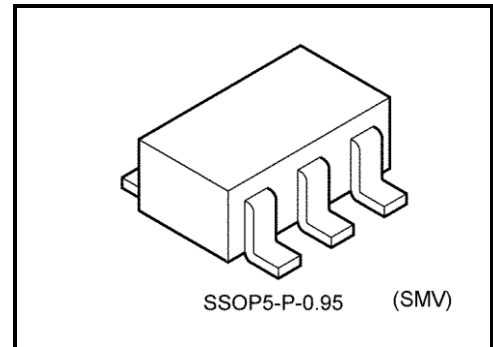


# TC7SHU04F

## INVERTER (Un-Buffer)

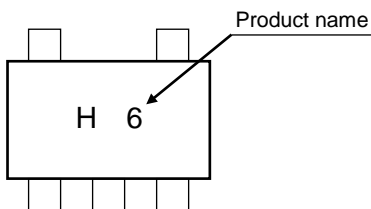
### Features

- 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 :  $V_{NIH} = V_{NIL} = 10\% V_{CC} \text{ (min)}$
- 5.5-V tolerant input.
- Wide operation voltage range :  $V_{CC} = 2 \text{ to } 5.5 \text{ V}$



Weight: 0.016 g (Typ.)

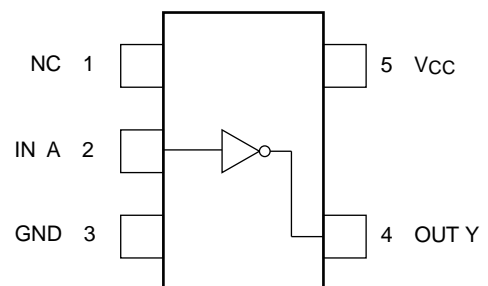
### Marking



### Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 7.0	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	$I_{OK}$	$\pm 20$ (Note 1)	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	200	mW
Storage temperature	$T_{stg}$	-65 to 150	°C
Lead temperature (10 s)	$T_L$	260	°C

### Pin Assignment (top view)



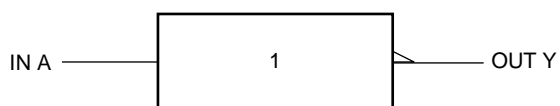
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Start of commercial production  
1993-09

## IEC Logic Symbol



## Truth Table

A	Y
L	H
H	L

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2 to 5.5	V
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	°C

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit	
				Min	Typ.	Max	Min	Max		
High-level input voltage	$V_{IH}$	—	2.0	1.7	—	—	1.7	—	V	
			3.0 to 5.5	$V_{CC} \times 0.8$	—	—	$V_{CC} \times 0.8$	—		
Low-level input voltage	$V_{IL}$	—	2.0	—	—	0.3	—	0.3	V	
			3.0 to 5.5	—	—	$V_{CC} \times 0.2$	—	$V_{CC} \times 0.2$		
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -50 \mu\text{A}$	2.0	1.8	2.0	—	1.8	V	
				3.0	2.7	3.0	—	2.7		—
		$V_{IN} = \text{GND}$	$I_{OH} = -4 \text{ mA}$	3.0	2.58	—	—	2.48		—
				4.5	3.94	—	—	3.80		—
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 50 \mu\text{A}$	2.0	—	0	0.2	—	0.2	V
				3.0	—	0	0.3	—	0.3	
				4.5	—	0	0.5	—	0.5	
		$V_{IN} = V_{CC}$	$I_{OL} = 4 \text{ mA}$	3.0	—	—	0.36	—	0.44	
4.5	—			—	0.36	—	0.44			
Input leakage current	$I_{IN}$	$V_{IN} = 5.5 \text{ V or GND}$	0 to 5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC} \text{ or GND}$	5.5	—	—	2.0	—	20.0	$\mu\text{A}$	

## 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
		VCC (V)	CL (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	tpLH	3.3 ± 0.3	15	—	5.0	8.9	1.0	10.5	ns
			50	—	7.5	11.4	1.0	13.0	
	tpHL	5.0 ± 0.5	15	—	3.5	5.5	1.0	6.5	
			50	—	5.0	7.0	1.0	8.0	
Input capacitance	CIN	—		—	5	10	—	10	pF
Power dissipation capacitance	CPD	(Note 2)		—	6	—	—	—	pF

Note 2: CPD is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

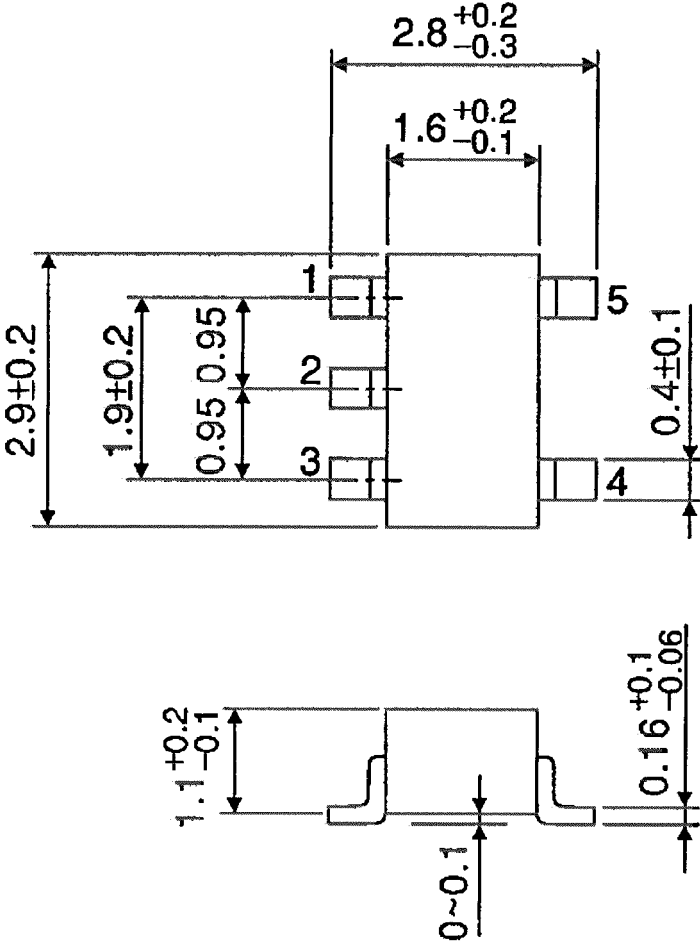
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP5-P-0.95

Unit: mm



Weight: 0.016 g (typ.)

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