

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7SHU04F, TC7SHU04FU

INVERTER

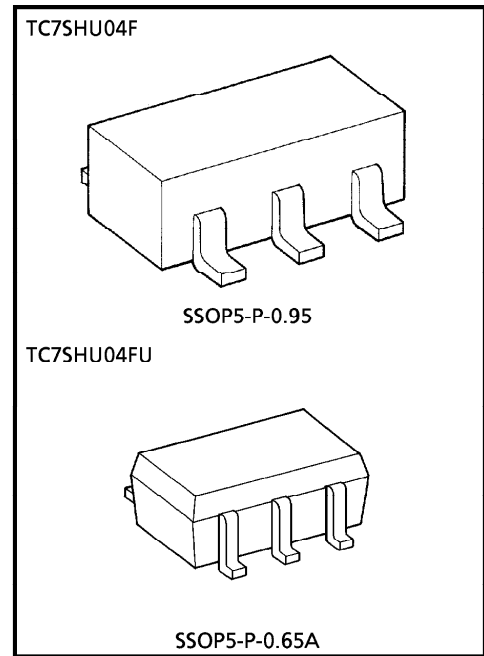
The TC7SHU04 is an advanced high speed CMOS INVERTER fabricated with silicon gate C²MOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. Since the internal circuit is composed of a single stage inverter, it can be used in analog applications such as crystal oscillators. An input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interfase 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

FEATURES

- High Speed $t_{pd} = 3.5ns$ (Typ.) at $V_{CC} = 5V$
- Low Power Dissipation $I_{CC} = 2\mu A$ (Max.) at $T_a = 25^\circ C$
- High Noise Immunity $V_{NIH} = V_{NIL} = 10\% V_{CC}$ (Min.)
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range $V_{CC(opr)} = 2 \sim 5.5V$

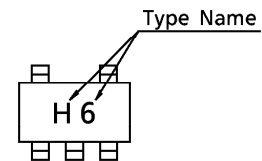
MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	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 (10s)	T_L	260	°C



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

MARKING



TRUTH TABLE

A	Y
L	H
H	L

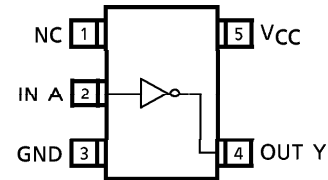
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LOGIC DIAGRAM



PIN ASSIGNMENT (TOP VIEW)



RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	2.0~5.5	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

PARAMETER	SYMBOL	TEST CIRCUIT	TEST CONDITION	$T_a = 25^\circ\text{C}$						UNIT	
				V_{CC}	MIN.	TYP.	MAX.	MIN.	MAX.		
High-Level Input Voltage	V_{IH}	—	—	2.0 3.0~ 5.5	1.7 V_{CC} $\times 0.8$	— — —	— — —	1.7 V_{CC} $\times 0.8$	— — —	V	
Low-Level Input Voltage	V_{IL}	—	—	2.0 3.0~ 5.5	— — —	— — —	0.30 V_{CC} $\times 0.2$	— — V_{CC} $\times 0.2$	0.30 V_{CC} $\times 0.2$	V	
High Level Output-Voltage	V_{OH}	—	$V_{IN} = V_{IL}$	$I_{OH} = -50\mu\text{A}$	2.0 3.0 4.5	1.8 2.7 4.0	2.0 3.0 4.5	— — —	1.8 2.7 4.0	— — —	V
			$V_{IN} = \text{GND}$		$I_{OH} = -4\text{mA}$ $I_{OH} = -8\text{mA}$	3.0 4.5	2.58 3.94	— —	— —	2.48 3.80	
Low-Level Output-Voltage	V_{OL}	—	$V_{IN} = V_{IH}$	$I_{OL} = 50\mu\text{A}$	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.2 0.3 0.5	— — —	0.2 0.3 0.5	V
			$V_{IN} = V_{CC}$		$I_{OL} = 4\text{mA}$ $I_{OL} = 8\text{mA}$	3.0 4.5	— —	— —	0.36 0.36	— —	
Input Leakage Current	I_{IN}	—	$V_{IN} = 5.5\text{V}$ 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		

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AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3\text{ns}$)

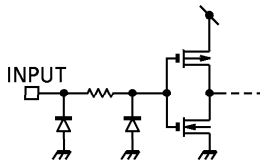
PARAMETER	SYMBOL	TEST CIR-CUIT	TEST CONDITION		Ta = 25°C			Ta = - 40~85°C		UNIT	
			V _{CC} (V)	C _L (pF)	MIN.	TYP.	MAX.	MIN.	MAX.		
Propagation Delay Time	t _{PLH}	—	—	3.3 ± 0.3	15	—	5.0	8.9	1.0	10.5	ns
					50	—	7.5	11.4	1.0	13.0	
	t _{PHL}			5.0 ± 0.5	15	—	3.5	5.5	1.0	6.5	
					50	—	5.0	7.0	1.0	8.0	
Input Capacitance	C _{IN}	—	—		—	5	10	—	10	pF	
Power Dissipation Capacitance	C _{PD}	—	Note (1)		—	6	—	—	—		

Note (1) : 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 :

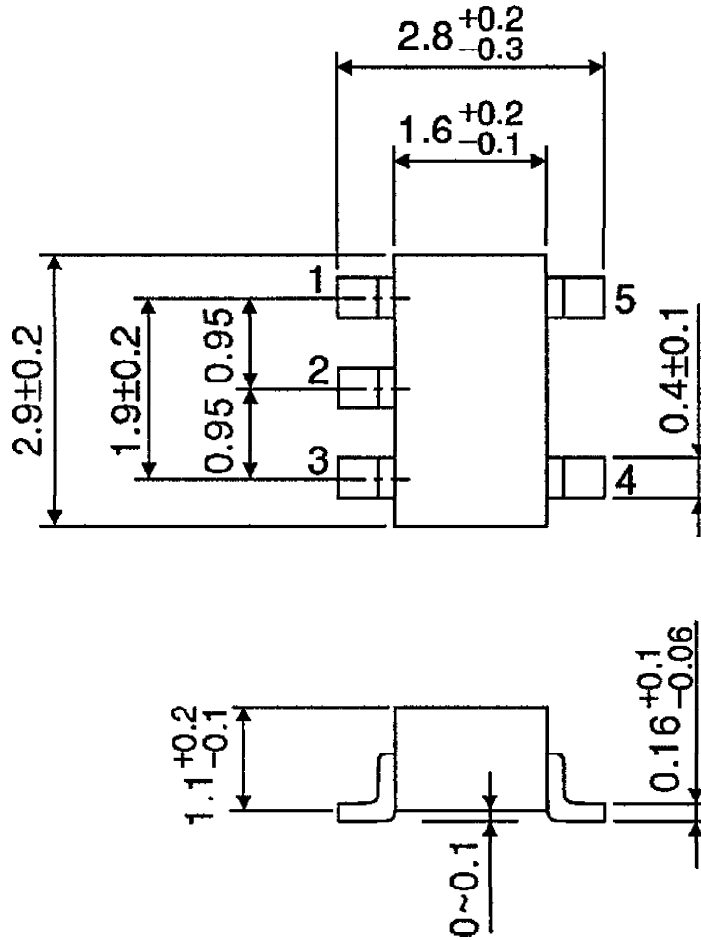
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

INPUT EQUIVALENT CIRCUIT



OUTLINE DRAWING
SSOP5-P-0.95

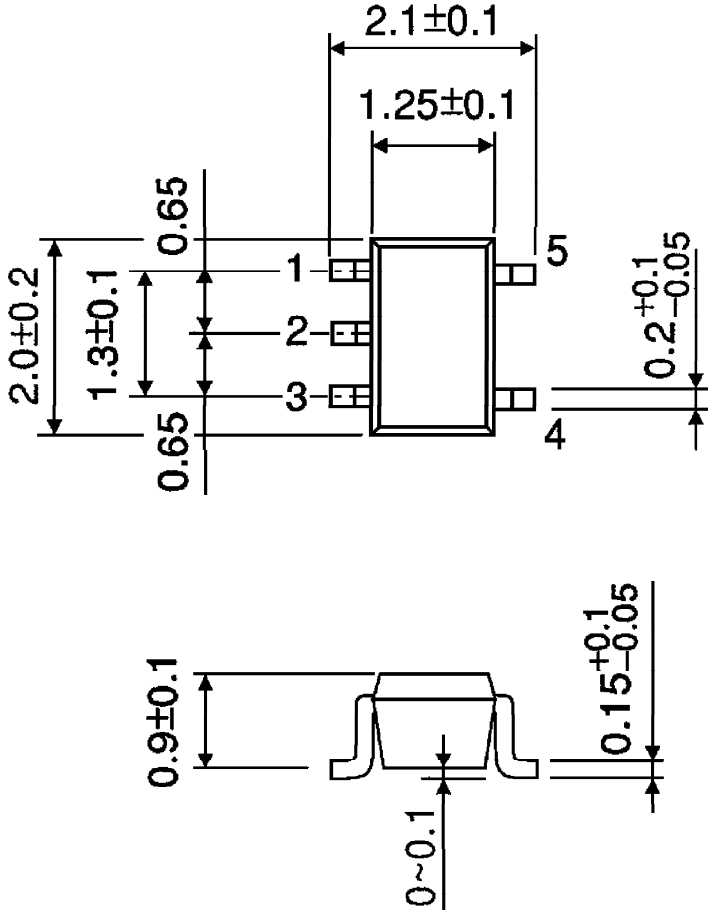
Unit : mm



Weight : 0.016g (Typ.)

OUTLINE DRAWING
SSOP5-P-0.65A

Unit : mm



Weight : 0.006g (Typ.)