

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC4W53F, TC4W53FU

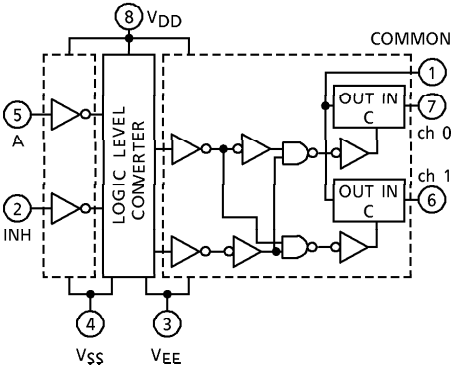
2-CHANNEL MULTIPLEXER / DEMULTIPLEXER

The TC4W53 is multiplexer with capabilities of selection and mixture of analog signal and digital signal. TC4W53F has 2 channel configuration. The digital signal to the control terminal turns "ON" the corresponding switch of each channel, with large amplitude ($V_{DD}-V_{EE}$) can be switched by the control signal with small logical amplitude ($V_{DD}-V_{SS}$). For example, in the case of $V_{DD}=5V$, $V_{SS}=0V$ and $V_{EE}=-5V$, signals between $-5V$ and $+5V$ can be switched from the logical circuit with signal power supply of 5 volts. As the ON-resistance of each switch is low, these can be connected to the circuits with low input impedance.

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}-V_{SS}$	$-0.5\sim 20$	V
DC Supply Voltage	$V_{DD}-V_{EE}$	$-0.5\sim 20$	V
Control Input Voltage	V_{CIN}	$V_{SS}-0.5\sim V_{DD}+0.5$	V
Switch I/O Voltage	V_I/V_O	$V_{EE}-0.5\sim V_{DD}+0.5$	V
Control Input Current	I_{CIN}	± 10	mA
Potential difference across I/O during ON	V_{I-O}	$-0.5\sim 0.5$	V
Power Dissipation	P_D	300	mW
Operating Temperature	T_{opr}	$-40\sim 85$	$^{\circ}C$
Storage Temperature	T_{stg}	$-65\sim 150$	$^{\circ}C$
Lead Temperature (10s)	T_L	260	$^{\circ}C$

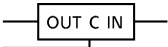
LOGIC DIAGRAM



TRUTH TABLE

CONTROL INPUT		ON CHANNEL
INH	A	
L	L	ch 0
L	H	ch 1
H	x	NONE

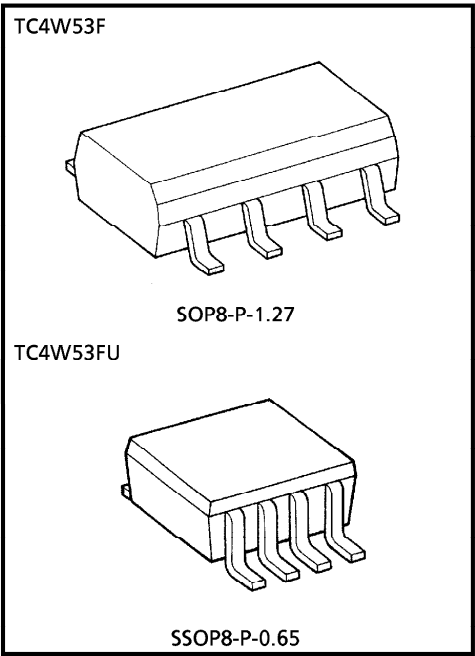
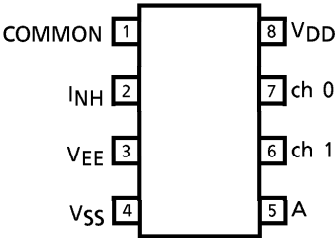
x : Don't Care



TRUTH TABLE

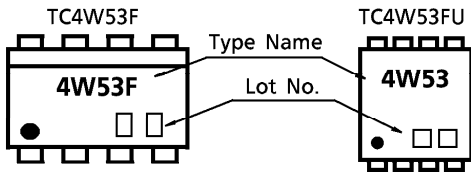
CON-TROL C	IMPE-DANCE BETWEEN IN-OUT
H	$0.5\sim 5\times 10^2\Omega$
L	$>10^9\Omega$

PIN ASSIGNMENT (TOP VIEW)



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

MARKING



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● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

RECOMMENDED OPERATING CONDITIONS

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

DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYM- BOL	TEST CONDITION				- 40°C		25°C			85°C		UNIT
		V _{SS} (V)	V _{EE} (V)	V _{DD} (V)	MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
Control Input High Voltage	V _{IH}	V _{IS} = V _{DD} thru 1kΩ	V _{EE} = V _{SS} R _L = 1kΩ to V _{SS} I _{LS} < 2μA on all OFF Channels	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}			5	—	1.5	—	2.25	1.5	—	1.5		
				10	—	3.0	—	4.5	3.0	—	3.0		
				15	—	4.0	—	6.75	4.0	—	4.0		
On-State Resistance	R _{ON}	0 ≤ V _{IS} ≤ V _{DD} R _L = 10kΩ	0	0	5	—	850	—	240	950	—	1200	Ω
			0	0	10	—	210	—	110	250	—	300	
			0	0	15	—	140	—	80	160	—	200	
ΔON-State Resistance Between 2 Switches	ΔR _{ON}	—	0	0	5	—	—	—	10	—	—	—	Ω
			0	0	10	—	—	—	6	—	—	—	
			0	0	15	—	—	—	4	—	—	—	
Input / Output Leakage Current	I _{OFF}	V _{IN} = 18V, V _{OUT} = 0V V _{IN} = 0V, V _{OUT} = 18V			18	—	± 100	—	± 0.01	± 100	—	± 1000	nA
					18	—	± 100	—	± 0.01	± 100	—	± 1000	
Quiescent Device Current	I _{DD}	V _{IN} = V _{SS} , V _{DD} *			5	—	5.0	—	0.005	5.0	—	150	μA
					10	—	10	—	0.010	10	—	300	
					15	—	20	—	0.015	20	—	600	
Input Current	I _{IN}	V _{IH} = 18V, V _{IL} = 0V			18	—	0.1	—	10 ⁻⁵	0.1	—	1.0	μA
					18	—	-0.1	—	-10 ⁻⁵	-0.1	—	-1.0	
Input Capacitance	C _{IN}	—			—	—	—	—	5	7.5	—	—	pF
Switch Input Capacitance	C _{IN}	—			—	—	—	—	10	—	—	—	pF
Switch Output Capacitance	C _{OUT}	—			10	—	—	—	17	—	—	—	
Feedthrough Capacitance	C _{IN-OUT}	—			10	—	—	—	0.2	—	—	—	

* All valid input combinations.

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AC ELECTRICAL CHARACTERISTICS (Ta = 25°C, CL = 50pF)

CHARACTERISTIC	SYMBOL	TEST CONDITION	TEST CONDITION			MIN.	TYP.	MAX.	UNIT
			VSS (V)	VEE (V)	VDD (V)				
Phase difference between input to output	ϕ_{I-O}	—	0 0 0	0 0 0	5 10 15	— — —	15 8 6	45 20 15	ns
Propagation Delay Time (A-OUT)	t_{pZL} t_{pZH} t_{pLZ} t_{pHZ}	$R_L = 1k\Omega$	0 0 0 0 0	0 0 0 -5 -7.5	5 10 15 5 7.5	— — — — —	170 90 70 100 80	550 240 160 240 160	ns
Propagation Delay Time (INH-OUT)	t_{pZL} t_{pZH}	$R_L = 1k\Omega$	0 0 0 0 0	0 0 0 -5 -7.5	5 10 15 5 7.5	— — — — —	120 60 50 80 60	380 200 160 200 160	ns
Propagation Delay Time (INH-OUT)	t_{pLZ} t_{pHZ}	$R_L = 1k\Omega$	0 0 0 0 0	0 0 0 -5 -7.5	5 10 15 5 7.5	— — — — —	170 90 70 100 80	450 210 160 210 160	ns
- 3dB Cutoff Frequency	f_{MAX} (I-O)	$R_L = 1k\Omega$ (*1)	-5	-5	5	—	40	—	MHz
Total Harmonic Distortion	—	$R_L = 10k\Omega$ $f = 1kHz$ (*2)	-2.5 -5 -7.5	-2.5 -5 -7.5	2.5 5 7.5	— — —	0.15 0.03 0.02	— — —	%
- 50dB Feedthrough (Switch OFF)	—	$R_L = 1k\Omega$ (*3)	-5	-5	5	—	500	—	kHz
Crosstalk (CONTROL-OUT)	—	$R_{IN} = 1k\Omega$ $R_{OUT} = 10k\Omega$ $C_L = 15pF$	0 0 0	0 0 0	5 10 15	— — —	200 400 600	— — —	mV

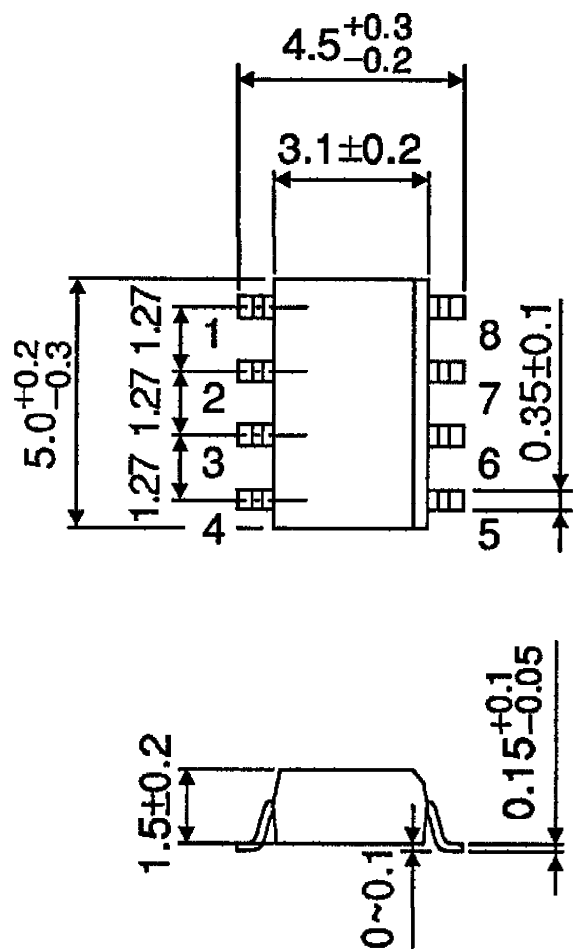
*1 Sine wave of $\pm 2.5V_{p-p}$ shall be used for V_{IS} and the frequency of $20\log_{10} \frac{V_{OS}}{V_{IS}}$
= -3dB shall be f_{MAX} .

*2 V_{IS} shall be sine wave of $\pm \left(\frac{V_{DD} - V_{EE}}{4} \right) p-p$.

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

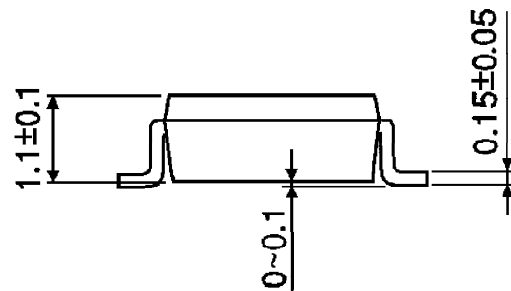
OUTLINE DRAWING
SOP8-P-1.27

Unit : mm



Weight : 0.05g (Typ.)

Unit : mm



Weight : 0.02g (Typ.)