

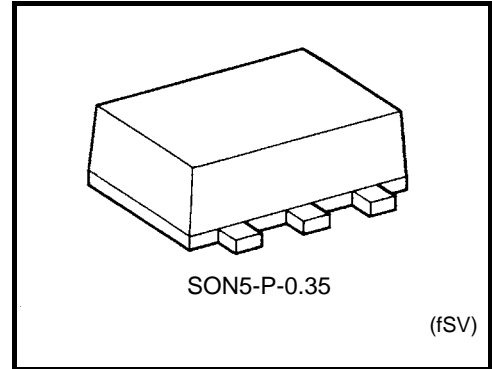
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7SH04FS

## INVERTER

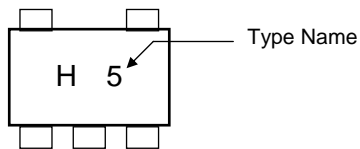
### Features

High speed:  $t_{pd} = 3.8$  ns (typ.) at  $V_{CC} = 5$  V  
Low power dissipation:  $I_{CC} = 2$   $\mu$ A (max) at  $T_a = 25^\circ$ C  
High noise immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (min)  
5.5V tolerant input.  
Wide operating voltage range:  $V_{CC}$  (opr) = 2~5.5 V

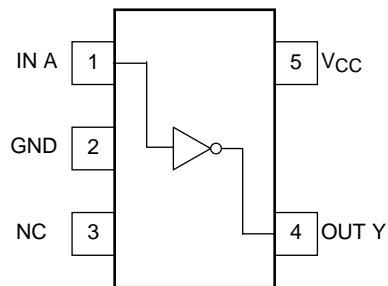


Weight : 0.001 g (Typ.)

### Marking



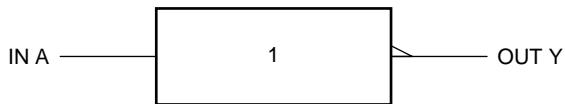
### Pin Assignment (top view)



## Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V <sub>CC</sub>	-0.5~7.0	V
DC input voltage	V <sub>IN</sub>	-0.5~7.0	V
DC output voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> + 0.5	V
Input diode current	I <sub>IK</sub>	-20	mA
Output diode current	I <sub>OK</sub>	±20	mA
DC output current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	P <sub>D</sub>	50	mW
Storage temperature	T <sub>stg</sub>	-65~150	°C

## Logic Diagram



## Truth Table

A	Y
L	H
H	L

## Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	2.0~5.5	V
Input voltage	V <sub>IN</sub>	0~5.5	V
Output voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-40~85	°C
Input rise and fall time	dt/dv	0~100 (V <sub>CC</sub> = 3.3 ± 0.3 V)	ns/V
		0~20 (V <sub>CC</sub> = 5 ± 0.5 V)	

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Circuit	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit	
					Min	Typ.	Max	Min	Max		
High-level input voltage	V <sub>IH</sub>	—	—	2.0	1.50	—	—	1.50	—	V	
				3.0~5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
Low-level input voltage	V <sub>IL</sub>	—	—	2.0	—	—	0.50	—	0.50	V	
				3.0~5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
High-level output voltage	V <sub>OH</sub>	—	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	2.0	1.9	2.0	—	1.9	—	V
					3.0	2.9	3.0	—	2.9	—	
					4.5	4.4	4.5	—	4.4	—	
				I <sub>OH</sub> = -4 mA	3.0	2.58	—	—	2.48	—	
4.5	3.94	—	—		3.80	—					
Low-level output voltage	V <sub>OL</sub>	—	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 50 μA	2.0	—	0.0	0.1	—	0.1	V
					3.0	—	0.0	0.1	—	0.1	
					4.5	—	0.0	0.1	—	0.1	
				I <sub>OL</sub> = 4 mA	3.0	—	—	0.36	—	0.44	
					4.5	—	—	0.36	—	0.44	
Input leakage current	I <sub>IN</sub>	—	V <sub>IN</sub> = 5.5 V or GND	0~5.5	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	I <sub>CC</sub>	—	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	2.0	—	20.0	μA	

## AC Characteristics (Input: $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Circuit	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
			V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Typ.	Max	Min	Max		
Propagation delay time	t <sub>pLH</sub>	—	—	3.3 ± 0.3	15	—	5.0	7.1	1.0	8.5	ns
					50	—	7.5	10.6	1.0	12.0	
	t <sub>pHL</sub>			5.0 ± 0.5	15	—	3.8	5.5	1.0	6.5	
					50	—	5.3	7.5	1.0	8.5	
Input capacitance	C <sub>IN</sub>	—	—	—	4	10	—	10	pF		
Power dissipation capacitance	C <sub>PD</sub>	—	—	(Note)	—	13	—	—	pF		

Note: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

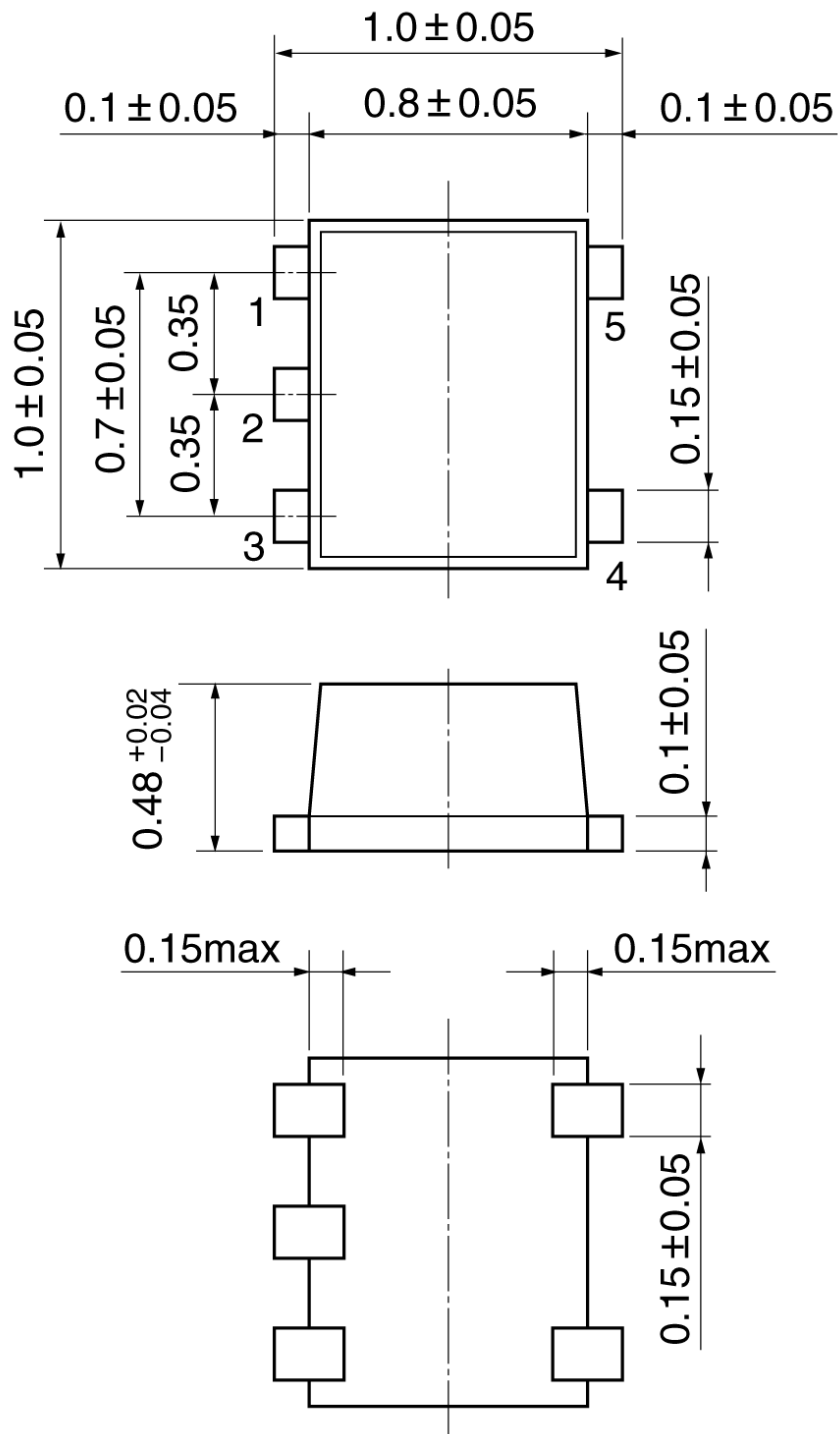
Average operating current can be obtained by the equation:

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

## Package Dimensions

SON5-P-0.35

Unit:mm



Weight: 0.001 g (typ.)

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