

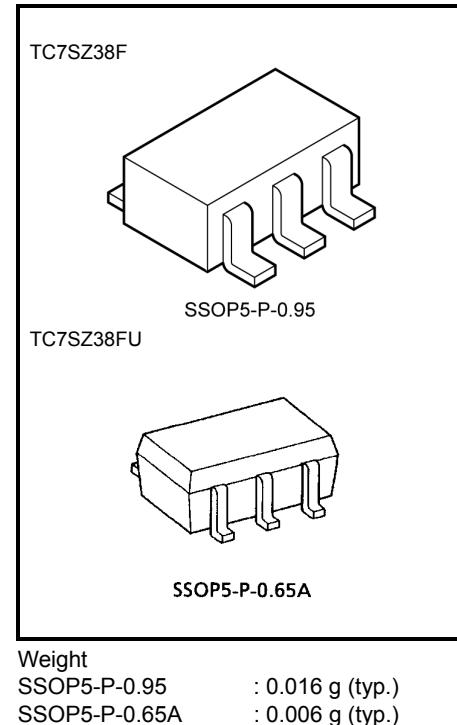
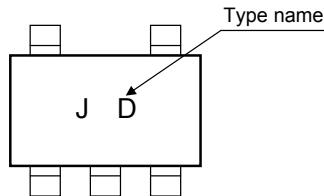
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

**TC7SZ38F, TC7SZ38FU**

2-Input NAND Gate(Open Drain Output)

**Features**

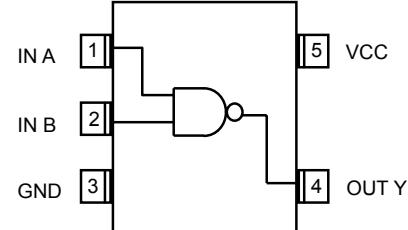
- High output drive: 24 mA (min) @VCC = 3 V
- Super high speed operation:  
 $t_{pz} = 2.2 \text{ ns}(\text{typ.}) @VCC = 5 \text{ V}, 50 \text{ pF}$
- Operation voltage range: VCC (opr) = 1.80~5.5 V
- 5.5V tolerant inputs.
- Power down protection is provided on output.
- Matches the performance of TC74LCX series when operated at 3.3 V VCC.

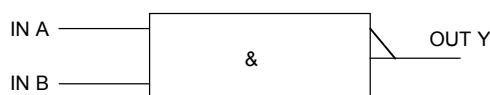
**Marking**

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>	$\pm 50$	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**

Input		Output
A	B	Y
L	L	*Z
L	H	*Z
H	L	*Z
H	H	L

\*: High Impedance

**Recommended Operating Conditions**

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	1.8~5.5	V
		1.5~5.5 (Note 1)	
Input voltage	V <sub>IN</sub>	0~5.5	V
Output voltage	V <sub>OUT</sub>	0~5.5 (Note 2)	V
		0~V <sub>CC</sub> (Note 3)	
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 1: Data retention only

Note 2: OFF state

Note 3: Low state

## Electrical Characteristics

## DC Characteristics

Characteristics		Symbol	Test Condition		V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit		
						Min	Typ.	Max	Min	Max			
Input voltage	High level	V <sub>IH</sub>	—	—	1.8	0.75 × V <sub>CC</sub>	—	—	0.75 × V <sub>CC</sub>	—	V		
					2.3~5.5	0.7 × V <sub>CC</sub>	—	—	0.7 × V <sub>CC</sub>	—			
	Low level	V <sub>IL</sub>	—	—	1.8	—	—	0.25 × V <sub>CC</sub>	—	0.25 × V <sub>CC</sub>			
					2.3~5.5	—	—	0.3 × V <sub>CC</sub>	—	0.3 × V <sub>CC</sub>			
High level output leakage current		I <sub>LKG</sub>	V <sub>IN</sub> = V <sub>IL</sub>		1.8~5.5	—	—	±5	—	±10	μA		
		1.8			—	0	0.1	—	0.1				
Output voltage	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	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:  $t_r = t_f = 3$  ns)

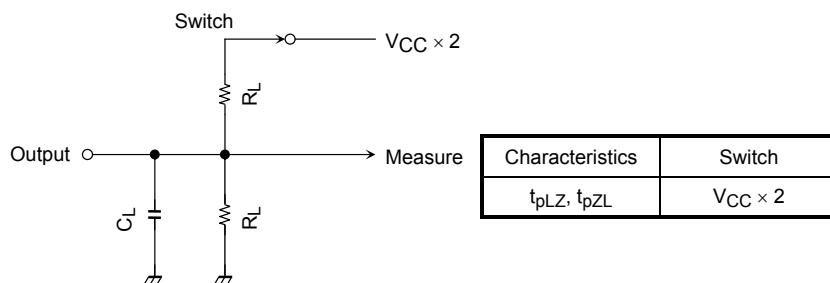
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min	
Propagation delay time	t <sub>pZL</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.65	1.5	6.5	12.7	1.5	13.2
			1.8	1.5	5.4	10.5	1.5	11.0
			2.5 ± 0.2	0.8	3.5	7.0	0.8	7.5
			3.3 ± 0.3	0.8	2.8	5.0	0.8	5.2
			5.0 ± 0.5	0.5	2.2	4.3	0.5	4.5
	t <sub>pLZ</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.65	1.5	5.5	12.7	1.5	13.2
			1.8	1.5	4.6	10.5	1.5	11.0
			2.5 ± 0.2	0.8	3.0	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	1.3	4.3	0.5	4.5
Input capacitance	C <sub>IN</sub>	—	0~5.5	—	4	—	—	— pF
Output capacitance	C <sub>OUT</sub>	—	5.5	—	3	—	—	— pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 4)	3.3	—	6.7	—	—	pF
			5.5	—	13	—	—	

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:

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

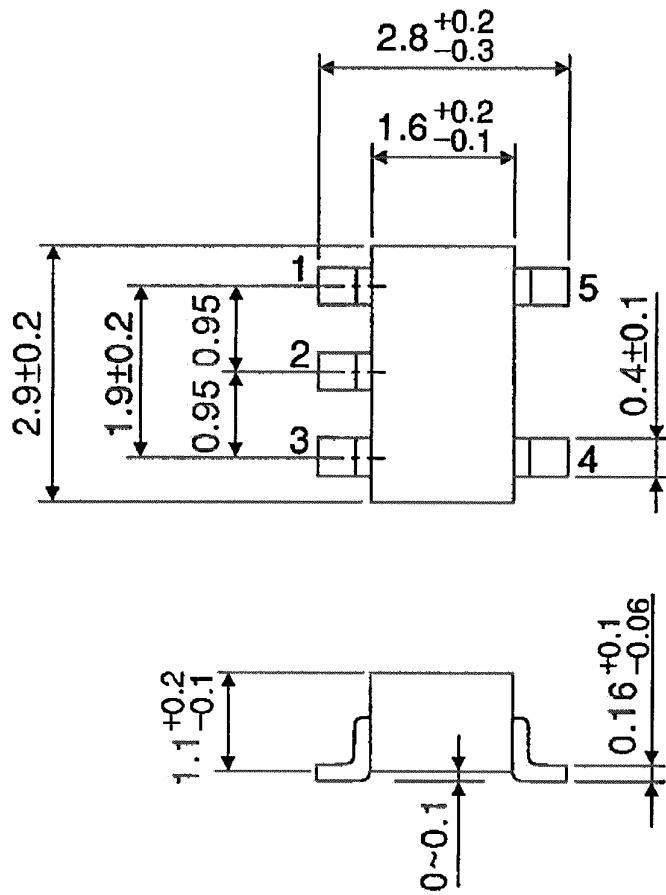
## AC Characteristics Measurement Circuit



## Package Dimensions

SSOP5-P-0.95

Unit : mm

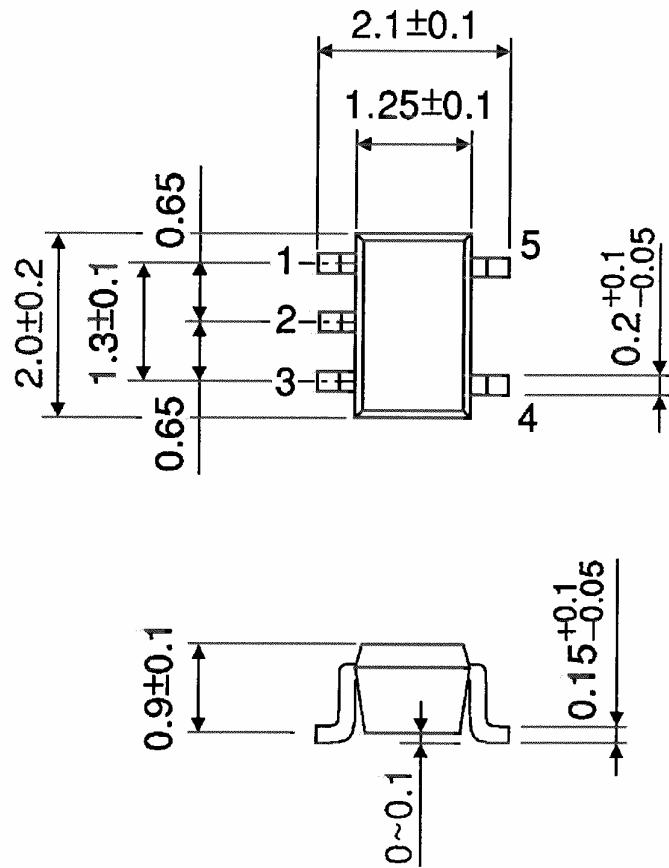


Weight: 0.016 g (typ.)

**Package Dimensions**

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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