

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC4W66F, TC4W66FU

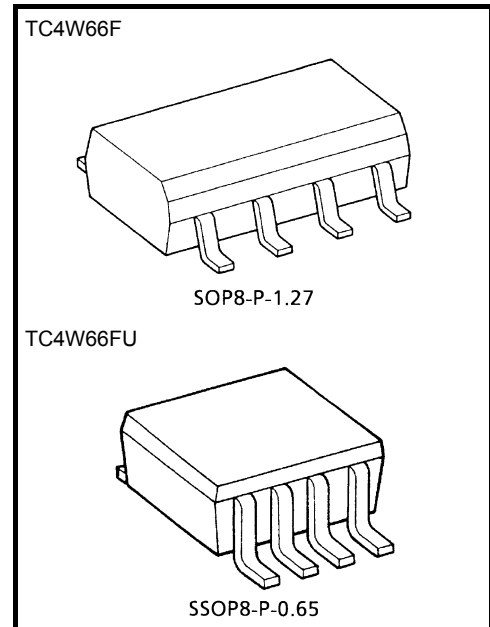
## Dual Bilateral Switch

The TC4W66 contains two independence circuits 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,  $R_{ON}$   
 $250\ \Omega$  (typ.) .....  $V_{DD} - V_{SS} = 5\ V$   
 $110\ \Omega$  (typ.) .....  $V_{DD} - V_{SS} = 10\ V$   
 $70\ \Omega$  (typ.) .....  $V_{DD} - V_{SS} = 15\ V$
- OFF-resistance,  $R_{OFF}$   
 $R_{OFF}$  (typ.)  $> 10^9\ \Omega$



Weight  
 SOP8-P-1.27: 0.05 g (typ.)  
 SSOP8-P-0.65: 0.02 g (typ.)

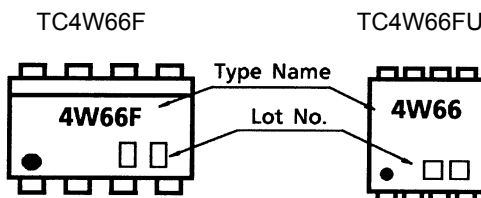
### Absolute Maximum Ratings

Characteristics	Symbol	Rating	Unit
DC supply voltage	$V_{DD}$	$V_{SS} - 0.5$ to $V_{SS} + 20$	V
Control input voltage	$V_{C\ IN}$	$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
Switch I/O voltage	$V_{I/O}$	$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
Power dissipation	$P_D$	300	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 to 85	$^{\circ}C$
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$
Lead temp./time	$T_L$	260 $^{\circ}C$ /10 s	

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.

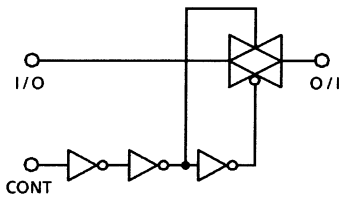
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

### Marking

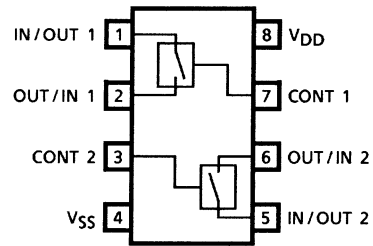


## Logic Diagram

(1/2 TC4W66F)



## Pin Assignment (top view)



## Truth Table

Control	Impedance Between IN/OUT-OUT/IN (Note 1)
H	$0.5 \text{ to } 5 \times 10^2 \Omega$
L	$>10^9 \Omega$

Note 1: See static electrical characteristics.

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
DC supply voltage	$V_{DD}$	—	3	—	18	V
Input/output voltage	$V_{DD}/V_{OUT}$	—	0	—	$V_{DD}$	V

## Static Electrical Characteristics (in case not specifically appointed, $V_{SS} = 0 \text{ V}$ )

Characteristics	Symbol	Test Circuit	Test Condition	$V_{DD}$ (V)	$T_a = -40^\circ\text{C}$		$T_a = 25^\circ\text{C}$			$T_a = 85^\circ\text{C}$		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	
$\Delta$ On-state resistance (between any 2 switches)	$R_{ON\Delta}$	—	—	5	—	—	—	10	—	—	—	$\Omega$
				10	—	—	—	6	—	—	—	
				15	—	—	—	4	—	—	—	
Input/output leakage current	$I_{OFF}$	—	$V_{IN} = 18 \text{ V},$ $V_{OUT} = 0 \text{ V}$	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	$I_{IL}$	—	$V_{IL} = 0 \text{ V}$	18	—	-0.1	—	$-10^{-5}$	-0.1	—	

## Dynamic Electrical Characteristics (Ta = 25°C, VSS = 0 V, CL = 50 pF)

Characteristics	Symbol	Test Circuit	Test Condition	Test Condition		Min	Typ.	Max	Unit
				VSS (V)	VDD (V)				
Phase difference between input to output	φI-O	—	CL = 50 pF	0	5	—	15	40	ns
				0	10	—	8	20	
				0	15	—	5	15	
Propagation delay time (CONTROL-OUT)	tpZL tpZH	—	RL = 1 kΩ CL = 50 pF	0	5	—	55	120	ns
				0	10	—	25	40	
				0	15	—	20	30	
Propagation delay time (CONTROL-OUT)	tpLZ tpHZ	—	RL = 1 kΩ CL = 50 pF	0	5	—	45	80	ns
				0	10	—	30	70	
				0	15	—	25	60	
Max control input repetition Rate	fmax (C)	—	RL = 1 kΩ CL = 50 pF	0	5	—	10	—	MHz
				0	10	—	12	—	
				0	15	—	12	—	
-3dB cutoff frequency	fmax (I-O)	—	RL = 1 kΩ CL = 50 pF (Note 1)	-5	5	—	30	—	MHz
Total harmonic distortion	—	—	RL = 10 kΩ f = 1 kHz (Note 2)	-5	5	—	0.03	—	%
-50dB feed through frequency	—	—	RL = 1 kΩ (Note 3)	-5	5	—	600	—	kHz
-50dB crosstalk frequency	—	—	RL = 1 kΩ (Note 4)	-5	5	—	1	—	MHz
Crosstalk (CONTROL-OUT)	—	—	RIN = 1 kΩ ROUT = 10 kΩ CL = 15 pF	0	5	—	200	—	mV
				0	10	—	400	—	
				0	15	—	600	—	
Input capacitance	CIN	—	Control input	—	—	—	5	7.5	pF
		—	Switch I/O	—	—	—	10	—	
Feed through capacitance	CIN-OUT	—	—	—	—	—	0.5	—	pF

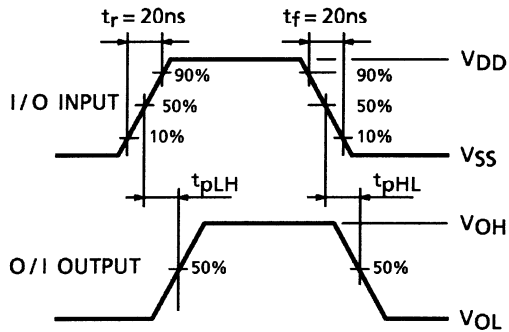
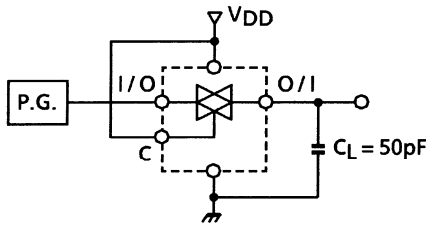
Note 1: Since wave of  $\pm 2.5 V_{p-p}$  shall be used for  $V_{IS}$  and the frequency of  $20 \log 10 \frac{V_{OS}}{V_{IS}} = -3dB$  shall be  $f_{max}$ .

Note 2:  $V_{IS}$  shall be sine wave of  $\pm 2.5 V_{p-p}$ .

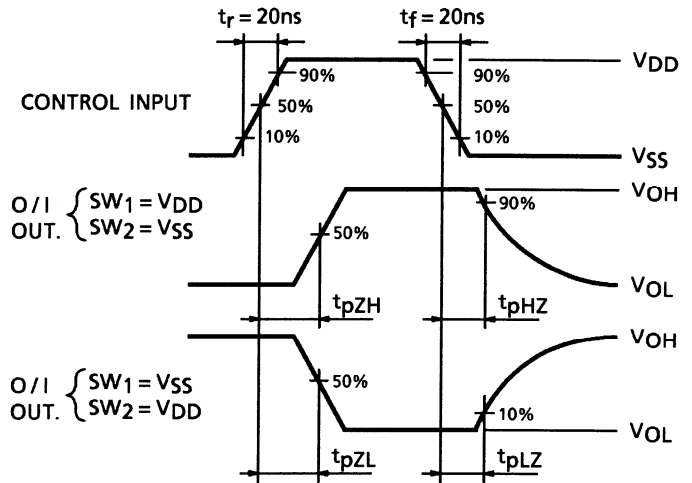
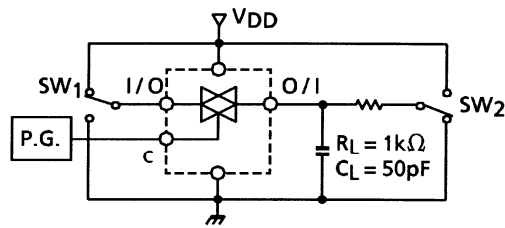
Note 3: Sine wave of  $\pm 2.5 V_{p-p}$  shall be used for  $V_{IS}$  and the frequency of  $20 \log 10 \frac{V_{OUT}}{V_{IS}} = -50dB$  shall be feed-through.

Note 4: Sine wave of  $\pm 2.5 V_{p-p}$  shall be used for  $V_{IS}$  and the frequency of  $20 \log 10 \frac{V_{OUT}}{V_{IS}} = -50dB$  shall be crosstalk.

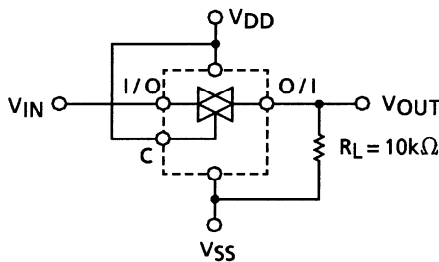
1.  $t_{pLH}$ ,  $t_{pHL}$   
I/O-O/I



2.  $t_{pZL}$ ,  $t_{pZH}$ ,  $t_{pLZ}$ ,  $t_{pHZ}$   
Control-O/I

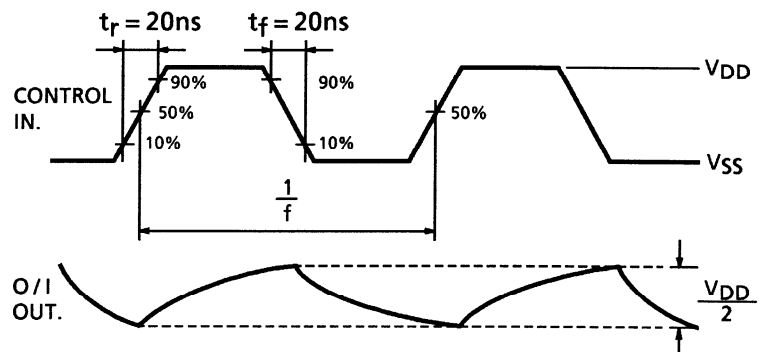
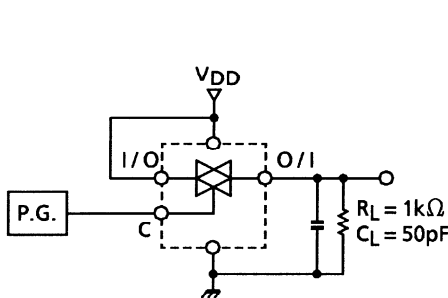


3.  $R_{ON}$

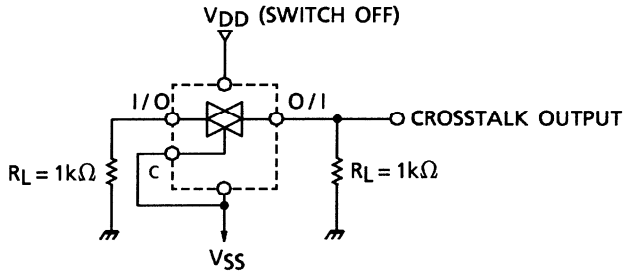
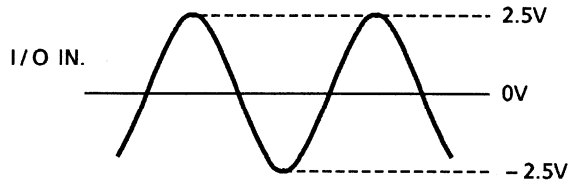
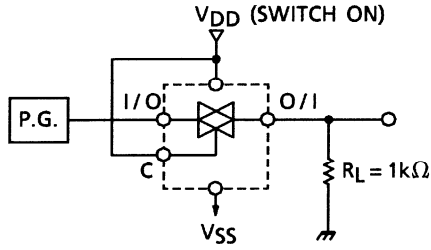


$$R_{ON} = 10 \times \frac{(V_{IN} - V_{OUT})}{V_{OUT}} \text{ (k}\Omega\text{)}$$

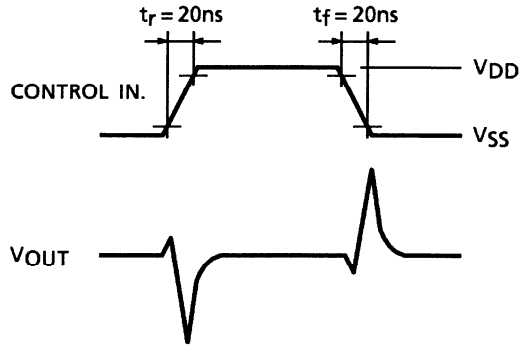
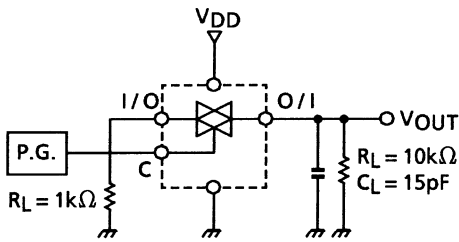
4.  $f_{max}$  (C)



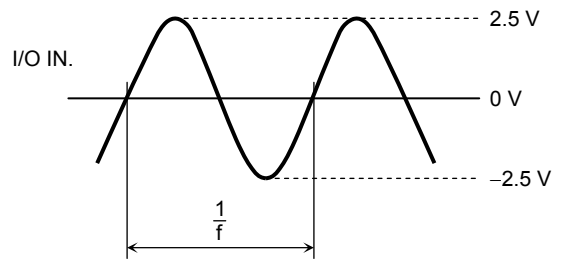
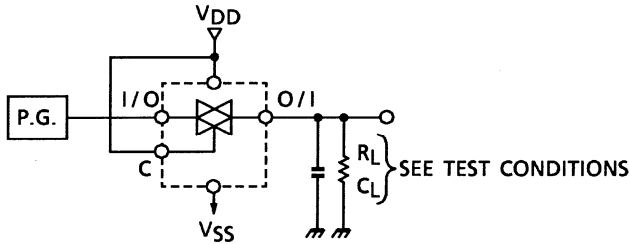
5. Crosstalk (switch I/O)



6. Crosstalk (control input)



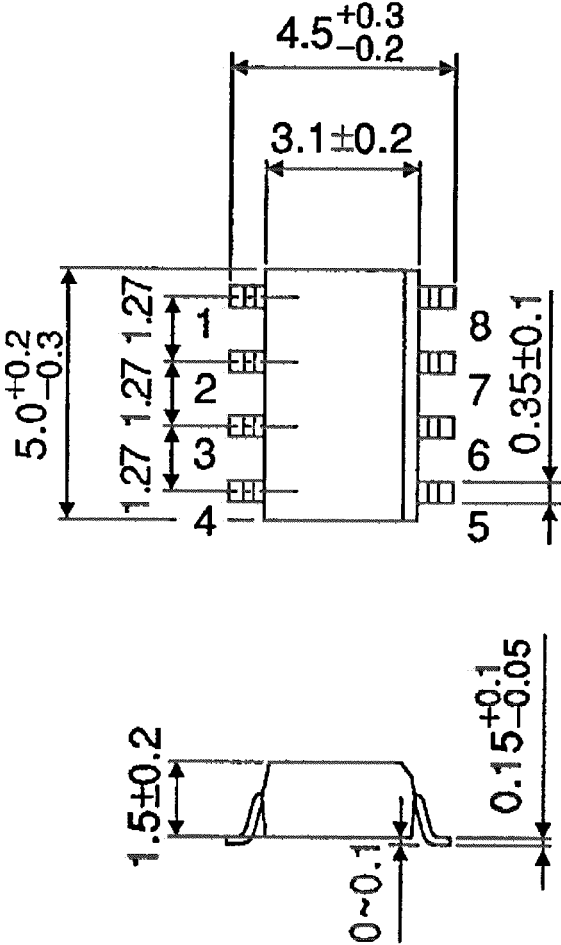
7. Total Harmonic Distortion,  $f_{max}$  (I/O-O/I), Feedthrough (switch OFF)



Package Dimensions

SOP8-P-1.27

Unit : mm

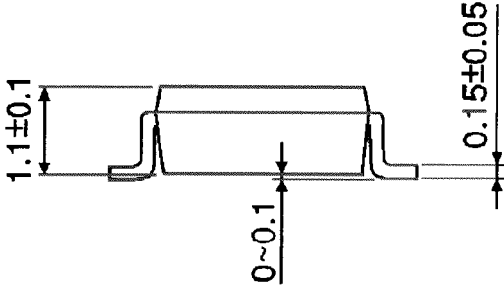
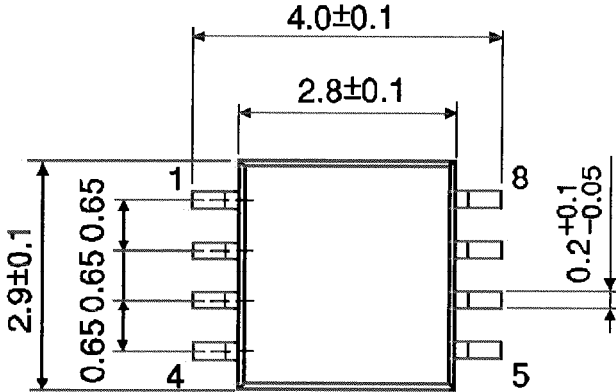


Weight: 0.05 g (typ.)

**Package Dimensions**

SSOP8-P-0.65

Unit : mm



Weight: 0.02 g (typ.)

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