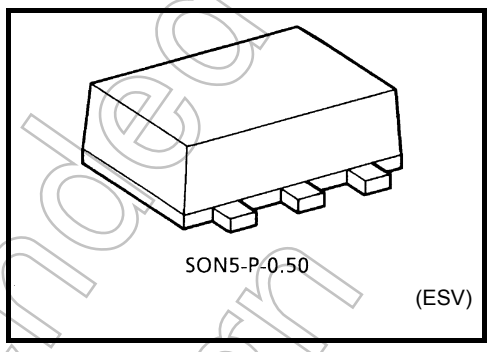
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SH02FE

2-Input NOR Gate

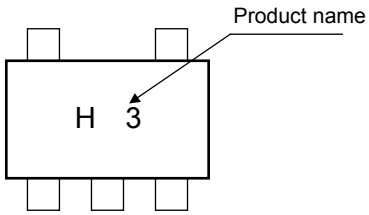
Features

- High speed operation : t_{pd} = 3.6 ns (typ.) at V_{CC} = 5V, 15pF
- Low power dissipation : I_{CC} = 2 μA (max) at Ta = 25°C
- High noise immunity : $V_{NIH} = V_{NIL}$ =28% V_{CC} (min)
- 5.5V tolerant inputs
- Wide operating voltage range : V_{CC} = 2 to 5.5V

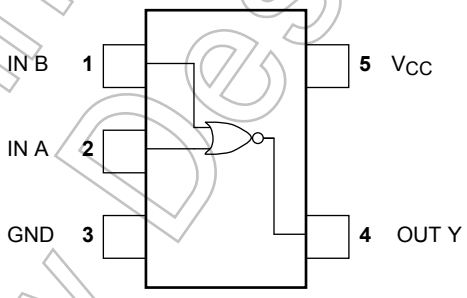


Weight: 0.003 g (typ.)

Marking



Pin Assignment (top view)



Absolute Maximum Ratings (Ta = 25°C)

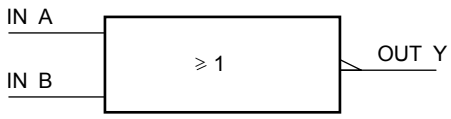
Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	− 0.5 to 7	V
DC input voltage	V_{IN}	− 0.5 to 7	V
DC output voltage	V_{OUT}	− 0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}	− 20	mA
Output diode current	I_{OK}	± 20 (Note 1)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC}/ground current	I_{CC}	± 50	mA
Power dissipation	P_D	150	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).

Note1: V_{OUT} < GND, V_{OUT} > V_{CC}

Start of commercial production
2003-09

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}	2 to 5.5	V
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 100 (V_{CC} = 3.3 V ± 0.3 V)	ns/V
		0 to 20 (V_{CC} = 5.0 ± 0.5 V)	

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40 to 85°C Min	Ta = −40 to 85°C Max	Unit
High-level input voltage	V_{IH}	—		2.0	1.5	—	—	1.5	—	V
				3.0 to 5.5	$V_{CC} \times 0.7$	—	—	$V_{CC} \times 0.7$	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.5	—	0.5	
				3.0 to 5.5	—	—	$V_{CC} \times 0.3$	—	$V_{CC} \times 0.3$	
High-level output voltage	V_{OH}	$V_{IN} = V_{IL}$	$I_{OH} = -50$ μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			$I_{OH} = -4$ mA	3.0	2.58	—	—	2.48	—	
			$I_{OH} = -8$ mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50$ μA	2.0	—	0	0.1	—	0.1	
				3.0	—	0	0.1	—	0.1	
				4.5	—	0	0.1	—	0.1	
			$I_{OL} = 4$ mA	3.0	—	—	0.36	—	0.44	
			$I_{OL} = 8$ mA	4.5	—	—	0.36	—	0.44	
Input leakage current	I_{IN}	$V_{IN} = 5.5$ V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND		5.5	—	—	2.0	—	20.0	μA

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

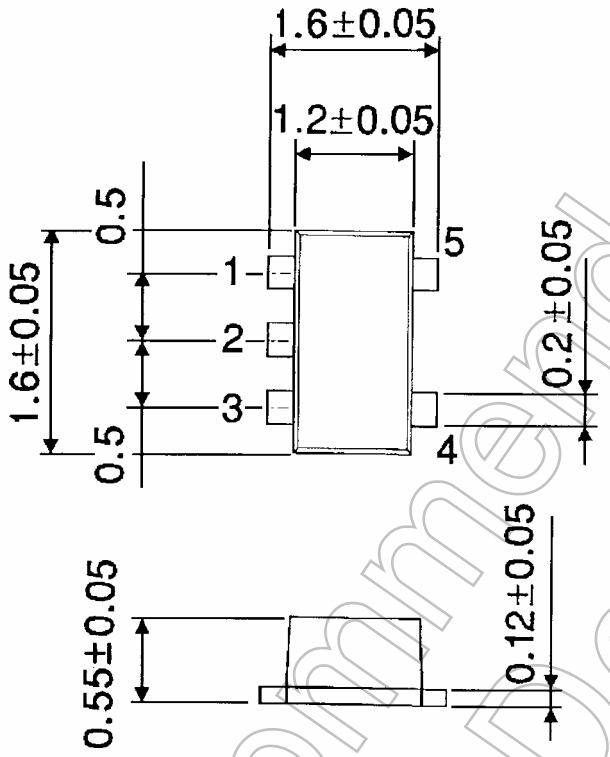
Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	5.6	7.9	1.0	9.5	ns
				50	—	8.1	11.4	1.0	13.0	
			5.0 ± 0.5	15	—	3.6	5.5	1.0	6.5	
				50	—	5.1	7.5	1.0	8.5	
Input capacitance	C_{IN}	—			—	4	10	—	10	pF
Power dissipation capacitance	C_{PD}	(Note 2)			—	15	—	—	—	pF

Note 2: 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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