

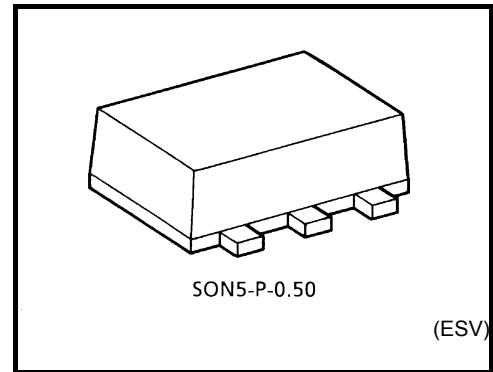
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SG14FE

Schmitt Inverter

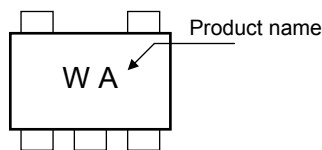
Features

- High-level output current: $I_{OH}/I_{OL} = \pm 8 \text{ mA (min)}$
at $V_{CC} = 3.0 \text{ V}$
- High-speed operation: $t_{pd} = 3.7 \text{ ns (typ.)}$
at $V_{CC} = 3.3 \text{ V}, 15\text{pF}$
- Operating voltage range: $V_{CC} = 0.9 \sim 3.6 \text{ V}$
- 5.5-V tolerant input.
- 3.6-V power down protection output.

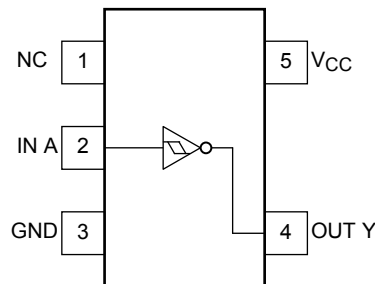


Weight: 0.003 g (typ.)

Marking



Pin Assignment (top view)



Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Value	Unit
Power supply voltage	V_{CC}	$-0.5 \sim 4.6$	V
DC input voltage	V_{IN}	$-0.5 \sim 7.0$	V
DC output voltage	V_{OUT}	$-0.5 \sim 4.6$ (Note 1)	V
		$-0.5 \sim V_{CC} + 0.5$ (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}	$-65 \sim 150$	$^\circ\text{C}$

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.

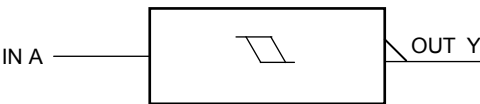
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: $V_{CC} = 0\text{V}$

Note 2: High or Low State. I_{OUT} absolute maximum rating must be observed.

Note 3: $V_{OUT} < \text{GND}$

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Value	Unit
Power supply voltage	V_{CC}	0.9~3.6	V
Input voltage	V_{IN}	0~5.5	V
Output voltage	V_{OUT}	0~5.5 (Note 4)	V
		0~ 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}	-40~85	°C

- Note 4: $V_{CC} = 0.0$ V
- Note 5: High or Low state
- Note 6: $V_{CC} = 3.0 \sim 3.6$ V
- Note 7: $V_{CC} = 2.3 \sim 2.7$ V
- Note 8: $V_{CC} = 1.65 \sim 1.95$ V
- Note 9: $V_{CC} = 1.4 \sim 1.6$ V
- Note 10: $V_{CC} = 1.1 \sim 1.3$ V
- Note 11: $V_{CC} = 0.9$ V

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C				Ta = -40~85°C		Unit
					V _{CC} (V)	Min	Typ.	Max	Min	Max	
Input 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	1.1~1.3	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
				I _{OH} = -1.7 mA	1.4~1.6	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
				I _{OH} = -3.0 mA	1.65~1.95	V _{CC} -0.45	—	—	V _{CC} -0.45	—	
				I _{OH} = -4.0 mA	2.3~2.7	2.0	—	—	2.0	—	
				I _{OH} = -8.0 mA	3.0~3.6	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	1.1~1.3	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
				I _{OL} = 1.7 mA	1.4~1.6	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
				I _{OL} = 3.0 mA	1.65~1.95	—	—	0.45	—	0.45	
				I _{OL} = 4.0 mA	2.3~2.7	—	—	0.4	—	0.4	
				I _{OL} = 8.0 mA	3.0~3.6	—	—	0.4	—	0.4	
Input leakage current		I _{IN}	V _{IN} = 0~5.5V	0~3.6	—	—	±0.1	—	±1.0	μA	
Power off leakage current		I _{OFF}	V _{IN} = 0~5.5V V _{OUT} = 0~3.6V	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 (Input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max
Propagation delay time	t_{pLH} t_{pHL}	$C_L = 10 \text{ pF}$, $R_L = 1 \text{ M}\Omega$	0.9	—	27.3	—	—	—
			1.1~1.3	—	13.0	22.6	1.0	35.9
			1.4~1.6	—	7.5	10.5	1.0	11.3
			1.65~1.95	—	6.0	7.8	1.0	8.2
			2.3~2.7	—	4.3	5.4	1.0	5.8
			3.0~3.6	—	3.5	4.4	1.0	4.6
		$C_L = 15 \text{ pF}$, $R_L = 1 \text{ M}\Omega$	0.9	—	29.5	—	—	—
			1.1~1.3	—	14.3	25.1	1.0	41.8
			1.4~1.6	—	8.0	11.5	1.0	12.6
			1.65~1.95	—	6.3	8.4	1.0	8.7
			2.3~2.7	—	4.6	5.7	1.0	6.1
			3.0~3.6	—	3.7	4.6	1.0	5.0
		$C_L = 30 \text{ pF}$, $R_L = 1 \text{ M}\Omega$	0.9	—	40.5	—	—	—
			1.1~1.3	—	19.6	35.7	1.0	58.1
			1.4~1.6	—	10.7	15.8	1.0	17.6
			1.65~1.95	—	7.8	10.7	1.0	11.7
			2.3~2.7	—	5.4	6.9	1.0	8.1
			3.0~3.6	—	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 ~ 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.

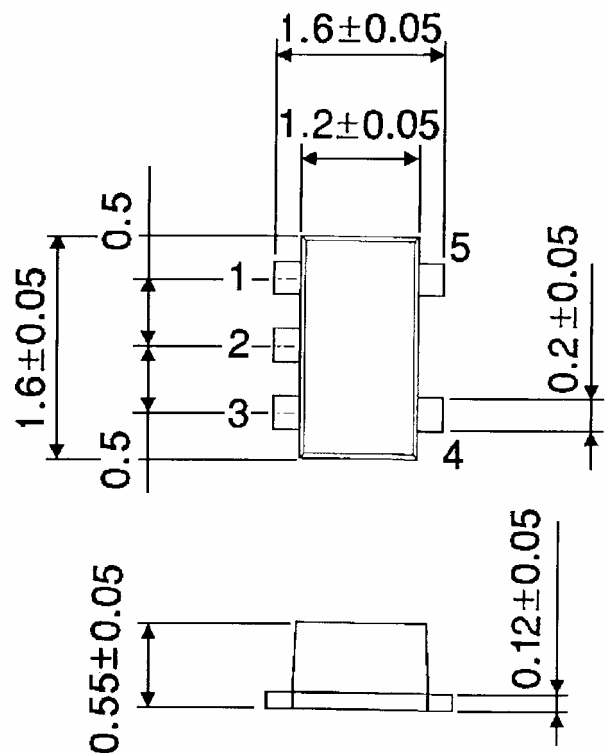
Average operating current can be obtained by the equation:

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

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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20070701-EN GENERAL

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