

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

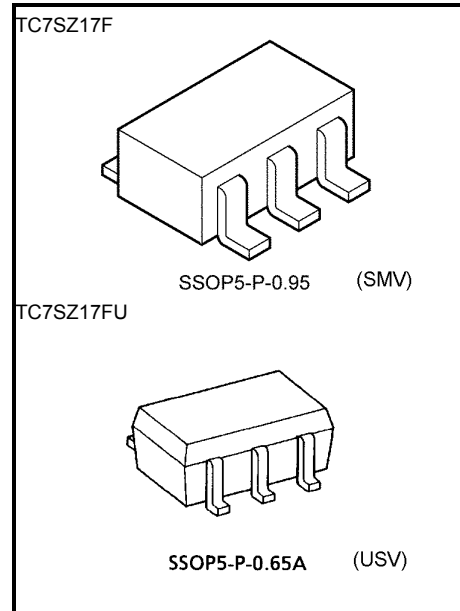
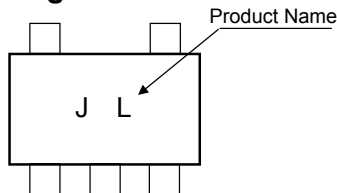
# TC7SZ17F, TC7SZ17FU

## Schmitt Buffer

### Features

- High output current :  $\pm 24\text{mA}$  (min) at  $V_{CC} = 3\text{V}$
- Super high speed operation :  $t_{pd} = 3.7\text{ns}$  (typ.)  
at  $V_{CC} = 5\text{V}$ ,  $50\text{pF}$
- Operation voltage range :  $V_{CC}(\text{opr}) = 1.65$  to  $5.5\text{V}$
- 5.5-V tolerant input
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at  $3.3\text{-}5\text{V } V_{CC}$

### Marking

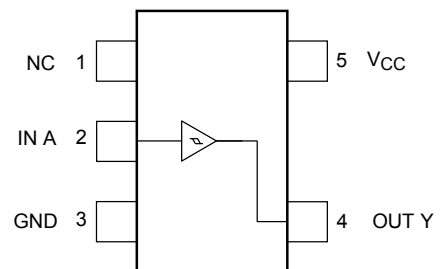


Weight:  
 SSOP5-P-0.95 : 0.016 g (typ.)  
 SSOP5-P-0.65A : 0.006 g (typ.)

### Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 6	V
DC input voltage	$V_{IN}$	-0.5 to 6	V
DC output voltage	$V_{OUT}$	-0.5 to 6 (Note 1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note 3)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	200	mW
Storage temperature	$T_{stg}$	-65 to 150	°C
Lead temperature (10 s)	$T_L$	260	°C

### Pin Assignment (top view)



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.

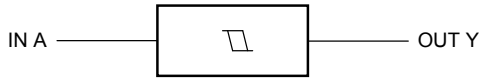
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1:  $V_{CC} = 0\text{V}$

Note 2: High or Low state. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

## IEC Logic Symbol



## Truth Table

A	Y
L	L
H	H

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	1.65 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 5)	V
		0 to $V_{CC}$ (Note 6)	
Operating temperature	$T_{opr}$	-40 to 85	°C

Note 4: Data retention only

Note 5:  $V_{CC} = 0$  V

Note 6: High or Low State

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$				$T_a = -40$ to $85^\circ\text{C}$		Unit
			$V_{CC}$ (V)	Min	Typ.	Max	Min	Max	
Threshold voltage	High level	—	1.65	0.6	1.0	1.4	0.6	1.4	V
			1.8	0.7	1.1	1.5	0.7	1.5	
			2.3	1.0	1.4	1.8	1.0	1.8	
			3.0	1.3	1.75	2.2	1.3	2.2	
			4.5	1.9	2.45	3.1	1.9	3.1	
			5.5	2.2	2.9	3.6	2.2	3.6	
	Low level	—	1.65	0.2	0.5	0.8	0.2	0.8	
			1.8	0.25	0.55	0.9	0.25	0.9	
			2.3	0.40	0.75	1.15	0.40	1.15	
			3.0	0.6	1.0	1.5	0.6	1.5	
			4.5	1.0	1.43	2.0	1.0	2.0	
			5.5	1.2	1.70	2.4	1.2	2.4	
Hysteresis voltage	—	—	1.65	0.1	0.48	0.9	0.1	1.0	V
			1.8	0.15	0.54	1.0	0.15	1.0	
			2.3	0.25	0.65	1.1	0.25	1.1	
			3.0	0.4	0.77	1.2	0.4	1.2	
			4.5	0.6	1.01	1.5	0.6	1.5	
			5.5	0.7	1.18	1.7	0.7	1.7	

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to 85°C		Unit	
				Min	Typ.	Max	Min	Max		
Output voltage	High level	V <sub>OH</sub> V <sub>IN</sub> = V <sub>P</sub>	I <sub>OH</sub> = -100 μA	1.65	1.55	1.65	—	1.55	—	V
				1.8	1.7	1.8	—	1.7	—	
				2.3	2.2	2.3	—	2.2	—	
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I <sub>OH</sub> = -4 mA	1.65	1.29	1.52	—	1.29	—	
				2.3	1.9	2.15	—	1.9	—	
				3.0	2.4	2.8	—	2.4	—	
				4.5	3.8	4.2	—	3.8	—	
	Low level	V <sub>OL</sub> V <sub>IN</sub> = V <sub>N</sub>	I <sub>OL</sub> = 100 μA	1.65	—	0	0.1	—	0.1	
				1.8	—	0	0.1	—	0.1	
				2.3	—	0	0.1	—	0.1	
				3.0	—	0	0.1	—	0.1	
				4.5	—	0	0.1	—	0.1	
			I <sub>OL</sub> = 4 mA	1.65	—	0.08	0.24	—	0.24	
				2.3	—	0.1	0.3	—	0.3	
				3.0	—	0.15	0.4	—	0.4	
				4.5	—	0.22	0.55	—	0.55	
I <sub>OL</sub> = 8 mA	2.3	—	0.1	0.3	—	0.3				
	3.0	—	0.15	0.4	—	0.4				
	4.5	—	0.22	0.55	—	0.55				
I <sub>OL</sub> = 16 mA	3.0	—	0.15	0.4	—	0.4				
	3.0	—	0.22	0.55	—	0.55				
	4.5	—	0.22	0.55	—	0.55				
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA	
Power OFF leakage current	I <sub>OFF</sub>	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0.0	—	—	1	—	10	μA	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = 5.5 V or GND	1.65 to 5.5	—	—	1	—	10	μA	

### AC Characteristics (Unless otherwise specified Input: t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to 85°C		Unit
				Min	Typ.	Max	Min	Max	
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.8 ± 0.15	2.0	9.1	15.0	2.0	15.6	ns
			2.5 ± 0.2	1.0	5.0	9.0	1.0	9.5	
			3.3 ± 0.3	1.0	3.7	6.3	1.0	6.5	
			5.0 ± 0.5	0.5	3.1	5.2	0.5	5.5	
			3.3 ± 0.3	1.5	4.4	7.2	1.5	7.5	
			5.0 ± 0.5	0.5	3.7	5.9	0.8	6.2	
Input capacitance	C <sub>IN</sub>	—	0 to 5.5	—	4	—	—	—	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 7)	3.3	—	24	—	—	—	pF
			5.5	—	30	—	—	—	pF

Note 7: CPD is defined as the value of the internal equivalent capacitance which is Calculated from the operating current consumption without load.

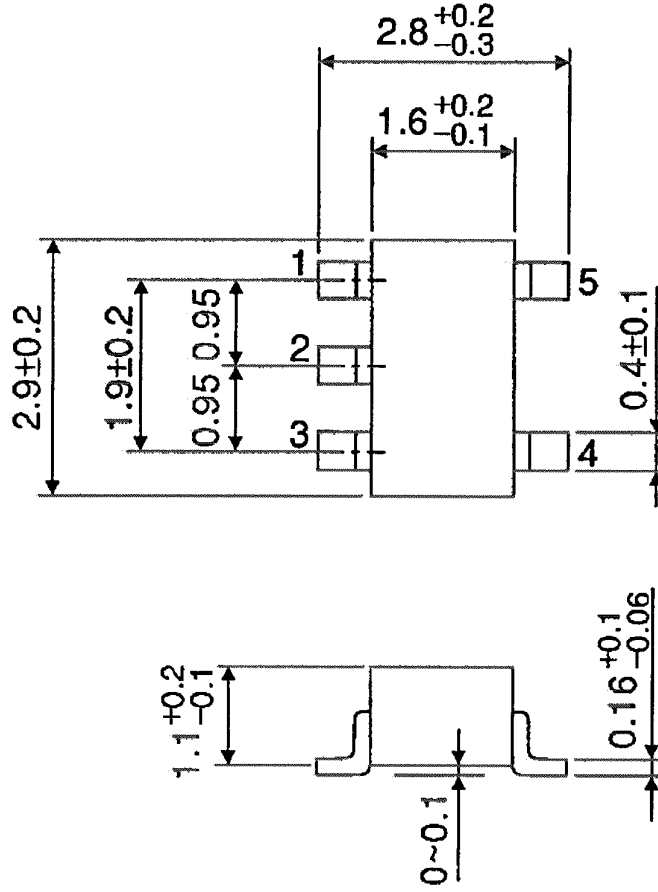
Average operating current can be obtained by the equation.

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

**Package Dimensions**

SSOP5-P-0.95

Unit : mm

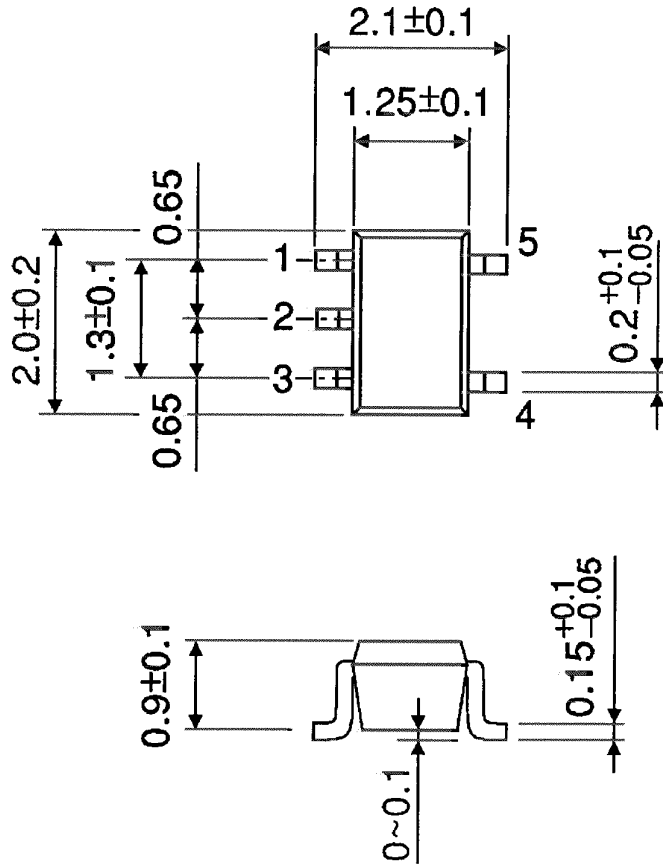


Weight: 0.016 g (typ.)

## Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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