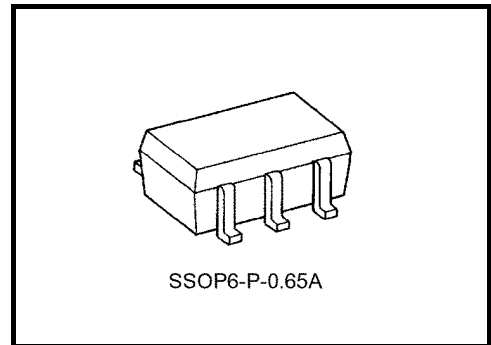


TC7PA53FU

2-Channel Multiplexer/Demultiplexer

Features

- Ultra-low on resistance: $R_{ON} = 21 \Omega$ (max) at $V_{CC} = 3.6 V$
- Operating voltage range: $V_{CC (opr.)} = 1.8$ to $3.6 V$
- 3.6 V Tolerant inputs.



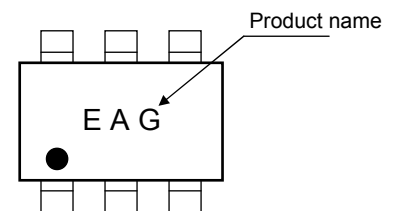
Weight: 0.0068 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

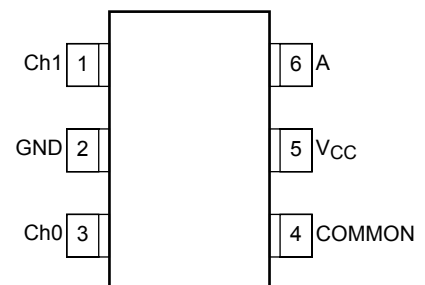
Characteristics		Symbol	Rating	Unit
Power supply voltage		V_{CC}	-0.5 to 4.6	V
DC input voltage		V_{IN}	-0.5 to 4.6	V
Switch I/O voltage		V_S	-0.5 to $V_{CC} + 0.5$	V
Clamp diode current	Control input block	I_{IK}	-50	mA
	Switch block		± 50	
Switch through current		I_T	100	mA
Power dissipation		P_D	200	mW
DC V_{CC} /ground current		I_{CC}	± 100	mA
Storage temperature		T_{stg}	-65 to 150	°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).

Marking



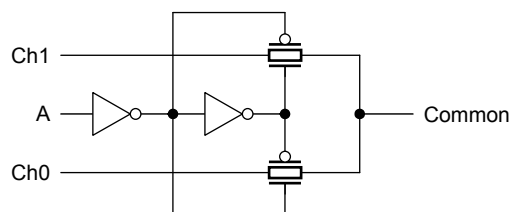
Pin Assignment (top view)



Truth Table

Input	On Channel
A	
L	Ch0
H	Ch1

System Diagram



Operating Ranges

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	1.8 to 3.6	V
Control input voltage	V_{IN}	0 to 3.6	V
Switch I/O voltage	V_S	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Control input rise and fall time	d_t/d_v	0 to 10	ns/V

Electrical Characteristics

DC Electrical Characteristics (Ta = -40 to 85°C)

Characteristics		Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit
Input voltage	High level	V _{IH}	—	1.8	V _{CC} × 0.75	—	V
				2.3 to 3.6	V _{CC} × 0.75	—	
	Low level	V _{IL}	—	1.8	—	V _{CC} × 0.25	
				2.3 to 3.6	—	V _{CC} × 0.25	
On resistance V _{I/O} = V _{CC} or GND		R _{ON}	V _{IN} = 0 V, I _O = 24 mA	3.6	—	19	Ω
			V _{IN} = 1.9 V, I _O = -24 mA	3.6	—	18	
			V _{IN} = 3.6 V, I _O = -24 mA	3.6	—	16	
			V _{IN} = 0 V, I _O = 24 mA	3.0	—	21	
			V _{IN} = 3 V, I _O = -24 mA	3.0	—	17	
			V _{IN} = 0 V, I _O = 18 mA	2.3	—	25	
			V _{IN} = 2.3 V, I _O = -18 mA	2.3	—	20	
			V _{IN} = 0 V, I _O = 6 mA	1.8	—	32	
			V _{IN} = 1.8 V, I _O = -6 mA	1.8	—	26	
On resistance V _{I/O} = V _{CC} to GND		R _{ON}	0 < V _{IN} < 3.6 V, I _O = 24 mA	3.6	—	21	Ω
			0 < V _{IN} < 3 V, I _O = 24 mA	3.0	—	23	
			0 < V _{IN} < 2.3 V, I _O = 18 mA	2.3	—	42	
			0 < V _{IN} < 1.8 V, I _O = 6 mA	1.8	—	140	
Control input leakage current		I _{IN}	V _{IN} = 0 to 3.6 V	3.6	—	±5.0	μA
Switch I/O leakage current		I _{SZ}	V _{IN} = 0 to 3.6 V	3.6	—	10.0	μA
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND	3.6	—	20.0	μA
Increase in I _{CC} per Input		ΔI _{CC}	V _{IH} = 3 V	3.6	—	750	

AC Characteristics (Ta = -40 to 85°C, input tr = tr = 2.0 ns, CL = 30 pF, RL = 500 Ω)

Characteristics	Symbol	Test Condition	VCC (V)	Min	Max	Unit
Output enable time	tpZL tpZH	Figure 1,2	1.8	—	9	ns
			2.5 ± 0.2	—	7	
			3.3 ± 0.3	—	5	
Output disable time	tpLZ tpHZ	Figure 1,2	1.8	—	9	ns
			2.5 ± 0.2	—	7	
			3.3 ± 0.3	—	5	

The propagation delay time is defined by test condition as follows: (calculating condition: see Figure 3)

$$\text{Propagation delay time (reference)} = - (C_{OS} + C_L) \cdot (R_{DRIVE} + R_{ON}) \cdot \ln \left(\frac{(V_{OH} - V_{OL}) - V_M}{(V_{OH} - V_{OL})} \right)$$

R_{DRIVE} = Output impedance of front circuit
V_M = Arbitrary output threshold voltage

Example of calculation:

$$\begin{aligned} \text{Propagation delay time (reference)} &= - (15 + 15) \cdot (0 + 21) \cdot \ln \left(\frac{(3.6 - 0) - 3.6 \cdot 50\%}{(3.6 - 0)} \right) \\ &= \text{approximately } 0.4 \text{ ns} \end{aligned}$$

Calculating condition:

V_{CC} = 3.6V, C_L = 15pF, R_{DRIVE} = 0Ω (ideal signal source), V_M = 50%

Input signal to switch = Digital signal ("H" level voltage=3.6V, "L" level voltage = 0V)

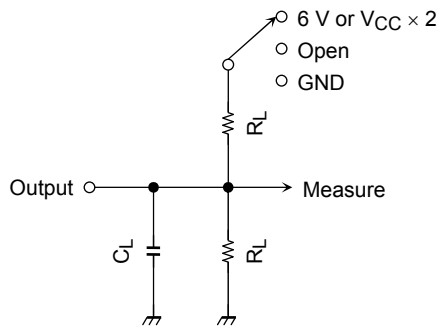
Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	VCC (V)	Typ.	Unit
Input capacitance	C _{IN}	—	1.8, 2.5, 3.3	3	pF
Common Terminal Capacitance	C _{IS}	—	1.8, 2.5, 3.3	6	pF
Switch Terminal Capacitance	C _{OS}	—	1.8, 2.5, 3.3	15	pF
Feed Through Capacitance	C _{IOS}	—	1.8, 2.5, 3.3	0.3	pF
Power dissipation capacitance	C _{PD}	f _{IN} = 10 MHz (Note 1)	1.8, 2.5, 3.3	5.5	pF

Note 1: 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 is given as:

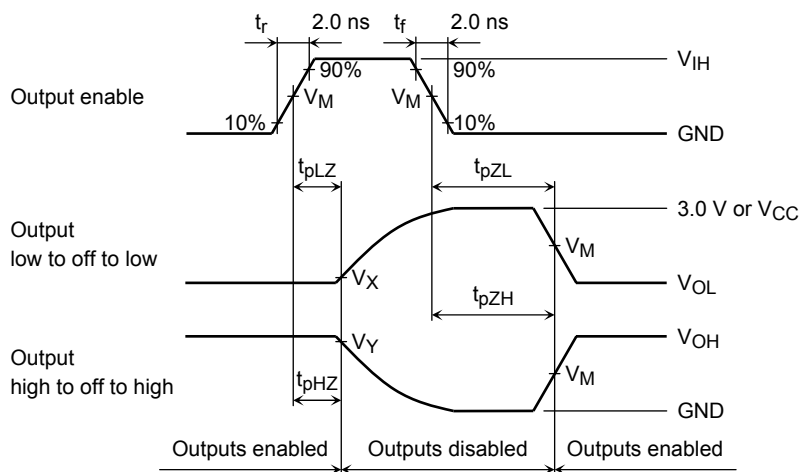
$$I_{CC} (\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

Figure 1 AC Test Circuit



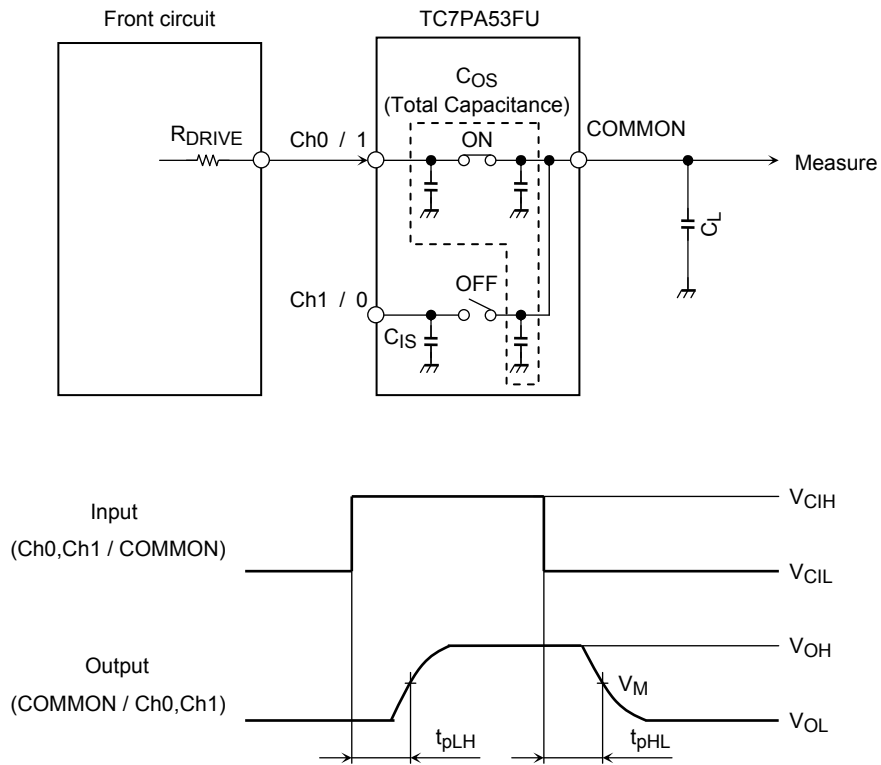
Characteristics	Switch
t_{pLZ}, t_{pZL}	6 V at $V_{CC} = 3.3 \pm 0.3$ V
	$V_{CC} \times 2$ at $V_{CC} = 2.5 \pm 0.2$ V
	$V_{CC} \times 2$ at $V_{CC} = 1.8$ V
t_{pHZ}, t_{pZH}	GND

Figure 2 AC Waveforms $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$



Symbol	V_{CC}		
	3.3 ± 0.3 V	2.5 ± 0.2 V	1.8 V
V_{IH}	2.7 V	V_{CC}	V_{CC}
V_M	1.5 V	$V_{CC}/2$	$V_{CC}/2$
V_X	$V_{OL} + 0.3$ V	$V_{OL} + 0.15$ V	$V_{OL} + 0.15$ V
V_Y	$V_{OH} - 0.3$ V	$V_{OH} - 0.15$ V	$V_{OH} - 0.15$ V

Figure 3 Calculating condition for propagation delay time t_{pLH} , t_{pHL}



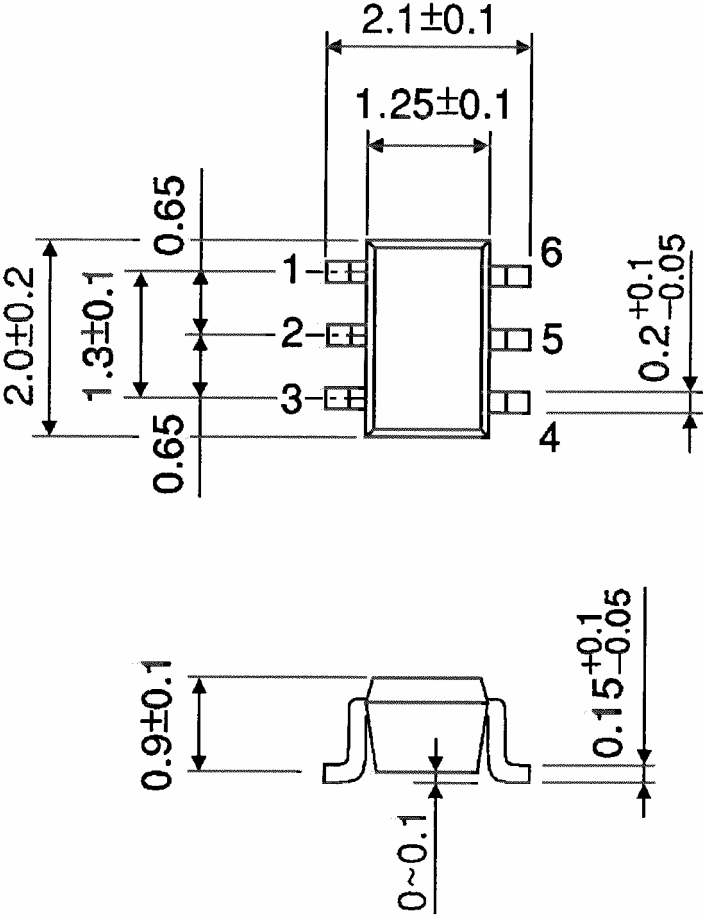
R_{DRIVE} = Output impedance of front circuit
 V_M = Arbitrary output threshold voltage
 V_{CIH} = "H" level input voltage to switch
 V_{CIL} = "L" level input voltage to switch

Symbol	V_{CC}		
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	1.8 V
V_M	arbitrary	arbitrary	arbitrary

Package Dimensions

SSOP6-P-0.65A

Unit: mm



Weight: 0.0068 g (typ.)

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20070701-EN GENERAL

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