TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7W66F,TC7W66FU,TC7W66FK

Dual Bilateral Switch

The TC7W66 is a high speed CMOS Dual Bilateral Switch fabricated with silicon gate CMOS technology.

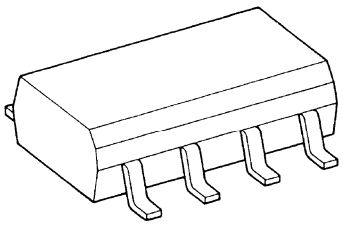
It consists of four independent high speed switches capable of controlling either digital or analog signals while maintaining the CMOS low power dissipation.

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.

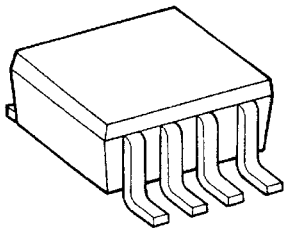
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC7W66F



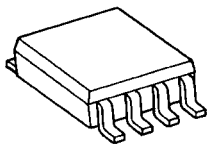
SOP8-P-1.27

TC7W66FU



SSOP8-P-0.65

TC7W66FK



SSOP8-P-0.50A

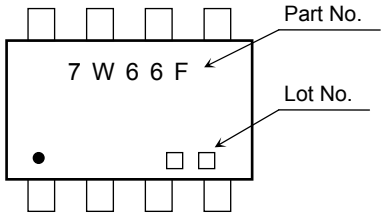
Weight
SOP8-P-1.27: 0.05 g (typ.)
SSOP8-P-0.65: 0.02 g (typ.)
SSOP8-P-0.50A: 0.01 g (typ.)

Features

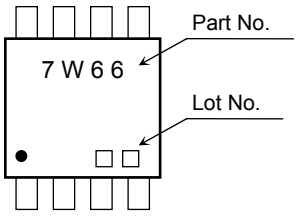
- High speed: t_{pd} = 7 ns (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 1 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- Low ON resistance: R_{ON} = 50 Ω (typ.) at V_{CC} = 9 V
- High degree of linearity: THD = 0.05 (typ.) at V_{CC} = 5 V
- Pin and function compatible with TC4W66

Marking

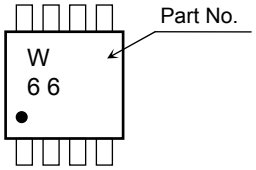
FM8



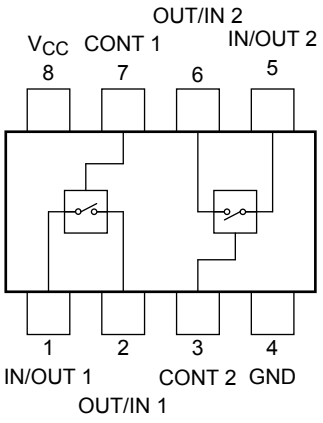
SM8



US8



Pin Configuration (top view)

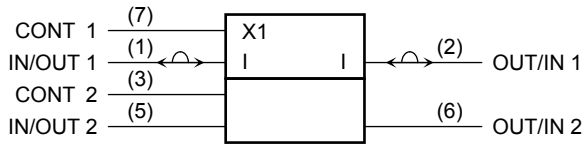


Absolute Maximum Ratings (Ta = 25°C)

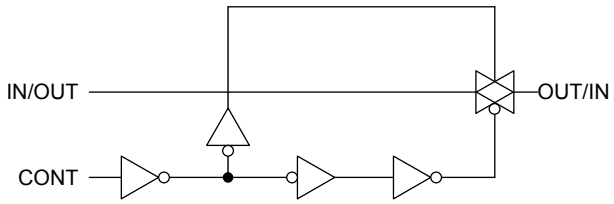
Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5 to 13	V
DC input voltage	V_{IN}	−0.5 to V_{CC} + 0.5	V
DC output voltage	V_{OUT}	−0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}	±20	mA
Output diode current	I_{OK}	±20	mA
DC output current	I_{OUT}	±25	mA
DC V_{CC}/ground current	I_{CC}	±25	mA
Power dissipation	P_D	300 (FM8, SM8)	mW
		200 (US8)	
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).

Logic Diagram



Logic Diagram (1/2 TC7W66)



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 $I_{I/O}$ ≤ 1 mA	4.5	—	96	170	—	200	Ω
				9.0	—	55	85	—	100	
				12.0	—	45	80	—	90	
			V_{IN} = V_{IHC} $V_{I/O}$ = V_{CC} or GND $I_{I/O}$ ≤ 1 mA	2.0	—	160	—	—	—	
				4.5	—	70	100	—	130	
				9.0	—	50	75	—	95	
				12.0	—	45	70	—	90	
Difference of ON resistance between switches		ΔR_{ON}	V_{IN} = V_{IHC} $V_{I/O}$ = V_{CC} to GND $I_{I/O}$ ≤ 1 mA	4.5	—	10	—	—	—	Ω
				9.0	—	5	—	—	—	
				12.0	—	5	—	—	—	
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_{INH} = V_{IHC}	12.0	—	—	±100	—	±1000	nA
Control input current		I_{IN}	V_{IN} = V_{CC} or GND	6.0	—	—	±100	—	±1000	nA
Quiescent supply 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	—	10	50	—	65	ns
			4.5	—	4	10	—	13	
			9.0	—	3	8	—	10	
			12.0	—	3	7	—	9	
Output enable time	t_{pZL} t_{pZH}	R_L = 1 kΩ	2.0	—	18	100	—	125	ns
			4.5	—	8	20	—	25	
			9.0	—	6	12	—	22	
			12.0	—	6	12	—	18	
Output disable time	t_{pLZ} t_{pHZ}	R_L = 1 kΩ	2.0	—	20	115	—	145	ns
			4.5	—	10	23	—	29	
			9.0	—	8	20	—	25	
			12.0	—	8	18	—	22	
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
Feed through 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:

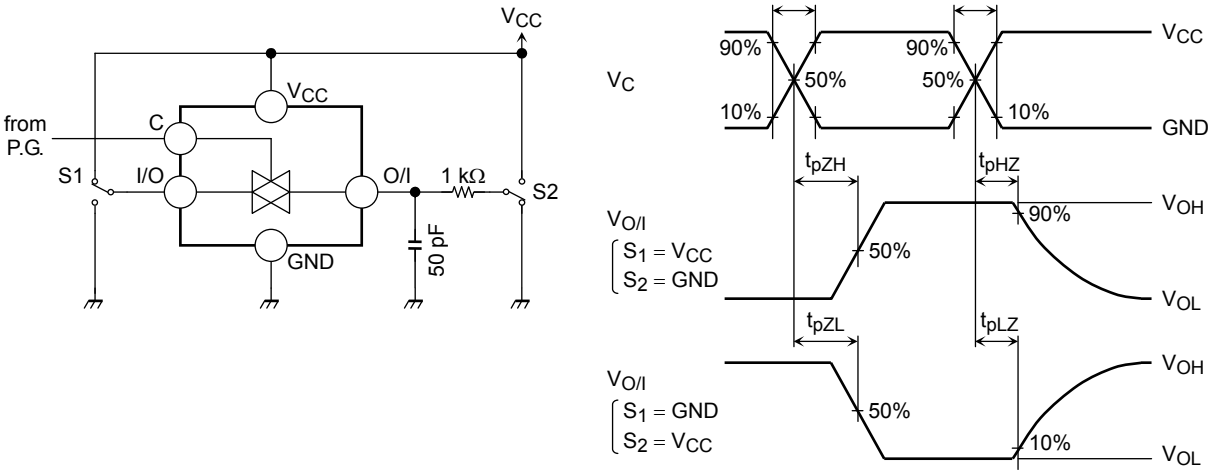
$I_{CC\ (opr)} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/2$

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

Characteristics	Symbol	Test Condition	V_{CC} (V)	Typ.	Unit
Sine wave distortion (T.H.D)	—	f_{IN} = 1 kHz, V_{IN} = 4.0 Vp-p @V_{CC} = 4.5 V R_L = 10 kΩ, V_{IN} = 8.0 V_{p-p} @V_{CC} = 9.0 V C_L = 50 pF	4.5	0.05	%
			9.0	0.04	
Frequency response (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 attenuation (switch OFF)	—	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 input to signal output)	—	R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, square wave ($t_r = t_f$ = 6 ns)	4.5	60	mV
			9.0	100	
Crosstalk (between any switches)	—	Adjust V_{IN} to obtain 0dBm at input R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, sine wave	4.5	−60	dB
			9.0	−60	

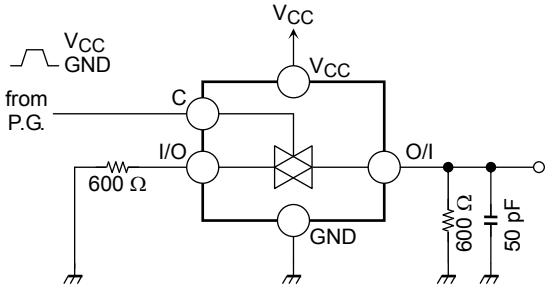
Switching Characteristics Test Circuits

1. t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}

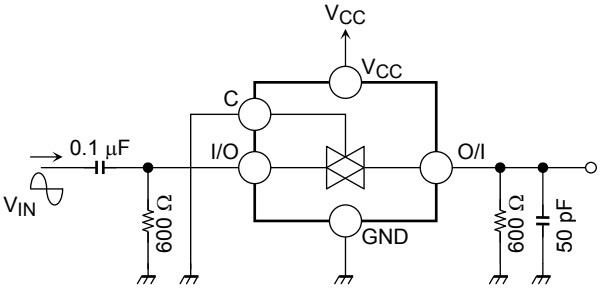


2. Cross Talk (control input-switch output)

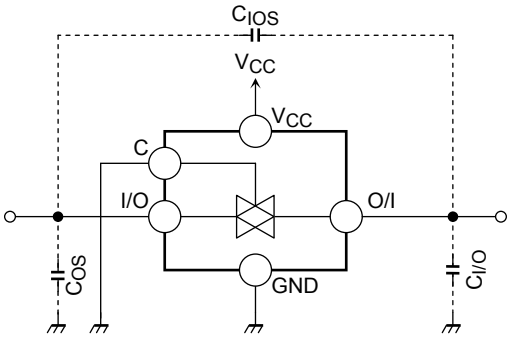
f_{in} = 1 MHz, duty = 50%, $t_r = t_f$ = 6 ns



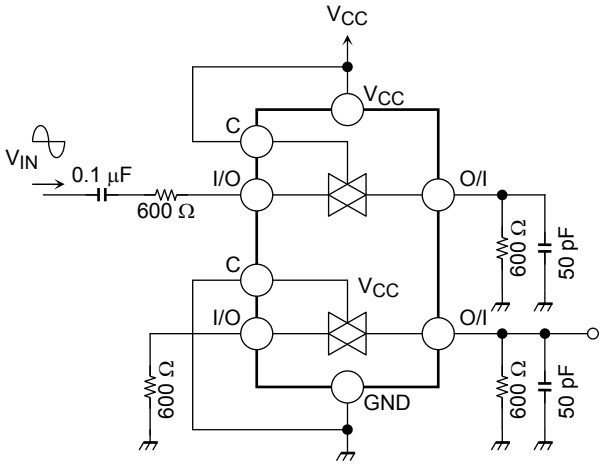
3. Feed Through Attenuation



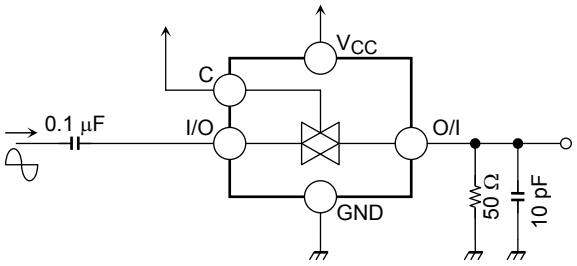
4. Clos, $C_{I/O}$



5. Cross Talk (between any two switches)

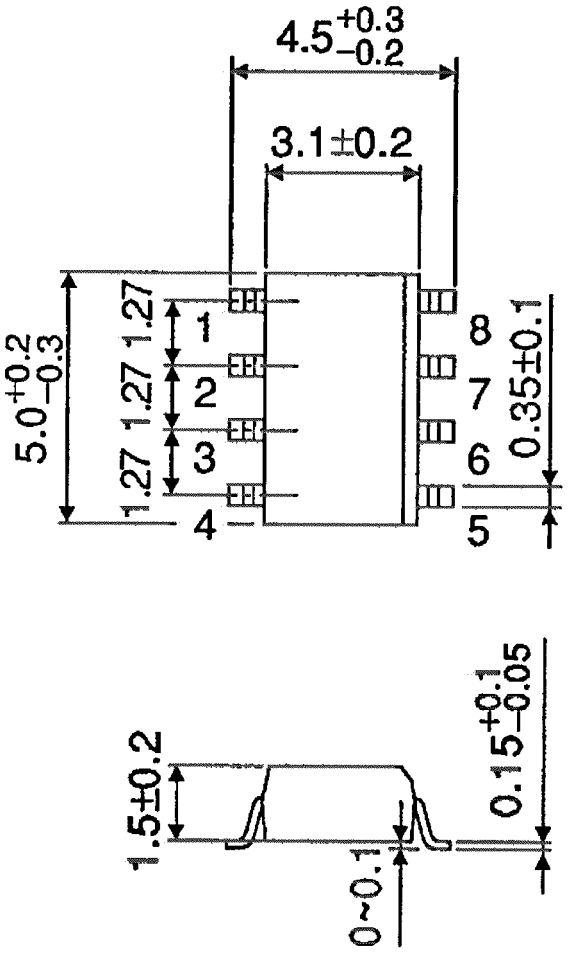


6. Frequency Response (switch ON)



Package Dimensions

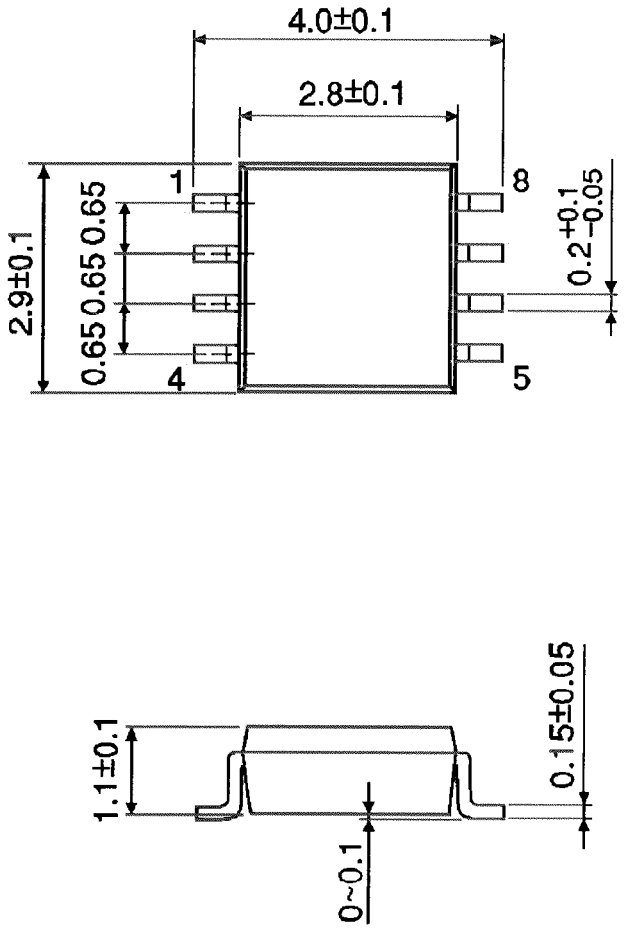
SOP8-P-1.27 Unit : mm



Weight: 0.05 g (typ.)

Package Dimensions

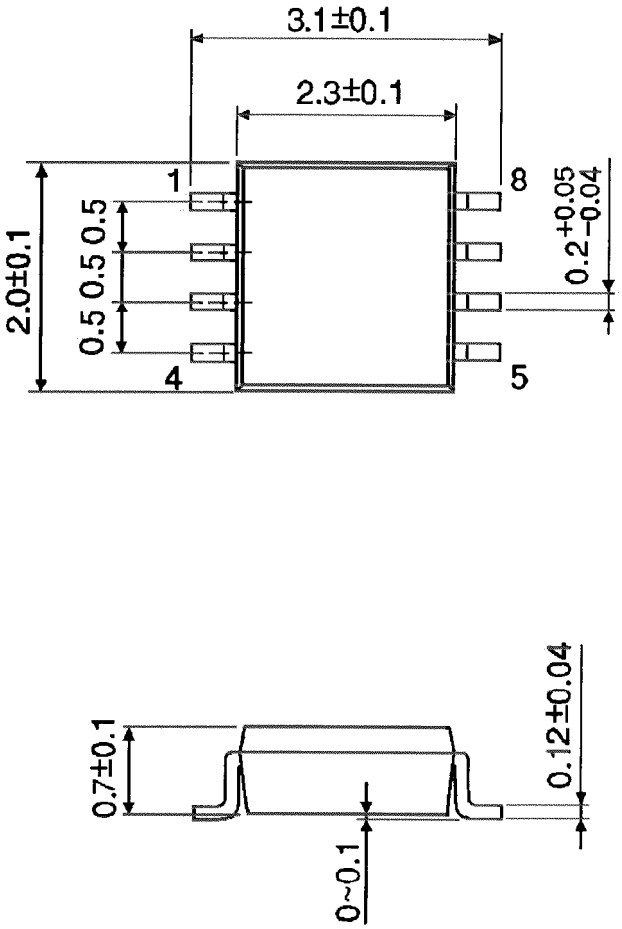
SSOP8-P-0.65 Unit : mm



Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A Unit : mm



Weight: 0.01 g (typ.)

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