

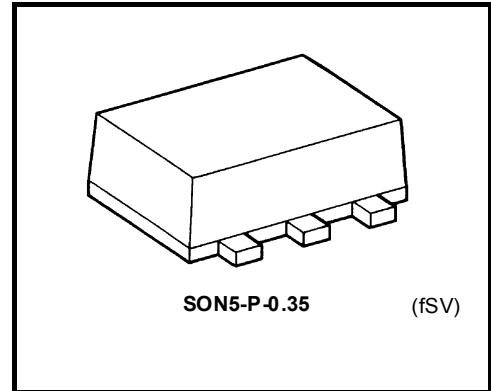
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7SZ02AFS

## 2-Input NOR Gate

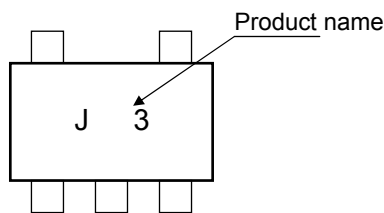
### Features

- High output current :  $\pm 24$  mA (min) at  $V_{CC} = 3.0V$
- Super high speed operation :  $t_{pd} = 2.4ns$  (typ.)  
at  $V_{CC} = 5V, 50pF$
- Operating voltage range :  $V_{CC} = 1.65$  to  $5.5V$
- 5.5-V tolerant inputs.

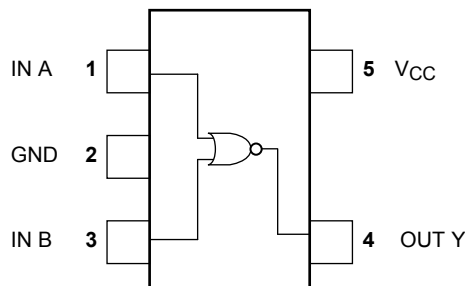


Weight : 0.001 g (typ.)

### Marking



### Pin Assignment (top view)



### Absolute Maximum Ratings (Ta = 25°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	$V_{CC}$	1.65 to 5.5	V
		1.5 to 5.5 (Note 2)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 ( $V_{CC} = 1.80\text{ V} \pm 0.15\text{ V}, 2.5\text{ V} \pm 0.2\text{ V}$ )	ns/V
		0 to 10 ( $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ )	
		0 to 5 ( $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ )	

Note 2: Data retention only

## 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>	—	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	—	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 <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	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA	
			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>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.80 ± 0.15	2.0	5.3	9.6	2.0	9.8	ns
			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 <sub>L</sub> = 50 pF, R <sub>L</sub> = 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.

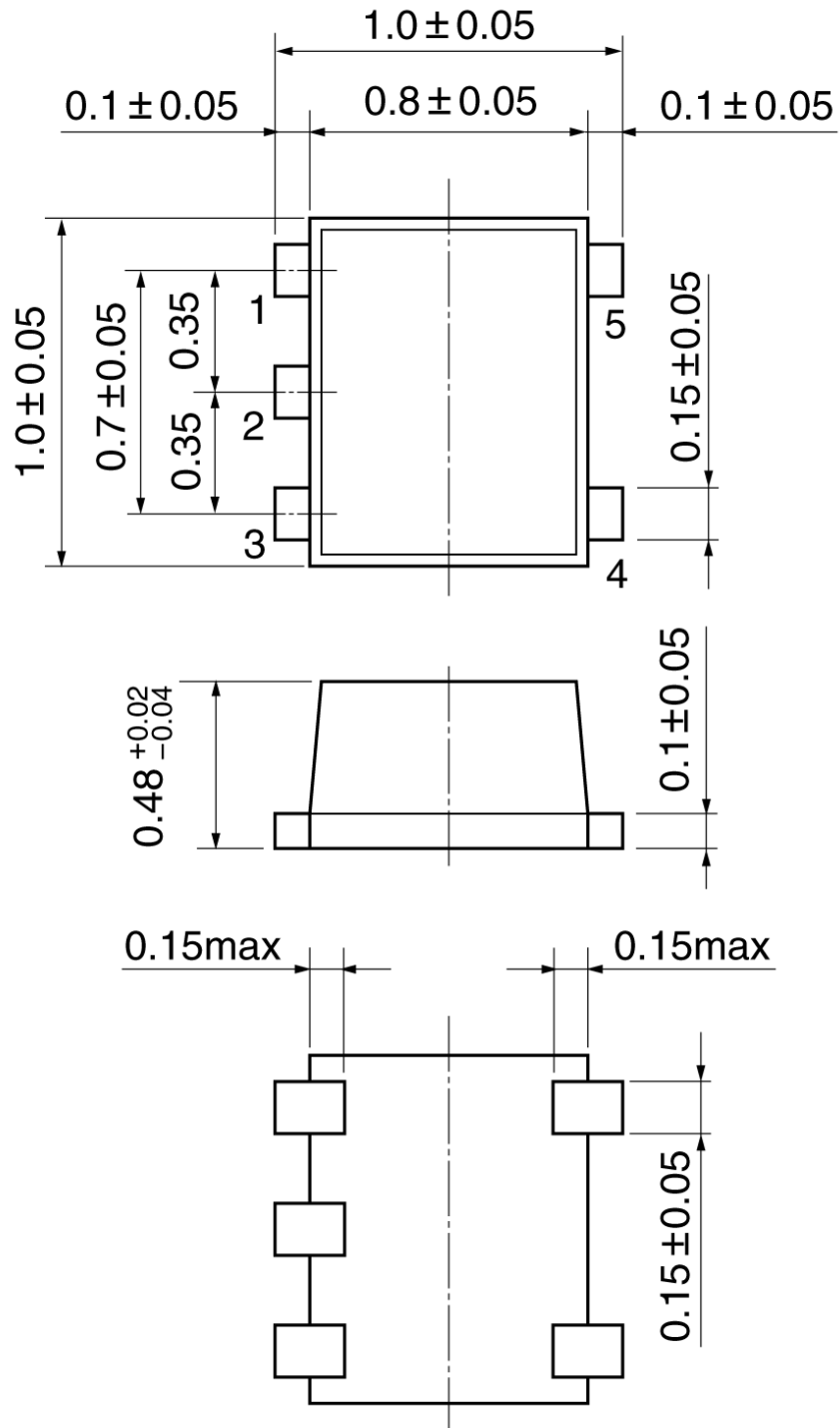
Average operating current can be obtained by the equation.

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

## Package Dimensions

SON5-P-0.35

Unit: mm



Weight: 0.001 g (typ.)

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