

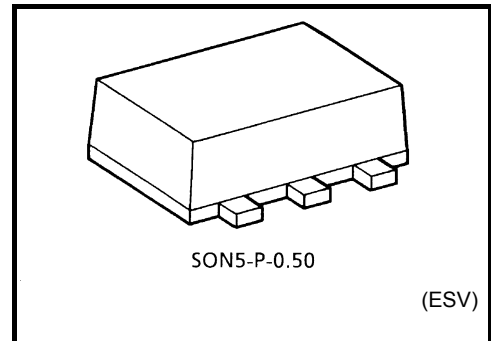
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SZ02FE

2-Input NOR Gate

Features

- High output current : $\pm 24\text{mA}$ (min) at $V_{CC} = 3\text{V}$
- Super high speed operation : $t_{pd} = 2.4\text{ ns}$ (typ.)
at $V_{CC} = 5\text{V}$, 50 pF
- Operating voltage range : $V_{CC} = 1.65\text{ to }5.5\text{ V}$
- 5.5-V tolerant inputs
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at $3.3\text{-V } V_{CC}$

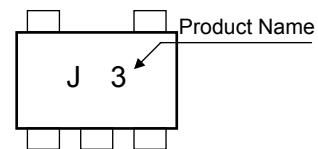


Weight: 0.003 g (typ.)

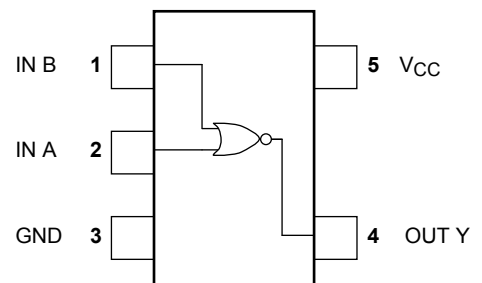
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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 (Note1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	-20 (Note3)	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	150	mW
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$

Marking



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: $V_{CC} = 0\text{V}$

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

Note 3: $V_{OUT} < \text{GND}$

Start of commercial production
2009-01

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 4)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 5)	V
		0 to V_{CC} (Note 6)	
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 4: Data retention only

Note 5: $V_{CC} = 0\text{ V}$

Note 6: High or Low State

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			V _{CC} (V)	Min	Typ.	Max	Min		Max	
High-level input voltage	V _{IH}	—	1.65 to 1.95	$V_{CC} \times 0.75$	—	—	$V_{CC} \times 0.75$	—	V	
			2.3 to 5.5	$V_{CC} \times 0.7$	—	—	$V_{CC} \times 0.7$	—		
Low-level input voltage	V _{IL}	—	1.65 to 1.95	—	—	$V_{CC} \times 0.25$	—	$V_{CC} \times 0.25$	V	
			2.3 to 5.5	—	—	$V_{CC} \times 0.3$	—	$V_{CC} \times 0.3$		
High-level output voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -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 _{OH} = -4 mA	1.65	1.29	1.52	—	1.29	—	
				2.3	1.9	2.15	—	1.9	—	
				3.0	2.4	2.8	—	2.4	—	
				4.5	3.8	4.2	—	3.8	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	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	
				2.3	—	0.1	0.3	—	0.3	
				3.0	—	0.15	0.4	—	0.4	
				4.5	—	0.22	0.55	—	0.55	
I _{OL} = 8 mA	1.65	—	0.15	0.4	—	0.4				
	2.3	—	0.22	0.55	—	0.55				
	3.0	—	0.22	0.55	—	0.55				
	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	
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} = V _{CC} or GND	1.65 to 5.5	—	—	2	—	20	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 _{pLH}	C _L = 15 pF, R _L = 1 MΩ	1.80 ± 0.15	2.0	4.4	9.5	2.0	10.0	ns
			2.5 ± 0.2	0.8	2.9	6.5	0.8	7.0	
	t _{pHL}		3.3 ± 0.3	0.5	2.3	4.5	0.5	4.7	
	5.0 ± 0.5		0.5	1.9	3.9	0.5	4.1		
	C _L = 50 pF, R _L = 500 Ω		3.3 ± 0.3	1.5	2.9	5.0	1.5	5.2	
			5.0 ± 0.5	0.8	2.4	4.3	0.8	4.5	
Input capacitance	C _{IN}	—	0 to 5.5	—	4	—	—	pF	
Power dissipation capacitance	C _{PD}	(Note 7)	3.3	—	18	—	—	—	pF
			5.5	—	24	—	—	—	

Note 7: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

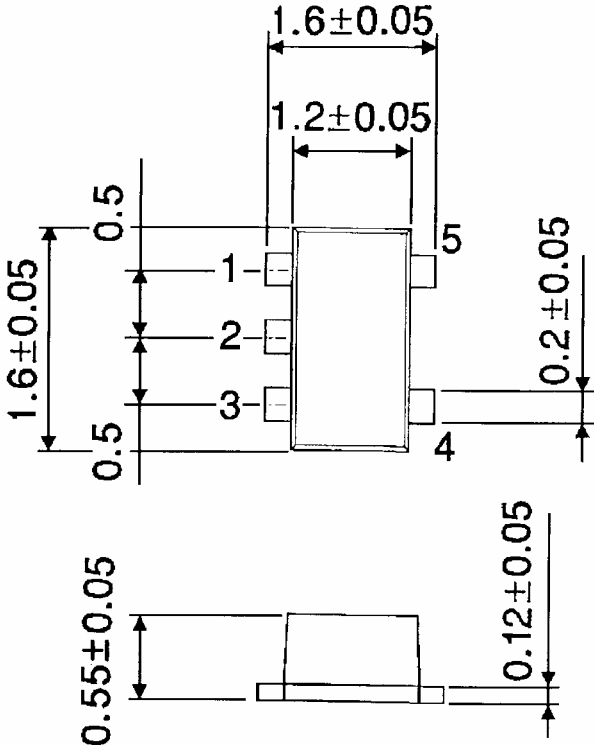
Average operating current can be obtained by the equation.

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

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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