

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

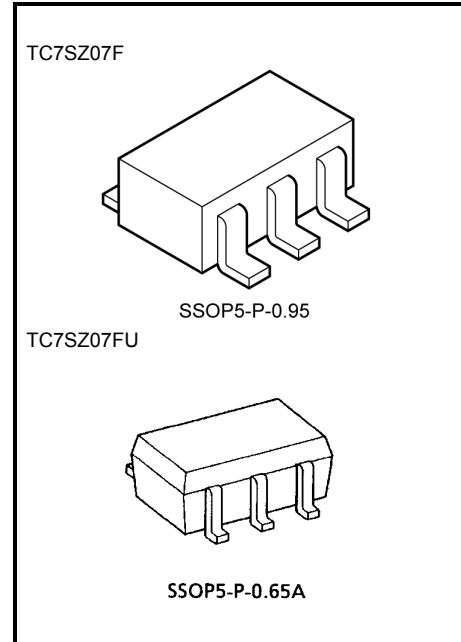
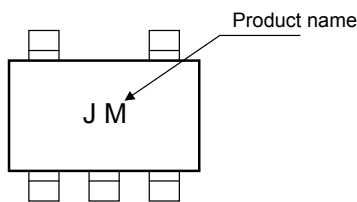
# TC7SZ07F, TC7SZ07FU

## NON-Inverter (Open Drain)

### Features

- High output drive:  $\pm 24$  mA (min)  
at  $V_{CC} = 3$  V
- Super high speed operation:  $t_{pZL} = 2.3$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operation voltage range:  $V_{CC (opr.)} = 1.65$  to 5.5 V
- 5.5-V tolerant input
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at 3.3 -V  $V_{CC}$

### Marking

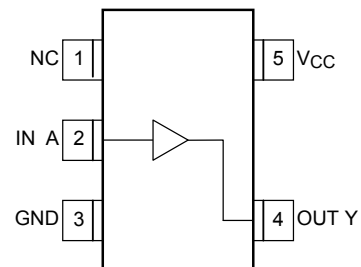


Weight  
 SSOP5-P-0.95 : 0.016 g (typ.)  
 SSOP5-P-0.65A: 0.006 g (typ.)

### 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	$I_{OUT}$	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

### Pin Assignment (top view)

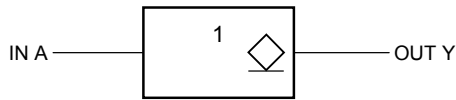


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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:  $V_{CC} = 0$ V or High impedance condition.  
 Note 2: Low State.  $I_{OUT}$  absolute maximum rating must be observed.  
 Note 3:  $V_{OUT} < GND$

**Logic Diagram**



**Truth Table**

A	Y
L	L
H	Z

Z: High Impedance

**Operating Ranges**

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	1.65 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	V <sub>IN</sub>	0 to 5.5	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-40 to 85	°C
Input rise and fall time	d <sub>t</sub> /d <sub>v</sub>	0 to 20 (V <sub>CC</sub> = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V)	ns/V
		0 to 10 (V <sub>CC</sub> = 3.3 V ± 0.3 V)	
		0 to 5 (V <sub>CC</sub> = 5.0 V ± 0.5 V)	

Note 4: Data retention only

## Electrical Characteristics

### DC Characteristics

Characteristics		Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to 85°C		Unit	
					Min	Typ.	Max	Min	Max		
Input voltage	High level	V <sub>IH</sub>	—	1.65 to 1.95	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V	
				2.3 to 5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
	Low level	V <sub>IL</sub>	—	1.65 to 1.95	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25		
				2.3 to 5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
Z-state output leakage current		I <sub>LKG</sub>	V <sub>IN</sub> = V <sub>IH</sub> V <sub>OUT</sub> = 0 to 5.5 V	1.65 to 5.5	—	—	±5	—	±10	μA	
Output voltage	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	1.65	—	0	0.1	—	0.1	V
					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> = 8 mA	2.3	—	0.1	0.3	—	0.3	
				I <sub>OL</sub> = 16 mA	3.0	—	0.15	0.4	—	0.4	
				I <sub>OL</sub> = 24 mA	3.0	—	0.22	0.55	—	0.55	
I <sub>OL</sub> = 32 mA	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	5.5	—	—	2	—	20	μA	

## AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

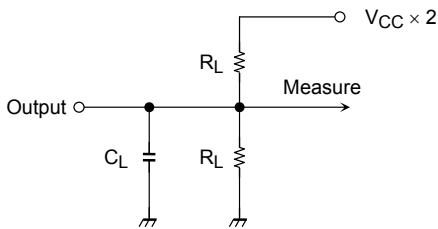
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Propagation delay time	t <sub>pZL</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.8 ± 0.15	1.8	5.5	9.5	1.8	10.5	ns
			2.5 ± 0.2	1.2	3.7	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.9	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	2.3	3.5	0.5	3.9	
	t <sub>pLZ</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.8 ± 0.15	1.8	4.3	9.5	1.8	10.5	
			2.5 ± 0.2	1.2	2.8	5.8	1.2	6.4	
			3.3 ± 0.3	0.8	2.1	4.4	0.8	4.8	
			5.0 ± 0.5	0.5	1.4	3.5	0.5	3.9	
Input capacitance	C <sub>IN</sub>	—	0 to 5.5	—	4	—	—	pF	
Output capacitance	C <sub>OUT</sub>	—	0 to 5.5	—	8	—	—	pF	
Power dissipation capacitance	C <sub>PD</sub>	(Note 5)	3.3	—	20	—	—	—	pF
			5.5	—	26	—	—	—	

Note5: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

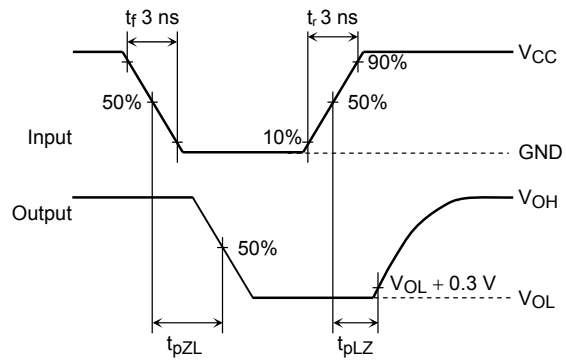
Average operating current can be obtained by the equation.

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

### AC Characteristics Measurement Circuit



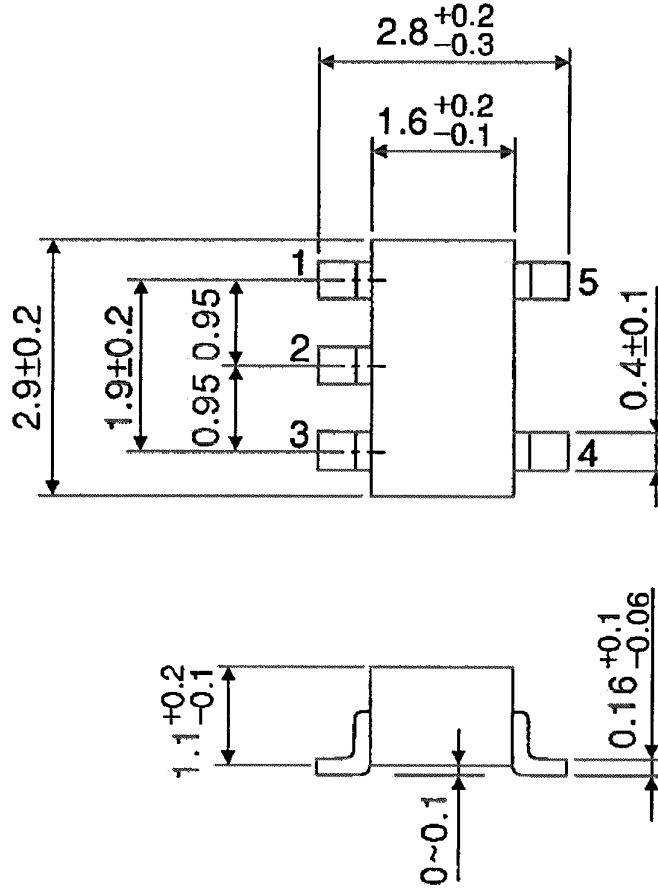
### AC Waveforms



**Package Dimensions**

SSOP5-P-0.95

Unit : mm

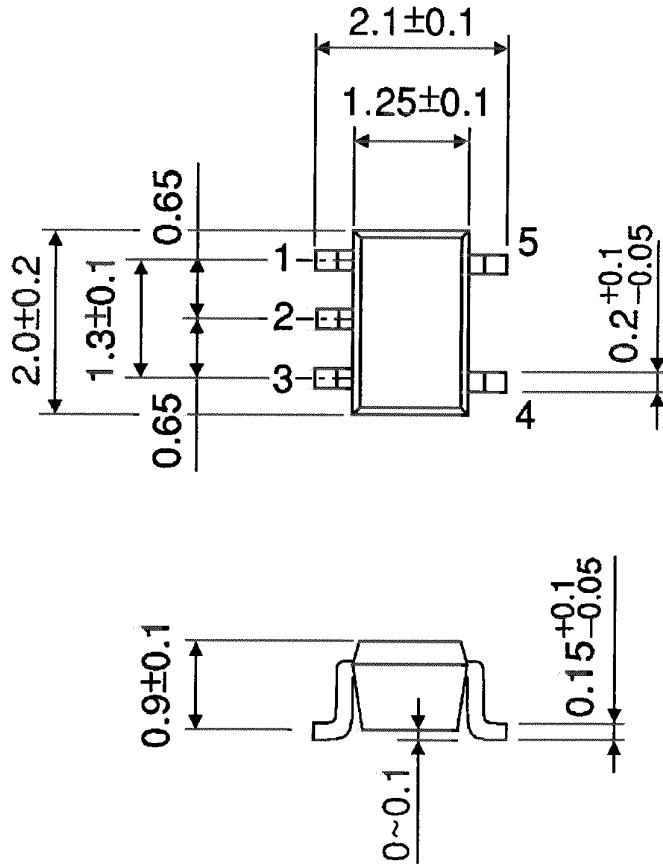


Weight: 0.016 g (typ.)

## Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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