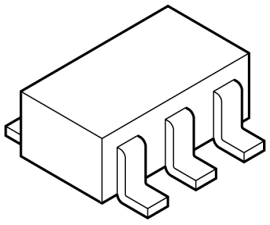
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7S02F, TC7S02FU

2-Input NOR Gate

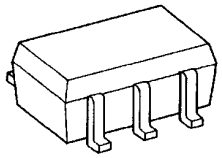
TC7S02F



SSOP5-P-0.95

(SMV)

TC7S02FU



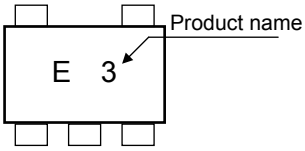
SSOP5-P-0.65A

(USV)

Features

- High Speed : t_{pd} = 7ns (typ.) at V_{CC} = 5 V
- Low power dissipation : I_{CC} = 1 μA (max) at Ta = 25°C
- High noise immunity : $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- Output drive capability : 5 LSTTL Loads
- Symmetrical Output Impedance : $|I_{OH}| = I_{OL}$ = 2mA (min)
- Balanced propagation delays : $t_{pLH} \fallingdotseq t_{pHL}$
- Wide operating voltage range : V_{CC} = 2 to 6 V

Marking

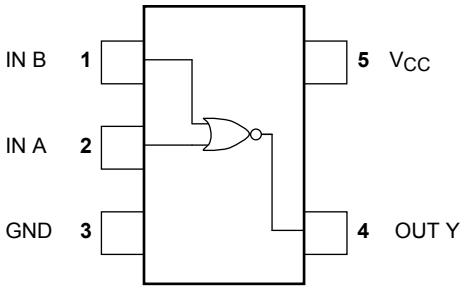


Weight
SSOP5-P-0.95 : 0.016 g (typ.)
SSOP5-P-0.65A : 0.006 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	−0.5 to 7.0	V
DC input voltage	V_{IN}	−0.5 to V_{CC} + 0.5	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	mA
DC output current	I_{OUT}	±12.5	mA
DC V_{CC}/ground current	I_{CC}	±25	mA
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	−65 to 150	°C
Lead temperature (10 s)	T_L	260	°C

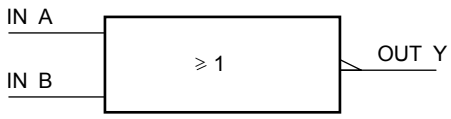
Pin Assignment (top view)



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).

Start of commercial production
1987-08

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}	2.0 to 6.0	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	−40 to 85	°C
Input rise and fall time	t_r , t_f	0 to 1000 (V_{CC} = 2.0 V)	ns
		0 to 500 (V_{CC} = 4.5 V)	
		0 to 400 (V_{CC} = 6.0 V)	

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C			Ta = −40 to 85°C		Unit
					Min	Typ.	Max	Min	Max	
High-level input voltage	V_{IH}	—		2.0	1.5	—	—	1.5	—	V
				4.5	3.15	—	—	3.15	—	
				6.0	4.2	—	—	4.2	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.5	—	0.5	
				4.5	—	—	1.35	—	1.35	
				6.0	—	—	1.8	—	1.8	
High-level output voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = −20 μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
				6.0	5.9	6.0	—	5.9	—	
			I_{OH} = −2 mA	4.5	4.18	4.31	—	4.13	—	
			I_{OH} = −2.6 mA	6.0	5.68	5.80	—	5.63	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	2.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
				6.0	—	0.0	0.1	—	0.1	
			I_{OL} = 2 mA	4.5	—	0.17	0.26	—	0.33	
			I_{OL} = 2.6 mA	6.0	—	0.18	0.26	—	0.33	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		6.0	—	—	1.0	—	10.0	μA

Output currents are 1/2 compared to TC74HC series models.

AC Characteristics (C_L= 15pF, V_{CC} = 5V, Input: $t_r = t_f$ = 6 ns)

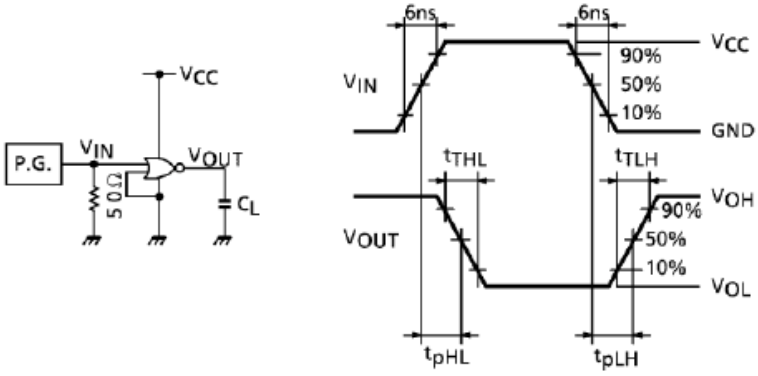
Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			Min	Typ.	Max	
Output transition time	t_{TLH} t_{THL}	—	—	5	10	ns
Propagation delay time	t_{pLH} t_{pLH}	—	—	7	15	ns

AC Characteristics (C_L= 50pF, Input: $t_r = t_f$ = 6 ns)

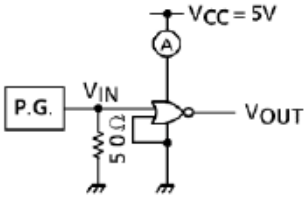
Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = –40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Output transition time	t_{TLH} t_{THL}	—	2.0	—	50	125	—	155	ns
			4.5	—	14	25	—	31	
			6.0	—	12	21	—	26	
Propagation delay time	t_{pLH} t_{pHL}	—	2.0	—	48	100	—	125	ns
			4.5	—	12	20	—	25	
			6.0	—	9	17	—	21	
Input capacitance	C_{IN}	—		—	5	10	—	10	pF
Power dissipation capacitance	C_{PD}	(Note 1)		—	10	—	—	—	pF

Note 1: 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:
$I_{CC\ (opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

Switching Characteristics Test Circuit



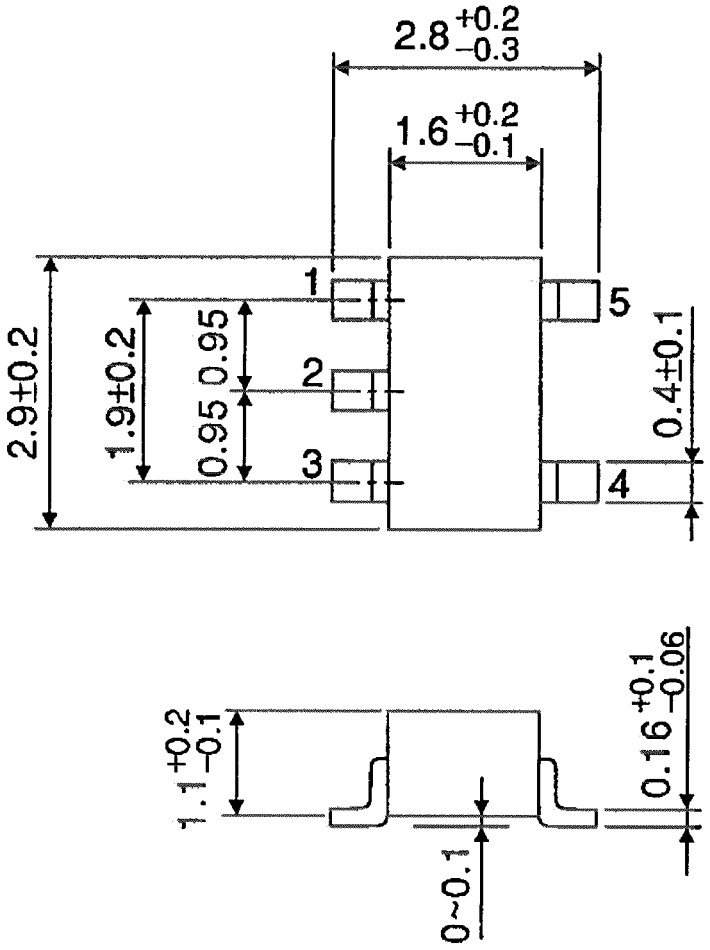
$I_{CC\ (opr.)}$ Test Circuit



Input waveform is the same as that in case of switching characteristics test.

Package Dimensions

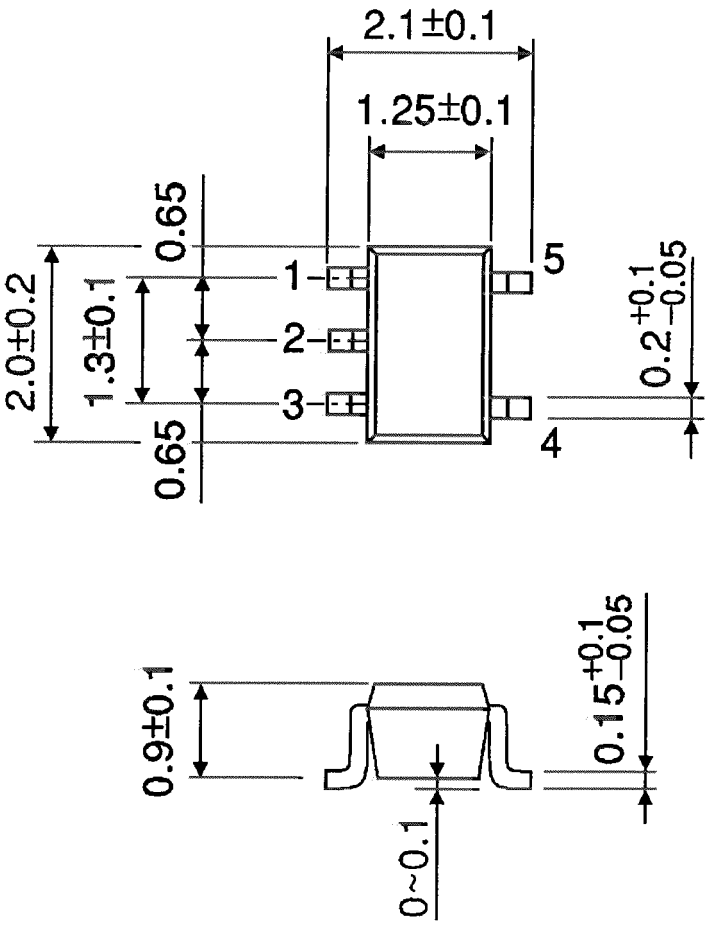
SSOP5-P-0.95 Unit : mm



Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A Unit : mm



Weight: 0.006 g (typ.)

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