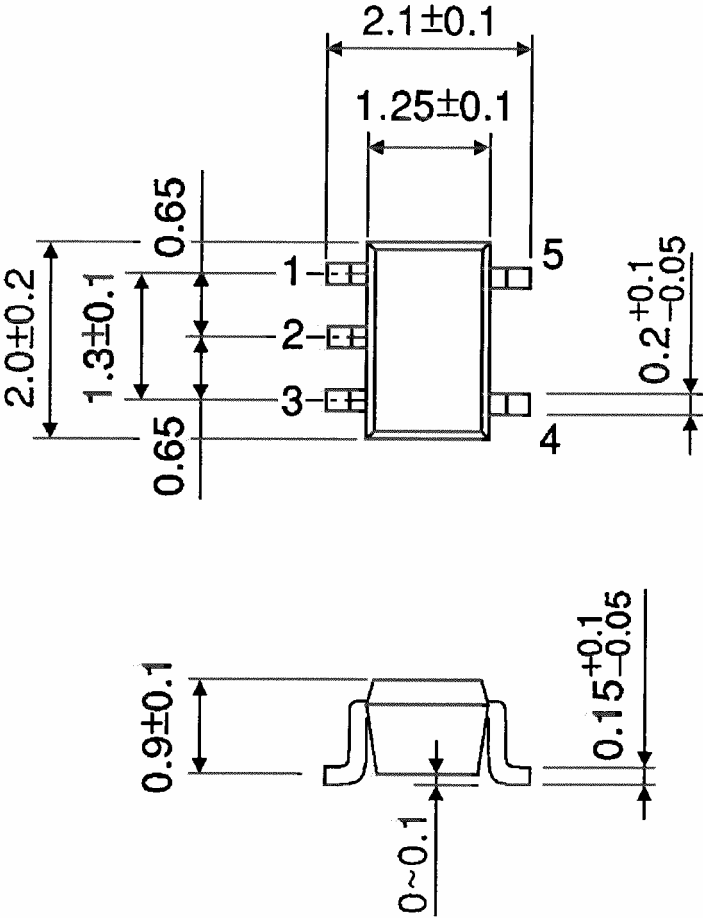


**Figure 4**

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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