TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7S02F, TC7S02FU

2-Input NOR Gate

Features

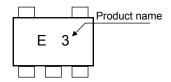
High Speed : t_{pd} = 7ns (typ.) at V_{CC} = 5 V
 Low power dissipation : I_{CC} = 1 µA (max) at Ta = 25°C
 High noise immunity : V_{NIH} = V_{NIL} = 28% V_{CC} (min)

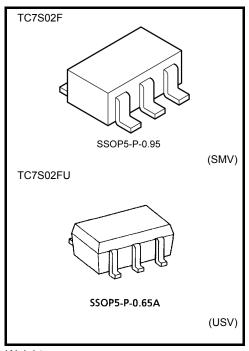
• Output drive capability : 5 LSTTL Loads

• Symmetrical Output Impedance : |I_{OH}| = I_{OL}= 2mA (min)

Balanced propagation delays : t_{pLH} ≒ t_{pHL}
 Wide operating voltage range : V_{CC} = 2 to 6 V

Marking





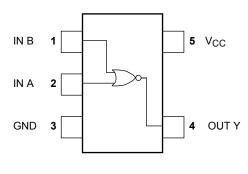
Weight

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	l _{IK}	±20	mA
Output diode current	lok	±20	mA
DC output current	lout	±12.5	mA
DC V _{CC} /ground current	Icc	±25	mA
Power dissipation	PD	200	mW
Storage temperature	T _{stg}	-65 to 150	°C
Lead temperature (10 s)	TL	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).



IEC Logic Symbol



Truth Table

Α	В	Y
L	L	Н
L	Н	L
Н	L	L
Н	Н	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}	٧
Output voltage	V _{OUT}	0 to V _{CC}	V
Operating temperature	T _{opr}	-40 to 85	°C
		0 to 1000 (V _{CC} = 2.0 V)	
Input rise and fall time	t _r , t _f	0 to 500 (V _{CC} = 4.5 V)	ns
		0 to 400 (V _{CC} = 6.0 V)	

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Electrical Characteristics

DC Characteristics

Characteristics Symbol T		ool Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
		1651	V _{CC} (V)		Min	Тур.	Max	Min.	Max.	Offic
High lovel			2.0	1.5	_	_	1.5	_		
High-level Input voltage		_		3.15	_	_	3.15	_		
input voltage				6.0	4.2	_	_	4.2	_	V
Low lovel				2.0		_	0.5	_	0.5	V
Low-level V _{IL} input voltage		_	4.5		_	1.35	_	1.35		
				6.0		_	1.8	_	1.8	
High-level output voltage	Voн	$V_{IN} = V_{IL}$	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	_	
			$I_{OH} = -2.6 \text{ mA}$	6.0	5.68	5.80	_	5.63	_	
			I _{OL} = 20 μA	2.0	_	0.0	0.1	_	0.1	
Low-level output voltage				4.5	_	0.0	0.1	_	0.1	
	V_{OL}	$V_{IN} = V_{IH}$		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	μΑ
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		6.0	_	_	1.0	_	10.0	μΑ

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		- Unit		
		rest Condition	Min.	Тур.	Max.	Offic
Output transition time	t _{TLH}		_	5	10	ns
	t _{THL}	_				
Propagation delay time	t _{pLH}	_	_	7	15	ns
	t _{pLH}					

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

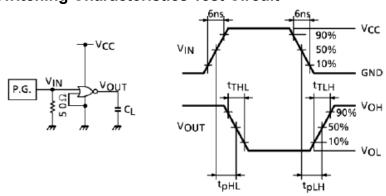
Characteristics Sy	Symbol	Test Condition		Ta = 25°C			Ta = -40	Unit	
	Syllibol	rest Condition	V _{CC} (V)	Min	Тур.	Max	Min.	Max.	Offic
Output transition time $ \begin{matrix} t_{TI} \\ t_{TH} \end{matrix} $	4		2.0		50	125	_	155	
	_	_	4.5		14	25	_	31	ns
	THL		6.0	_	12	21	_	26	
Propagation delay time	t _{pLH}	_	2.0	_	48	100	_	125	
			4.5	_	12	20	_	25	ns
			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.

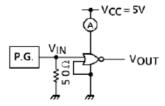
Average operating current can be obtained by the equation:

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

Switching Characteristics Test Circuit



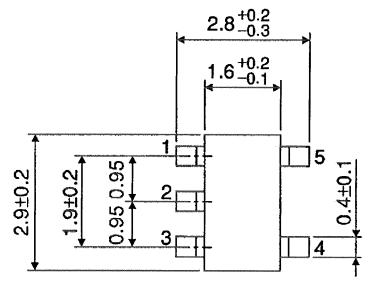
$I_{CC\ (opr.)}$ Test Circuit

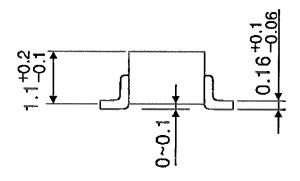


Input waveform is the same as that in case of switching characteristics test.

Package Dimensions

SSOP5-P-0.95 Unit: mm



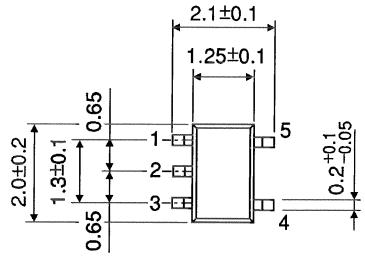


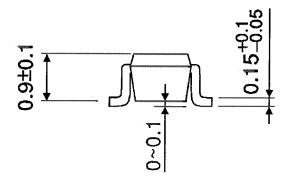
Weight: 0.016 g (typ.)

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Package Dimensions

SSOP5-P-0.65A Unit: mm





Weight: 0.006 g (typ.)

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