TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

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.

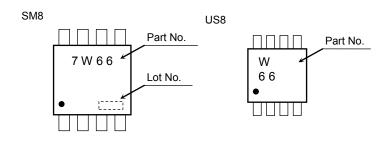
The switch turns ON while the C input is high, and the switch turns OFF while low.

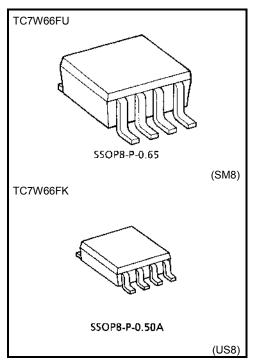
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

Features

- High speed: $t_{pd} = 7$ ns (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 1 \mu A \text{ (max)}$ at $T_{a} = 25 \text{°C}$
- High noise immunity: VNIH = VNIL = 28% VCC (min)
- Low ON resistance: $RON = 50 \Omega$ (typ.) at VCC = 9 V
- High degree of linearity: THD = 0.05% (typ.) at $V_{CC} = 5 \text{ V}$
- Pin and function compatible with TC4W66

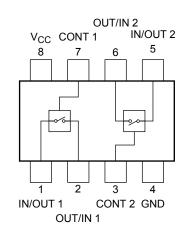
Marking





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

Pin Configuration (top view)



Start of commercial production 1996-02

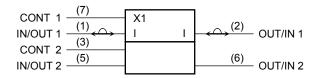
Absolute Maximum Ratings (Ta = 25°C)

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	lout	±25	mA	
DC V _{CC} /ground current	Icc	±25	mA	
Power dissipation	PD	300 (SM8)	mW	
Power dissipation	FD	200 (US8)	IIIVV	
Storage temperature range	T _{stg}	−65 to 150	°C	
Lead temperature (10 s)	TL	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).

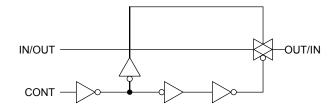
Logic Diagram



Truth Table

Control	Switch Function
Н	ON
L	OFF

Logic Diagram (1/2 TC7W66)





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)	
		0 to 500 (V _{CC} = 4.5 V)	20
		0 to 400 (V _{CC} = 6.0 V)	ns
		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	Тур.	Max	Min	Max		
				2.0	1.5	_	_	1.5	_	
	l lieb level			4.5	3.15	_	_	3.15	_	
	High level	V_{IHC}	_	9.0	6.3	_	_	6.3	_	
Control input				12.0	8.4	_	_	8.4	_	V
voltage				2.0	_	_	0.5	_	0.5	V
	l and lavel	V		4.5	_	_	1.35	_	1.35	
	Low level	V _{ILC}	_	9.0	_	_	2.7	_	2.7	
				12.0	-	_	3.6	_	3.6	
			\\ = \\ =	4.5	-	96	170	_	200	
			$V_{IN} = V_{IHC}$ $V_{I/O} = V_{CC}$ to GND	9.0	_	55	85	_	100	
		$R_{ON} \begin{tabular}{l} $I_{I/O} \le 1 \text{ mA} \\ \\ $V_{IN} = V_{IHC} \\ $V_{I/O} = V_{CC} \text{ or GND} \\ $I_{I/O} \le 1 \text{ mA} \\ \end{tabular}$	I _{I/O} ≤ 1 mA	12.0	_	45	80	_	90	
ON resistance			$V_{I/O} = V_{CC}$ or GND	2.0	_	160	_	_	_	Ω
				4.5	-	70	100	_	130	
				9.0	-	50	75	_	95	
				12.0	1	45	70	_	90	
Difference of O	iNI		V., - V., o	4.5	-	10	_	_	_	Ω
resistance betw		ΔR _{ON}	$V_{IN} = V_{IHC}$ $V_{I/O} = V_{CC}$ to GND	9.0	-	5	_	_	_	
switches		$I_{I/O} \leq 1 \text{ mA}$	12.0	-	5	_	_	_		
Input/output lea current (switch	akage off)	l _{OFF}	$V_{OS} = V_{CC}$ or GND $V_{IS} = GND$ or V_{CC} $V_{IN} = V_{ILC}$	12.0	_	_	±100	_	±1000	nA
Switch input lea current (switch on outp	•	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		V _{IN} = V _{CC} or GND	12.0	-	_	±100	_	±1000	nA	
				6.0	-	_	1.0	_	10.0	
Quiescent supp	oly current	rent I _{CC} V _{IN}	V _{IN} = V _{CC} or GND	9.0	-	_	4.0	_	40.0	μΑ
				12.0		_	8.0	_	80.0	



AC Electrical Characteristics ($C_L = 50 \text{ pF}$, input $t_r = t_f = 6 \text{ ns}$)

Characteristics	Symbol Test Condition		,	Ta = 25°C		Ta = −40 to 85°C		Unit	
	,			Min	Тур.	Max	Min	Max	
		_	2.0		10	50		65	- ns
Phase difference between	φI/O		4.5	_	4	10	_	13	
input and output	ψι/Ο		9.0	_	3	8	_	10	
			12.0	_	3	7	_	9	
			2.0	_	18	100	_	125	
Output enable time	t _{pZL}	$R_L = 1 k\Omega$	4.5	_	8	20	_	25	ns
Output chable time	t _{pZH}		9.0	_	6	12	_	22	- 115
			12.0		6	12	_	18	
	t _{pLZ} t _{pHZ}	$R_L = 1 \text{ k}\Omega$	2.0	_	20	115	_	145	ns MHz
Output disable time			4.5	_	10	23	_	29	
Output disable time			9.0	_	8	20	_	25	
			12.0	_	8	18	_	22	
	_	$R_L = 1 \text{ k}\Omega$ $C_L = 15 \text{ pF}$ $V_{OUT} = 1/2 \text{ V}_{CC}$	2.0		30	_	_	_	
Maximum control input			4.5		30	_	_	_	
frequency			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:

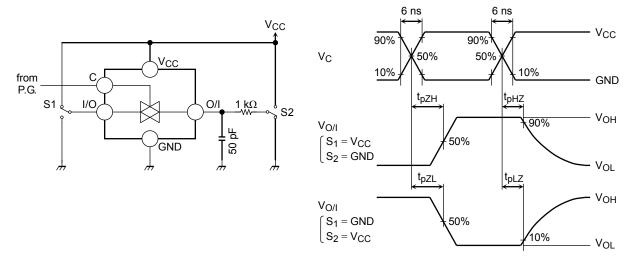
 $I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$

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

Characteristics	Symbol	Test Condition	V _{CC} (V)	Тур.	Unit
Sine wave distortion		$f_{IN} = 1 \text{ kHz}, V_{IN} = 4.0 \text{ Vp-p } @V_{CC} = 4.5 \text{ V}$	4.5	0.05	%
(T.H.D)	_	$R_L = 10 \text{ k}\Omega, V_{IN} = 8.0 \text{ V}_{p-p} \text{ @V}_{CC} = 9.0 \text{ V}$ $C_L = 50 \text{ pF}$	9.0	0.04	
Frequency response (switch ON)		Adjust V _{IN} voltage to obtain 0dBm at V _{OS} Increase f _{IN} frequency until dB	4.5	200	
	f _{MAX}	$\label{eq:matter} \begin{split} &\text{Meter reads} - 3\text{dB} \\ &\text{R}_L = 50~\Omega,~\text{C}_L = 10~\text{pF} \\ &\text{f}_{\text{IN}} = 1~\text{MHz},~\text{sine wave} \end{split}$	9.0	200	MHz
Feed Through attenuation (switch OFF)	_	V _{IN} is centered at V _{CC} /2 Adjust input for 0dBm	4.5	-60	-ID
		R_L = 600 Ω , C_L = 50 pF f_{IN} = 1 MHz, sine wave	9.0	-60	dB
Crosstalk (control input to signal output)	_	$R_L = 600 \Omega$, $C_L = 50 pF$ $f_{IN} = 1 MHz$, square wave $(t_r = t_f = 6 ns)$	4.5	60	mV
			9.0	100	IIIV
Crosstalk (between any switches)	_	Adjust V _{IN} to obtain 0dBm at input	4.5	-60	-ID
		$R_L = 600 \Omega$, $C_L = 50 pF$ $f_{IN} = 1 MHz$, sine wave	9.0	-60	dB

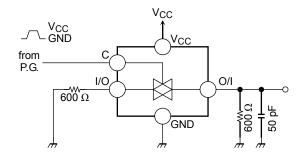
Switching Characteristics Test Circuits

$1. \quad t_{pLZ},\, t_{pHZ},\, t_{pZL},\, t_{pZH}$

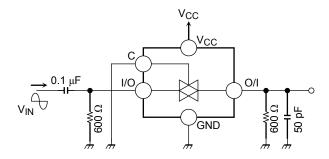


2. Cross Talk (control input-switch output)

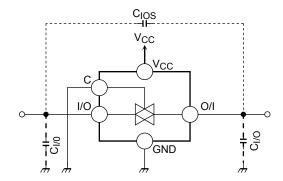
$$f_{IN} = 1$$
 MHz, duty = 50%, $t_r = t_f = 6$ ns



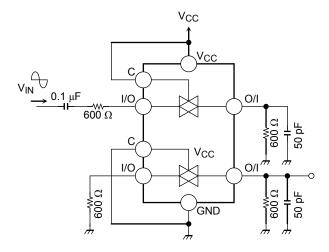
3. Feed Through Attenuation



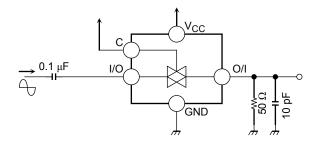
4. C_{IOS}, C_{I/O}



5. Cross Talk (between any two switches)

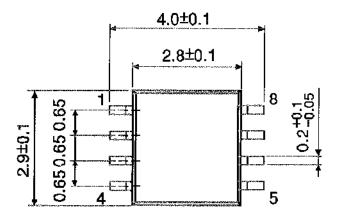


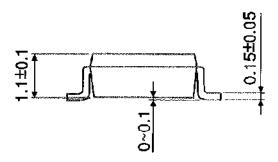
6. Frequency Response (switch ON)



Package Dimensions

SSOP8-P-0.65 Unit: mm

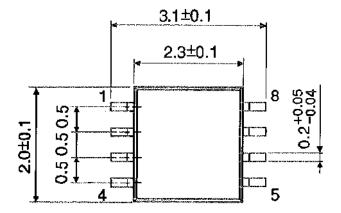


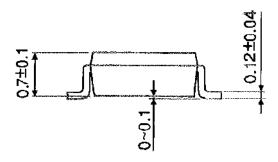


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A Unit: mm





Weight: 0.01 g (typ.)

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