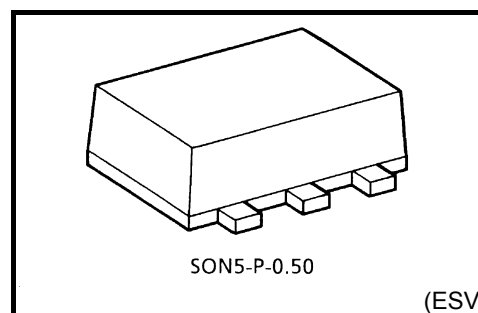


# TC7SHU04FE

## INVERTER (Un-Buffer)

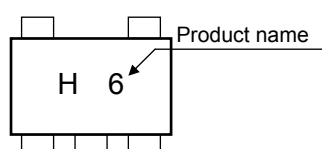
### Features

- Super high speed operation :  $t_{pd} = 3.5\text{ns}$  (typ.)  
@ $V_{CC} = 5\text{V}$ ,  $C_L = 15\text{pF}$
- Low power dissipation :  $I_{CC} = 2\mu\text{A}$  (max) @ $T_a = 25^\circ\text{C}$
- High noise immunity :  $V_{NIH} = V_{NIH} = 10\% V_{CC}$  (min)
- 5.5V tolerant input.
- Wide operation voltage range :  $V_{CC} = 2$  to  $5.5\text{V}$

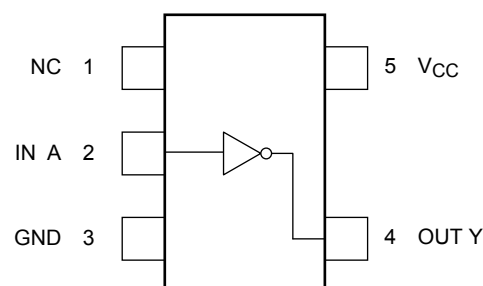


Weight: 0.003 g (typ.)

### Marking



### Pin Assignment (top view)



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

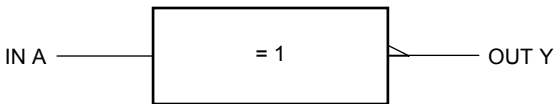
Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 7	V
DC input voltage	$V_{IN}$	-0.5 to 7	V
DC output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	$\pm 20$ (Note1)	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	150	mW
Storage temperature	$T_{stg}$	-65 to 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:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	2 to 5.5	V
Input voltage	V <sub>IN</sub>	0 to 5.5	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	−40 to 85	°C

**Electrical Characteristics**
**DC Characteristics**

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V <sub>IH</sub>	—		2.0	1.7	—	—	1.7	—	V
				3.0 to 5.5	V <sub>CC</sub> × 0.8	—	—	V <sub>CC</sub> × 0.8	—	
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.3	—	0.3	V
				3.0 to 5.5	—	—	V <sub>CC</sub> × 0.2	—	V <sub>CC</sub> × 0.2	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	2.0	1.8	2.0	—	1.8	—	V
				3.0	2.7	3.0	—	2.7	—	
				4.5	4.0	4.5	—	4.0	—	
		V <sub>IN</sub> =GND	I <sub>OH</sub> = -4 mA	3.0	2.58	—	—	2.48	—	
			I <sub>OH</sub> = -8 mA	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	0.2	—	0.2	V
				3.0	—	0	0.3	—	0.3	
				4.5	—	0	0.5	—	0.5	
		V <sub>IN</sub> =V <sub>CC</sub>	I <sub>OL</sub> = 4 mA	3.0	—	—	0.36	—	0.44	
			I <sub>OL</sub> = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0 to 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 (unless otherwise specified, input:  $t_r = t_f = 3\text{ ns}$ )**

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
		V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	$t_{pLH}$ $t_{pHL}$	$3.3 \pm 0.3$	15	—	5.0	8.9	1.0	10.5	ns
			50	—	7.5	11.4	1.0	13.0	
		$5.0 \pm 0.5$	15	—	3.5	5.5	1.0	6.5	
			50	—	5.0	7.0	1.0	8.0	
Input capacitance	C <sub>IN</sub>			—	5	10	—	10	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note 2)		—	6	—	—	—	pF

Note 2: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

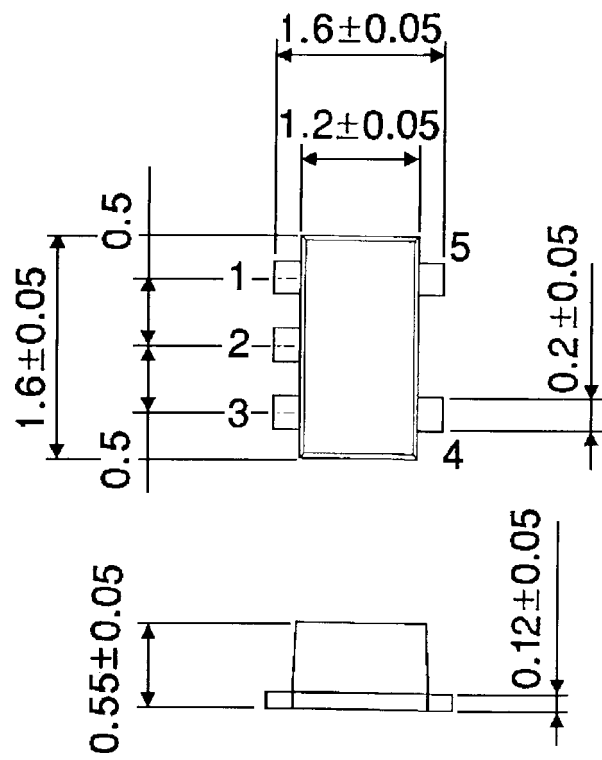
Average operating current can be obtained by the equation.

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

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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