

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

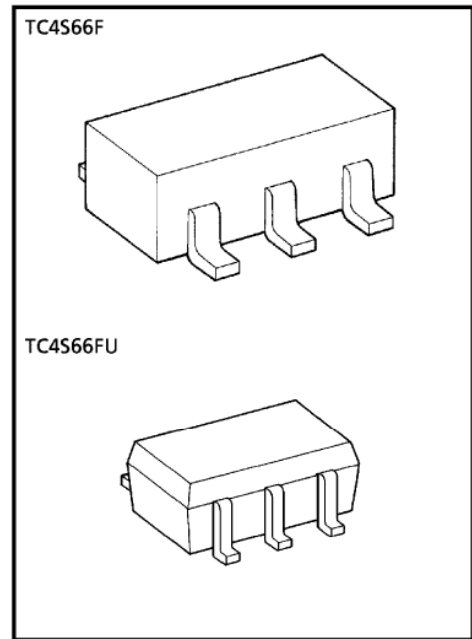
# TC4S66F, TC4S66FU

## BILATERAL SWITCH

TC4S66F/FU contains one circuit of bidirectional switches. When control input, CONT is set to "H" level, the impedance between input and output of the switch becomes low and when it is set to "L" level, the switch becomes high. This can be applied for switching of analog signals and digital signals.

### FEATURES

- ON-resistance ( $R_{ON}$ )
  - 300  $\Omega$  (Typ.) . . . .  $V_{DD} - V_{SS} = 5\text{ V}$
  - 110  $\Omega$  (Typ.) . . . .  $V_{DD} - V_{SS} = 10\text{ V}$
  - 70  $\Omega$  (Typ.) . . . .  $V_{DD} - V_{SS} = 15\text{ V}$
- OFF-resistance ( $R_{OFF}$ )
  - $R_{OFF}$  (Typ.)  $> 10^9\ \Omega$



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

### Absolute Maximum Ratings

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}$	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Control Input Voltage	$V_{C\ IN}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
Switch I/O Voltage	$V_{I/O}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
Power Dissipation	$P_D$	200	mW
Potential difference across I/O during ON	$V_I - V_O$	$\pm 0.5$	V
Control Input Current	$I_{C\ IN}$	$\pm 10$	mA
Operating Temperature Range	$T_{opr}$	-40~85	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$	-65~150	$^{\circ}\text{C}$
Lead Temperature (10 s)	$T_L$	260	$^{\circ}\text{C}$

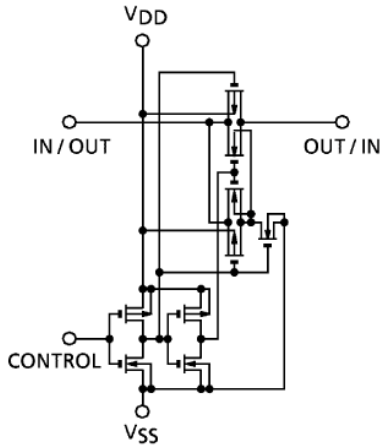
### TRUTH TABLE

CONTROL	IMPEDANCE BETWEEN IN/OUT-OUT/IN *
H	$0.5 \sim 5 \times 10^2\ \Omega$
L	$> 10^9\ \Omega$

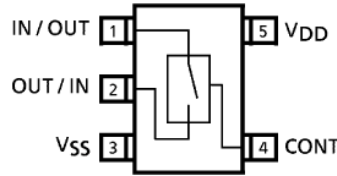
\* : See static electrical characteristics.

Start of commercial production  
1988-01

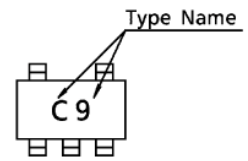
### CIRCUIT DIAGRAM



### PIN ASSIGNMENT (TOP VIEW)



### MARKING



### Operating Ranges ( $V_{SS} = 0\text{ V}$ )

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	$V_{DD}$	3	—	18	V
Input/Output Voltage	$V_{IN}/V_{OUT}$	0	—	$V_{DD}$	V

### STATIC ELECTRICAL CHARACTERISTICS (In case not specifically appointed, $V_{SS} = 0\text{ V}$ )

CHARACTERISTIC	SYM-BOL	TEST CONDITION	$V_{DD}$ (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
Control Input High Voltage	$V_{IH}$	$ I_{IS}  = 10\ \mu\text{A}$	5	3.5	—	3.5	2.75	—	3.5	—	V
			10	7.0	—	7.0	5.50	—	7.0	—	
			15	11.0	—	11.0	8.25	—	11.0	—	
Control Input Low Voltage	$V_{IL}$	$ I_{IS}  = 10\ \mu\text{A}$	5	—	1.5	—	2.25	1.5	—	1.5	V
			10	—	3.0	—	4.5	3.0	—	3.0	
			15	—	4.0	—	6.75	4.0	—	4.0	
On-State Resistance	$R_{ON}$	$0 \leq V_{IS} \leq V_{DD}$ $R_L = 10\ \text{k}\Omega$	5	—	800	—	290	950	—	1200	$\Omega$
			10	—	210	—	120	250	—	300	
			15	—	140	—	85	160	—	200	
Input/Output Leakage Current	$I_{OFF}$	$V_{IN} = 18\text{ V}$ $V_{OUT} = 0\text{ V}$ $V_{IN} = 0\text{ V}$ $V_{OUT} = 18\text{ V}$	18	—	$\pm 100$	—	$\pm 0.1$	$\pm 100$	—	$\pm 1000$	nA
			18	—	$\pm 100$	—	$\pm 0.1$	$\pm 100$	—	$\pm 1000$	
Quiescent Device Current	$I_{DD}$	$V_{IN} = V_{DD}, V_{SS}$	5	—	0.25	—	0.001	0.25	—	7.5	$\mu\text{A}$
			10	—	0.5	—	0.001	0.5	—	15	
			15	—	1.0	—	0.002	1.0	—	30	
Input Current	H Level	$I_{IH}$	$V_{IH} = 18\text{ V}$	18	—	0.1	—	$10^{-5}$	0.1	—	$\mu\text{A}$
	L Level	$I_{OL}$	$V_{IL} = 0\text{ V}$	18	—	-0.1	—	$-10^{-5}$	-0.1	—	

**DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>SS</sub> (V) V <sub>DD</sub> (V)		MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (IN-OUT)	t <sub>pLH</sub> t <sub>pHL</sub>	C <sub>L</sub> = 50 pF	0	5	—	15	40	ns
			0	10	—	8	20	
			0	15	—	5	15	
Propagation Delay Time (CONTROL-OUT)	t <sub>pZL</sub> t <sub>pZH</sub>	R <sub>L</sub> = 1 kΩ	0	5	—	55	120	
		C <sub>L</sub> = 50 pF	0	10	—	25	40	
			0	15	—	20	30	
Propagation Delay Time (CONTROL-OUT)	t <sub>pLZ</sub> t <sub>pHZ</sub>	R <sub>L</sub> = 1 kΩ	0	5	—	45	80	
		C <sub>L</sub> = 50 pF	0	10	—	30	70	
			0	15	—	25	60	
Max. Control Input Repetition Rate	f <sub>MAX</sub> (C)	R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF	0	5	—	10	—	MHz
			0	10	—	12	—	
			0	15	—	12	—	
- 3dB Cut Off Frequency	f <sub>MAX</sub> (I/O)	R <sub>L</sub> = 1 kΩ C <sub>L</sub> = 50 pF (*1)	-5	5	—	30	—	
Total Harmonic Distortion	—	R <sub>L</sub> = 10 kΩ f = 1 kHz (*2)	-5	5	—	0.03	—	%
- 50dB Feedthrough Frequency	—	R <sub>L</sub> = 1 kΩ (*3)	-5	5	—	600	—	kHz
Crosstalk (CONTROL-OUT)	—	R <sub>IN</sub> = 1 kΩ	0	5	—	200	—	mV
		R <sub>OUT</sub> = 10 kΩ	0	10	—	400	—	
		C <sub>L</sub> = 15 pF	0	15	—	600	—	
Input Capacitance	C <sub>IN</sub>	Control Input	—	—	—	5	7.5	pF
		Switch I/O	—	—	—	10	—	
Feedthrough Capacitance	C <sub>IN-OUT</sub>	—	—	—	—	0.5	—	

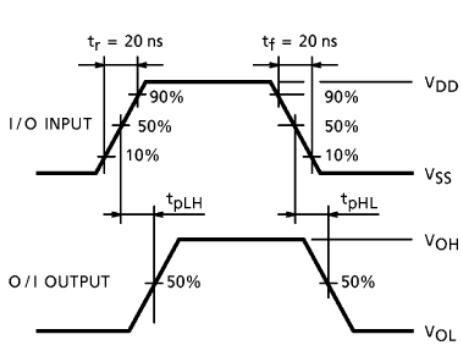
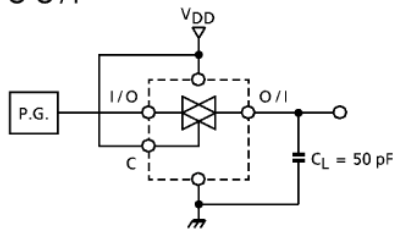
\*1 : The frequency at  $20\log_{10} \frac{V_{OS}}{V_{IS}} = -3$  dB shall be f<sub>MAX</sub> (I/O) using sine wave of ±2.5 V<sub>p-p</sub> for V<sub>IS</sub>.

\*2 : V<sub>IS</sub> shall be sine wave of ±2.5 V.

\*3 : The frequency at  $20\log_{10} \frac{V_{OS}}{V_{IS}} = 50$  dB shall be the feed through using of ±2.5 V<sub>p-p</sub>.

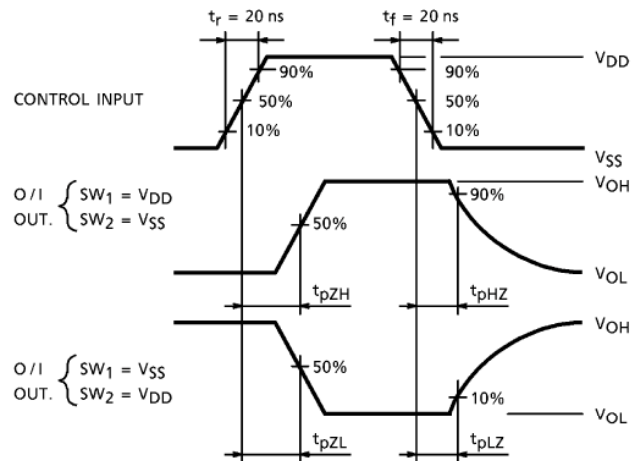
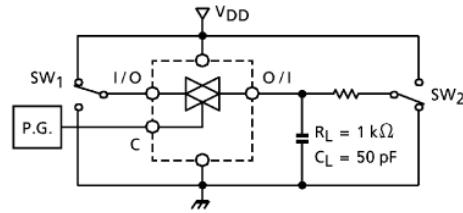
### 1. $t_{pLH}$ , $t_{pHL}$

I/O-O/I

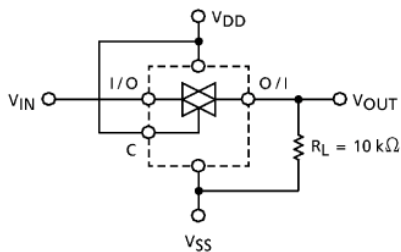


### 2. $t_{pZL}$ , $t_{pZH}$ , $t_{pLZ}$ , $t_{pHZ}$

CONTROL-O/I

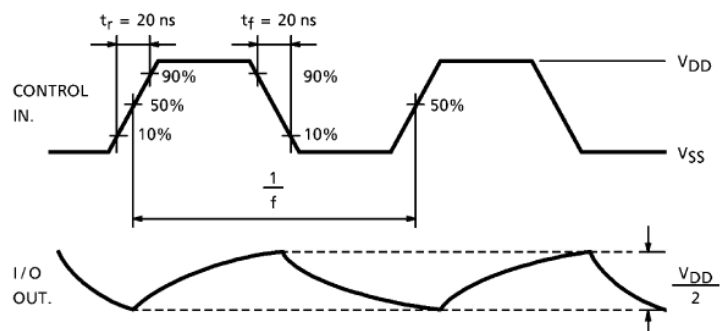
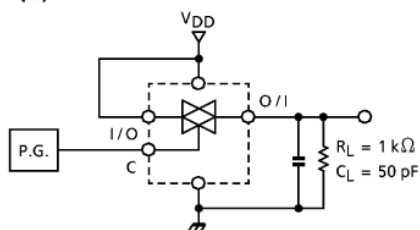


### 3. RON

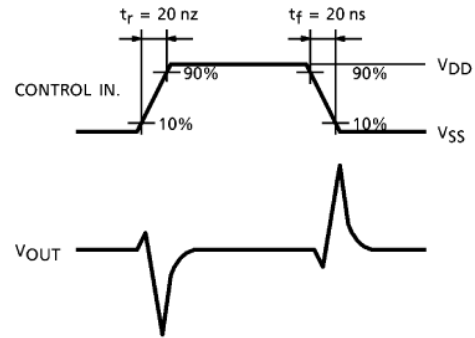
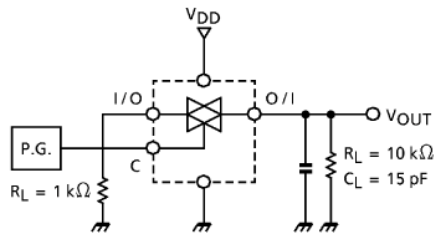


$$R_{ON} = 10 \times \frac{(V_{IN} - V_{OUT})}{V_{OUT}} \text{ (k}\Omega\text{)}$$

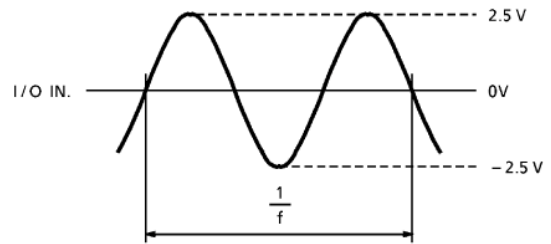
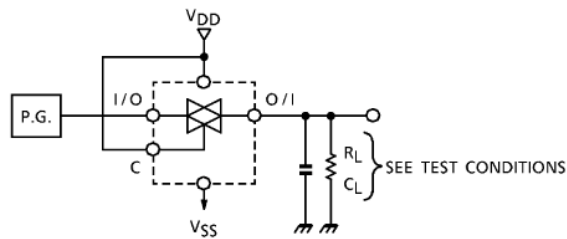
### 4. $f_{MAX}(C)$



5. CROSSTALK (CONTROL INPUT)

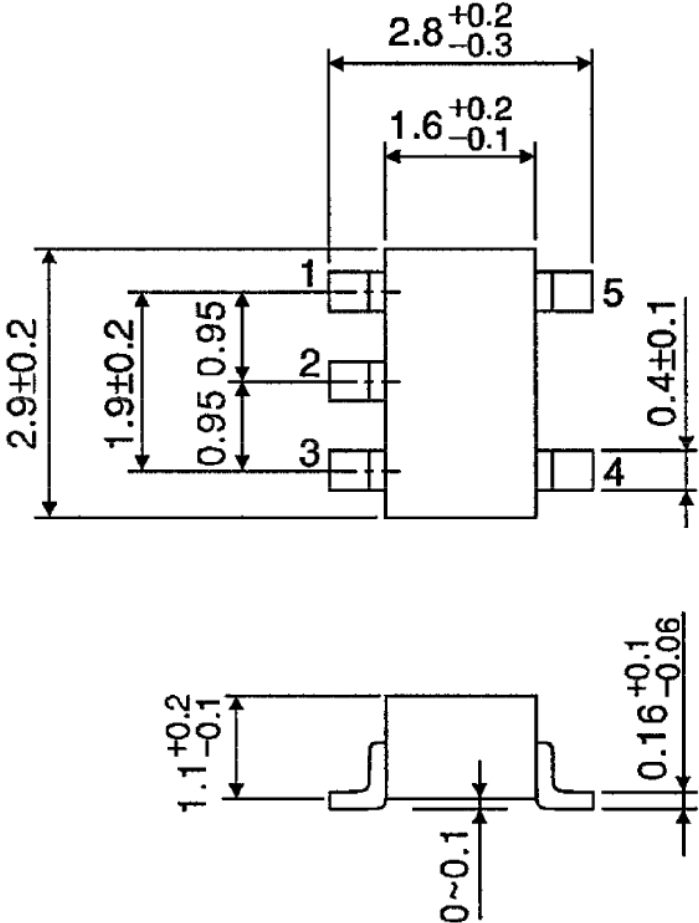


6. TOTAL HARMONIC DISTORTION,  $f_{MAX}$  (I/O-O/I), FEEDTHROUGH (SWITCH OFF)



PACKAGE DIMENSIONS  
SSOP5-P-0.95

Unit : mm



Weight : 0.016 g (Typ.)



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