

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

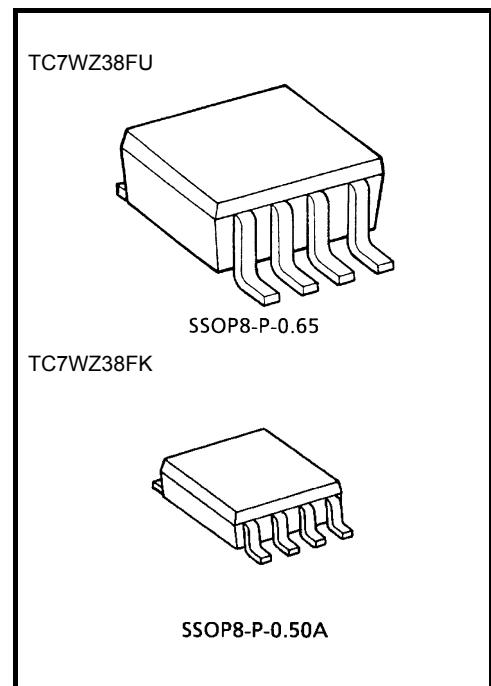
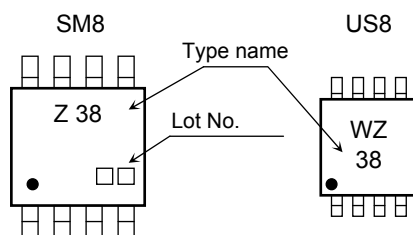
TC7WZ38FU, TC7WZ38FK

Dual 2 Input NAND Gate (Open Drain)

Features

- High output drive: ± 24 mA (min) at $V_{CC} = 3$ V
- Super high speed operation: $t_{pZL} = 2.2$ ns (typ.)
at $V_{CC} = 5$ V, 50 pF
- Operation voltage range: $V_{CC} (opr) = 1.65 \sim 5.5$ 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

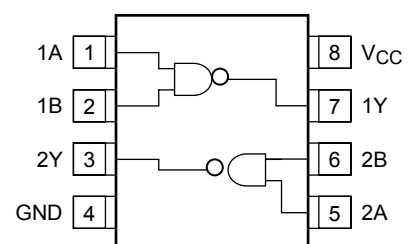


Weight
 SSOP8-P-0.65 : 0.02 g (typ.)
 SSOP8-P-0.50A : 0.01 g (typ.)

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}	$-0.5 \sim 6$	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	300 (SM8) 200 (US8)	mW
Storage temperature	T_{stg}	$-65 \sim 150$	$^\circ\text{C}$
Lead temperature (10s)	T_L	260	$^\circ\text{C}$

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.).

Truth Table

A	B	Y
L	L	*H
L	H	*H
H	L	*H
H	H	L

* : High impedance

Logic Diagram



Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V _{CC}	1.65~5.5	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	d _t /d _v	0~20 (V _{CC} = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V)	ns/V
		0~10 (V _{CC} = 3.3 V ± 0.3 V)	
		0~5 (V _{CC} = 5.5 V ± 0.5 V)	

Note 1: Data retention only

Note 2: V_{CC} = 0 V

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}	—		1.65~1.95	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}	—		1.65~1.95	—	—	0.25 × V _{CC}	—	0.25 × V _{CC}	
					2.3~5.5	—	—	0.3 × V _{CC}	—	0.3 × V _{CC}	
Output voltage	Low level	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 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 _{OL} = 4 mA	1.65	—	0.08	0.24	—	0.24	
				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	—	
Off-state current		I _{OZ}	V _{IN} = V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±5	—	±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} = 5.5 V or GND		1.65~5.5	—	—	1	—	10	μA

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

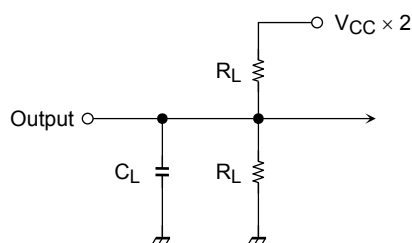
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max
Propagation delay time	t _{pZL}	C _L = 50 pF, R _L = 500 Ω	1.8 ± 0.15	2.0	5.2	9.2	2.0	9.6
			2.5 ± 0.2	1.5	3.5	5.7	1.5	6.1
			3.3 ± 0.3	1.0	2.8	4.1	1.0	4.5
			5.0 ± 0.5	0.5	2.2	3.4	0.5	3.6
	t _{pLZ}	C _L = 50 pF, R _L = 500 Ω	1.8 ± 0.15	2.0	4.6	9.2	2.0	9.6
			2.5 ± 0.2	1.5	3.2	5.7	1.5	6.1
			3.3 ± 0.3	1.0	2.4	4.1	1.0	4.5
			5.0 ± 0.5	0.5	1.6	3.4	0.5	3.6
Input capacitance	C _{IN}	—	0~5.5	—	3.0	—	—	pF
Output capacitance	C _{OUT}	—	0~5.5	—	2.5	—	—	pF
Power dissipation capacitance	C _{PD}	(Note 4)	3.3	—	6.9	—	—	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.

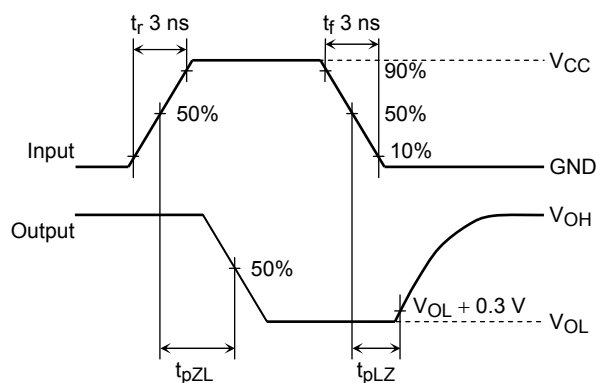
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

Test Circuit



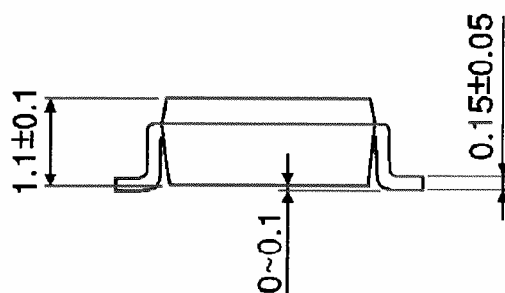
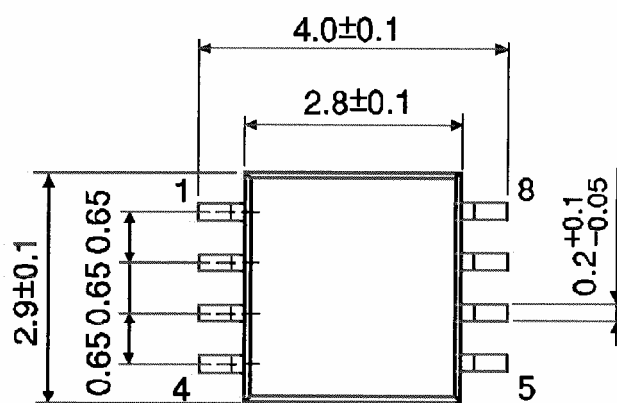
AC Waveform



Package Dimensions

SSOP8-P-0.65

Unit : mm

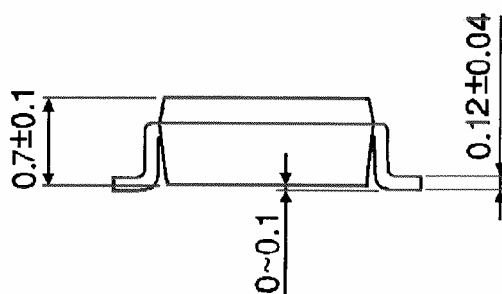
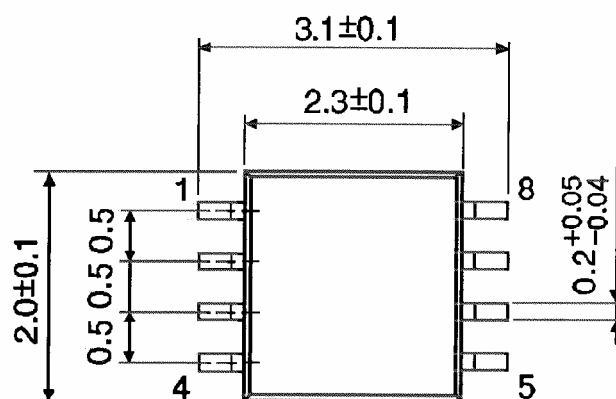


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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20070701-EN GENERAL

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