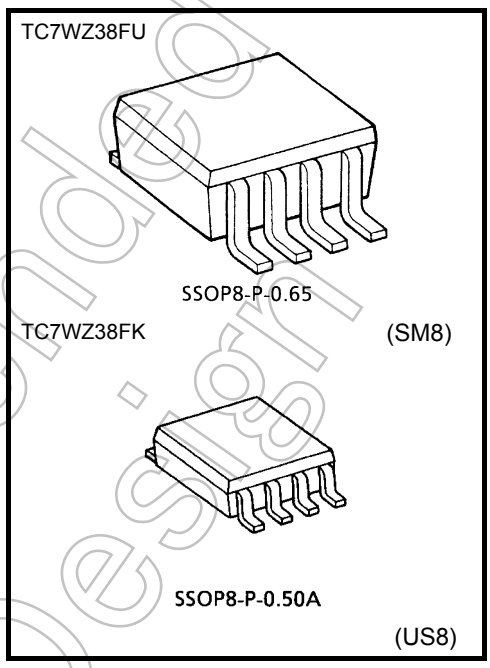
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7WZ38FU, TC7WZ38FK

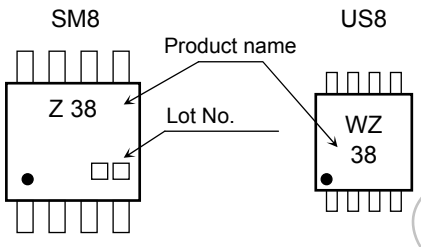
Dual 2 Input NAND Gate (Open Drain)



Features

- High output current: 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 to 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

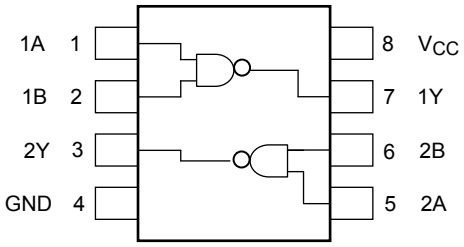


Weight
SSOP8-P-0.65 : 0.02 g (typ.)
SSOP8-P-0.50A : 0.01 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	−0.5 to 6	V
DC input voltage	V_{IN}	−0.5 to 6	V
DC output voltage	V_{OUT}	−0.5 to 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}	±50	mA
Power dissipation	P_D	300 (SM8) 200 (US8)	mW
Storage temperature	T_{stg}	−65 to 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).

Note 1: Do not exceed I_{OUT} of absolute maximum ratings.

Note 2: V_{OUT} < GND

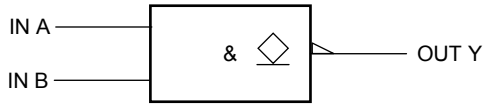
Start of commercial production
2000-08

Truth Table

A	B	Y
L	L	Z
L	H	Z
H	L	Z
H	H	L

Z: High impedance

IEC Logic Symbol



Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.65 to 5.5	V
		1.5 to 5.5 (Note 3)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 4)	V
		0 to V_{CC} (Note 5)	
Operating temperature	T_{opr}	−40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 (V_{CC} = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V)	ns/V
		0 to 10 (V_{CC} = 3.3 V ± 0.3 V)	
		0 to 5 (V_{CC} = 5.0 V ± 0.5 V)	

Note 3: Data retention only

Note 4: OFF state

Note 5: Low state

Electrical Characteristics

DC Characteristics

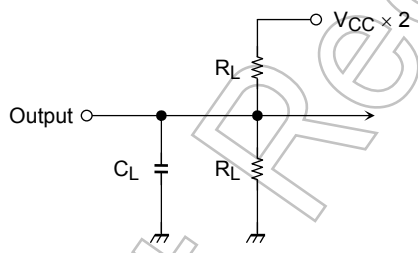
Characteristics		Symbol	Test Condition		V_{CC} (V)	Ta = 25°C			Ta = −40 to 85°C		Unit
						Min	Typ.	Max	Min	Max	
Input voltage	High level	V_{IH}	—		1.65 to 1.95	V_{CC} × 0.75	—	—	V_{CC} × 0.75	—	V
					2.3 to 5.5	V_{CC} × 0.7	—	—	V_{CC} × 0.7	—	
	Low level	V_{IL}	—		1.65 to 1.95	—	—	V_{CC} × 0.25	—	V_{CC} × 0.25	
					2.3 to 5.5	—	—	V_{CC} × 0.3	—	V_{CC} × 0.3	
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 to 5.5	—	—	±1	—	±10	μA
Off-state carent		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 to 5.5	—	—	1	—	10	μA

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

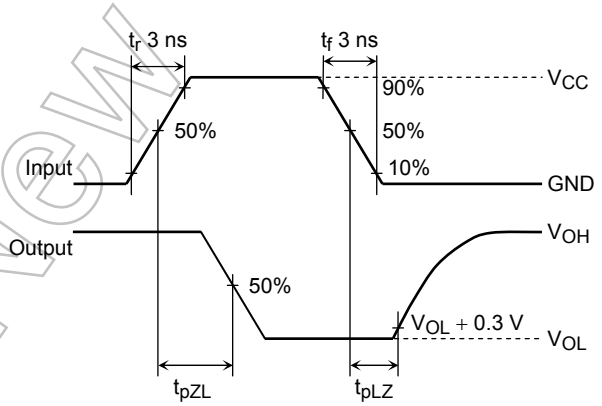
Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pZL}	C_L = 50 pF, R_L = 500 Ω	1.8 ± 0.15	2.0	5.2	9.2	2.0	9.6	ns
			2.5 ± 0.2	1.5	3.5	5.7	1.5	6.1	
			3.3 ± 0.3	1.0	2.8	4.1	1.0	4.5	
			5.0 ± 0.5	0.5	2.2	3.4	0.5	3.6	
	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 to 5.5	—	3.0	—	—	—	pF
Output capacitance	C_{OUT}	—	0 to 5.5	—	2.5	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 6)	3.3	—	6.9	—	—	—	pF
			5.5	—	13	—	—	—	

Note 6: 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:
$I_{CC\ (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$

Test Circuit

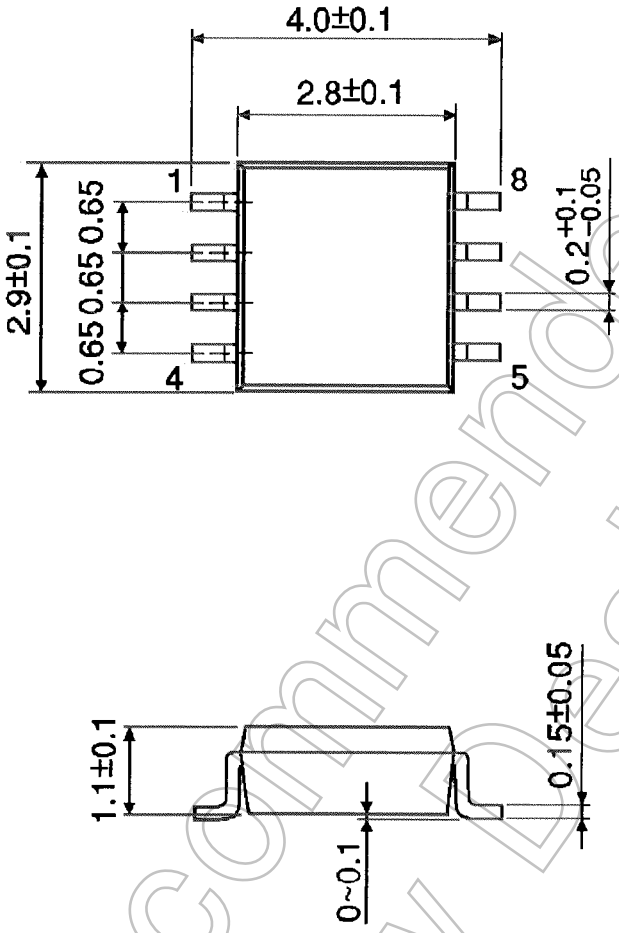


AC Waveform



Package Dimensions

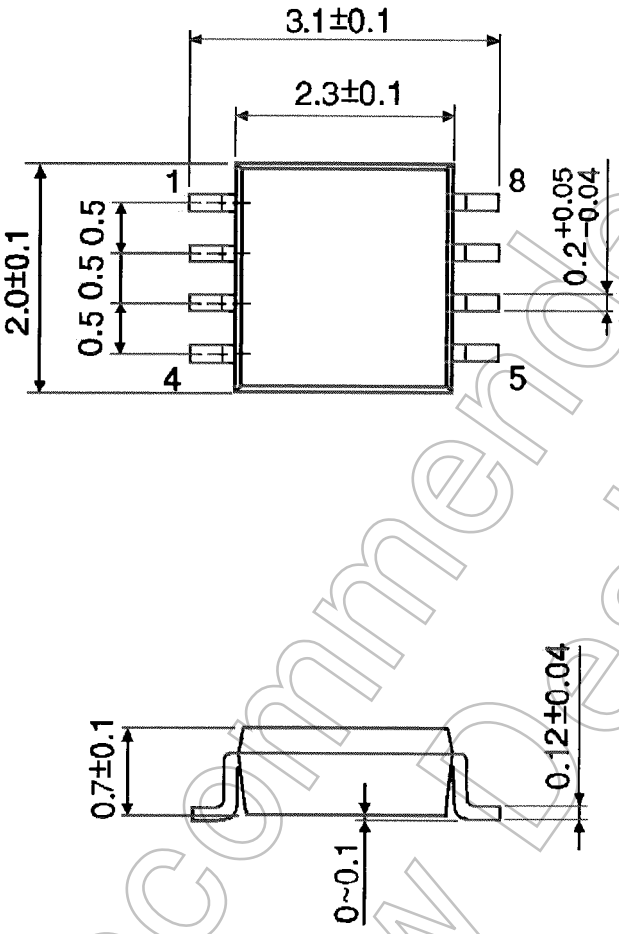
SSOP8-P-0.65 Unit : mm



Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A Unit : mm



Weight: 0.01 g (typ.)

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