

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

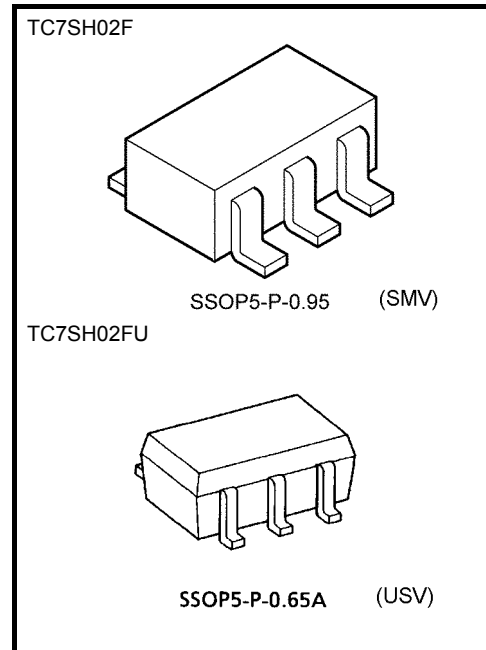
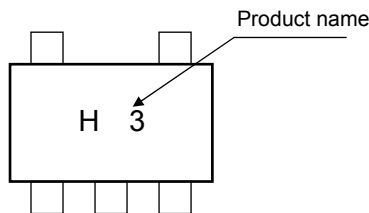
TC7SH02F, TC7SH02FU

2-Input NOR Gate

Features

- High Speed Operation : $t_{pd} = 3.6 \text{ ns (typ.)}$
at $V_{CC} = 5 \text{ V}$, 15 pF
- Low Power Dissipation : $I_{CC} = 2\mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- Balanced Propagation Delays : $t_{pLH} \cong t_{pHL}$
- High noise immunity : $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- 5.5-V Tolerant Inputs
- Wide Operating Voltage Range : $V_{CC} = 2 \text{ to } 5.5\text{V}$

Marking

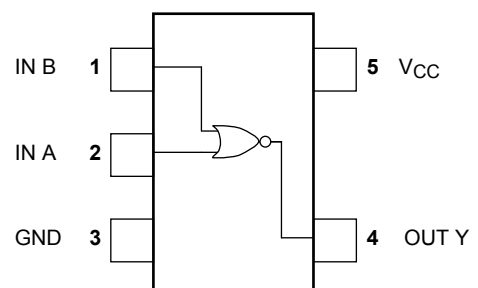


Weight
 SSOP5-P-0.95 : 0.016 g (typ.)
 SSOP5-P-0.65A : 0.006 g (typ.)

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	200	mW
Storage Temperature	T_{stg}	- 65 to 150	°C
Lead Temperature(10s)	T_L	260	°C

Pin Assignment (top view)



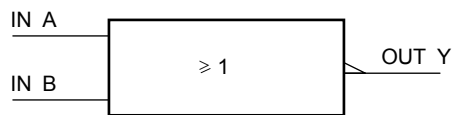
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

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

Start of commercial production
 1995-03

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 ($V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$)	ns/V
		0 to 20 ($V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$)	

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}	—		2.0	1.5	—	—	1.5	V	
				3.0 to 5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7		—
Low-level input voltage	V _{IL}	—		2.0	—	—	0.5	—	V	
				3.0 to 5.5	—	—	V _{CC} × 0.3	—		V _{CC} × 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		—
			I _{OH} = -4 mA	4.5	4.4	4.5	—	4.4		—
				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	—	V	
				3.0	—	0	0.1	—		0.1
			I _{OL} = 4 mA	4.5	—	0	0.1	—		0.1
				I _{OL} = 8 mA	3.0	—	—	0.36		—
			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	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 _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	t _{pLH}	3.3 ± 0.3	15	—	5.6	7.9	1.0	9.5	ns
			50	—	8.1	11.4	1.0	13.0	
	t _{pHL}	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.

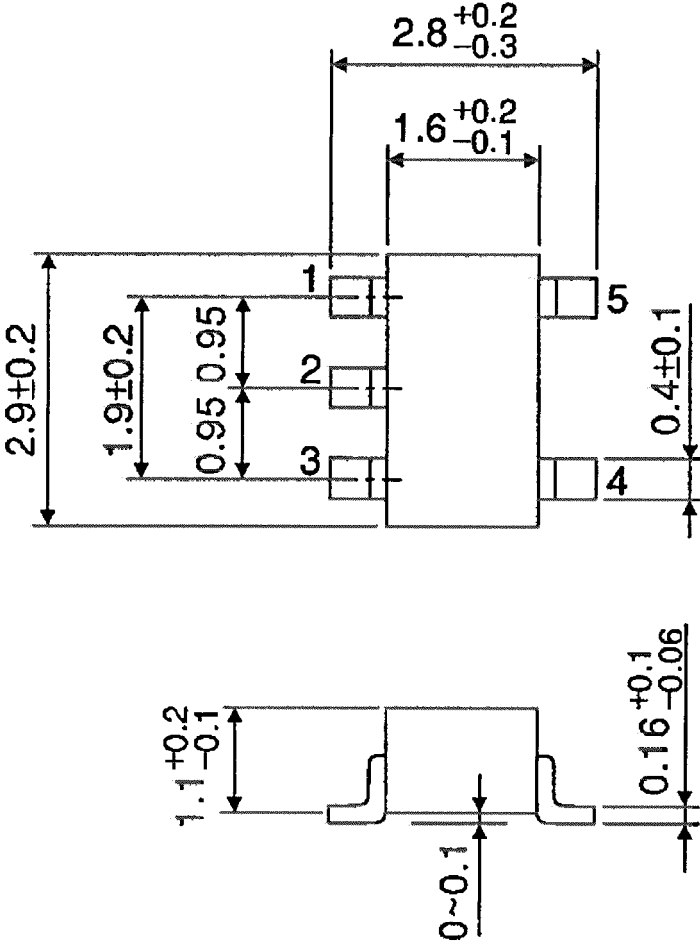
Average operating current can be obtained by the equation :

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

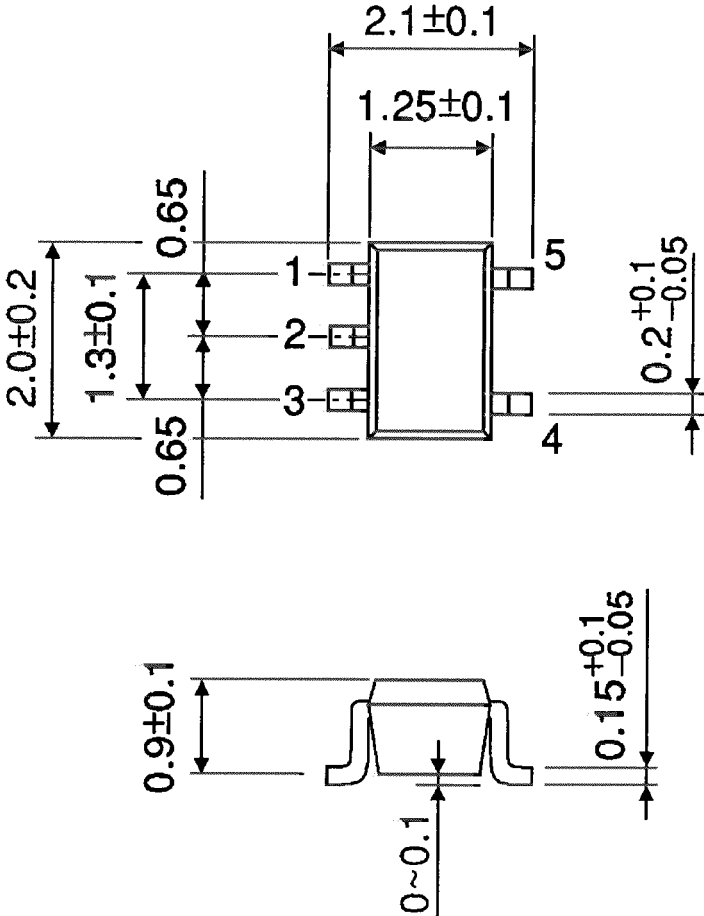


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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