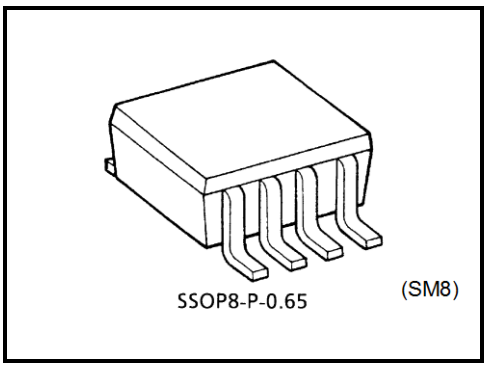
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4W53FU

2-Channel Multiplexer, Demultiplexer

The TC4W53FU is multiplexer with capabilities of selection and mixture of analog signal and digital signal.
TC4W53FU has 2 channel configuration.
The digital signal to the control terminal turns "ON" the corresponding switch of each channel a 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} = 5 V, V_{SS} = 0V and V_{EE} = –5V , signals between –5 V and +5 V can be switched from the logical circuit with a signal power supply of 5 V.
As the ON-resistance of each switch is low, these can be connected to circuit with low input impedance.

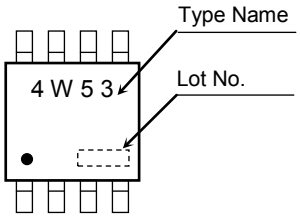


Weight
SSOP8-P-0.65: 0.02 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{DD}-V_{SS}	–0.5 to 20	V
	V_{DD}-V_{EE}	–0.5 to 20	
Control input voltage	V_{CIN}	V_{SS} – 0.5 to V_{DD} + 0.5	V
Switch I/O voltage	$V_{I/O}$	V_{EE} – 0.5 to V_{DD} + 0.5	V
Control input current	I_{CIN}	±10	mA
Potential difference across I/O during ON	V_{I-O}	–0.5 to 0.5	V
Power dissipation	P_D	300	mW
Operating temperature range	T_{opr}	–40 to 85	°C
Storage temperature range	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).

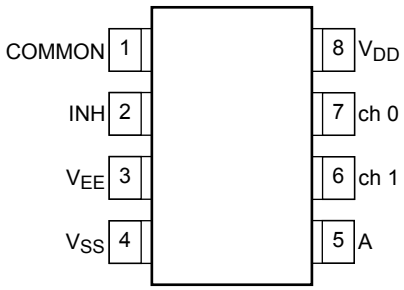
Start of commercial production
1990-05

Truth Table

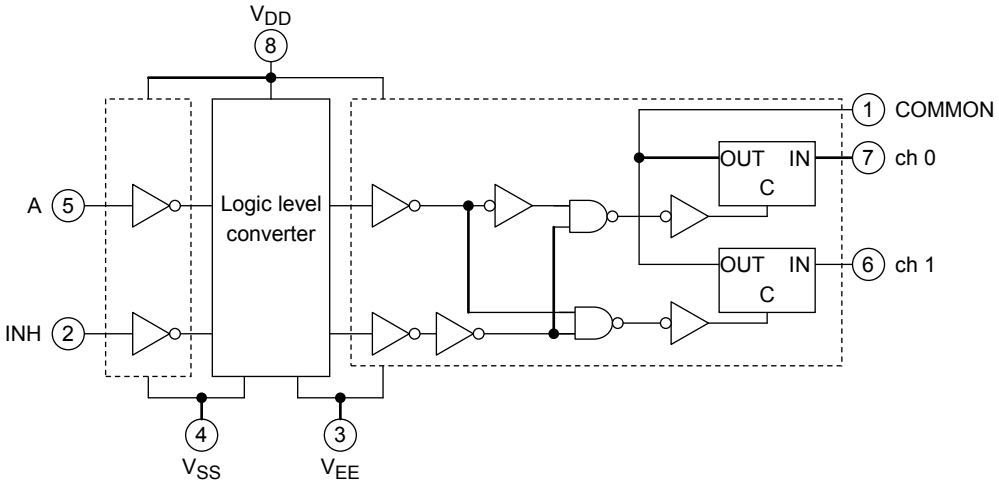
Control Input		On Channel
INH	A	
L	L	ch 0
L	H	ch 1
H	X	none

X: Don't care

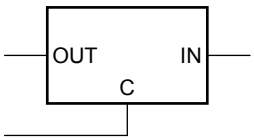
Pin Assignment (top view)



Logic Diagram



Truth Table



Control C	Impedance between IN/OUT
H	0.5 to 5 × 10^2 Ω
L	> 10^9 Ω

Operating Ranges

Characteristics	Symbol	Min.	Typ.	Max.	Unit
DC supply voltage	V_{DD}-V_{SS}	3	—	18	V
	V_{DD}-V_{EE}	3	—	18	
Control input voltage	V_{IN}	V_{SS}	—	V_{DD}	V
Switch input/output voltage	$V_{I/O}$	V_{EE}	—	V_{DD}	V

Static Electrical Characteristics

Characteristics	Symbol	Test Condition				Ta = −40°C		Ta = 25°C			Ta = 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}	$V_{IS} = V_{DD}$	$V_{EE} = V_{SS}$ $R_L = 1\ k\Omega$ $I_{LS} < 2\ \mu A$ 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}	thru 1 kΩ			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}	$0 \le V_{IS} \le V_{DD}$ $R_L = 10\ k\Omega$	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 any 2 switches)	ΔR_{ON}	—	0	0	5	—	—	—	10	—	—	—	Ω
			0	0	10	—	—	—	6	—	—	—	
			0	0	15	—	—	—	4	—	—	—	
Input/output leakage current	I_{OFF}	$V_{IN} = 18\ V$, $V_{OUT} = 0\ V$			18	—	±100	—	±0.01	±100	—	±1000	nA
		$V_{IN} = 0\ V$, $V_{OUT} = 18\ V$			18	—	±100	—	±0.01	±100	—	±1000	
Quiescent device current	I_{DD}	$V_{IN} = V_{SS}$, V_{DD} (Note)			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}	$V_{IH} = 18\ V$, $V_{IL} = 0\ V$			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	—	—	—	
Feed through capacitance	C_{IN}-C_{OUT}	—			10	—	—	—	0.2	—	—	—	pF

Note : All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, C_L = 50 pF)

Characteristics	Symbol	Test Condition	V_{SS} (V)	V_{EE} (V)	V_{DD} (V)	Min	Typ.	Max	Unit
Phase difference between input to output (switch IN-OUT)	ϕI-O	—	0	0	5	—	15	45	ns
			0	0	10	—	8	20	
			0	0	15	—	6	15	
Propagation delay time (A-OUT)	t_{pZL} t_{pZH} t_{pLZ} t_{pHZ}	R_L = 1 kΩ	0	0	5	—	170	550	ns
			0	0	10	—	90	240	
			0	0	15	—	70	160	
			0	−5	5	—	100	240	
			0	−7.5	7.5	—	80	160	
Propagation delay time (INH-OUT)	t_{pZL} t_{pZH}	R_L = 1 kΩ	0	0	5	—	120	380	ns
			0	0	10	—	60	200	
			0	0	15	—	50	160	
			0	−5	5	—	80	200	
			0	−7.5	7.5	—	60	160	
	t_{pLZ} t_{pHZ}	R_L = 1 kΩ	0	0	5	—	170	450	ns
			0	0	10	—	90	210	
			0	0	15	—	70	160	
			0	−5	5	—	100	210	
			0	−7.5	7.5	—	80	160	
Frequency response	$f_{MAX\ (I-O)}$	R_L = 1 kΩ (Note 1)	−5	−5	5	—	40	—	MHz
Total harmonic distortion	—	R_L = 10 kΩ f = 1 kHz (Note 2)	−2.5	−2.5	2.5	—	0.15	—	%
			−5	−5	5	—	0.03	—	
			−7.5	−7.5	7.5	—	0.02	—	
Feedthrough frequency (switch off)	—	R_L = 1 kΩ (Note 3)	−5	−5	5	—	500	—	kHz
Crosstalk frequency	—	R_L = 1 kΩ (Note 4)	−5	−5	5	—	1.5	—	MHz
Crosstalk (CONTROL-OUT)	—	R_{IN} = 1 kΩ R_{OUT} = 10 kΩ C_L = 15 pF	0	0	5	—	200	—	mV
			0	0	10	—	400	—	
			0	0	15	—	600	—	

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}.

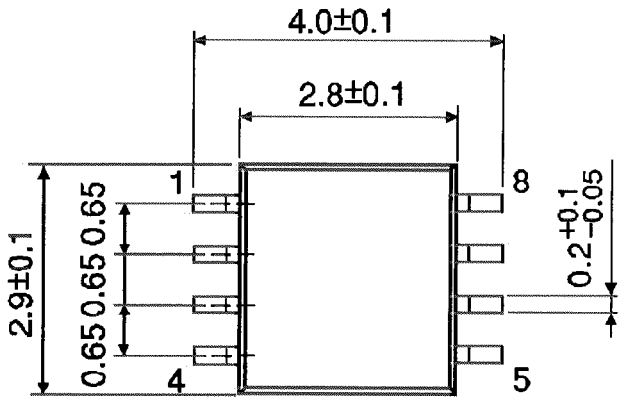
Note 2: V_{IS} shall be sine wave of $\pm\left(\frac{V_{DD} - V_{EE}}{4}\right)_{p\text{-}p}$.

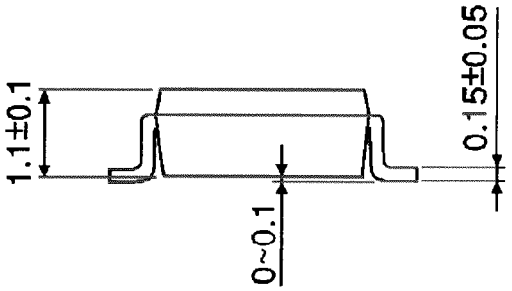
Note 3: Sine wave of ±2.5 V_{p-p} shall be used for V_{IS} and the frequency of 20 log $_{10}$ $\frac{V_{OS}}{V_{IS}}$ = −50dB shall be feed-through.

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

Package Dimensions

SSOP8-P-0.65 Unit : mm





Weight: 0.02 g (typ.)

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