

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

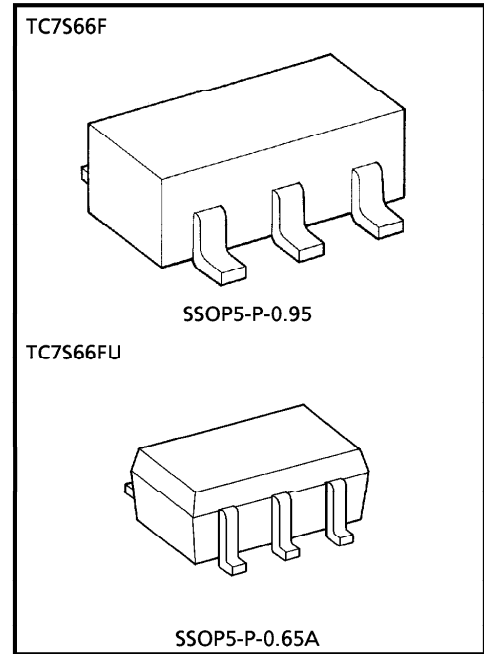
# TC7S66F, TC7S66FU

## BILATERAL SWITCH

The TC7S66 is a high Speed C<sup>2</sup>MOS BILATERAL SWITCH fabricated with silicon gate C<sup>2</sup>MOS technology. It consists of a high speed switch capable of controlling either digital or analog signals while maintaining the C<sup>2</sup>MOS 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 .....  $t_{pd} = 7ns$  (Typ.) at  $V_{CC} = 5V$
- Low Power Dissipation .....  $I_{CC} = 1\mu A$  (Max.) at  $T_a = 25^\circ C$
- High Noise Immunity .....  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Low ON Resistance .....  $R_{ON} = 100\Omega$  (Typ.) at  $V_{CC} = 9V$
- Low T.H.D .....  $THD = 0.05\%$  (Typ.) at  $V_{CC} = 5V$
- Pin and Function Compatible with TC4S66F

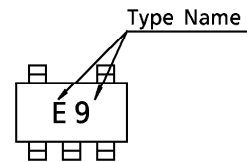


Weight SSOP5-P-0.95 : 0.016g (Typ.)  
 SSOP5-P-0.65A : 0.006g (Typ.)

### MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{CC}$	-0.5~13	V
Control Input Voltage	$V_{IN}$	-0.5~ $V_{CC} + 0.5$	V
Switth I/O Voltage	$V_{I/O}$	-0.5~ $V_{CC} + 0.5$	V
Control Diode Current	$I_{CK}$	$\pm 20$	mA
Output Diode Current	$I_{IOK}$	$\pm 20$	mA
Through I/O Current	$I_T$	$\pm 12.5$	mA
DC $V_{CC}$ /Ground Current	$I_{CC}$	$\pm 25$	mA
Power Dissipation	$P_D$	200	mW
Storage Temperature	$T_{stg}$	-65~150	$^\circ C$
Lead Temperature (10s)	$T_L$	260	$^\circ C$

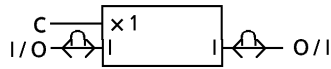
### MARKING



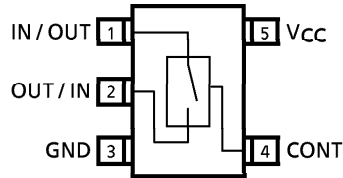
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LOGIC DIAGRAM



PIN ASSIGNMENT (TOP VIEW)



TRUTH TABLE

CONTROL	SWITCH FUNCTION
H	ON
L	OFF

RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	$V_{CC}$	2~12	V
Control Input Voltage	$V_{IN}$	0~ $V_{CC}$	V
Switch I/O Voltage	$V_{I/O}$	0~ $V_{CC}$	V
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise and Fall Time	$t_r, t_f$	0~1000 ( $V_{CC} = 2.0V$ ) 0~500 ( $V_{CC} = 4.5V$ ) 0~400 ( $V_{CC} = 6.0V$ ) 0~250 ( $V_{CC} = 10.0V$ )	ns

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	$T_a = 25^\circ C$			$T_a = -40 \sim 85^\circ C$		UNIT	
			$V_{CC}$	MIN.	TYP.	MAX.	MIN.		MAX.
High-level Control Input Voltage	$V_{IHC}$	—	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 Control Input Voltage	$V_{ILC}$	—	2.0	—	—	0.5	—	0.5	V
			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 $V_{I/O} \leq 1mA$	4.5	—	192	340	—	400	$\Omega$
			9.0	—	110	170	—	200	
			12.0	—	90	160	—	180	
		$V_{IN} = V_{IHC}$ $V_{I/O} = V_{CC}$ or GND $V_{I/O} \leq 1mA$	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	—	—	$\pm 100$	—	$\pm 1000$	nA

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**DC ELECTRICAL CHARACTERISTICS**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C				Ta = -40~85°C		UNIT
			V <sub>CC</sub>	MIN.	TYP.	MAX.	MIN.	MAX.	
Switch Input Leakage Current (SW ON, Output OPEN)	I <sub>Iz</sub>	V <sub>OS</sub> = V <sub>CC</sub> or GND V <sub>IN</sub> = V <sub>IHC</sub>	12.0	—	—	± 100	—	± 1000	nA
Control Input Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	12.0	—	—	± 100	—	± 1000	
Quiscent Device Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> 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<sub>L</sub> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C				Ta = -40~85°C		UNIT
			V <sub>CC</sub>	MIN.	TYP.	MAX.	MIN.	MAX.	
Phase difference between input and output	φ <sub>I-O</sub>	—	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 <sub>pZL</sub> t <sub>pZH</sub>	R <sub>L</sub> = 1kΩ	2.0	—	20	150	—	190	
			4.5	—	13	30	—	38	
			9.0	—	9	18	—	33	
			12.0	—	8	18	—	27	
Output Disable Time	t <sub>pLZ</sub> t <sub>pHZ</sub>	R <sub>L</sub> = 1kΩ	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 <sub>L</sub> = 1kΩ C <sub>L</sub> = 15pF V <sub>OUT</sub> = 1/2 V <sub>CC</sub>	2.0	—	30	—	—	—	MHz
			4.5	—	30	—	—	—	
			9.0	—	30	—	—	—	
			12.0	—	30	—	—	—	
Control Input Capacitance	C <sub>IN</sub>	—	—	5	10	—	10	—	
Switch Terminal Capacitance	C <sub>I/O</sub>	—	—	6	—	—	—	pF	
Feedthrough Capacitance	C <sub>IOS</sub>	—	—	0.5	—	—	—	—	
Power Dissipation Capacitance	C <sub>pD</sub>	(Note 1)	—	—	15	—	—	—	

Note 1 : C<sub>pD</sub> is defined as the value of internal equivalent Capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

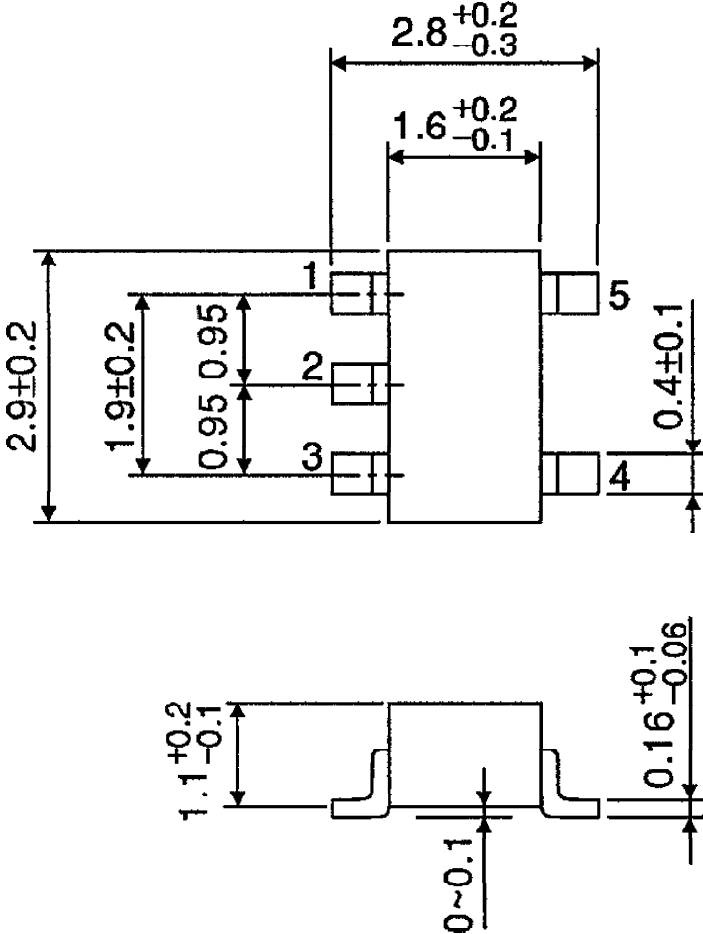
**ANALOG SWITCH CHARACTERISTICS (GND = 0V, Ta = 25°C)**

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub>	TYP.	UNIT
Total Harmonic Distortion (T.H.D)	—	f <sub>IN</sub> = 1kHz V <sub>IN</sub> = 4V <sub>pp</sub> (V <sub>CC</sub> = 4.5V) R <sub>L</sub> = 10kΩ V <sub>IN</sub> = 8V <sub>pp</sub> (V <sub>CC</sub> = 9.0V) C <sub>L</sub> = 50pF	4.5 9.0	0.05 0.04	%
Maximum Propagation Frequency (SWITCH ON)	f <sub>MAX</sub>	Adjust f <sub>IN</sub> voltage to obtain 0dBm at V <sub>OS</sub> Increase f <sub>IN</sub> frequency until dB Meter reads - 3dB. R <sub>L</sub> = 50Ω C <sub>L</sub> = 10pF, f <sub>IN</sub> = 1MHz, Sine Wave	4.5 9.0	200 200	MHz
Feedthrough (SWITCH ON)	—	V <sub>in</sub> is ceintered at V <sub>CC</sub> /2 Adjust input for 0dBm R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF f <sub>IN</sub> = 1MHz, Sine Wave	4.5 9.0	- 60 - 60	dB
Crosstalk (CONTROL SWITCH)	—	R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF IN = 1MHz, PULSE (t <sub>r</sub> = t <sub>f</sub> = 6ns)	4.5 9.0	60 100	mV

Note : These characteristics are determined by design of devices.

OUTLINE DRAWING  
SSOP5-P-0.95

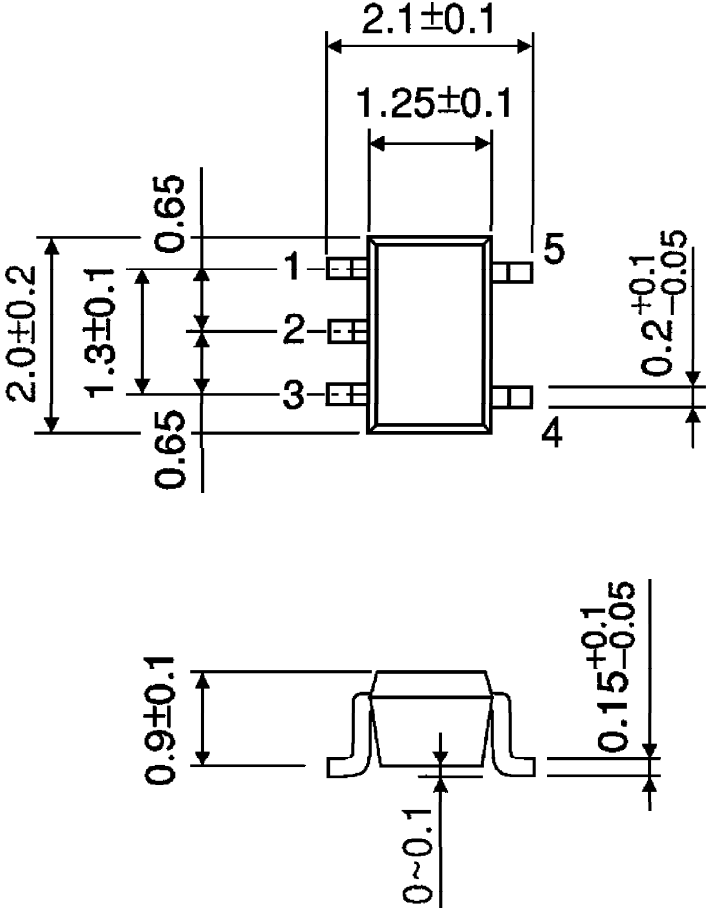
Unit : mm



Weight : 0.016g (Typ.)

OUTLINE DRAWING  
SSOP5-P-0.65A

Unit : mm



Weight : 0.006g (Typ.)