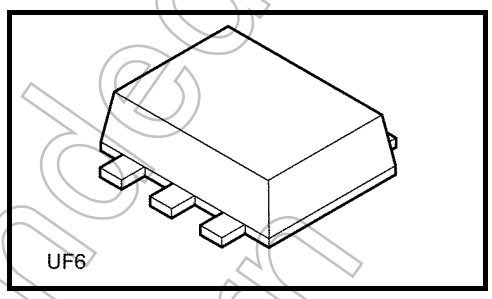
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SP3066TU, TC7SP3067TU

TC7SP3066TU Low Voltage Dual Supply Single Bus Switch (analog)
TC7SP3067TU Low Voltage Dual Supply Single Bus Switch (analog)



Weight: 0.007 g (typ.)

The TC7SP3066 and TC7SP3067 are high-speed CMOS one-bit analog bus switches with separate power supplies for control and switch portions. In the TC7SP3066, the switch is on when Output Enable (OE) is High. In the TC7SP3067, the switch is on when Output Enable ($\overline{OE}$) is Low.

The TC7SP3066 and TC7SP3067 support power-down protection by incorporating 3.6-V-torelant control inputs.

These devices are suitable for applications where the control voltage is lower than the signal line voltage.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

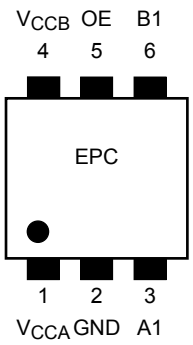
Features

- Operating voltage range:
  V_{CCA} = 1.1 to 2.7 V (Control portion)
  V_{CCB} = 1.65 to 3.6 V (Switch portion)
- ON-resistance: R_{ON} = 8 Ω (max) (V_{CCB} = 2.7 V)
  R_{ON} = 10 Ω (max) (V_{CCB} = 2.3 V)
- ESD performance: Machine model ≥ ±200 V
  Human body model ≥ ±2000 V
- Ultra-small package: UF6
- 3.6-V tolerance function and power-down protection at the Output Enable input.

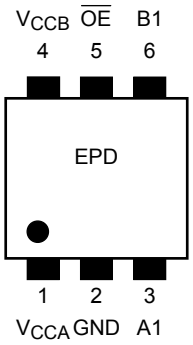
Start of commercial production
2005-12

Pin Assignment (top view)

TC7SP3066TU



TC7SP3067TU

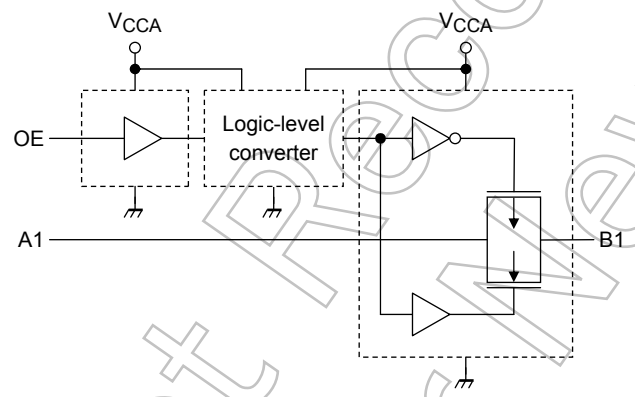


Truth Table

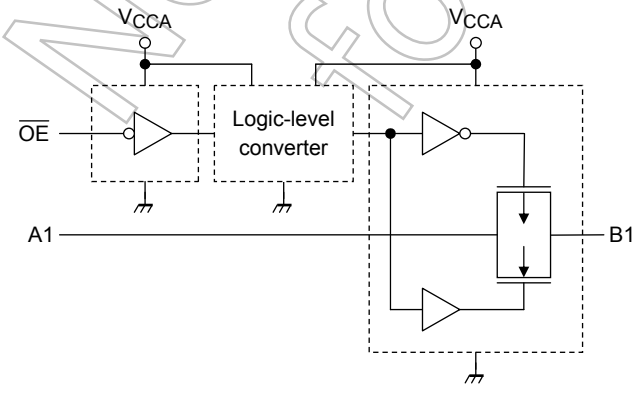
Input (3066) OE	Function	Input (3067) $\overline{OE}$	Function
H	Aport = Bport	H	Disconnected
L	Disconnected	L	Aport = Bport

Circuit Schematic

TC7SP3066TU



TC7SP3067TU



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage (Note 2)	V_{CCA}	−0.5 to 4.6	V
	V_{CCB}	−0.5 to 4.6	
Control input voltage (OE (3066)/ $\overline{OE}$ (3067))	V_{IN}	−0.5 to 4.6	V
Switch input/output voltage	V_S	−0.5 to V_{CCB} + 0.5	V
Diode current in the control portion	I_{IK}	−25	mA
Diode current in the switch portion	I_{IK}	±50 (Note 3)	mA
Switch input/output current	I_S	128	mA
DC V_{CC}/ground current	I_{CCA}	±50	mA
	I_{CCB}	±100	
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	−65 to 150	°C

Note 1: 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).

Note 2: Do not supply a voltage to the V_{CCB} pin when V_{CCA} is in the OFF state.

Note 3: $V_S < GND$, $V_S > V_{CCB}$

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CCA}	1.1 to 2.7	V
	V_{CCB}	1.65 to 3.6	
Control input voltage	V_{IN}	0 to 3.6	V
Switch input/output voltage	V_S	0 to V_{CCB}	V
Operating temperature	T_{opr}	−40 to 85	°C
Control input rise and fall times	dt/dv	0 to 10	ns/V

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CCA} or GND.

Electrical Characteristics

DC Characteristics ($1.1\ V \le V_{CCA} \le 2.7\ V$, $1.65\ V \le V_{CCB} \le 3.6\ V$)

Characteristics	Symbol	Test Condition		V_{CCA} (V)	V_{CCB} (V)	Ta = −40 to 85°C		Unit
						Min	Max	
High-level input voltage	V_{IH}	OE (3066), $\overline{OE}$ (3067)		$1.1 \le V_{CCA} < 1.4$	1.65 to 3.6	$0.70 \times V_{CCA}$	—	V
				$1.4 \le V_{CCA} < 1.65$	1.65 to 3.6	$0.70 \times V_{CCA}$	—	V
				$1.65 \le V_{CCA} < 2.3$	2.3 to 3.6	$0.70 \times V_{CCA}$	—	V
				$2.3 \le V_{CCA} \le 2.7$	2.7 to 3.6	1.6	—	V
Low-level input voltage	V_{IL}	OE (3066), $\overline{OE}$ (3067)		$1.1 \le V_{CCA} < 1.4$	1.65 to 3.6	—	$0.30 \times V_{CCA}$	V
				$1.4 \le V_{CCA} < 1.65$	1.65 to 3.6	—	$0.30 \times V_{CCA}$	V
				$1.65 \le V_{CCA} < 2.3$	2.3 to 3.6	—	$0.30 \times V_{CCA}$	V
				$2.3 \le V_{CCA} \le 2.7$	2.7 to 3.6	—	0.7	V
ON-resistance (Note)	R_{ON}	V_{IS} = 0 V	I_{IS} = 30 mA	1.1 to 2.7	2.7	—	8	Ω
		V_{IS} = 2.7 V	I_{IS} = 30 mA	1.1 to 2.7	2.7	—	12	
		V_{IS} = 2.1 V	I_{IS} = 15 mA	1.1 to 2.7	2.7	—	20	
		V_{IS} = 0 V	I_{IS} = 24 mA	1.1 to 2.3	2.3	—	10	
		V_{IS} = 2.3 V	I_{IS} = 24 mA	1.1 to 2.3	2.3	—	15	
		V_{IS} = 2.0 V	I_{IS} = 15 mA	1.1 to 2.3	2.3	—	25	
Switch-off leakage current	I_{SZ}	A1, B1 = 0 to V_{CCB} $\overline{OE}$ = V_{CCA}, OE = GND		1.1 to 2.7	1.65 to 3.6	—	±2.0	μA
Control input current	I_{IN}	$\overline{OE}$ or OE = 0 to 3.6 V		1.1 to 2.7	1.65 to 3.6	—	±1.0	μA
Quiescent supply current	I_{CCA}	V_{IN} = V_{CCA} or GND, I_S = 0 A		1.1 to 2.7	1.65 to 3.6	—	4.0	μA
	I_{CCB}	V_{IN} = V_{CCA} or GND, I_S = 0 A		1.1 to 2.7	1.65 to 3.6	—	4.0	
	I_{CCA}	$V_{CCA} \le V_{IN} \le 3.6$ V, I_S = 0 A		1.1 to 2.7	1.65 to 3.6	—	4.0	
	I_{CCB}	$V_{CCA} \le V_{IN} \le 3.6$ V, I_S = 0 A		1.1 to 2.7	1.65 to 3.6	—	4.0	

Note: ON-resistance is measured by measuring the voltage drop across the switch at the indicated current. V_{IS} is defined as the lower voltage at the A and B pins.

AC Characteristics (Ta = –40 to 85°C, Input: $t_r = t_f = 2.0$ ns)

$V_{CCA} = 2.5 \pm 0.2$ V, $V_{CCB} = 3.3 \pm 0.3$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.25	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	7	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	7	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

$V_{CCA} = 1.8 \pm 0.15$ V, $V_{CCB} = 3.3 \pm 0.3$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.25	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	9	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	9	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

$V_{CCA} = 1.5 \pm 0.1$ V, $V_{CCB} = 3.3 \pm 0.3$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.25	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	12	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	12	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

$V_{CCA} = 1.2 \pm 0.1$ V, $V_{CCB} = 3.3 \pm 0.3$ V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.25	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	20	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	20	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

V_{CCA} = 1.8 ± 0.15 V, V_{CCB} = 2.5 ± 0.2 V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.61	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	11	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	11	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

V_{CCA} = 1.5 ± 0.1 V, V_{CCB} = 2.5 ± 0.2 V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.61	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	12	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	12	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

V_{CCA} = 1.2 ± 0.1 V, V_{CCB} = 2.5 ± 0.2 V

Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	0.61	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	17	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	17	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

V_{CCA} = 1.2 ± 0.1 V, V_{CCB} = 1.8 ± 0.15 V

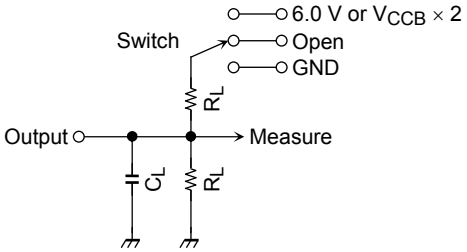
Characteristics	Symbol	Test Condition	Min	Max	Unit
Propagation delay time (bus to bus)	t_{pLH} t_{pHL}	Figures 1 and 2 (Note)	—	1.15	ns
3-state output enable time	t_{pZL} t_{pZH}	Figures 1 and 3	—	25	
3-state output disable time	t_{pLZ} t_{pHZ}	Figures 1 and 3	—	25	

Note: Calculated from the RC time constant of the ON-resistance of the output and the capacitive load.

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition			Typ.	Unit
			V_{CCA} (V)	V_{CCB} (V)		
Control input capacitance	C_{IN}		2.5	3.3	7	pF
Switch input/output capacitance	$C_{I/O}$	$\overline{OE}$ = V_{CCA}, OE = GND	2.5	3.3	10	pF

AC Test Circuit



Parameter	Switch	
t_{pLH}, t_{pHL}	Open	
t_{pLZ}, t_{pZL}	6.0 V	@ V_{CCB} = 3.3 ± 0.3 V
	V_{CCB} × 2	@ V_{CCB} = 2.5 ± 0.2 V @ V_{CCB} = 1.8 ± 0.15 V
t_{pHZ}, t_{pZH}	GND	

Symbol	V_{CCB} (output)	
	3.3 ± 0.3 V 2.5 ± 0.2 V	1.8 ± 0.15 V
R_L	500 Ω	1 kΩ
C_L	30 pF	30 pF

Figure 1

AC Test Waveform

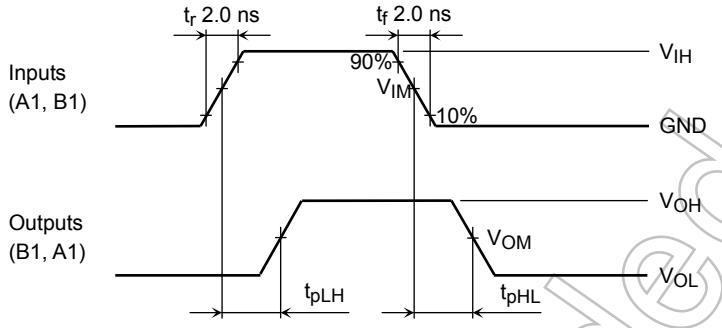


Figure 2 t_{pLH}, t_{pHL}

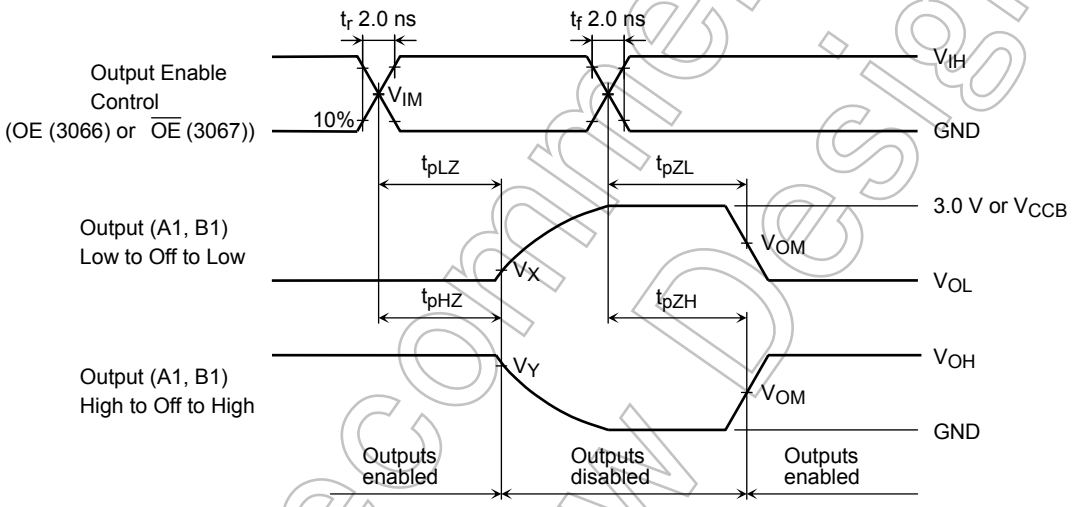
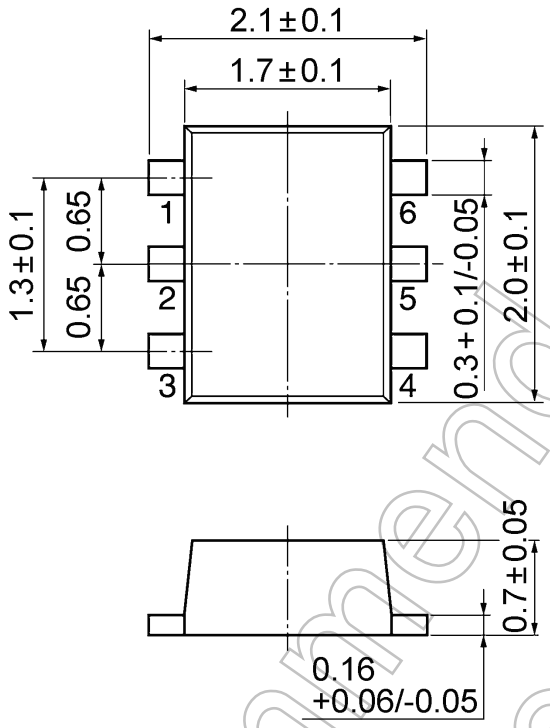


Figure 3 t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}

	Symbol	V_{CCA} or V_{CCB}		
		3.3 ± 0.3 V	2.5 ± 0.2 V 1.8 ± 0.15 V	1.5 ± 0.1 V 1.2 ± 0.1 V
Input	V_{IH}	—	V_{CCA}	V_{CCA}
	V_{IM}	—	$V_{CCA}/2$	$V_{CCA}/2$
Output	V_{OM}	$V_{OH}/2$	$V_{OH}/2$	—
	V_X	V_{OL} + 0.3 V	V_{OL} + 0.15 V	—
	V_Y	V_{OH} − 0.3 V	V_{OH} − 0.15 V	—

Package Dimensions

UF6 Unit: mm



Weight: 0.007 g (typ.)

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