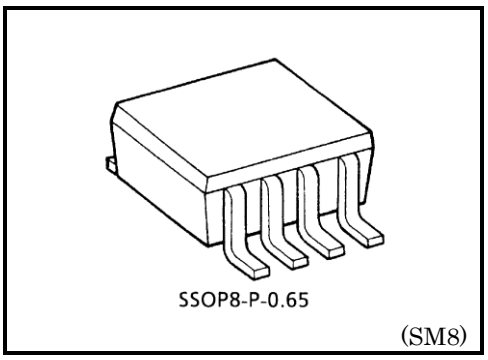
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4W66FU

Dual Bilateral Switch

The TC4W66FU 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.



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

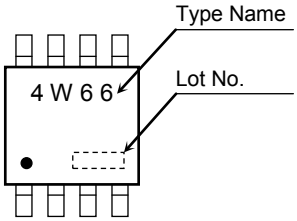
Features

- ON-resistance, R_{ON}
  - 250 Ω (typ.) ..... $V_{DD} - V_{SS} = 5$ V
  - 110 Ω (typ.) ..... $V_{DD} - V_{SS} = 10$ V
  - 70 Ω (typ.) ..... $V_{DD} - V_{SS} = 15$ V
- OFF-resistance, R_{OFF}
  - R_{OFF} (typ.) > 10^9 Ω

Absolute Maximum Ratings (Ta = 25°C)

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	±0.5	V
Control input current	$I_{C\ IN}$	±10	mA
Operating temperature range	T_{opr}	−40 to 85	°C
Storage temperature	T_{stg}	−65 to 150	°C
Lead temperature (10 s)	T_L	260	°C

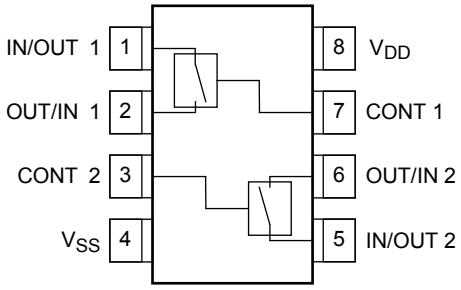
Marking



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).

Start of commercial production
1989-12

Pin Assignment (top view)

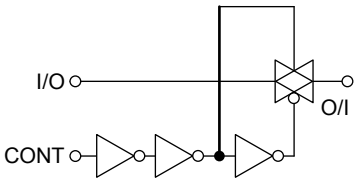


Truth Table

Control	Impedance Between IN/OUT-OUT/IN (Note 1)
H	0.5 to 5 × 10^2 Ω
L	>10^9 Ω

Note 1: See static electrical characteristics.

Logic Diagram



Operating Ranges (V_{SS} = 0 V)

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

Static Electrical Characteristics (V_{SS} = 0 V)

Characteristics		Symbol	Test Condition		Ta = −40°C		Ta = 25°C			Ta = 85°C		Unit
				V_{DD} (V)	Min	Max	Min	Typ.	Max	Min	Max	
Control input high voltage		V_{IH}	$\|I_{IS}\|$ = 10 μA	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 μA	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}	$0 \le V_{IS} \le V_{DD}$ R_L = 10 kΩ	5	—	800	—	290	950	—	1200	Ω
				10	—	210	—	120	250	—	300	
				15	—	140	—	85	160	—	200	
ΔOn-state resistance (between any 2 switches)		$R_{ON}\Delta$	—	5	—	—	—	10	—	—	—	Ω
				10	—	—	—	6	—	—	—	
				15	—	—	—	4	—	—	—	
Input/output leakage current		I_{OFF}	V_{IN} = 18 V, V_{OUT} = 0 V	18	—	±100	—	±0.1	±100	—	±1000	nA
			V_{IN} = 0 V, V_{OUT} = 18 V	18	—	±100	—	±0.1	±100	—	±1000	
Quiescent device current		I_{DD}	$V_{IN} = V_{DD}, V_{SS}$	5	—	0.25	—	0.001	0.25	—	7.5	μA
				10	—	0.5	—	0.001	0.5	—	15	
				15	—	1.0	—	0.002	1.0	—	30	
Control input current	H level	I_{IH}	V_{IH} = 18 V	18	—	0.1	—	10^{-5}	0.1	—	1.0	μA
	L level	I_{IL}	V_{IL} = 0 V	18	—	−0.1	—	-10^{-5}	−0.1	—	−1.0	

Dynamic Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V_{SS} (V)	V_{DD} (V)	Min	Typ.	Max	Unit
Phase difference between input to output	ϕI-O	C_L = 50 pF	0	5	—	15	40	ns
			0	10	—	8	20	
			0	15	—	5	15	
Propagation delay time (CONTROL-OUT)	t_{pZL} t_{pZH}	R_L = 1 kΩ C_L = 50 pF	0	5	—	55	120	ns
			0	10	—	25	40	
			0	15	—	20	30	
Propagation delay time (CONTROL-OUT)	t_{pLZ} t_{pHZ}	R_L = 1 kΩ C_L = 50 pF	0	5	—	45	80	ns
			0	10	—	30	70	
			0	15	—	25	60	
Max control input repetition Rate	f_{MAX} (C)	R_L = 1 kΩ C_L = 50 pF	0	5	—	10	—	MHz
			0	10	—	12	—	
			0	15	—	12	—	
Frequency Response	f_{MAX} (I-O)	R_L = 1 kΩ C_L = 50 pF (Note 1)	−5	5	—	30	—	MHz
Total harmonic distortion	—	R_L = 10 kΩ f = 1 kHz (Note 2)	−5	5	—	0.03	—	%
Feed through frequency (Switch OFF)	—	R_L = 1 kΩ (Note 3)	−5	5	—	600	—	kHz
Crosstalk frequency	—	R_L = 1 kΩ (Note 4)	−5	5	—	1	—	MHz
Crosstalk (CONTROL-OUT)	—	R_{IN} = 1 kΩ R_{OUT} = 10 kΩ C_L = 15 pF	0	5	—	200	—	mV
			0	10	—	400	—	
			0	15	—	600	—	
Input capacitance	C_{IN}	Control input			—	5	7.5	pF
		Switch I/O			—	10	—	
Feed through capacitance	C_{IN-OUT}	—			—	0.5	—	pF

Note 1: Sine wave of ±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 ±2.5 V_{p-p}.

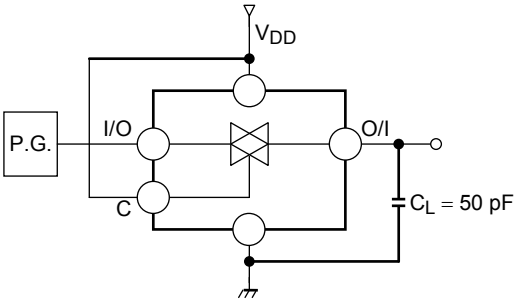
Note 3: Sine wave of ±2.5 V_{p-p} shall be used for V_{IS} and the frequency of 20 ℓog $_{10}$ $\frac{V_{OUT}}{V_{IS}}$ = −50dB shall be feed-through.

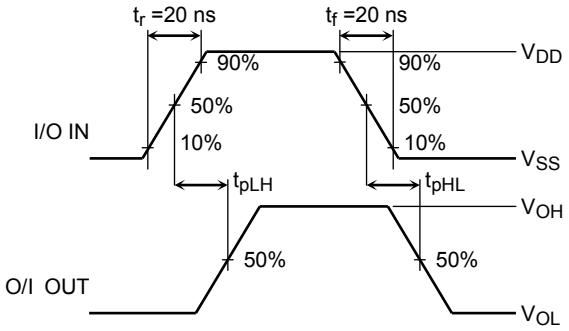
Note 4: Sine wave of ±2.5 V_{p-p} shall be used for V_{IS} and the frequency of 20 ℓog $_{10}$ $\frac{V_{OUT}}{V_{IS}}$ = −50dB shall be crosstalk.

Circuit For Measurement of Electrical Characteristics

1. t_{pLH}, t_{pHL}

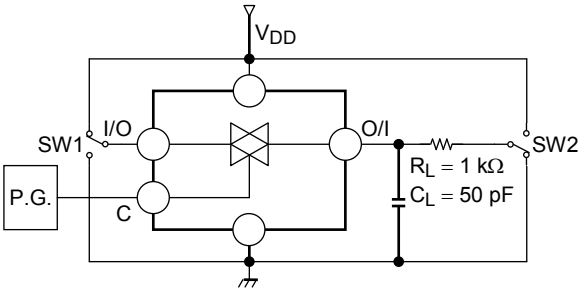
I/O-O/I

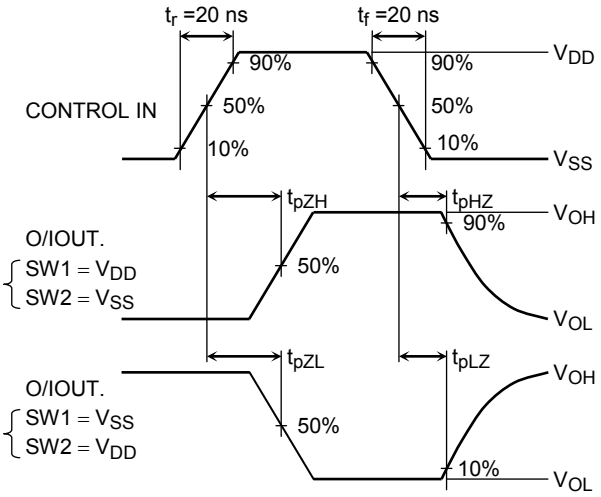




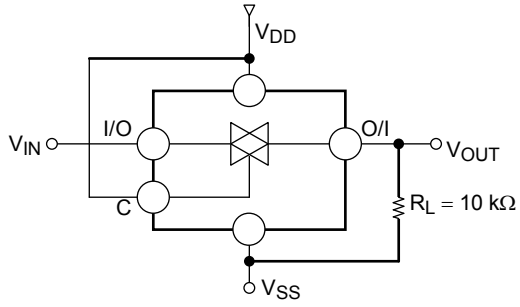
2. t_{pZL}, t_{pZH}, t_{pLZ}, t_{pHZ}

CONTROL-O/I





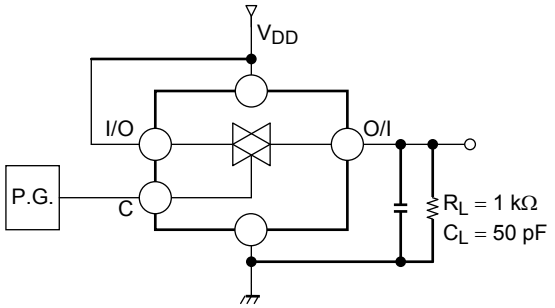
3. R_{ON}

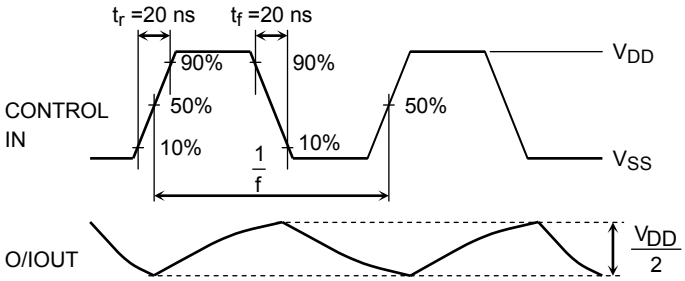


R_{ON} calculation method

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

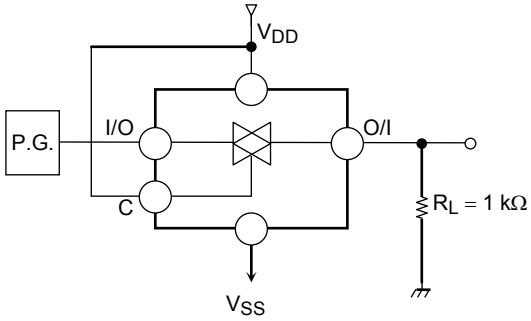
4. f_{MAX} (C)

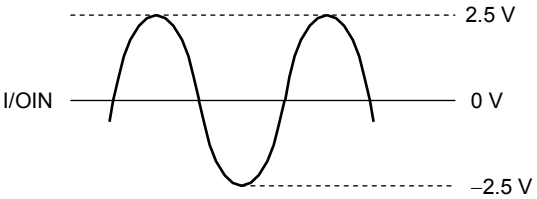




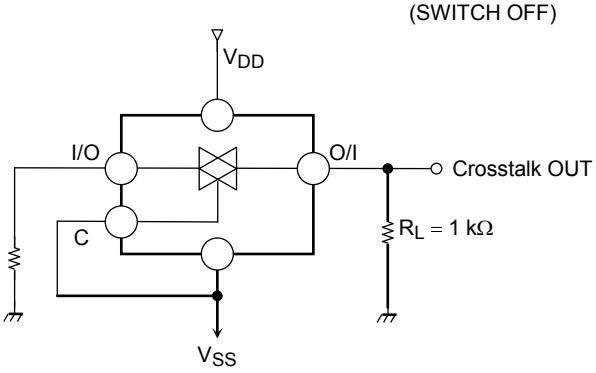
5. Crosstalk frequency

(SWITCH ON)

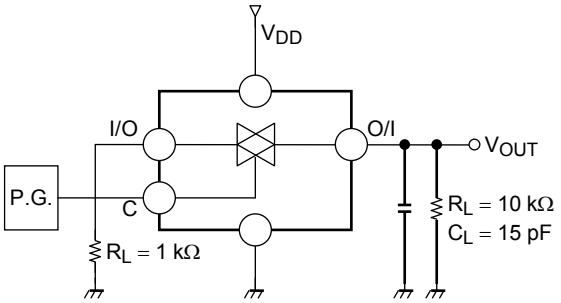


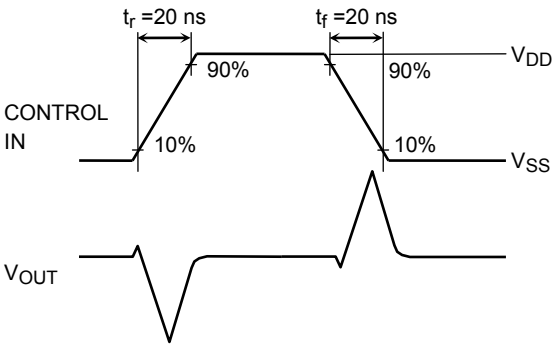


(SWITCH OFF)

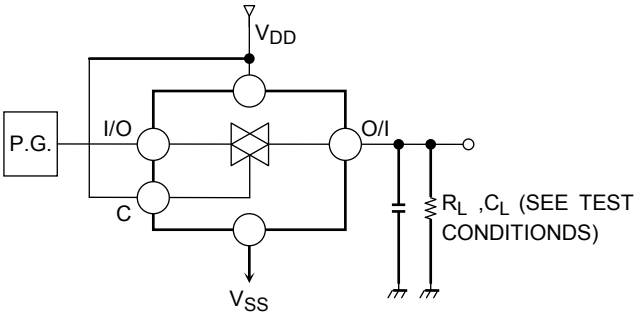


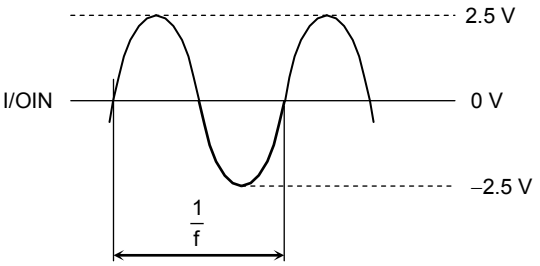
6. Crosstalk (Control input)





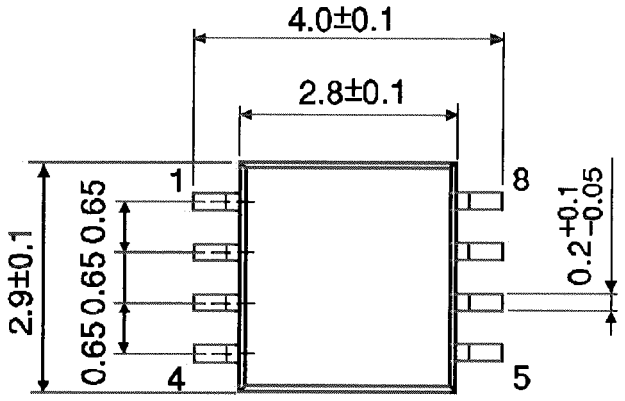
7. Total Harmonic Distortion, f_{MAX} (I/O-O/I), Feedthrough frequency(Switch OFF)

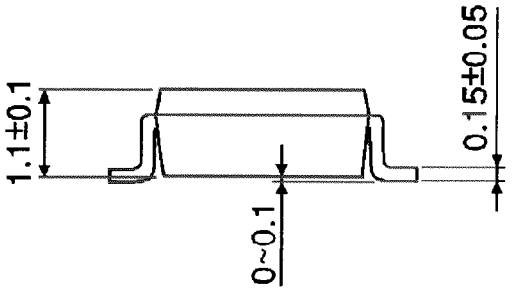




Package Dimensions

SSOP8-P-0.65 Unit : mm





Weight: 0.02 g (typ.)

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