TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

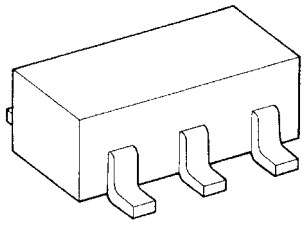
TC7SHU04F,TC7SHU04FU

INVERTER (Un-Buffer)

Features

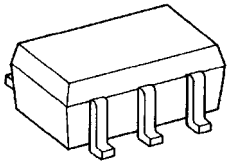
- Super high speed operation : t_{PD} = 3.5 ns (typ.) @V_{CC} = 5 V
- Low power dissipation : I_{CC} = 2 μA (Max.) @ Ta = 25°C
- High noise immunity : $V_{NIH} = V_{NIH}$ = 10% V_{CC} (Min.)
- 5.5V tolerant input.
- Wide operation voltage range : V_{CC} (opr) = 2~5.5 V

TC7SHU04F



SSOP5-P-0.95

TC7SHU04FU



SSOP5-P-0.65A

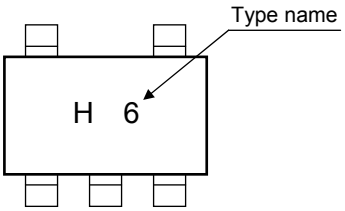
Weight
SSOP5-P-0.95 : 0.016 g (typ.)
SSOP5-P-0.65A : 0.006 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

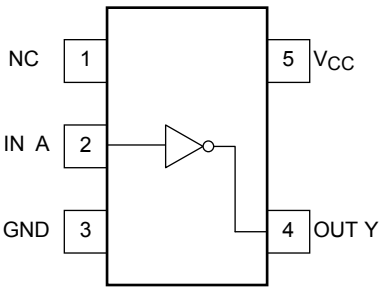
Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5~7.0	V
DC input voltage	V_{IN}	−0.5~7.0	V
DC output voltage	V_{OUT}	−0.5~V_{CC} + 0.5	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	±20	mA
DC output current	I_{OUT}	±25	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	−65~150	°C
Lead temperature (10 s)	T_L	260	°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).

Marking



Pin Assignment (top view)



Logic Diagram

Truth Table

INPUT	OUTPUT
A	Y
L	H
H	L

Operating Ranges

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

DC Electrical Characteristics

Characteristics	Symbol	Test Circuit	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
High-level input voltage	V_{IH}	—	—		2.0	1.7	—	—	1.7	—	V
					3.0~5.5	V_{CC} × 0.8	—	—	V_{CC} × 0.8	—	
Low-level input voltage	V_{IL}	—	—		2.0	—	—	0.3	—	0.3	V
					3.0~5.5	—	—	V_{CC} × 0.2	—	V_{CC} × 0.2	
High-level output voltage	V_{OH}	—	V_{IN} = V_{IL}	I_{OH} = −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_{IN} =GND	I_{OH} = −4 mA	3.0	2.58	—	—	2.48	—	
				I_{OH} = −8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V_{OL}	—	V_{IN} = V_{IH}	I_{OL} = 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_{IN} =V_{CC}	I_{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
				I_{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current	I_{IN}	—	V_{IN} = 5.5 V or GND		0~5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	—	V_{IN} = V_{CC} or GND		5.5	—	—	2.0	—	20.0	μA

AC Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40~85°C		Unit
		V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{PLH} t_{PHL}	3.3 ± 0.3	15	—	5.0	8.9	1.0	10.5	ns
			50	—	7.5	11.4	1.0	13.0	
		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)		—	6	—	—	—	pF

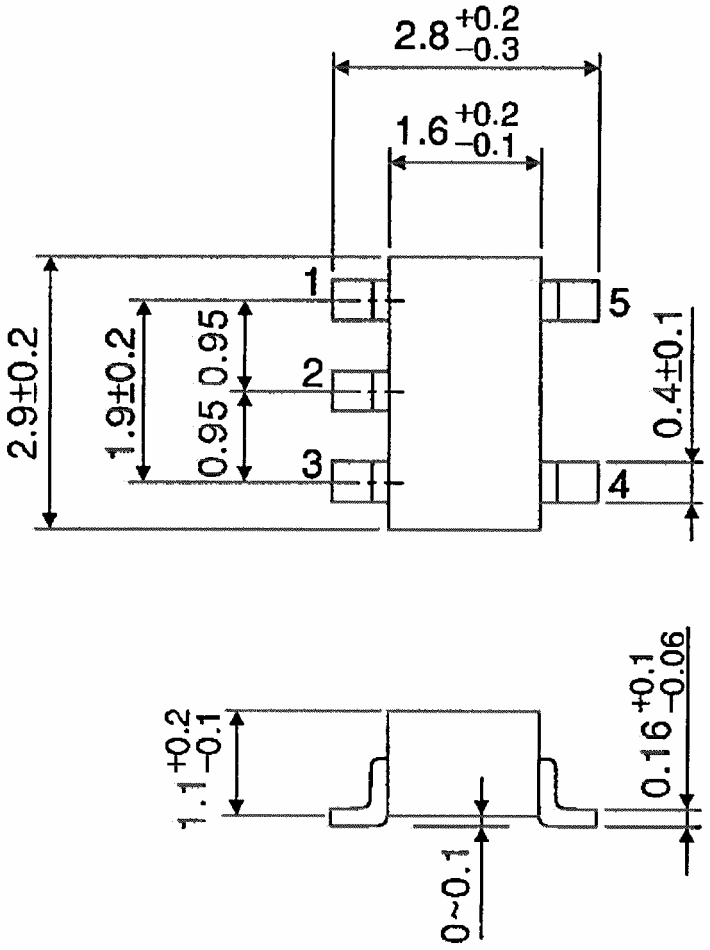
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

Package Dimensions

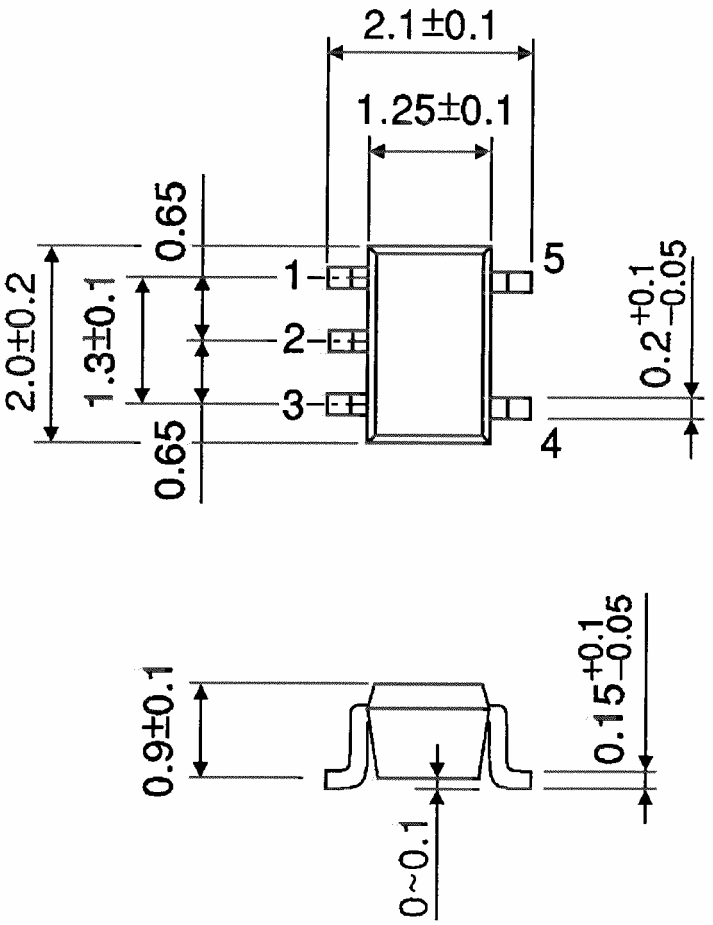
SSOP5-P-0.95 Unit : mm



Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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