

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

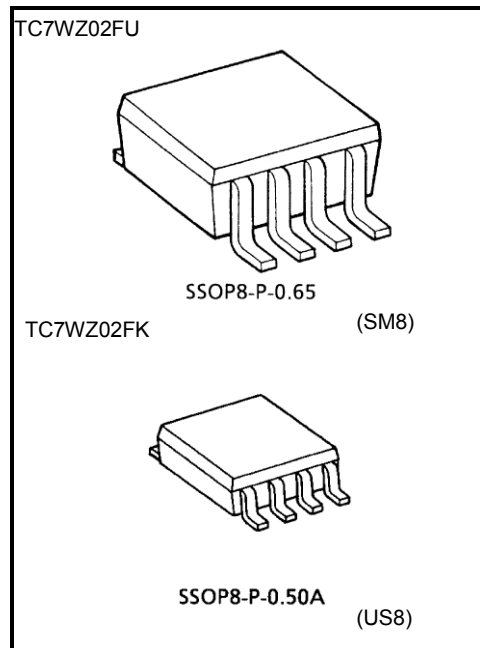
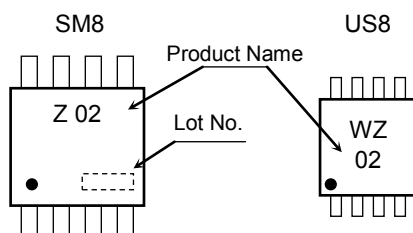
## TC7WZ02FU, TC7WZ02FK

Dual 2-Input NOR Gate

### Features

- High output current :  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation :  $t_{pd} = 2.4$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operating voltage range :  $V_{CC} = 1.65$  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

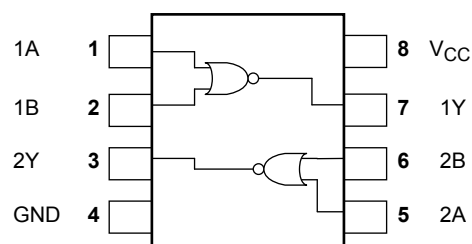


Weight  
SSOP8-P-0.65 : 0.02 g (typ.)  
SSOP8-P-0.50A : 0.01 g (typ.)

### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
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
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note 3)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	300 (SM8)200 (US8)	mW
Storage temperature	$T_{stg}$	-65 to 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).

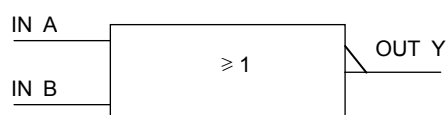
Note 1:  $V_{CC} = 0$  V

Note 2: High or Low state. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

Start of commercial production  
2000-08

## IEC Logic Symbol



## Truth Table

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

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	1.65 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	V <sub>IN</sub>	0 to 5.5	V
Output voltage	V <sub>OUT</sub>	0 to 5.5 (Note 5)	V
		0 to V <sub>CC</sub> (Note 6)	
Operating temperature	T <sub>opr</sub>	−40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 (V <sub>CC</sub> = 1.80 V ± 0.15 V, 2.5 V ± 0.2 V)	ns/V
		0 to 10 (V <sub>CC</sub> = 3.3 V ± 0.3 V)	
		0 to 5 (V <sub>CC</sub> = 5.0 V ± 0.5 V)	

Note 4: Data retention only

Note 5: V<sub>CC</sub> = 0 V

Note 6: High or low state

**Electrical Characteristics**
**DC Characteristics**

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit							
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max						
Input voltage	High level	V <sub>IH</sub>	—	1.65 to 1.95	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V							
				2.3 to 5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—								
	Low level	V <sub>IL</sub>	—	1.65 to 1.95	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25								
				2.3 to 5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3								
Output voltage	High level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	1.65	1.55	1.65	—	1.55	—	V						
					2.3	2.2	2.3	—	2.2	—							
					3.0	2.9	3.0	—	2.9	—							
					4.5	4.4	4.5	—	4.4	—							
				I <sub>OH</sub> = -4 mA	1.65	1.29	1.52	—	1.29	—							
					I <sub>OH</sub> = -8 mA	2.3	1.9	2.15	—	1.9		—					
					I <sub>OH</sub> = -16 mA	3.0	2.4	2.8	—	2.4		—					
					I <sub>OH</sub> = -24 mA	3.0	2.3	2.68	—	2.3		—					
					I <sub>OH</sub> = -32 mA	4.5	3.8	4.2	—	3.8		—					
					Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	1.65	—		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 <sub>OL</sub> = 4 mA	1.65	—	0.08				0.24	—	0.24							
		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 to 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> = 5.5 V or GND		1.65 to 5.5		—	—	1	—	10	μA

**AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3 \text{ ns}$ )**

Characteristics	Symbol	Test Condition	Ta = 25°C				Ta = −40 to 85°C		Unit
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.8 ± 0.15	2.0	5.4	9.8	2.0	10.0	ns
			2.5 ± 0.2	1.2	3.3	5.4	1.2	5.8	
			3.3 ± 0.3	0.8	2.5	3.8	0.8	4.1	
			5.0 ± 0.5	0.5	2.0	3.0	0.5	3.3	
		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	3.3 ± 0.3	1.2	3.1	4.6	1.2	5.0	
			5.0 ± 0.5	0.8	2.4	3.7	0.8	4.0	
Input capacitance	C <sub>IN</sub>	—	0 to 5.5	—	3.0	—	—	—	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 7)	3.3	—	18	—	—	—	pF
			5.5	—	24	—	—	—	

Note 7: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

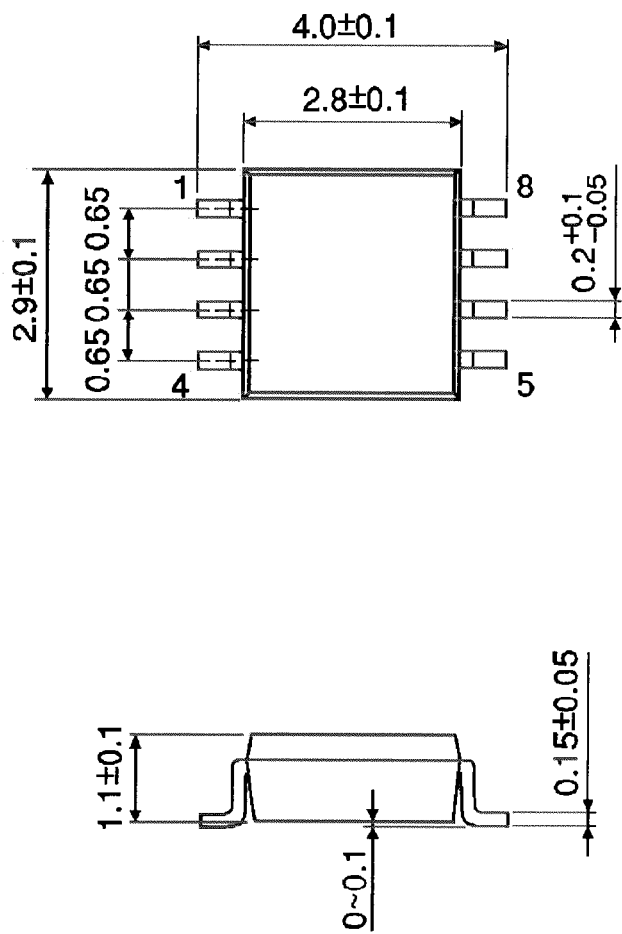
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP8-P-0.65

Unit : mm

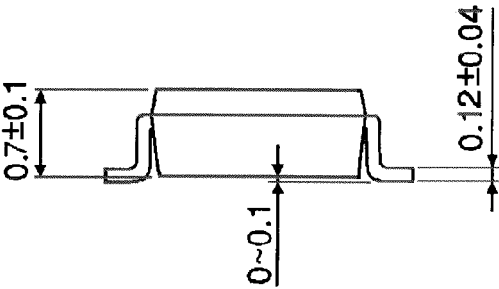
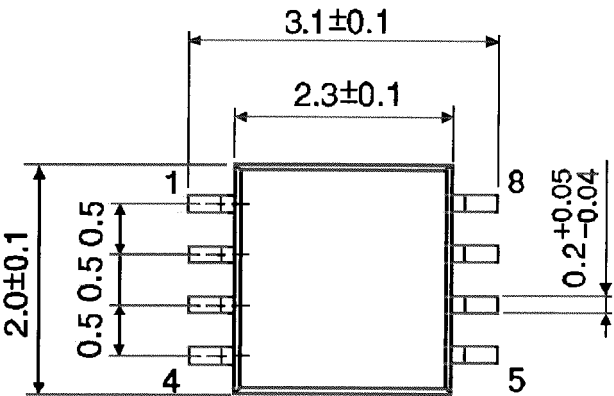


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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