

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7PB54FC, TC7PB54FK

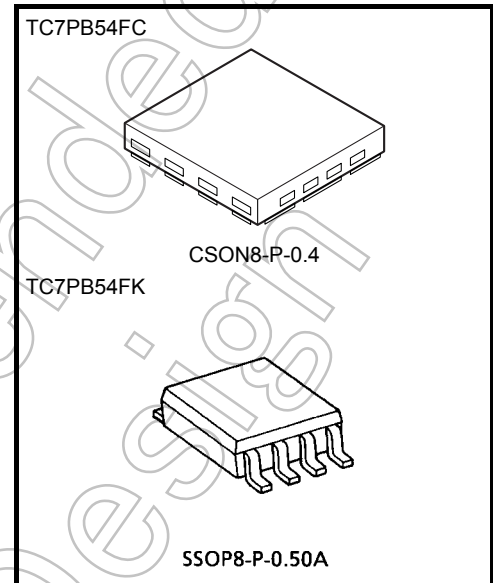
## Single 1-of-3 Demultiplexer with N-channel pull-down MOSFET

The TC7PB54 is a single 1-of-3 high-speed CMOS demultiplexer designed for low-voltage applications. The low ON-resistance of the switch allows the input (COM) to be connected to the outputs (Ch0 and Ch1) while maintaining CMOS low power dissipation. The device uses P-channel MOSFETs for the switch block between the input and output pins. The single-input multiplexer can direct the potential supplied on the COM pin to one of the Ch0 to Ch2 pins depending on the combined state of control pins A and B. The unused Chx pins are clamped to ground using an N-channel MOSFET.

All inputs are equipped with protection circuits against static discharge.

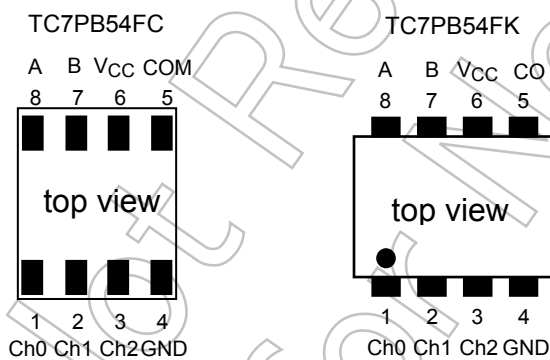
### Features

- Operating voltage range:  $V_{CC} = 2$  to  $3.6$  V
- High-speed operation:  $t_{pd} = 70$  ns (max) @  $2.7$  V
- Very low ON-resistance:  $R_{ON} = 3 \Omega$  (max) @  $2.7$  V
- High latch-up immunity: Higher than or equal to  $\pm 300$  mA
- ESD performance: Machine model  $\geq \pm 200$  V  
Human body model  $\geq \pm 2000$  V
- Package: CSON8 (CST8), SSOP8 (US8)

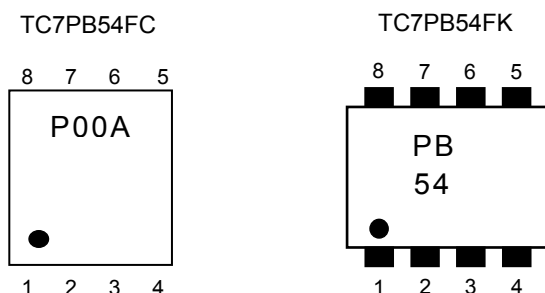


Weight  
 CSON8-P-0.4: 0.002 g (typ.)  
 SSOP8-P-0.50A: 0.01 g (typ.)

### Pin Assignment (top view)



### Marking

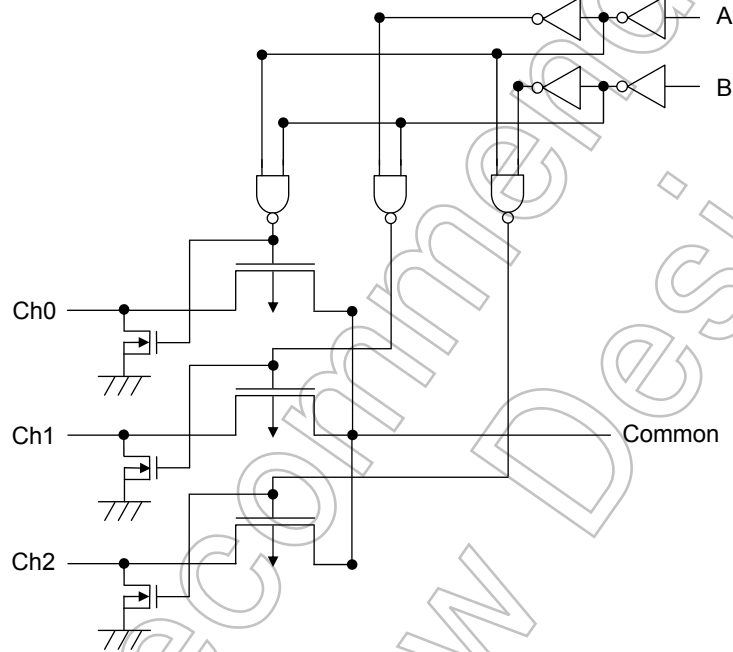


Start of commercial production  
2006-07

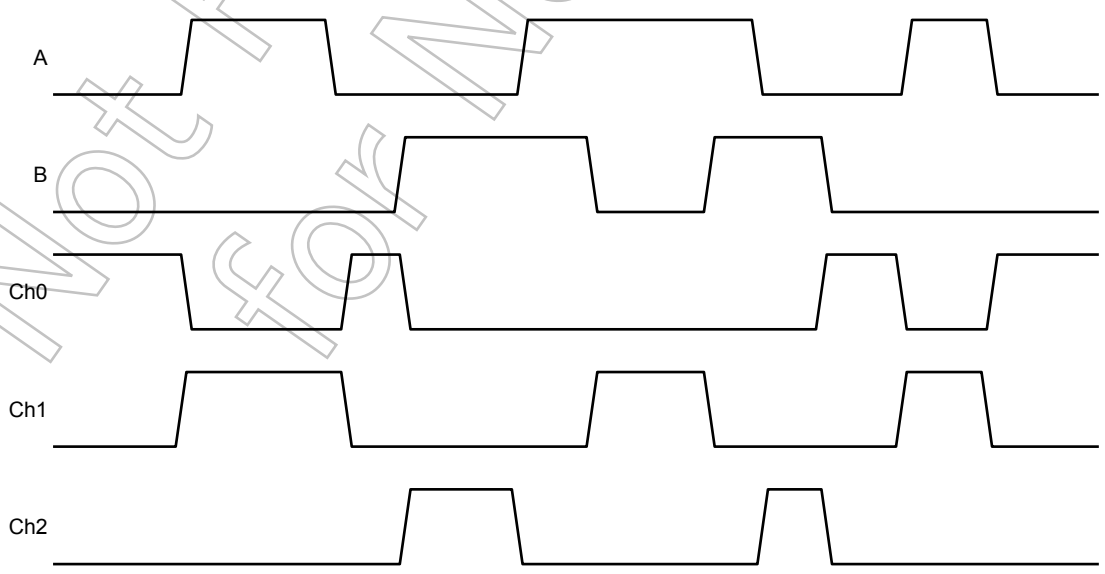
**Truth Table**

Input		Function		
A	B	Ch0	Ch1	Ch2
L	L	COM	L	L
H	L	L	COM	L
L	H	L	L	COM
H	H	L	L	L

**System Diagram**



**Timing Chart**



Note: COM = V<sub>CC</sub>

### Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	-0.5 to 4.6	V
DC input voltage (A, B)	$V_{IN}$	-0.5 to 4.6	V
DC switch voltage (COM and Ch)	$V_S$	-0.5 to $V_{CC} + 0.5$	V
Input diode current (A, B)	$I_{IK}$	-25	mA
Output diode current (COM and Ch)		$\pm 25$	mA
Switch I/O current (COM to Ch)	$I_S$	128	mA
N-channel MOSFET current (Note 2)	$I_{OUT}$	25	mA
Power dissipation	$P_D$	150 (CSON8) 200 (SSOP8)	mW
DC VCC/ground current	$I_{CC}/I_{GND}$	$\pm 50$	mA
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, may lead to deterioration in IC performance or even destruction.

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.).

Note 2: N-channel MOSFET allowable current to clamp the unused pin to ground.

### Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	2.0 to 3.6	V
Input voltage (A, B)	$V_{IN}$	0 to 3.6	V
DC switch voltage (COM and Ch) (Note 2)	$V_S$	0 to $V_{CC} + 0.3$	V
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}C$
Input rise and fall time (A, B)	dt/dv	0 to 10	ns/V

Note 1: The operating ranges must be maintained to ensure the normal operation of the device.

Unused inputs must be tied to either  $V_{CC}$  or GND.

Note 2: Ensure that the voltages on the COM and Ch pins do not exceed  $V_{CC} + 0.3$  V even during a power-up sequence or when the power decreases.

## Electrical Characteristics

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

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Min	Typ.	Max	Unit
High-level input voltage	V <sub>IH</sub>	—	2.8	1.55	—	—	V
			2.3	1.50	—	—	
Low-level input voltage	V <sub>IL</sub>	—	2.8	—	—	0.6	
			2.3	—	—	0.5	
Input leakage current (A, B)	I <sub>IN</sub>	A, B = 0 to 3.6 V	2.0 to 3.6	—	—	±1.0	μA
Off-state leakage current	I <sub>Iz</sub>	COM, Ch = 0 to V <sub>CC</sub>	2.0 to 3.6	—	—	±1.0	μA
Output diode current (COM and Ch)	I <sub>IK</sub>	COM, Ch = V <sub>CC</sub> - 0.3 V to V <sub>CC</sub> + 0.3 V	2.0 to 3.6	—	—	100	μA
Switch ON resistance (Note 1)	R <sub>ON</sub>	V <sub>IS</sub> = 2.7 to 3.0 V, I <sub>IS</sub> = 3 mA (Note 1)	2.7 to 3.0	—	1.6	3	Ω
		V <sub>IS</sub> = 2.3 V, I <sub>IS</sub> = 3 mA	2.3	—	2.1	5	
		V <sub>IS</sub> = 2.7 to 3.0 V, I <sub>IS</sub> = 30 mA (Note 2)	2.7 to 3.0	—	1.6	3	
		V <sub>IS</sub> = 2.3 V, I <sub>IS</sub> = 30 mA	2.3	—	2.1	5	
N-ch MOSFET ON resistance	R	I <sub>L</sub> = 5 mA	2.7	—	—	50	Ω
		I <sub>L</sub> = 4 mA	2.3	—	—	75	
Increase in I <sub>CC</sub> per Input	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	3.6	—	—	10	μA
	I <sub>CC</sub> T	PER INPUT: V <sub>IN</sub> = 1.7 V	2.95	—	—	25	μA

Note 1: Measured by the voltage drop between the COM and Ch pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (COM or Ch) pins.

Note 2: The typical value of Ron is V<sub>CC</sub> (= 2.85 V).

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

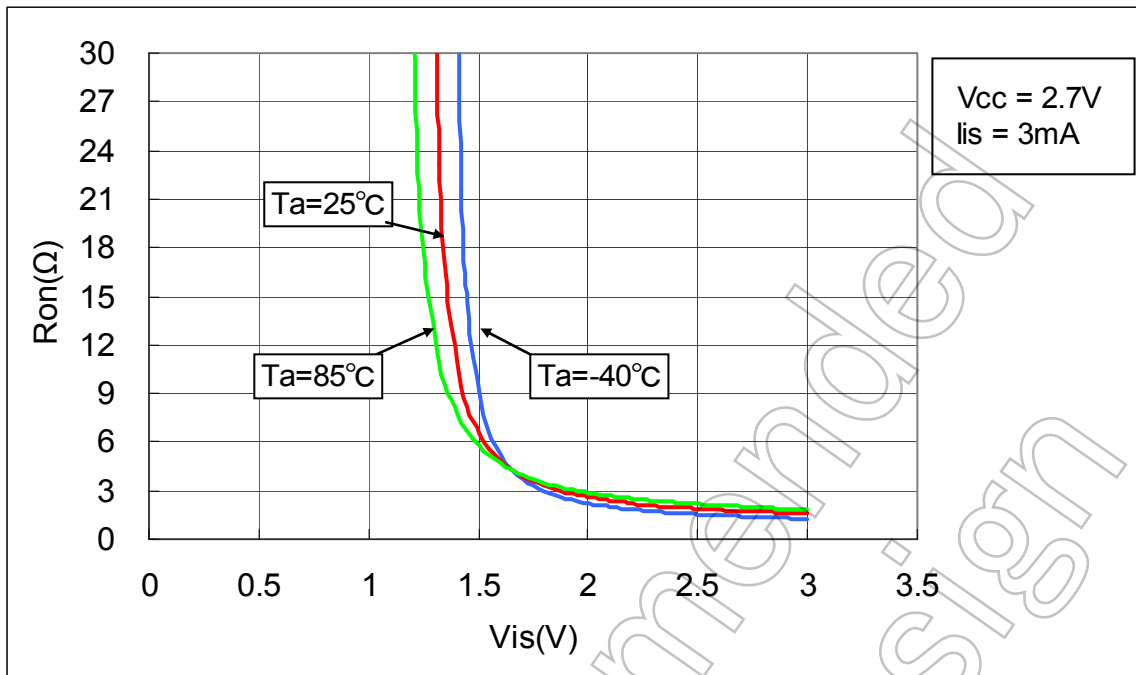
Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Min	Max	Unit
Propagation delay time (A, B to Ch)	t <sub>pLH</sub>	COM ≡ V <sub>CC</sub> (Figures 1 and 2)	3.0 ± 0.3	—	70	ns
	t <sub>pHL</sub>		2.5 ± 0.2	—	140	

### Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Typ.	Unit
Control input capacitance (A, B)	C <sub>IN</sub>	(Note)	3.0	5	pF
COM-Ch I/O capacitance	C <sub>I/O</sub>	(Note)	3.0	70	pF

Note: Capacitance quoted is not tested.

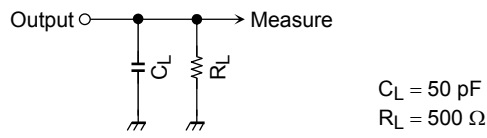
**$R_{ON} - V_{IS}$  Characteristic Curves  $V_{CC} = 2.7\text{ V}$ ,  $I_{IS} = 3\text{ mA}$ ,  $T_a = -40/25/85^\circ\text{C}$**



**Meanings of Symbols**

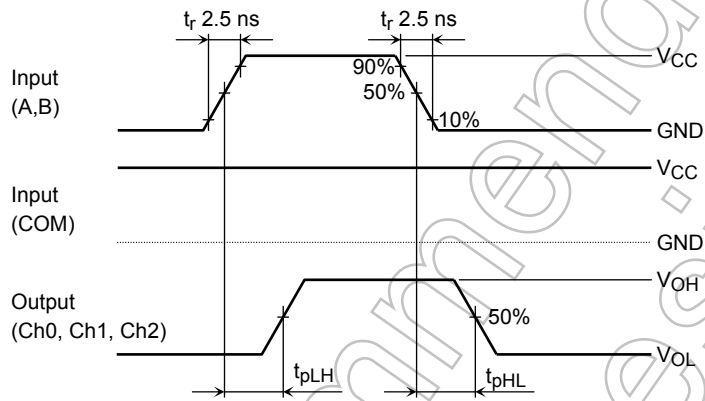
Symbol	Description
$I_{IN}$	Leakage current when voltage is applied to the A pin
$I_{IZ}$	Leakage current when voltage of 0 to $V_{CC}$ is applied between the COM and Ch pins
$I_{IK}$	Leakage current when voltage of $V_{CC}$ to $V_{CC} + 0.3\text{ V}$ is applied between the COM and Ch pins
$R_{ON}$	Resistance between the COM and Ch pins
$V_{IS}$	Reference voltage for measuring $R_{ON}$
$I_{IS}$	Reference current for measuring $R_{ON}$
R	Resistance of the N-channel MOS used to fixed the logical state
$I_L$	Reference current drawn from the N-channel MOS used to fixed the logical state

**AC Test Circuit**



**Figure 1**

**AC Waveforms**



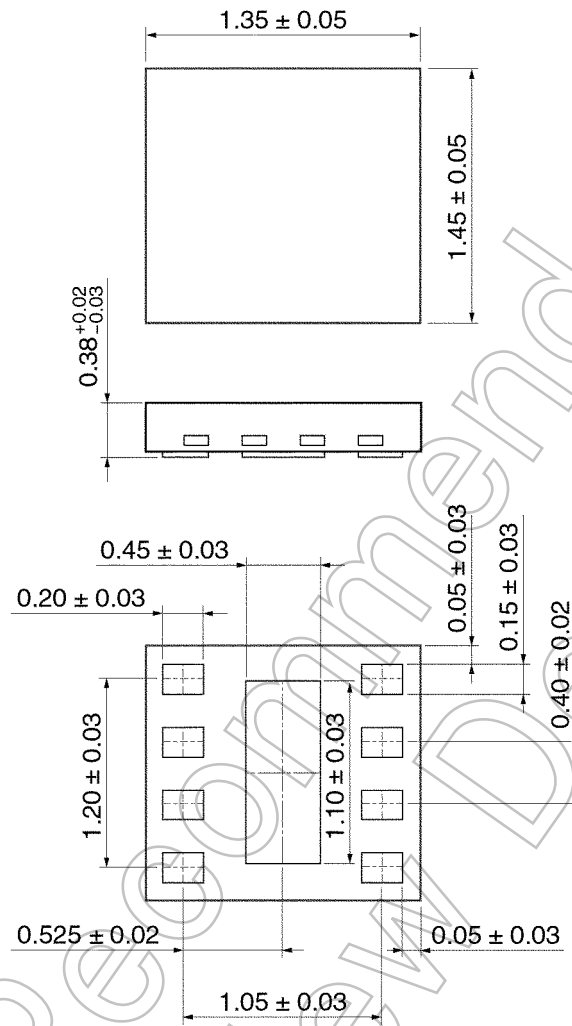
**Figure 2  $t_{pLH}$ ,  $t_{pHL}$**

Not Recommended for New Design

**Package Dimensions**

CSON8-P-0.4

Unit: mm



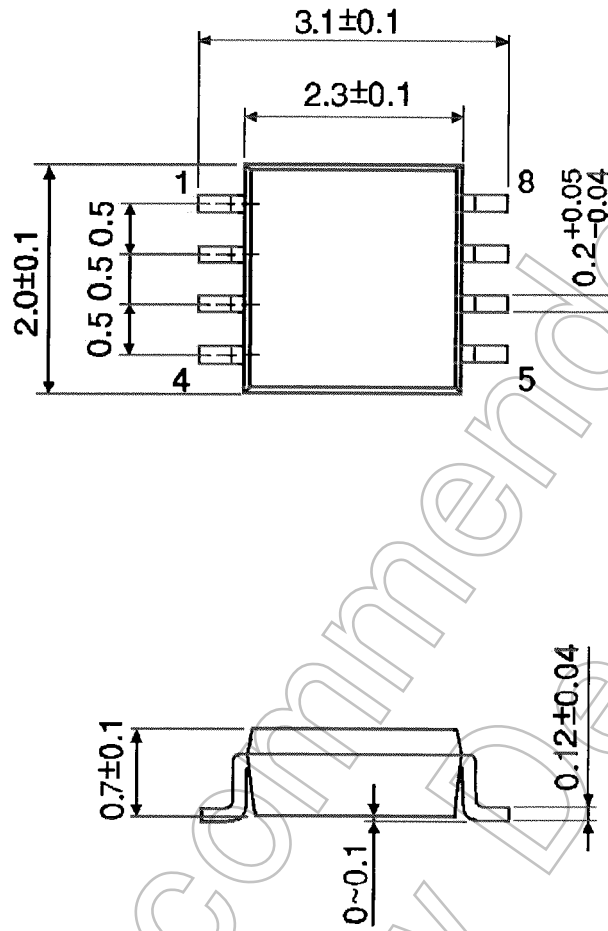
Weight: 0.002 g (typ.)

Not Recommended for New Design

**Package Dimensions**

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

Not Recommended for New Design



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