

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

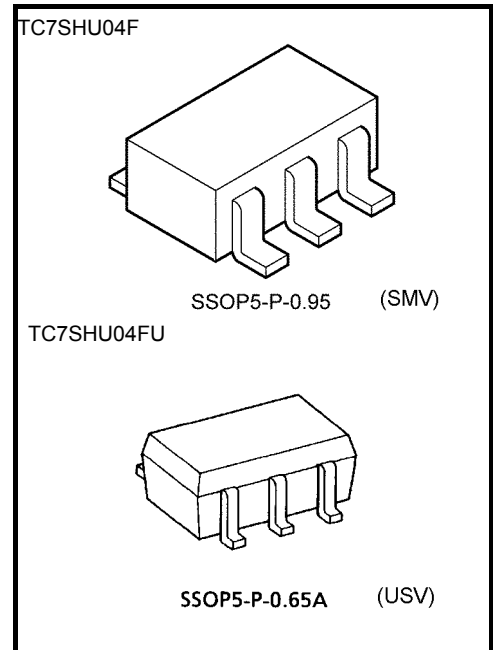
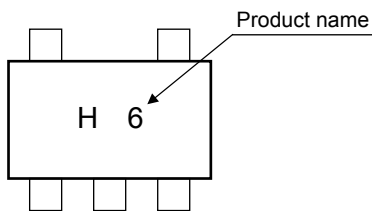
TC7SHU04F, TC7SHU04FU

INVERTER (Un-Buffer)

Features

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

Marking

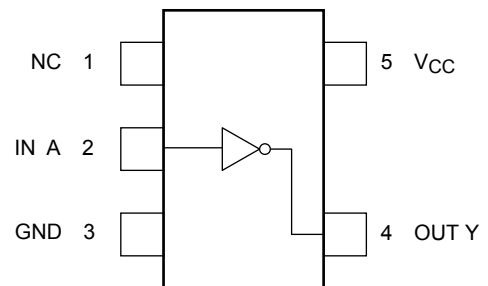


Weight
 SSOP5-P-0.95 : 0.016 g (Typ.)
 SSOP5-P-0.65A : 0.006 g (Typ.)

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}	± 20 (Note 1)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 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)

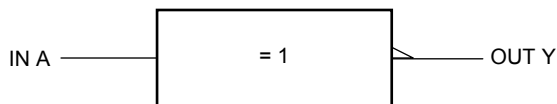


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

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	—	—	± 0.1	—	± 1.0	μA	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC} \text{ or GND}$	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 _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	t _{pLH}	3.3 ± 0.3	15	—	5.0	8.9	1.0	10.5	ns
			50	—	7.5	11.4	1.0	13.0	
	t _{pHL}	5.0 ± 0.5	15	—	3.5	5.5	1.0	6.5	
			50	—	5.0	7.0	1.0	8.0	
Input capacitance	C _{IN}			—	5	10	—	10	pF
Power dissipation capacitance	C _{PD}	(Note 2)		—	6	—	—	—	pF

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

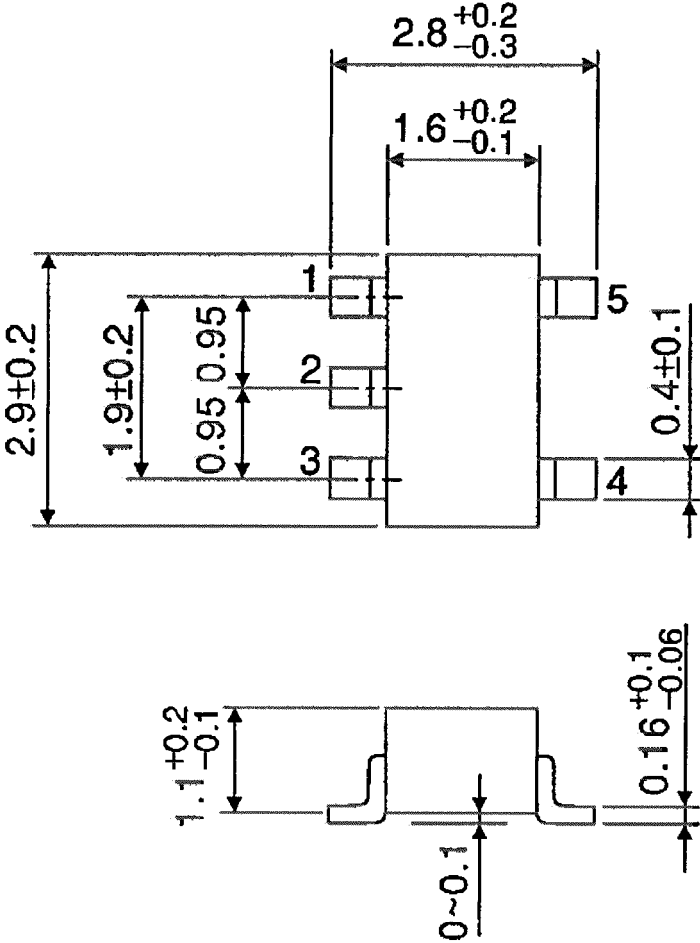
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

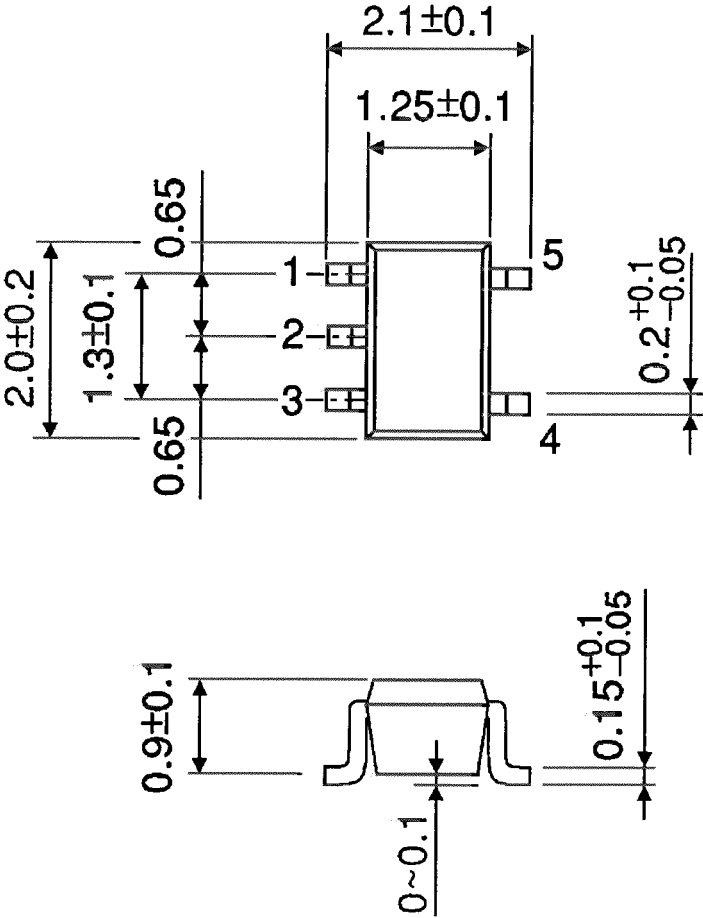


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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