

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

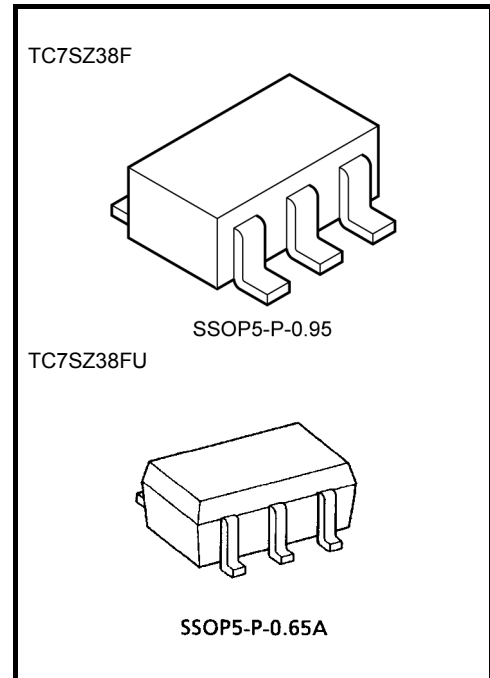
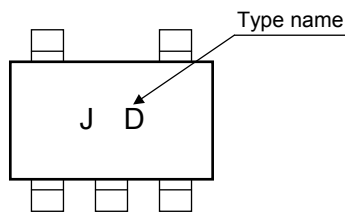
TC7SZ38F, TC7SZ38FU

2-Input NAND Gate(Open Drain Output)

Features

- High output drive: 24 mA (min) @VCC = 3 V
- Super high speed operation:
 $t_{pZ} = 2.2 \text{ ns (typ.) @ } V_{CC} = 5 \text{ V, } 50 \text{ pF}$
- Operation voltage range: $V_{CC (opr)} = 1.80 \sim 5.5 \text{ V}$
- 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

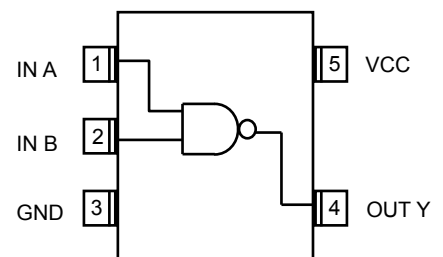


Weight
 SSOP5-P-0.95 : 0.016 g (typ.)
 SSOP5-P-0.65A : 0.006 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

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

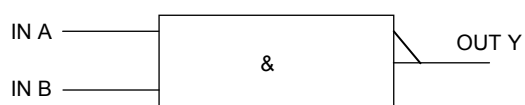
Pin Assignment (top view)



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).

Logic Diagram



Truth Table

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

*: High Impedance

Operating Ranges

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 _{CC} (V)	Min	Typ.	Max	Min		Max	
Input voltage	High level	V _{IH}	—	1.8	0.75 × V _{CC}	—	—	0.75 × V _{CC}	—	V	
				2.3~5.5	0.7 × V _{CC}	—	—	0.7 × V _{CC}	—		
	Low level	V _{IL}	—	1.8	—	—	0.25 × V _{CC}	—	0.25 × V _{CC}		
				2.3~5.5	—	—	0.3 × V _{CC}	—	0.3 × V _{CC}		
High level output leakage current		I _{LKG}	V _{IN} = V _{IL}	1.8~5.5	—	—	±5	—	±10	μA	
Output voltage	Low level	V _{OL}	V _{IN} = V _{IL}	I _{OL} = 100 μA	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 _{OL} = 8 mA	2.3	—	0.1	0.3	—	0.3	
				I _{OL} = 16 mA	3.0	—	0.15	0.4	—	0.4	
				I _{OL} = 24 mA	3.0	—	0.22	0.55	—	0.55	
I _{OL} = 32 mA	4.5	—	0.22	0.55	—	0.55					
Input leakage current		I _{IN}	V _{IN} = 5.5 V or GND	0~5.5	—	—	±1	—	±10	μA	
Power off leakage current		I _{OFF}	V _{IN} or V _{OUT} = 5.5 V	0.0	—	—	1	—	10	μA	
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND	5.5	—	—	2	—	20	μA	

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

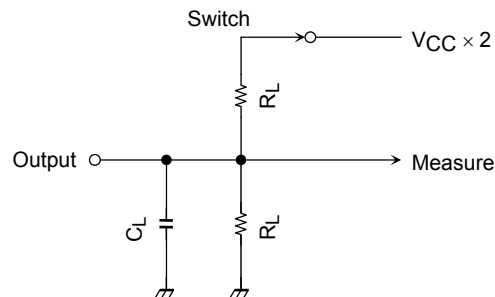
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit	
			V _{CC} (V)	Min	Typ.	Max	Min		Max
Propagation delay time	t _{pZL}	C _L = 50 pF, R _L = 500 Ω	1.65	1.5	6.5	12.7	1.5	13.2	ns
			1.8	1.5	5.4	10.5	1.5	11.0	
			2.5 ± 0.2	0.8	3.5	7.0	0.8	7.5	
			3.3 ± 0.3	0.8	2.8	5.0	0.8	5.2	
			5.0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

Note 4: C_{PD} 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

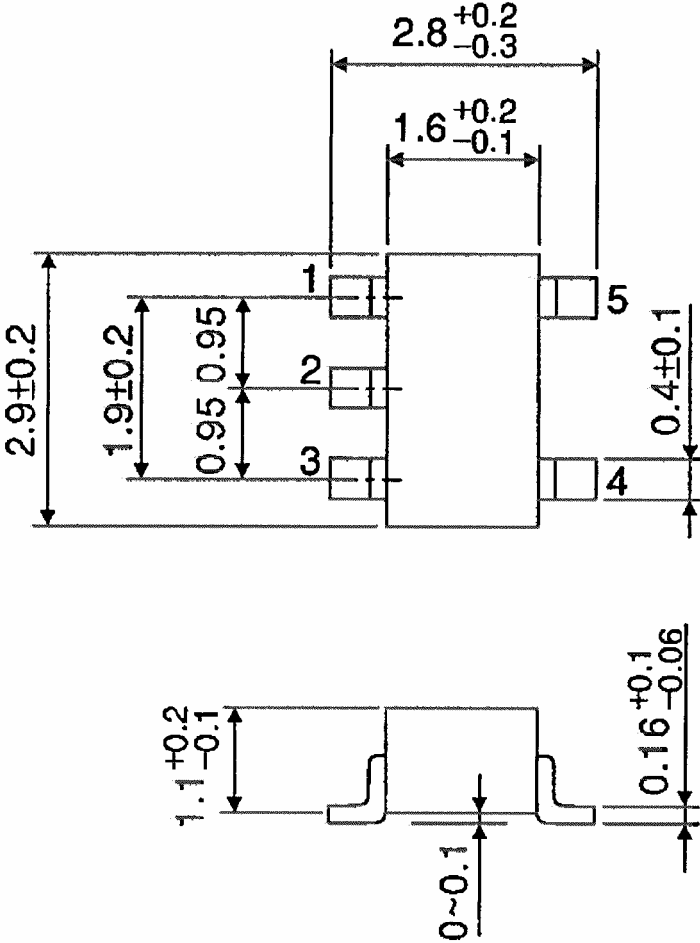


Characteristics	Switch
t _{pLZ} , t _{pZL}	V _{CC} × 2

Package Dimensions

SSOP5-P-0.95

Unit : mm

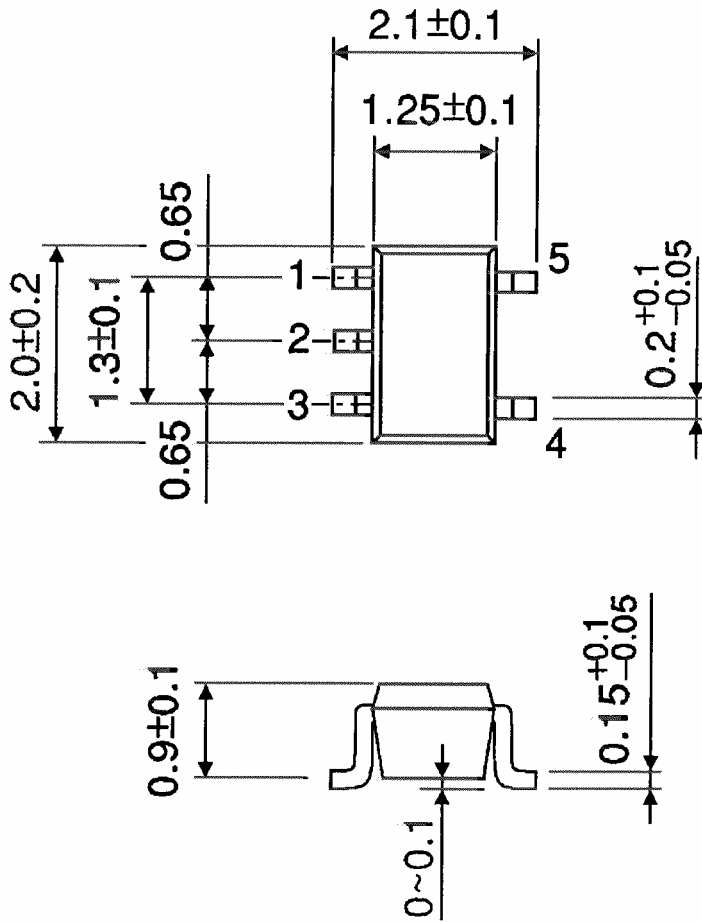


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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