TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7S66F, TC7S66FU

Bilateral Switch

The TC7S66 is a high Speed C^2MOS Bilateral Switch fabricated with silicon gate C^2MOS technology.

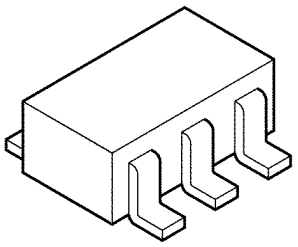
It consists of a high speed switch capable of controlling either digital or analog signals while maintaining the C^2MOS low power dissipation.

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.

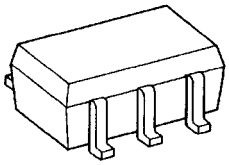
Input is equipped with protection circuits against static discharge or transient excess voltage.

TC7S66F



SSOP5-P-0.95

TC7S66FU



SSOP5-P-0.65A

Weight
SSOP5-P-0.95 : 0.016 g (typ.)
SSOP5-P-0.65A : 0.006 g (typ.)

Features

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

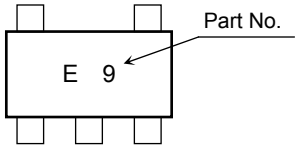
Absolute Maximum Ratings (Ta = 25°C)

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	°C
Lead temperature (10 s)	T_L	260	°C

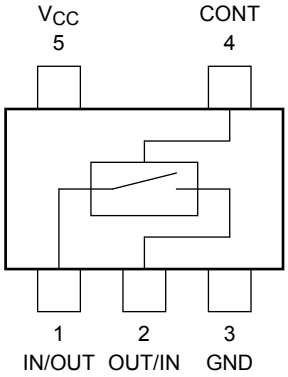
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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

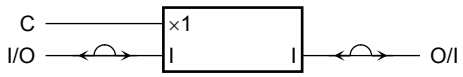
Marking



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		Ta = 25°C			Ta = –40 to 85°C		Unit
				V_{CC} (V)	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 $I_{I/O} \leq 1$ 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 $I_{I/O} \leq 1$ 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	ϕI-O	—	2.0	—	20	75	—	100	ns
			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 kΩ	2.0	—	20	150	—	190	ns
			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 kΩ	2.0	—	40	170	—	220	ns
			4.5	—	11	35	—	44	
			9.0	—	10	30	—	38	
			12.0	—	9	27	—	33	
Maximum control input frequency	—	R_L = 1 kΩ C_L = 15 pF V_{OUT} = 1/2 V_{CC}	2.0	—	30	—	—	—	MHz
			4.5	—	30	—	—	—	
			9.0	—	30	—	—	—	
			12.0	—	30	—	—	—	
Control input capacitance	C_{IN}	—		—	5	10	—	10	pF
Switch terminal capacitance	$C_{I/O}$	—		—	6	—	—	—	pF
Feedthrough capacitance	C_{IOS}	—		—	0.5	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note)		—	15	—	—	—	pF

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:

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

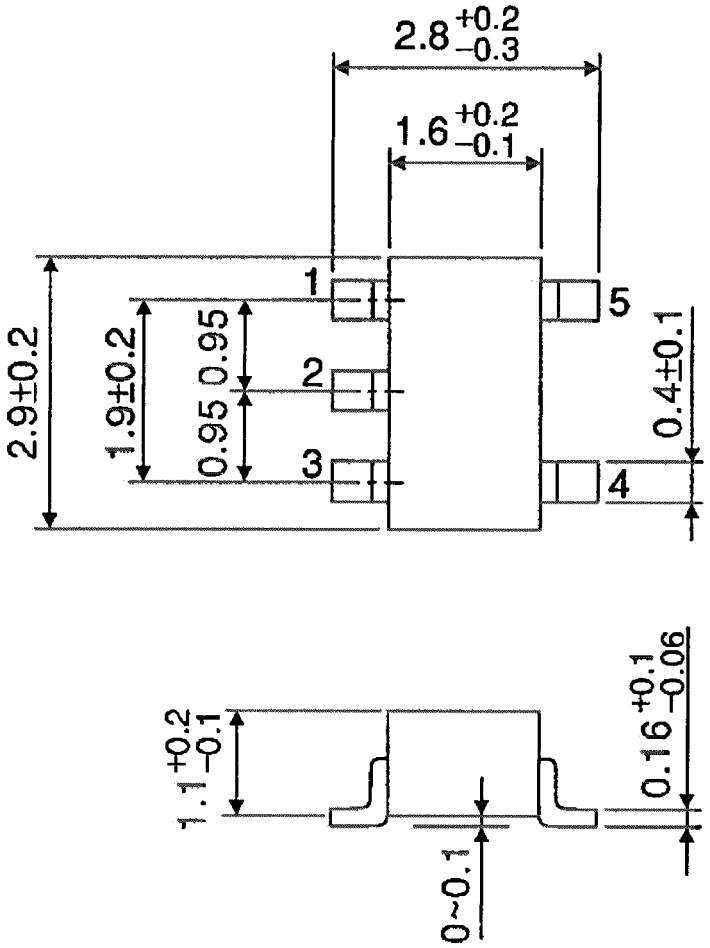
Analog Switch Characteristics (GND = 0 V, Ta = 25°C) (Note)

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 kΩ, 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

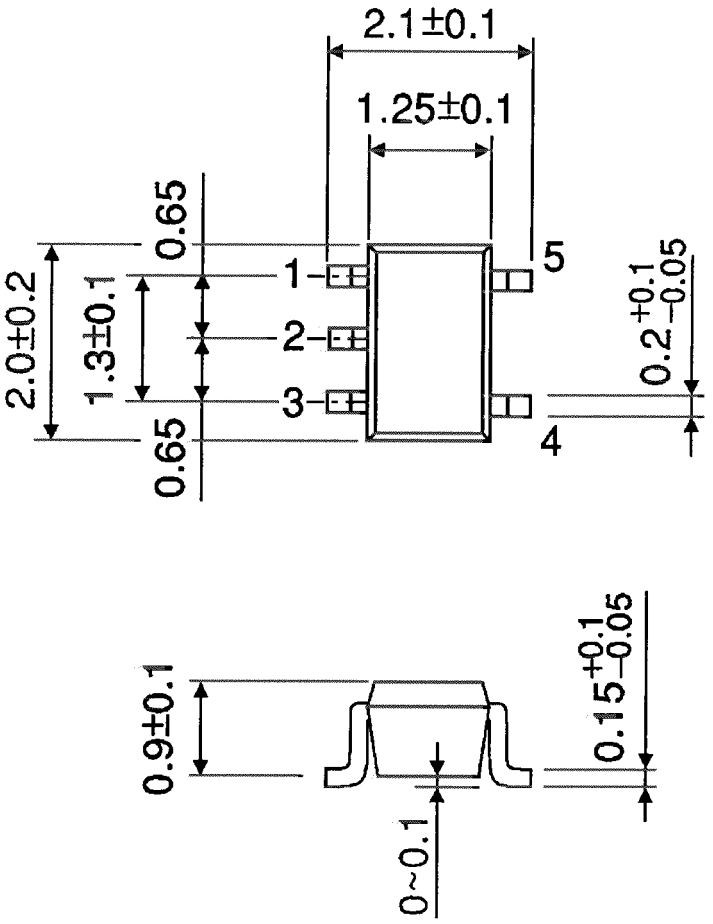


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А