

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

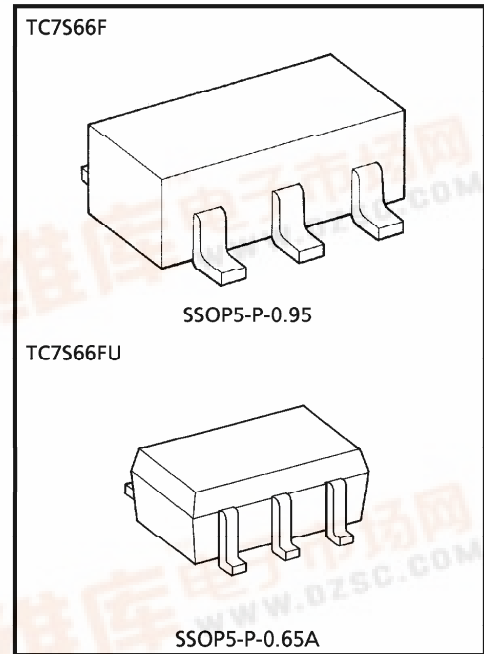
TC7S66F, TC7S66FU

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.) at $V_{CC} = 5\text{V}$
- Low Power Dissipation $I_{CC} = 1\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- High Noise Immunity $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Low ON Resistance $R_{ON} = 100\Omega$ (Typ.) at $V_{CC} = 9\text{V}$
- Low T.H.D $\text{THD} = 0.05\%$ (Typ.) at $V_{CC} = 5\text{V}$
- Pin and Function Compatible with TC4S66F

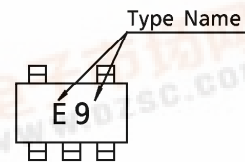


Weight SSOP5-P-0.95 : 0.016g (Typ.)
SSOP5-P-0.65A : 0.006g (Typ.)

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
Swth I/O Voltage	$V_{I/O}$	-0.5~ $V_{CC} + 0.5$	V
Control Diode Current	I_{CK}	± 20	mA
Output 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	T_{stg}	-65~150	°C
Lead Temperature (10s)	T_L	260	°C

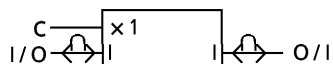
MARKING



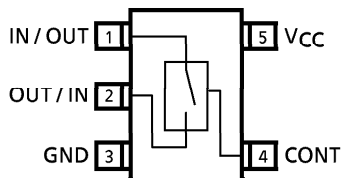
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TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

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	Ω
			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	—	—	± 100	—	± 1000	nA

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DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			VCC	MIN.	TYP.	MAX.	MIN.		MAX.
Switch Input Leakage Current (SW 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	
Quiscent 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 = 50pF, Input t_r = t_f = 6ns)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			VCC	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 = 1kΩ	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 = 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 _L = 1kΩ C _L = 15pF 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	—	
Switch Terminal Capacitance	C _{I/O}	—	—	6	—	—	—	pF	
Feedthrough Capacitance	C _{IOS}	—	—	0.5	—	—	—	—	
Power Dissipation Capacitance	C _{PD}	(Note 1)	—	—	15	—	—	—	—

Note 1 : C_{PD} 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 :

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

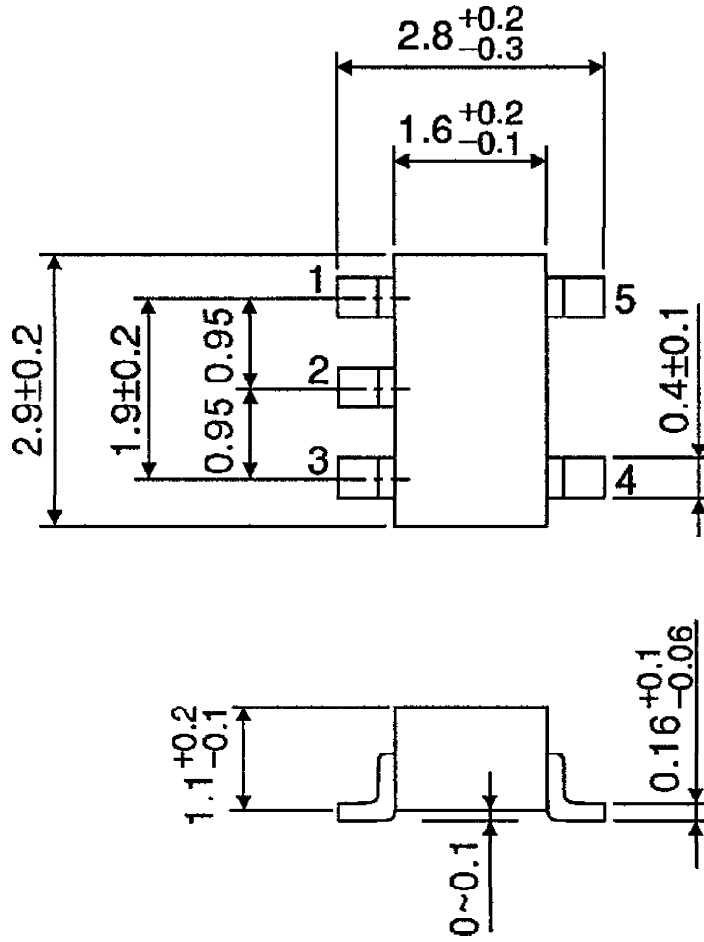
ANALOG SWITCH CHARACTERISTICS (GND = 0V, Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC}	TYP.	UNIT
Total Harmonic Distortion (T.H.D)	—	f _{IN} = 1kHz V _{IN} = 4V _{PP} (V _{CC} = 4.5V) R _L = 10kΩ V _{IN} = 8V _{PP} (V _{CC} = 9.0V) C _L = 50pF	4.5 9.0	0.05 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 = 50Ω C _L = 10pF, f _{IN} = 1MHz, Sine Wave	4.5 9.0	200 200	MHz
Feedthrough (SWITCH ON)	—	V _{in} is ceintred at V _{CC} /2 Adjust input for 0dBm R _L = 600Ω, C _L = 50pF f _{IN} = 1MHz, Sine Wave	4.5 9.0	-60 -60	dB
Crosstalk (CONTROL SWITCH)	—	R _L = 600Ω, C _L = 50pF IN = 1MHz, PULSE (t _r = t _f = 6ns)	4.5 9.0	60 100	mV

Note : These characteristics are determined by design of devices.

OUTLINE DRAWING
SSOP5-P-0.95

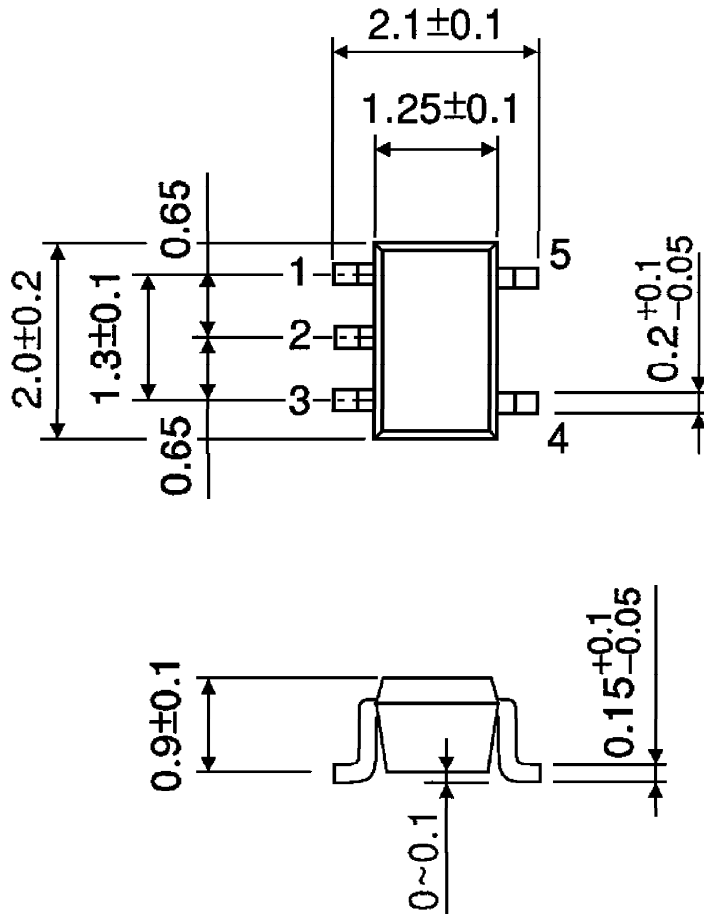
Unit : mm



Weight : 0.016g (Typ.)

OUTLINE DRAWING
SSOP5-P-0.65A

Unit : mm



Weight : 0.006g (Typ.)