

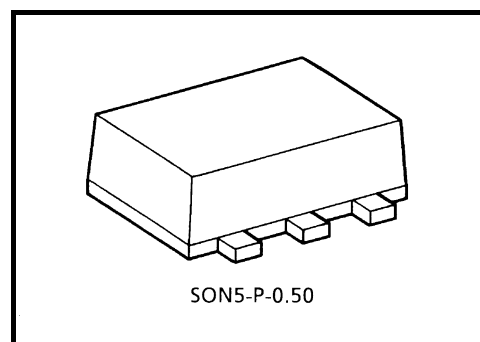
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SHU04FE

INVERTER (Un-Buffer)

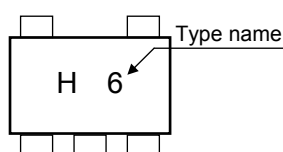
Features

- Super high speed operation : $t_{PD} = 3.5 \text{ ns (typ.)}$
@ $V_{CC} = 5 \text{ V}$
- Low power dissipation : $I_{CC} = 2 \mu\text{A (Max.)}$
@ $T_a = 25^\circ\text{C}$
- High noise immunity : $V_{NIH} = V_{NIH}$
 $= 10\% V_{CC} \text{ (Min.)}$
- 5.5V tolerant input.
- Wide operation voltage range : $V_{CC} \text{ (opr)} = 2 \sim 5.5 \text{ V}$

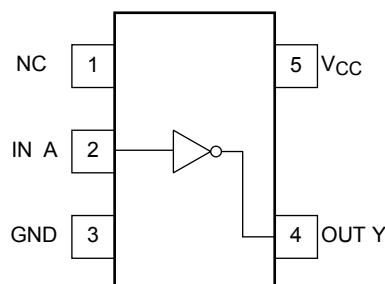


Weight: 0.003 g (typ.)

Marking



Pin Assignment (top view)



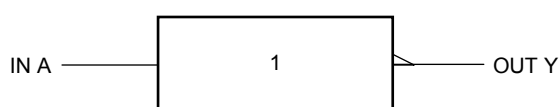
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	$-0.5 \sim 7$	V
DC input voltage	V_{IN}	$-0.5 \sim 7$	V
DC output voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	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	150	mW
Storage temperature	T_{stg}	$-65 \sim 150$	$^\circ\text{C}$

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).

Logic Diagram



Truth Table

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

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Circuit	Test Condition		Ta = 25°C				Ta = -40~85°C		Unit
					V _{CC} (V)	Min	Typ.	Max	Min	Max	
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: $t_r = t_f = 3\text{ ns}$)

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}	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)		—	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.

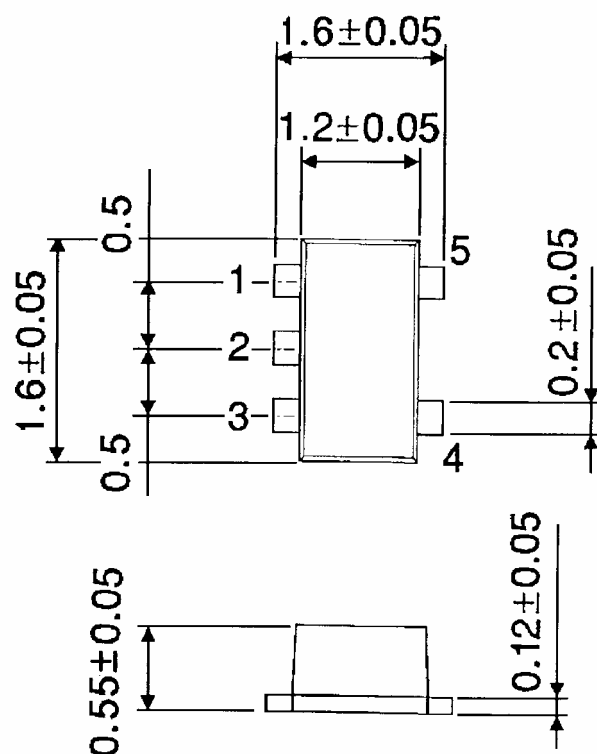
Average operating current can be obtained by the equation.

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

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

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