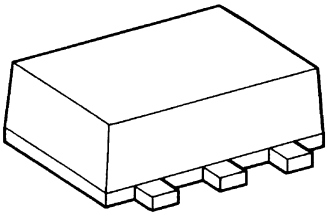
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SG14FE

Schmitt Inverter

Features

- High output current : ±8 mA (min) at V_{CC} = 3.0 V
- Super high speed operation : t_{pd} = 3.7 ns (typ.) at V_{CC} = 3.3 V, 15pF
- Operating voltage range : V_{CC} = 0.9 to 3.6 V
- 5.5-V tolerant input.
- 3.6-V power down protection output.

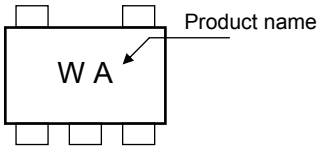


SON5-P-0.50

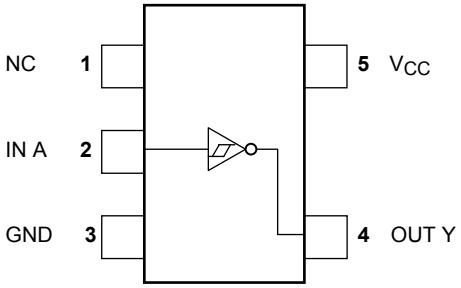
(ESV)

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 4.6	V
DC input voltage	V_{IN}	−0.5 to 7.0	V
DC output voltage	V_{OUT}	−0.5 to 4.6 (Note 1)	V
		−0.5 to V_{CC} + 0.5 (Note 2)	
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	−20 (Note 3)	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

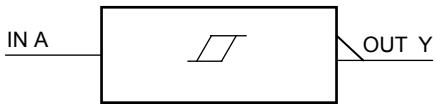
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Note 1: V_{CC}=0V

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

Note 3: V_{OUT}<GND

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	0.9 to 3.6	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 3.6 (Note 4)	V
		0 to V_{CC} (Note 5)	
Output Current	I_{OH}/I_{OL}	±8.0 (Note 6)	mA
		±4.0 (Note 7)	
		±3.0 (Note 8)	
		±1.7 (Note 9)	
		±0.3 (Note 10)	
		±0.02 (Note 11)	
Operating temperature	T_{opr}	−40 to 85	°C

Note 4: V_{CC} = 0 V

Note 5: High or Low state

Note 6: V_{CC} = 3.0 to 3.6 V

Note 7: V_{CC} = 2.3 to 2.7 V

Note 8: V_{CC} = 1.65 to 1.95 V

Note 9: V_{CC} = 1.4 to 1.6 V

Note 10: V_{CC} = 1.1 to 1.3 V

Note 11: V_{CC} = 0.9 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
Threshold voltage	Positive threshold voltage	V_P	—		0.9	—	—	0.73	—	0.80	V
					1.1	—	—	0.86	—	0.93	
					1.4	—	—	1.07	—	1.12	
					1.65	—	—	1.23	—	1.25	
					2.3	—	—	1.66	—	1.68	
					3.0	—	—	2.14	—	2.15	
	Negative threshold voltage	V_N	—		0.9	0.18	—	—	0.07	—	
					1.1	0.26	—	—	0.18	—	
					1.4	0.36	—	—	0.31	—	
					1.65	0.45	—	—	0.41	—	
					2.3	0.69	—	—	0.64	—	
					3.0	0.96	—	—	0.91	—	
Hysteresis voltage		V_H	—		0.9	0.20	—	0.38	0.15	0.53	V
					1.1	0.25	—	0.41	0.21	0.53	
					1.4	0.35	—	0.48	0.34	0.57	
					1.65	0.42	—	0.56	0.40	0.60	
					2.3	0.60	—	0.74	0.61	0.76	
					3.0	0.79	—	0.93	0.80	0.94	
Output voltage	High level	V_{OH}	V_{IN} = V_{IL}	I_{OH} = −0.02 mA	0.9	0.75	—	—	0.75	—	V
				I_{OH} = −0.3 mA	1.1 to 1.3	V_{CC} × 0.75	—	—	V_{CC} × 0.75	—	
				I_{OH} = −1.7 mA	1.4 to 1.6	V_{CC} × 0.75	—	—	V_{CC} × 0.75	—	
				I_{OH} = −3.0 mA	1.65 to 1.95	V_{CC} -0.45	—	—	V_{CC} -0.45	—	
				I_{OH} = −4.0 mA	2.3 to 2.7	2.0	—	—	2.0	—	
				I_{OH} = −8.0 mA	3.0 to 3.6	2.48	—	—	2.48	—	
	Low level	V_{OL}	V_{IN} = V_{IH}	I_{OL} = 0.02 mA	0.9	—	—	0.1	—	0.1	
				I_{OL} = 0.3 mA	1.1 to 1.3	—	—	V_{CC} × 0.25	—	V_{CC} × 0.25	
				I_{OL} = 1.7 mA	1.4 to 1.6	—	—	V_{CC} × 0.25	—	V_{CC} × 0.25	
				I_{OL} = 3.0 mA	1.65 to 1.95	—	—	0.45	—	0.45	
				I_{OL} = 4.0 mA	2.3 to 2.7	—	—	0.4	—	0.4	
				I_{OL} = 8.0 mA	3.0 to 3.6	—	—	0.4	—	0.4	
Input leakage current		I_{IN}	V_{IN} = 0 to 5.5V		0 to 3.6	—	—	±0.1	—	±1.0	μA
Power off leakage current		I_{OFF}	V_{IN} = 0 to 5.5V V_{OUT} = 0 to 3.6V		0	—	—	1.0	—	10.0	μA
Quiescent supply current		I_{CC}	V_{IN} = V_{CC} or GND		3.6	—	—	1.0	—	10.0	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)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	C_L = 10 pF, R_L = 1 MΩ	0.9	—	27.3	—	—	—	ns
			1.1 to 1.3	—	13.0	22.6	1.0	35.9	
			1.4 to 1.6	—	7.5	10.5	1.0	11.3	
			1.65 to 1.95	—	6.0	7.8	1.0	8.2	
			2.3 to 2.7	—	4.3	5.4	1.0	5.8	
			3.0 to 3.6	—	3.5	4.4	1.0	4.6	
		C_L = 15 pF, R_L = 1 MΩ	0.9	—	29.5	—	—	—	
			1.1 to 1.3	—	14.3	25.1	1.0	41.8	
			1.4 to 1.6	—	8.0	11.5	1.0	12.6	
			1.65 to 1.95	—	6.3	8.4	1.0	8.7	
			2.3 to 2.7	—	4.6	5.7	1.0	6.1	
			3.0 to 3.6	—	3.7	4.6	1.0	5.0	
		C_L = 30 pF, R_L = 1 MΩ	0.9	—	40.5	—	—	—	
			1.1 to 1.3	—	19.6	35.7	1.0	58.1	
			1.4 to 1.6	—	10.7	15.8	1.0	17.6	
			1.65 to 1.95	—	7.8	10.7	1.0	11.7	
			2.3 to 2.7	—	5.4	6.9	1.0	8.1	
			3.0 to 3.6	—	4.3	5.2	1.0	6.1	
Input capacitance	C_{IN}	—	3.6	—	3	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 12)	0.9 to 3.6	—	7	—	—	—	pF

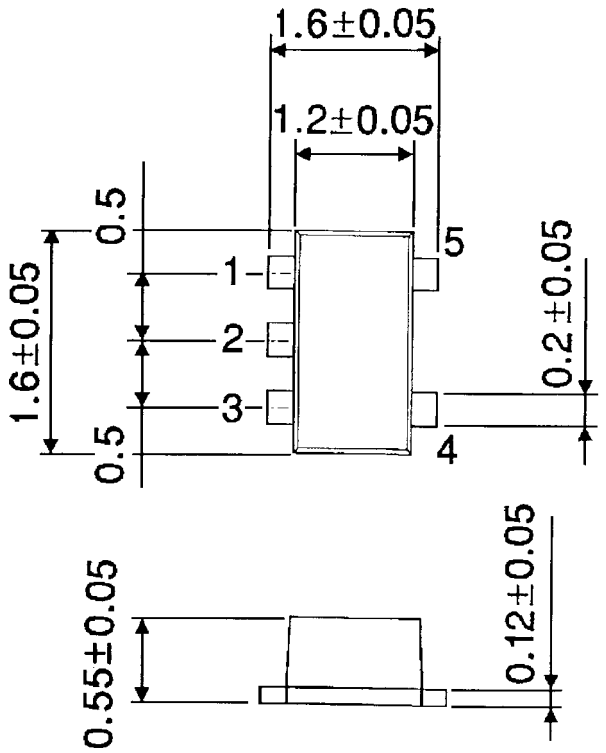
Note 12: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

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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