

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7S66F, TC7S66FU

Bilateral Switch

The TC7S66 is a high Speed C²MOS Bilateral Switch fabricated with silicon gate C²MOS technology.

It consists of a high speed switch capable of controlling either digital or analog signals while maintaining the C²MOS low power dissipation.

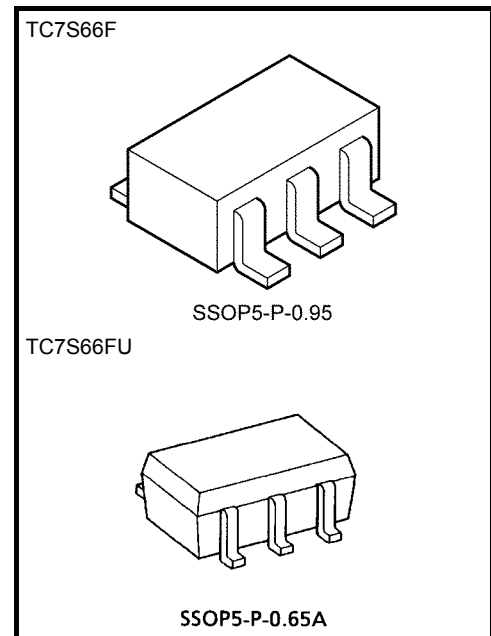
Control input (C) is provided to control the switch.

The switch turns ON while the C input is high, and the switch turns OFF while low.

Input is equipped with protection circuits against static discharge or transient excess voltage.

Features

- High speed: $t_{pd} = 7 \text{ ns (typ.) @ } V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 1 \text{ } \mu\text{A (max) @ } T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Low ON resistance: $R_{ON} = 100 \text{ } \Omega \text{ (typ.) @ } V_{CC} = 9 \text{ V}$
- Low T.H.D: $\text{THD} = 0.05\% \text{ (typ.) @ } V_{CC} = 5 \text{ V}$
- Pin and function compatible with TC4S66F



Weight

SSOP5-P-0.95 : 0.016 g (typ.)

SSOP5-P-0.65A : 0.006 g (typ.)

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

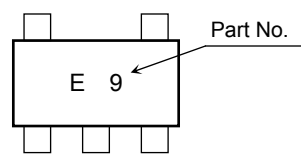
Characteristics	Symbol	Rating	Unit
DC Supply voltage	V_{CC}	-0.5 to 13	V
Control input voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	V
Switch I/O voltage	$V_{I/O}$	-0.5 to $V_{CC} + 0.5$	V
Control diode current	I_{CK}	± 20	mA
I/O diode current	I_{IOK}	± 20	mA
Through I/O current	I_T	± 12.5	mA
DC V_{CC} /ground current	I_{CC}	± 25	mA
Power dissipation	P_D	200	mW
Storage temperature range	T_{stg}	-65 to 150	$^\circ\text{C}$
Lead temperature (10 s)	T_L	260	$^\circ\text{C}$

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.

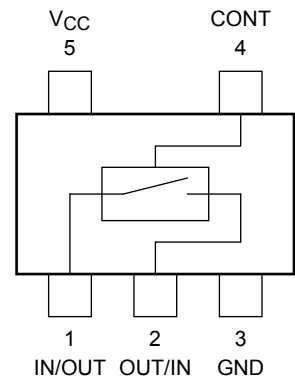
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Start of commercial production
1991-06

Marking



Pin Configuration (top view)



Logic Diagram



Truth Table

Control	Switch Function
H	ON
L	OFF

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 12	V
Control input voltage	V_{IN}	0 to V_{CC}	V
Switch I/O voltage	$V_{I/O}$	0 to V_{CC}	V
Operating temperature range	T_{opr}	-40 to 85	°C
Input rise and fall time	t_r, t_f	0 to 1000 ($V_{CC} = 2.0$ V)	ns
		0 to 500 ($V_{CC} = 4.5$ V)	
		0 to 400 ($V_{CC} = 6.0$ V)	
		0 to 250 ($V_{CC} = 10.0$ V)	

Electrical Characteristics
DC Electrical Characteristics

Characteristics		Symbol	Test Condition	V _{CC} (V)	Ta = 25°C			Ta = -40 to 85°C		Unit
					Min	Typ.	Max	Min	Max	
Control input voltage	High level	V _{IHC}	—	2.0	1.5	—	—	1.5	—	V
				4.5	3.15	—	—	3.15	—	
				9.0	6.3	—	—	6.3	—	
				12.0	8.4	—	—	8.4	—	
	Low level	V _{ILC}	—	2.0	—	—	0.5	—	0.5	
				4.5	—	—	1.35	—	1.35	
				9.0	—	—	2.7	—	2.7	
				12.0	—	—	3.6	—	3.6	
ON resistance		R _{ON}	V _{IN} = V _{IHC} V _{I/O} = V _{CC} to GND I _{I/O} ≤ 1 mA	4.5	—	192	340	—	400	Ω
				9.0	—	110	170	—	200	
				12.0	—	90	160	—	180	
			V _{IN} = V _{IHC} V _{I/O} = V _{CC} or GND I _{I/O} ≤ 1 mA	2.0	—	320	—	—	—	
				4.5	—	140	200	—	260	
				9.0	—	100	150	—	190	
				12.0	—	90	140	—	180	
Input/output leakage current (switch off)		I _{OFF}	V _{OS} = V _{CC} or GND V _{IS} = GND or V _{CC} V _{IN} = V _{ILC}	12.0	—	—	±100	—	±1000	nA
Switch input leakage current (switch on, output open)		I _{IZ}	V _{OS} = V _{CC} or GND V _{IN} = V _{IHC}	12.0	—	—	±100	—	±1000	nA
Control input current		I _{IN}	V _{IN} = V _{CC} or GND	12.0	—	—	±100	—	±1000	nA
Quiescent device current		I _{CC}	V _{IN} = V _{CC} or GND	6.0	—	—	1.0	—	10.0	μA
				9.0	—	—	4.0	—	40.0	
				12.0	—	—	8.0	—	80.0	

AC Electrical Characteristics ($C_L = 50$ pF, input $t_r = t_f = 6$ ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max
Phase difference between input and output	ϕ_{I-O}	—	2.0	—	20	75	—	100
			4.5	—	7	15	—	20
			9.0	—	4	12	—	15
			12.0	—	4	11	—	14
Output enable time	t_{pZL} t_{pZH}	$R_L = 1$ k Ω	2.0	—	20	150	—	190
			4.5	—	13	30	—	38
			9.0	—	9	18	—	33
			12.0	—	8	18	—	27
Output disable time	t_{pLZ} t_{pHZ}	$R_L = 1$ k Ω	2.0	—	40	170	—	220
			4.5	—	11	35	—	44
			9.0	—	10	30	—	38
			12.0	—	9	27	—	33
Maximum control input frequency	—	$R_L = 1$ k Ω $C_L = 15$ pF $V_{OUT} = 1/2 V_{CC}$	2.0	—	30	—	—	—
			4.5	—	30	—	—	—
			9.0	—	30	—	—	—
			12.0	—	30	—	—	—
Control input capacitance	C_{IN}	—	—	—	5	10	—	10
Switch terminal capacitance	$C_{I/O}$	—	—	—	6	—	—	—
Feedthrough capacitance	C_{IOS}	—	—	—	0.5	—	—	—
Power dissipation capacitance	C_{PD}	(Note)	—	—	15	—	—	—

Note: C_{PD} 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:

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

Analog Switch Characteristics (GND = 0 V, Ta = 25°C) (Note)

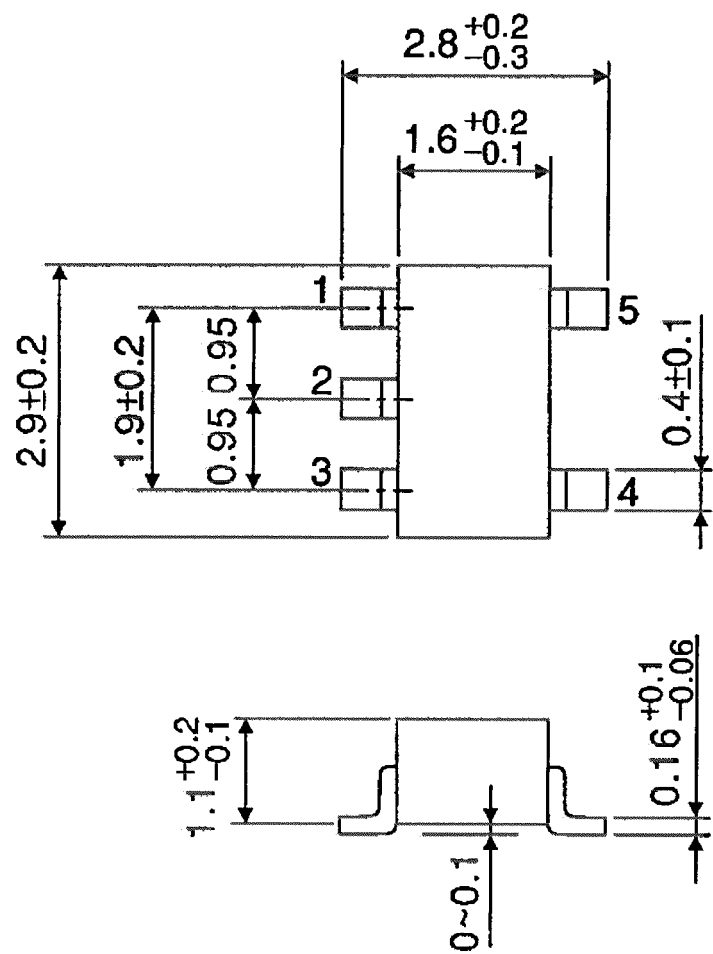
Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Total harmonic distortion (T.H.D)	—	$f_{IN} = 1$ kHz, $V_{IN} = 4$ V _{p-p} ($V_{CC} = 4.5$ V) $R_L = 10$ k Ω , $V_{IN} = 8$ V _{p-p} ($V_{CC} = 9.0$ V) $C_L = 50$ pF	4.5	0.05	%
			9.0	0.04	
Maximum propagation frequency (switch on)	f_{MAX}	Adjust f_{IN} voltage to obtain 0dBm at V_{OS} increase f_{IN} frequency until dB meter reads -3dB. $R_L = 50$ Ω , $C_L = 10$ pF $f_{IN} = 1$ MHz, Sine wave	4.5	200	MHz
			9.0	200	
Feedthrough (switch on)	—	V_{IN} is centered at $V_{CC}/2$ adjust input for 0dBm $R_L = 600$ Ω , $C_L = 50$ pF $f_{IN} = 1$ MHz, Sine wave	4.5	-60	dB
			9.0	-60	
Crosstalk (control switch)	—	$R_L = 600$ Ω , $C_L = 50$ pF $f_{IN} = 1$ MHz, Pulse ($t_r = t_f = 6$ ns)	4.5	60	mV
			9.0	100	

Note: These characteristics are determined by design of devices.

Package Dimensions

SSOP5-P-0.95

Unit : mm

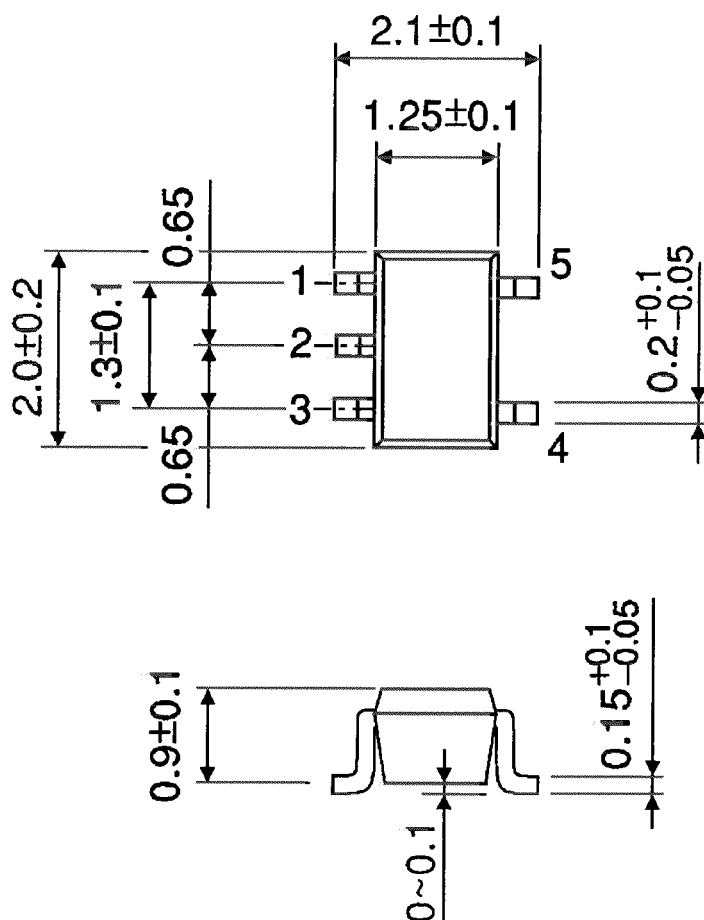


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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