

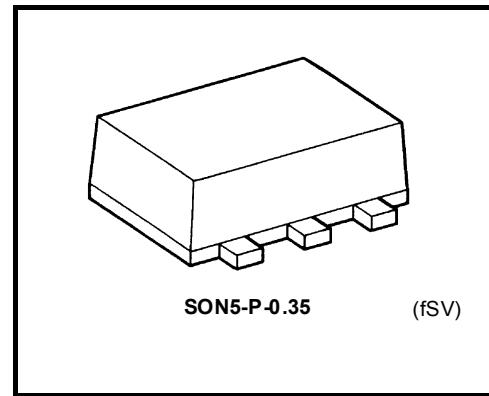
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7SZ02AFS

## 2-Input NOR Gate

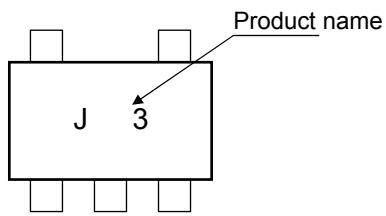
### Features

- High output current :  $\pm 24$  mA (min) at  $V_{CC} = 3.0$  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.

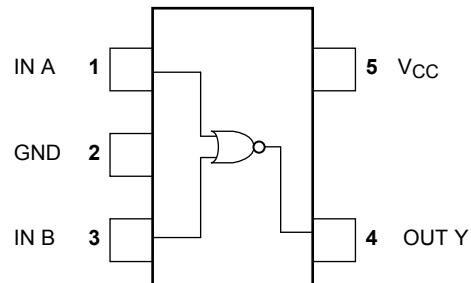


Weight : 0.001 g (typ.)

### Marking



### Pin Assignment (top view)



### 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 $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	$\pm 20$ (Note 1)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	50	mW
Storage temperature	$T_{stg}$	-65 to 150	°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).

Note 1:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

**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 2)	
Input voltage	V <sub>IN</sub>	0 to 5.5	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	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 2: Data retention only

## Electrical Characteristics

## DC Characteristics

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to 85°C		Unit	
				Min	Typ.	Max	Min	Max		
High-level input voltage	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 input voltage	V <sub>IL</sub>	—	1.65 to 1.95	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25	V	
			2.3 to 5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
High-level output voltage	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		
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	1.65	—	0	0.1	—	V	
				2.3	—	0	0.1	—		
				3.0	—	0	0.1	—		
				4.5	—	0	0.1	—		
			I <sub>OL</sub> = 4 mA	1.65	—	0.08	0.24	—		
			I <sub>OL</sub> = 8 mA	2.3	—	0.1	0.3	—		
			I <sub>OL</sub> = 16 mA	3.0	—	0.15	0.4	—		
			I <sub>OL</sub> = 24 mA	3.0	—	0.22	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
	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:  $t_r = t_f = 3$  ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min	
Propagation delay time	t <sub>pLH</sub>	$C_L = 15$ pF, $R_L = 1$ MΩ	1.80 ± 0.15	2.0	5.3	9.6	2.0	9.8
			2.5 ± 0.2	0.8	3.2	5.3	0.8	5.7
			3.3 ± 0.3	0.5	2.4	3.7	0.5	4.0
			5.0 ± 0.5	0.5	1.9	2.9	0.5	3.2
	t <sub>pHL</sub>	$C_L = 50$ pF, $R_L = 500$ Ω	3.3 ± 0.3	1.5	3.0	4.6	1.5	4.9
			5.0 ± 0.5	0.8	2.4	3.6	0.8	3.9
Input capacitance	C <sub>IN</sub>	—	0 to 5.5	—	4	—	—	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 3)	3.3	—	19	—	—	pF
			5.5	—	27	—	—	

Note 3: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

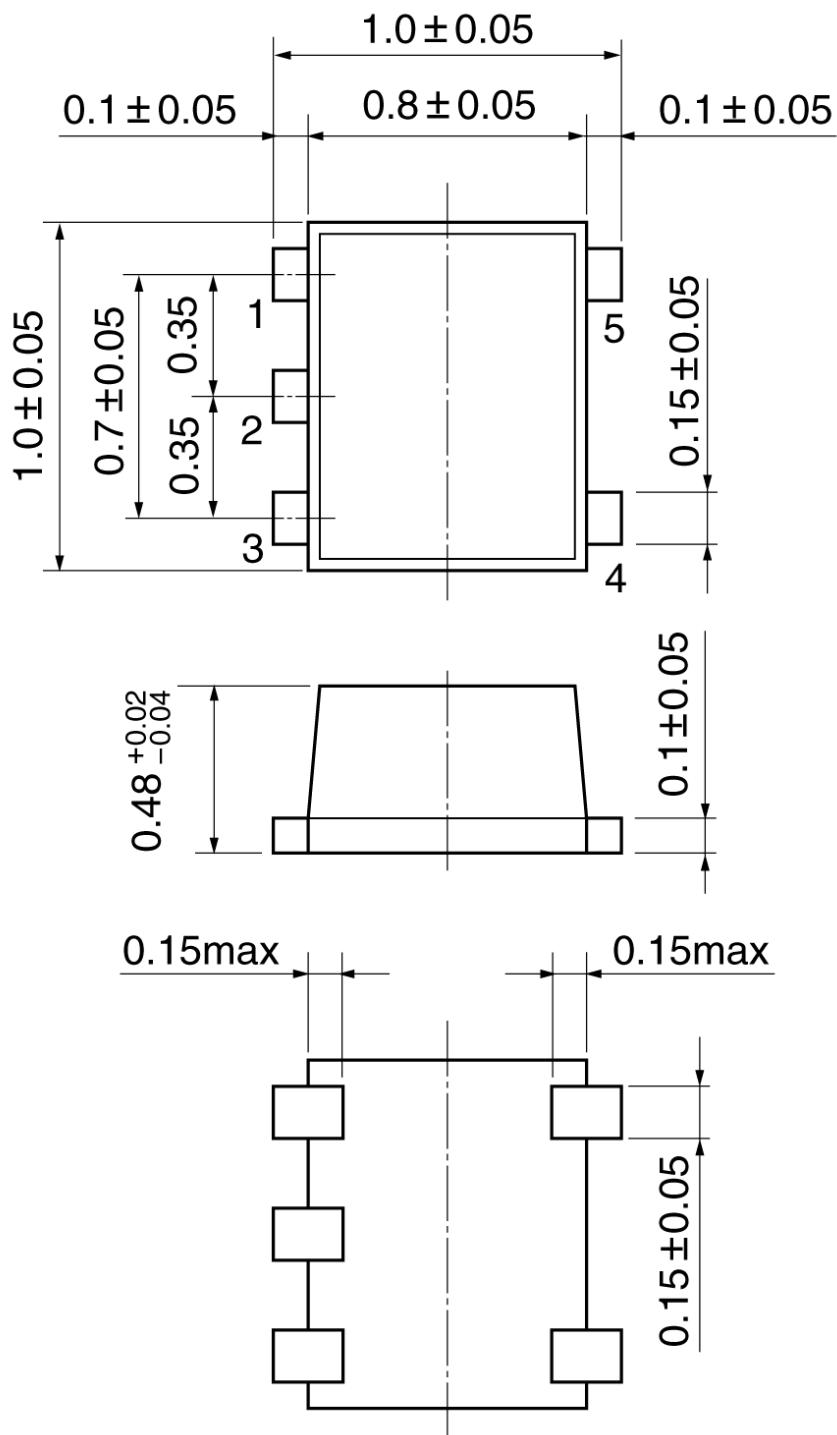
Average operating current can be obtained by the equation.

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

**Package Dimensions**

SON5-P-0.35

Unit: mm



Weight: 0.001 g (typ.)

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