TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SBD384AFU

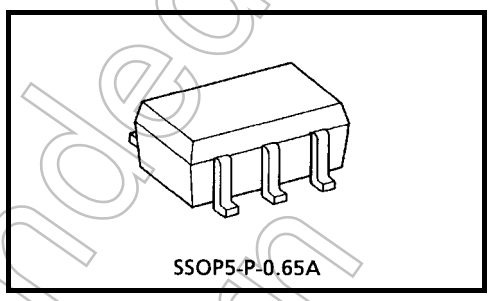
Single Bus Switch with Level Shifting

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.

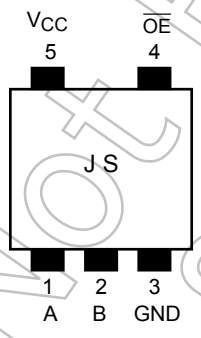


Weight: 0.006 g (typ.)

Features

- Operating voltage: V_{CC} = 4.5 to 5.5 V
- High speed operation: t_{pd} = 0.32 ns (max)
- Low on resistance: R_{ON} = 5 Ω (typ.)
- ESD performance: Machine model ≥ ±200 V
  Human body model ≥ ±2000 V
- TTL level input (control input)
- Low Power Dissipation: I_{CC} = 10 μA (max.)
- Package: USV

Pin Assignment (top view)

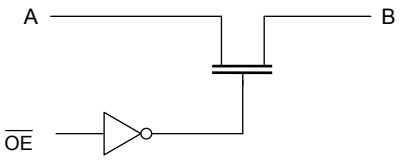


Start of commercial production
2003-02

Truth Table

Input $\overline{OE}$	Function
L	A port = B port
H	Disconnect

System Diagram



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Power supply range	V_{CC}	−0.5 to 7.0	V
DC input voltage	V_{IN}	−0.5 to 7.0	V
DC switch voltage	V_S	−0.5 to 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}	±100	mA
Storage temperature	T_{stg}	−65 to 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 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Switch voltage	V_S	0 to 5.5	V
Operating temperature	T_{opr}	−40 to 85	°C
Input rise and fall time	dt/dv	0 to 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_{CC} (V)	Min	Typ. (Note 1)	Max	Unit
Input voltage	"H" level	V_{IH}	—		4.5 to 5.5	2.0	—	—	V
	"L" level	V_{IL}	—		4.5 to 5.5	—	—	0.8	
High-level output voltage (Note 2)		V_{OH}	I_{OH}=-1μA V_{IS} = V_{CC}		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_{IN}	V_{IN} = 0 to 5.5 V		4.5 to 5.5	—	—	±1.0	μA
Power off leakage current		I_{OFF}	A, B, $\overline{OE}$ = 0 to 5.5 V		0	—	—	±1.0	μA
Off-STATE leakage current (switch off)		I_{SZ}	A, B = 0 to 5.5 V, $\overline{OE}$ = V_{CC}		4.5 to 5.5	—	—	±1.0	μA
ON resistance (Note 3)		R_{ON}	V_{IS} = 0 V	I_{IS} = 64 mA	4.5	—	5	9	Ω
					4.75	—	5	8	
				I_{IS} = 30 mA	4.5	—	5	9	
					4.75	—	5	8	
			V_{IS} = 2.3 V, I_{IS} = 15 mA		4.5	—	35	65	
					4.75	—	35	50	
Quiescent supply current		I_{CC}	V_{IN} = V_{CC} or GND, I_{OUT} = 0		5.5	—	—	10	μA
Increase in I_{CC} per input		ΔI_{CC}	V_{IN} = 3.4 V (one input)		5.5	—	—	2.5	mA

Note 1: Typical values are at V_{CC} = 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 couses to drop a V_{OH} 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_{CC} (V)	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figure 1, Figure 2	(Note)	4.5	—	0.32	ns
Output enable time	t_{pZL} t_{pZH}	Figure 1, Figure 3		4.5	—	4.5	ns
Output disable time	t_{pLZ} t_{pHZ}	Figure 1, Figure 3		4.5	—	4.5	ns

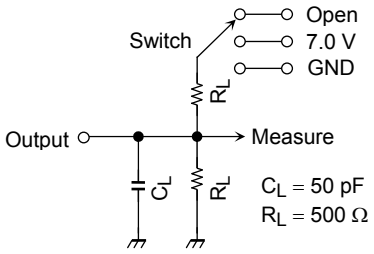
Note: The propagation delay time is calculated by the RC (on-resistance and load capacitance) time constant.

Capacitive Characteristics (Ta = 25°C)

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

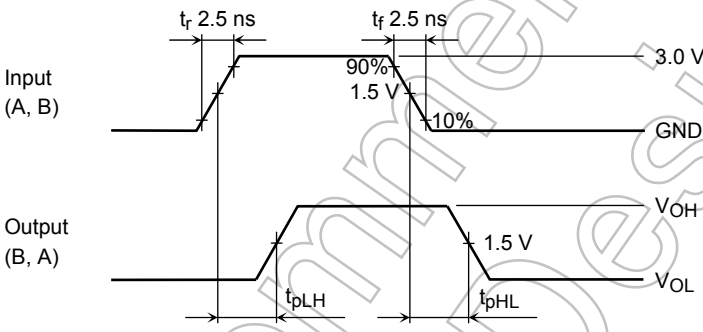


Figure 2 t_{pLH}, t_{pHL}

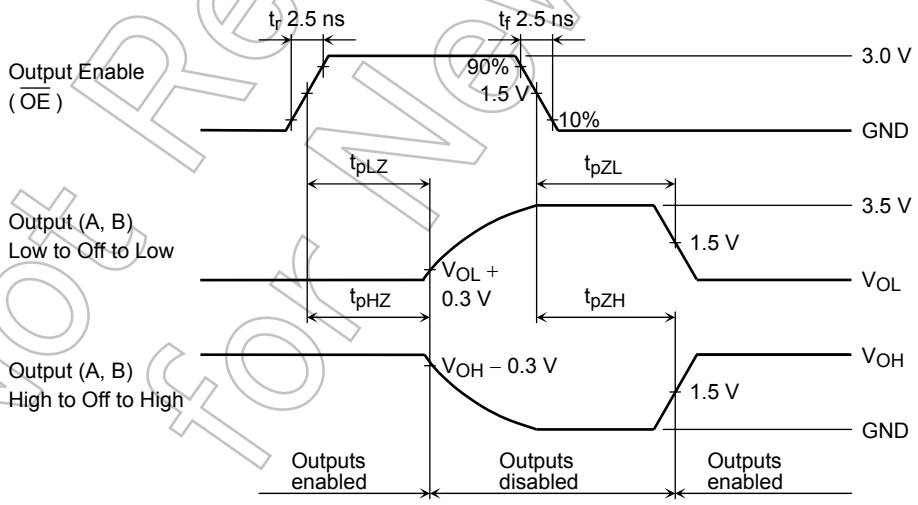
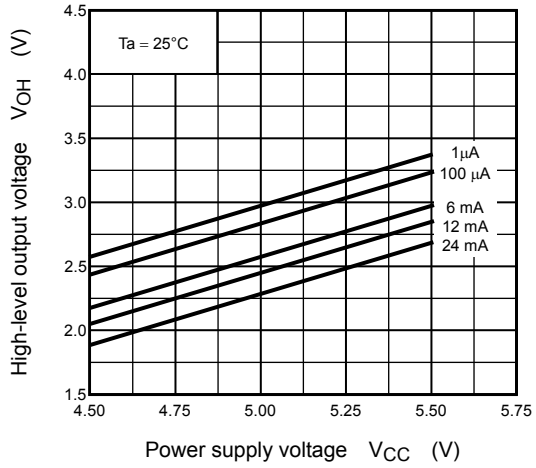
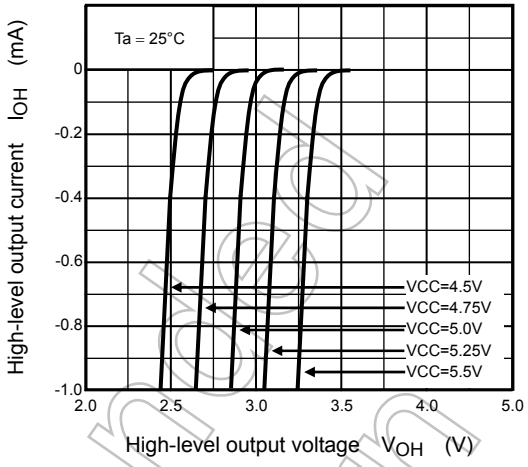
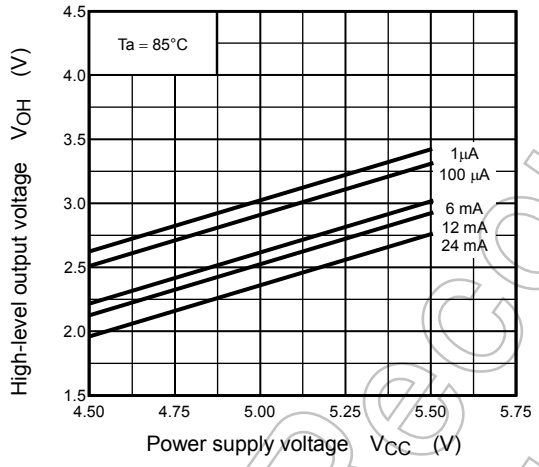


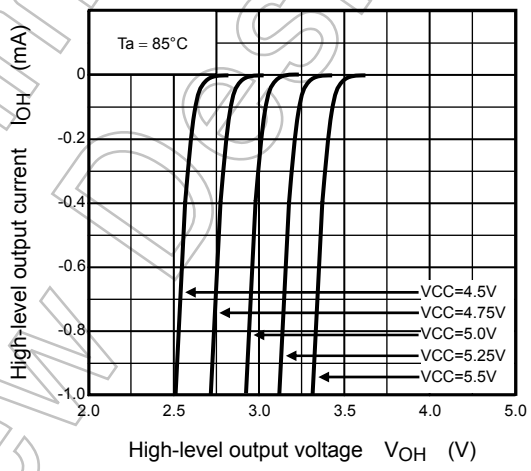
Figure 3 t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}

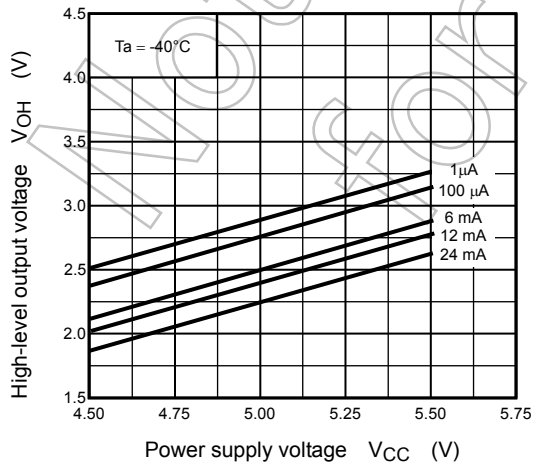
V_{OH} – V_{CC} Characteristics (typ.)











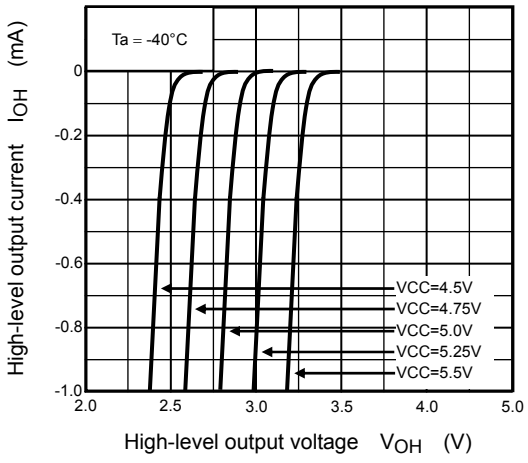
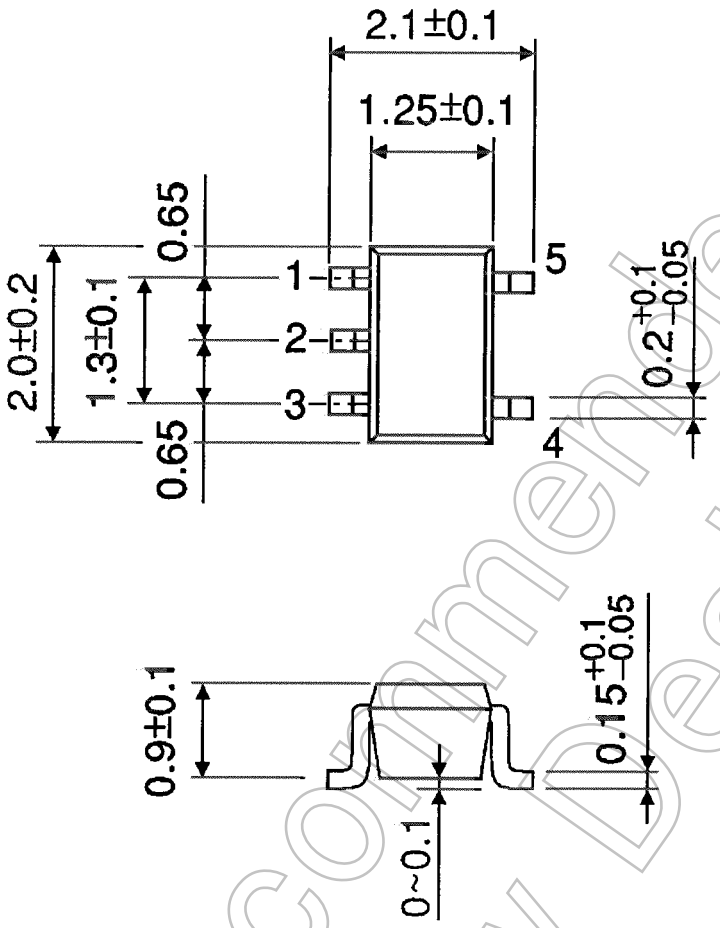


Figure 4

Package Dimensions

SSOP5-P-0.65A Unit : mm



Weight: 0.006 g (typ.)

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