

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

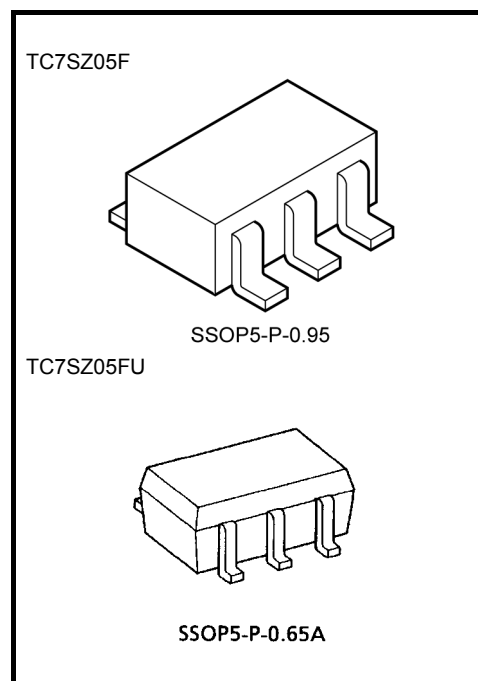
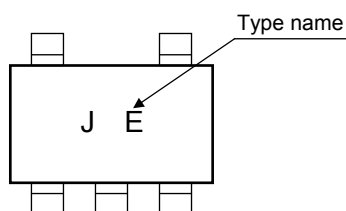
## TC7SZ05F, TC7SZ05FU

Inverter (Open Drain)

### Features

- High output drive: 24 mA (min) at  $V_{CC} = 3\text{ V}$
- Super high speed operation:  $t_{pZ} = 1.9\text{ ns (typ.)}$   
at  $V_{CC} = 5\text{ V}$ , 50 pF
- Operation voltage range:  $V_{CC\text{ (opr)}} = 1.8\sim 5.5\text{ V}$
- 5.5-V tolerant inputs
- 5.5-V power down protection outputs
- 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 ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	$-0.5\sim 6$	V
DC input voltage	$V_{IN}$	$-0.5\sim 6$	V
DC output voltage	$V_{OUT}$	$-0.5\sim 6$ (Note 1)	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note 2)	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	$T_{stg}$	$-65\sim 150$	$^\circ\text{C}$
Lead temperature (10s)	$T_L$	260	$^\circ\text{C}$

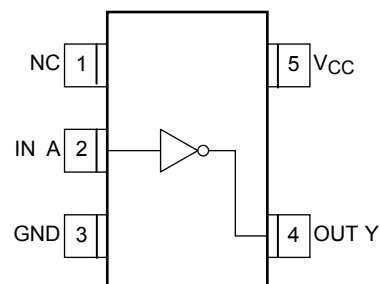
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

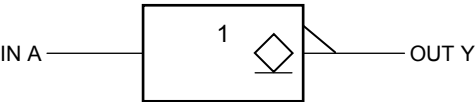
Note 1:  $I_{OUT}$  absolute maximum rating must be observed

Note 2:  $V_{OUT} < GND$

### Pin Assignment (top view)



Logic Diagram



Truth Table

A	Y
L	Z
H	L

Z: High Impedance

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	1.8~5.5	V
		1.5~5.5 (Note 3)	
Input voltage	V <sub>IN</sub>	0~5.5	V
Output voltage	V <sub>OUT</sub>	0~5.5	V
Operating temperature	T <sub>opr</sub>	−40~85	°C
Input rise and fall time	dt/dv	0~20 (V <sub>CC</sub> = 1.8 V, 2.5 V ± 0.2 V)	ns/V
		0~10 (V <sub>CC</sub> = 3.3 V ± 0.3 V)	
		0~5 (V <sub>CC</sub> = 5.5 V ± 0.5 V)	

Note 3: Data retention only

**Electrical Characteristics**
**DC Characteristics**

Characteristics		Symbol	Test Condition		Ta = 25°C				Ta = -40~85°C		Unit
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max	
Input voltage	High level	V <sub>IH</sub>	—	1.8	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V	
				2.3~5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
	Low level	V <sub>IL</sub>	—	1.8	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25		
				2.3~5.5	—	—	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>IL</sub> V <sub>OUT</sub> = 0~5.5 V	1.8~5.5	—	—	±5	—	±10	μA	
Output voltage	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	1.8	—	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	0~5.5	—	—	±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> = V <sub>CC</sub> or GND	5.5	—	—	2	—	20	μA	

AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3\text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C				Ta = -40~85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	tpZL	CL = 50 pF, RL = 500 Ω	1.8	1.5	4.6	10.5	1.5	11.0	ns
			2.5 ± 0.2	0.8	3.0	7.0	0.8	7.5	
			3.3 ± 0.3	0.8	2.4	5.0	0.8	5.2	
			5.0 ± 0.5	0.5	1.9	4.3	0.5	4.5	
	tpLZ	CL = 50 pF, RL = 500 Ω	1.8	1.5	4.1	10.5	1.5	11.0	ns
			2.5 ± 0.2	0.8	2.5	7.0	0.8	7.5	
			3.3 ± 0.3	0.8	2.1	5.0	0.8	5.2	
			5.0 ± 0.5	0.5	1.2	4.3	0.5	4.5	
Input capacitance	CIN	—	0~5.5	—	4	—	—	pF	
Power dissipation capacitance	CPD	(Note 4)	3.3	—	3.6	—	—	pF	
			5.5	—	6.5	—	—		

Note 4: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

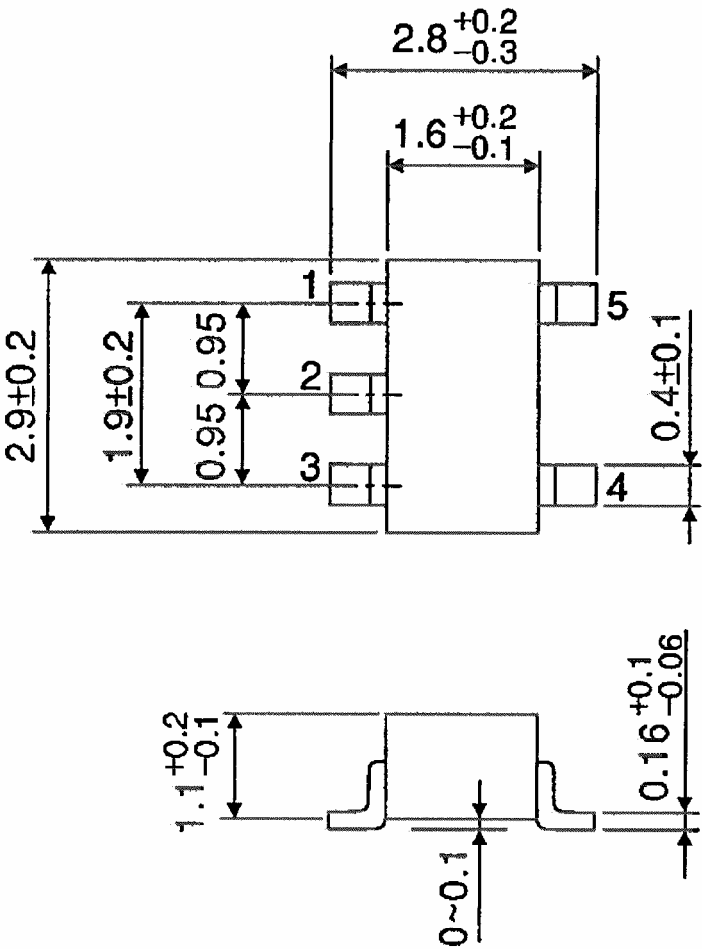
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

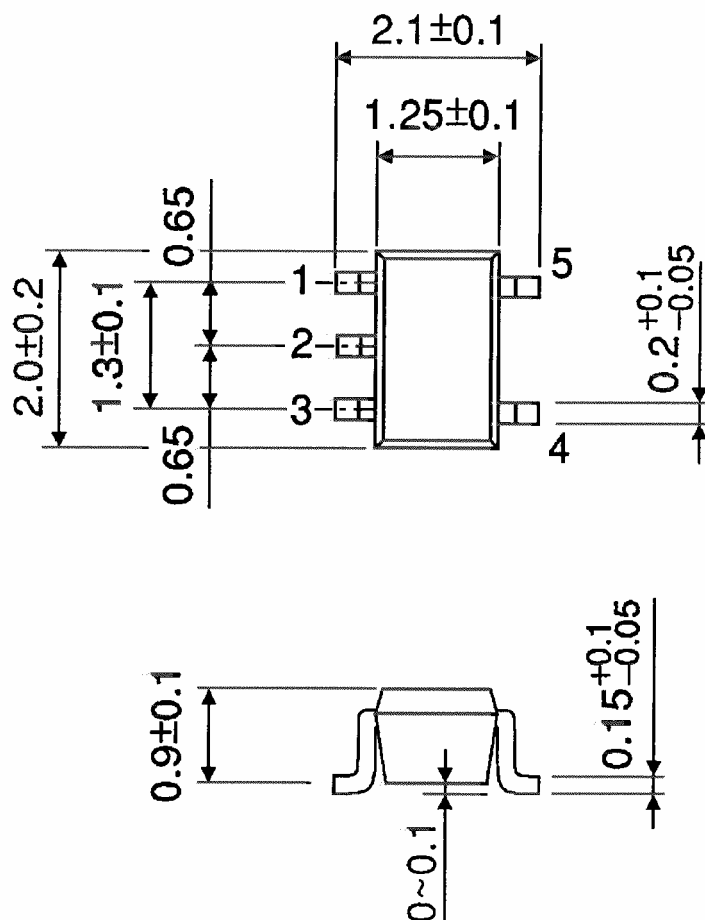


Weight: 0.016 g (typ.)

**Package Dimensions**

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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