

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

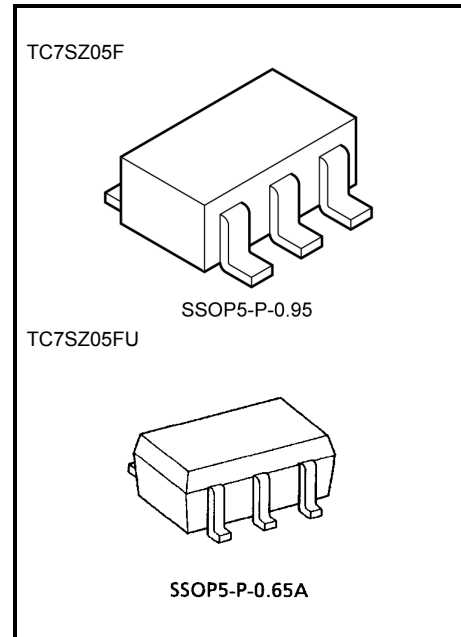
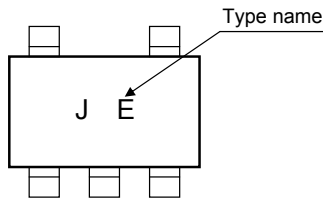
# TC7SZ05F, TC7SZ05FU

Inverter (Open Drain)

## Features

- High output drive: 24 mA (min) @V<sub>CC</sub> = 3 V
- Super high speed operation:  
 $t_{pz} = 1.9 \text{ ns (typ.) @ } V_{CC} = 5 \text{ V, } 50 \text{ pF}$
- Operation voltage range: V<sub>CC (opr)</sub> = 1.80~5.5 V
- 5.5V tolerant input.
- Power down protection is provided on output.
- Matches the performance of TC74LCX series when operated at 3.3 V V<sub>CC</sub>.

## Marking

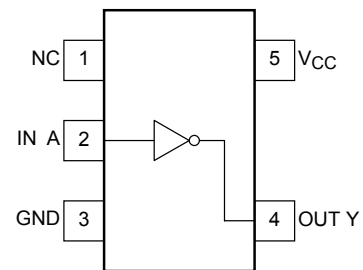


Weight  
 SSOP5-P-0.95 : 0.016 g (typ.)  
 SSOP5-P-0.65A : 0.006 g (typ.)

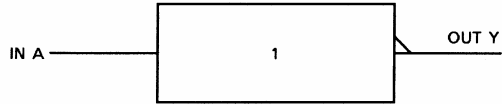
## Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V <sub>CC</sub>	-0.5~6	V
DC input voltage	V <sub>IN</sub>	-0.5~6	V
DC output voltage	V <sub>OUT</sub>	-0.5~6	V
Input diode current	I <sub>IK</sub>	-20	mA
Output diode current	I <sub>OK</sub>	-20	mA
DC output current	I <sub>OUT</sub>	50	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	P <sub>D</sub>	200	mW
Storage temperature	T <sub>stg</sub>	-65~150	°C
Lead temperature (10s)	T <sub>L</sub>	260	°C

## Pin Assignment (top view)



**Logic Diagram**



**Truth Table**

A	Y
L	*Z
H	L

\*: High impedance

**Recommended Operating Conditions**

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	1.8~5.5	V
		1.5~5.5 (Note 1)	
Input voltage	$V_{IN}$	0~5.5	V
Output voltage	$V_{OUT}$	0~5.5 (Note 2)	V
		0~ $V_{CC}$ (Note 3)	
Operating temperature	$T_{opr}$	-40~85	°C
Input rise and fall time	dt/dv	0~20 ( $V_{CC} = 1.8\text{ V}, 2.5\text{ V} \pm 0.2\text{ V}$ )	ns/V
		0~10 ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ )	
		0~5 ( $V_{CC} = 5.5\text{ V} \pm 0.5\text{ V}$ )	

Note 1: Data retention only

Note 2: OFF state

Note 3: Low state

## 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		
High level Output leakage		I <sub>LKG</sub>	V <sub>IN</sub> = V <sub>IL</sub>	1.8~5.5	—	—	±5	—	±10	μA	
Output voltage	V <sub>OL</sub>	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> = 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
			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	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	
	t <sub>pLZ</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 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	C <sub>IN</sub>	—	0~5.5	—	4	—	—	—	pF
Power dissipation capacitance	C <sub>PD</sub>	(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.

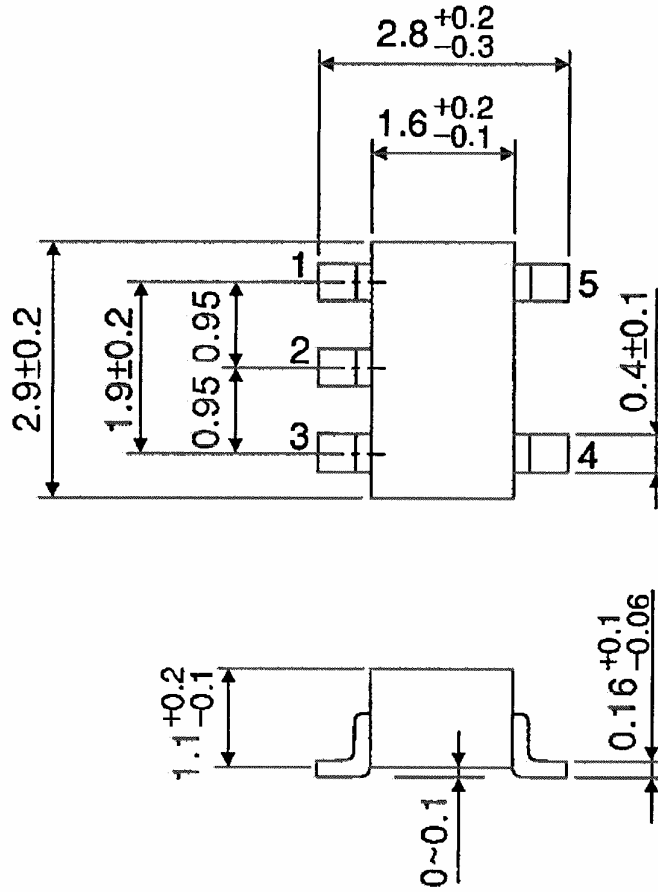
Average operating current can be obtained by the equation:

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

## Package Dimensions

SSOP5-P-0.95

Unit : mm

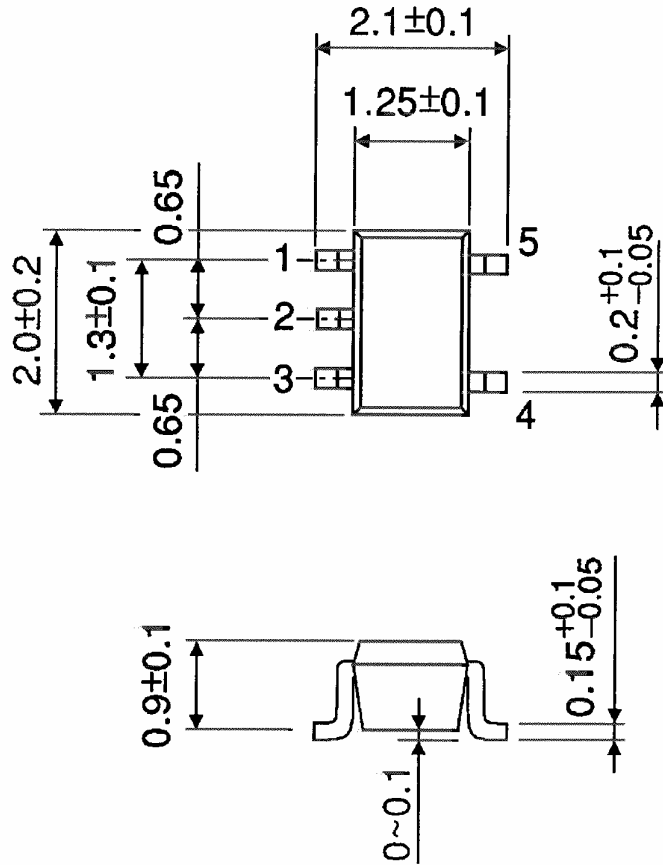


Weight: 0.016 g (typ.)

## Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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