

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

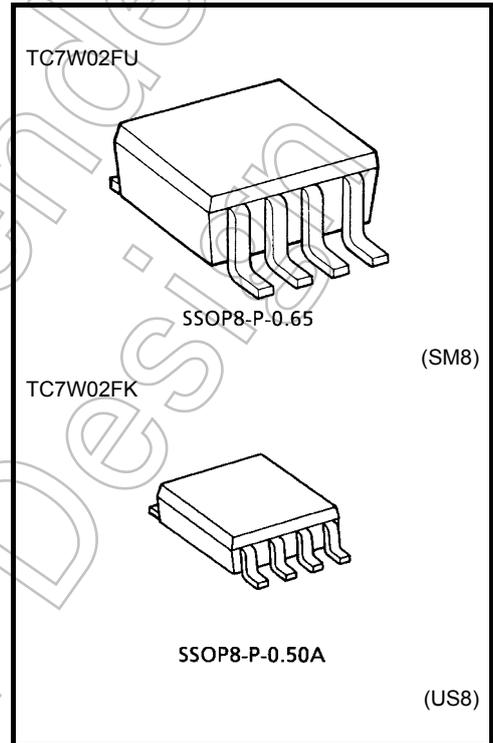
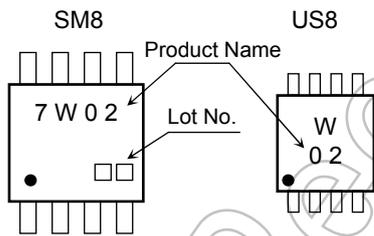
# TC7W02FU, TC7W02FK

## Dual 2-Input NOR Gate

### Features

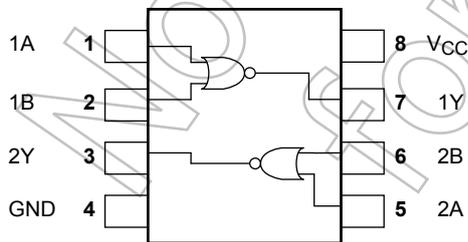
- High Speed :  $t_{pd} = 6\text{ns}$  (typ.) at  $V_{CC} = 5\text{V}$
- Low power dissipation :  $I_{CC} = 1\mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity :  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Output drive capability : 10 LSTTL Loads
- Symmetrical Output Impedance :  $|I_{OH}| = I_{OL} = 4\text{mA}$  (min)
- Balanced propagation delays :  $t_{pLH} \cong t_{pHL}$
- Wide operating voltage range :  $V_{CC} = 2$  to  $6\text{V}$

### Marking



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

### Pin Assignment (top view)



Start of commercial production  
1991-09

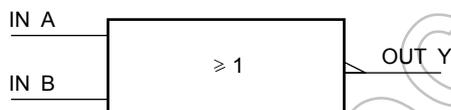
## Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	-0.5 to 7.0	V
DC input voltage	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
DC output voltage	V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> + 0.5	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>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±25	mA
Power dissipation	P <sub>D</sub>	300 (SM8)	mW
		200 (US8)	
Storage temperature	T <sub>stg</sub>	-65 to 150	°C
Lead temperature (10 s)	T <sub>L</sub>	260	°C

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).

## 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>	2.0 to 6.0	V
Input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub>	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-40 to 85	°C
Input rise and fall time	t <sub>r</sub> , t <sub>f</sub>	0 to 1000 (V <sub>CC</sub> = 2.0 V)	ns
		0 to 500 (V <sub>CC</sub> = 4.5 V)	
		0 to 400 (V <sub>CC</sub> = 6.0 V)	

## 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
High-level input voltage	V <sub>IH</sub>	—		2.0	1.5	—	—	1.5	V	
				4.5	3.15	—	—	3.15		—
				6.0	4.2	—	—	4.2		—
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.5	—	V	
				4.5	—	—	1.35	—		1.35
				6.0	—	—	1.8	—		1.8
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2.0	1.9	2.0	—	1.9	V	
				4.5	4.4	4.5	—	4.4		—
				6.0	5.9	6.0	—	5.9		—
				I <sub>OH</sub> = -4 mA	4.5	4.18	4.31	—		4.13
I <sub>OH</sub> = -5.2 mA	6.0	5.68	5.80	—	5.63	—				
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2.0	—	0.0	0.1	—	V	
				4.5	—	0.0	0.1	—		0.1
				6.0	—	0.0	0.1	—		0.1
				I <sub>OL</sub> = 4 mA	4.5	—	0.17	0.26		—
I <sub>OL</sub> = 5.2 mA	6.0	—	0.18	0.26	—	0.33				
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	1.0	—	10.0	μA

Not Recommended for New

**AC Characteristics (C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C)**

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			Min	Typ.	Max	
Output Transition Time	t <sub>TLH</sub>	—	—	4	8	ns
	t <sub>THL</sub>	—	—	4	8	
Propagation Delay Time	t <sub>pLH</sub>	—	—	6	12	ns
	t <sub>pHL</sub>	—	—	6	12	

**AC Characteristics (C<sub>L</sub> = 50pF, Input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)**

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Output Transition Time	t <sub>TLH</sub>	—	2.0	—	25	75	—	95	ns
	t <sub>THL</sub>		4.5	—	7	15	—	19	
			6.0	—	6	13	—	16	
Propagation delay time	t <sub>pLH</sub>	—	2.0	—	25	75	—	95	ns
	t <sub>pHL</sub>		4.5	—	9	15	—	19	
			6.0	—	8	13	—	16	
Input capacitance	C <sub>IN</sub>	—	—	5	10	—	10	pF	
Power dissipation capacitance	C <sub>PD</sub>	(Note 1)	—	21	—	—	—	pF	

Note 1: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

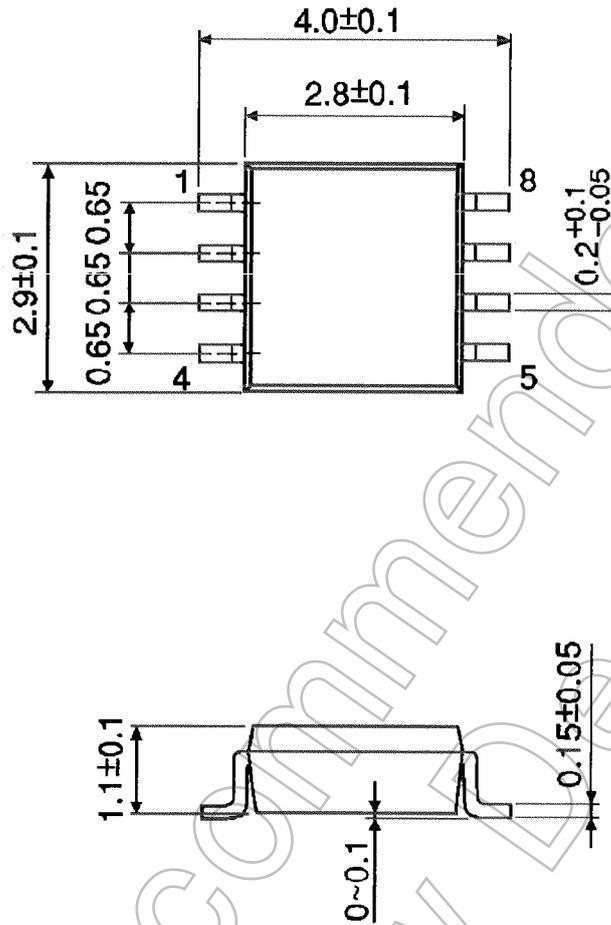
Average operating current can be obtained by the equation:

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

**Package Dimensions**

SSOP8-P-0.65

Unit : mm



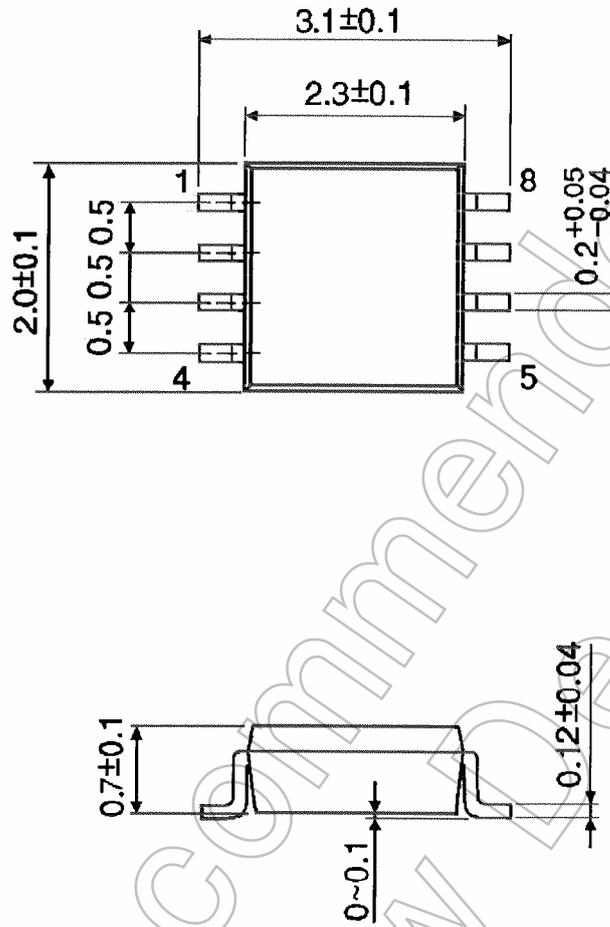
Weight: 0.02 g (typ.)

Not Recommended for New Design

**Package Dimensions**

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

Not Recommended for New Design

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