

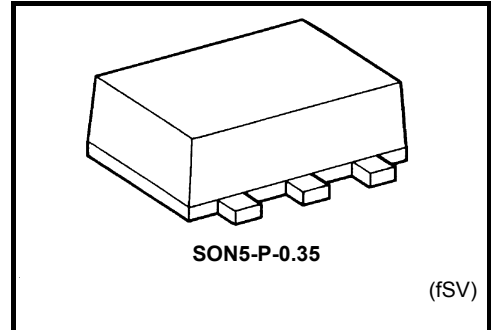
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SG04AFS

Inverter

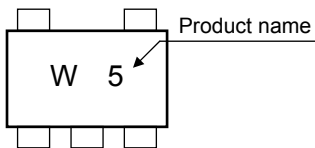
Features

- High output current : ± 8 mA (min) at $V_{CC} = 3.0$ V
- Super high speed operation : $t_{pd} = 2.3$ ns (typ.)
at $V_{CC} = 3.3$ V, $1 C_L = 5$ pF
- Operating voltage range : $V_{CC} = 0.9$ to 3.6 V
- 5.5-V tolerant input.
- ESD performance : Machine model $\geq \pm 200$ V
Human body model $\geq \pm 2000$ V

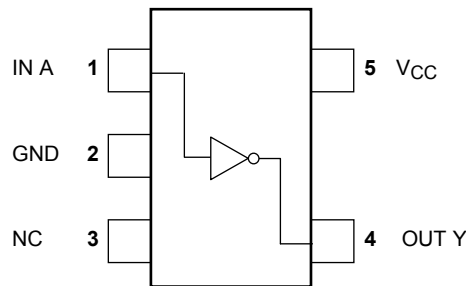


Weight: 0.001 g (typ.)

Marking



Pin Assignment (top view)



Absolute Maximum Ratings (Ta = 25°C)

Characteristic	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 $V_{CC} + 0.5$	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	50	mW
Storage temperature	T_{stg}	-65 to 150	°C

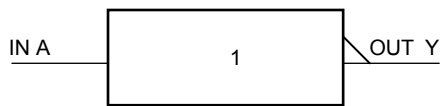
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

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

Start of commercial production
2004-11

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristic	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 V_{CC}	V
Output current	I_{OH}/I_{OL}	± 8.0 (Note 2)	mA
		± 4.0 (Note 3)	
		± 3.0 (Note 4)	
		± 1.7 (Note 5)	
		± 0.3 (Note 6)	
		± 0.02 (Note 7)	
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 10 (Note 8)	ns/V

Note 2: $V_{CC} = 3.0$ to 3.6 V

Note 3: $V_{CC} = 2.3$ to 2.7 V

Note 4: $V_{CC} = 1.65$ to 1.95 V

Note 5: $V_{CC} = 1.4$ to 1.6 V

Note 6: $V_{CC} = 1.1$ to 1.3 V

Note 7: $V_{CC} = 0.9$ V

Note 8: $V_{IN} = 0.8$ to 2.0 V, $V_{CC} = 3.0$ V

Electrical Characteristics

DC Characteristics

Characteristic	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}	—	0.9	V _{CC}	—	—	V _{CC}	—	V	
			1.1 to 1.3	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—		
			1.4 to 1.6	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—		
			1.65 to 1.95	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—		
			2.3 to 2.7	1.7	—	—	1.7	—		
			3.0 to 3.6	2.0	—	—	2.0	—		
Low-level input voltage	V _{IL}	—	0.9	—	—	GND	—	GND	V	
			1.1 to 1.3	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3		
			1.4 to 1.6	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35		
			1.65 to 1.95	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35		
			2.3 to 2.7	—	—	0.7	—	0.7		
			3.0 to 3.6	—	—	0.8	—	0.8		
High-level output voltage	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 output voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 0.02 mA	0.9	—	—	0.1	—	0.1	V
			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	
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)

Characteristic	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	—	18.6	—	—	ns	
			1.1 to 1.3	—	8.7	18.4	1.0		34.2
			1.4 to 1.6	—	4.9	8.5	1.0		10.0
			1.65 to 1.95	—	3.8	6.2	1.0		6.7
			2.3 to 2.7	—	2.6	3.9	1.0		4.4
			3.0 to 3.6	—	2.1	3.1	1.0		3.7
		C _L = 15 pF, R _L = 1 MΩ	0.9	—	21.0	—	—		—
			1.1 to 1.3	—	9.8	21.5	1.0		37.1
			1.4 to 1.6	—	5.4	9.3	1.0		11.2
			1.65 to 1.95	—	4.2	6.9	1.0		7.1
			2.3 to 2.7	—	2.8	4.4	1.0		5.0
			3.0 to 3.6	—	2.3	3.4	1.0		3.9
		C _L = 30 pF, R _L = 1 MΩ	0.9	—	31.2	—	—		—
			1.1 to 1.3	—	13.8	29.6	1.0		56.0
			1.4 to 1.6	—	7.4	13.1	1.0		15.9
			1.65 to 1.95	—	5.6	9.2	1.0		9.6
			2.3 to 2.7	—	3.7	5.7	1.0		6.1
			3.0 to 3.6	—	2.9	4.4	1.0		4.8
Input capacitance	C _{IN}	—	3.6	—	3	—	—	pF	
Power dissipation capacitance	C _{PD}	(Note 9)	0.9 to 3.6	—	6	—	—	—	pF

Note 9: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

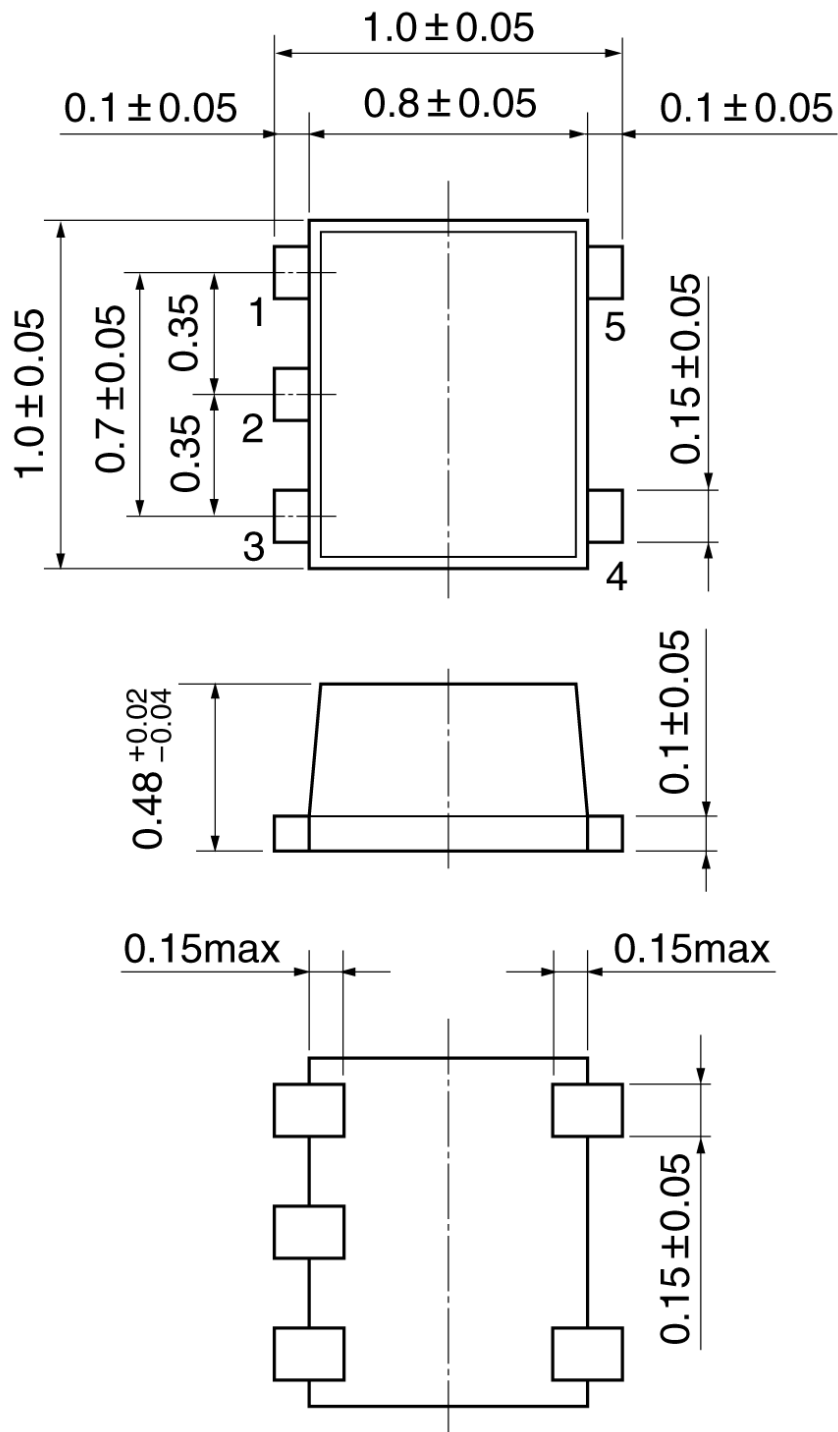
Average operating current can be obtained by the equation:

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

Package Dimensions

SON5-P-0.35

Unit: mm



Weight: 0.001 g (typ.)

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