

TC7SU04F, TC7SU04FU

INVERTER

The TC7SU04 is a high speed C²MOS INVERTER fabricated with silicon gate C²MOS technology.

It achieves high speed operation similar to equivalent LSTTL while maintaining the C²MOS low power dissipation.

The internal circuit is composed of single stages inverter, it can be applied for crystal oscillation.

The input is equipped with protection circuits against static discharge or transient excess voltage.

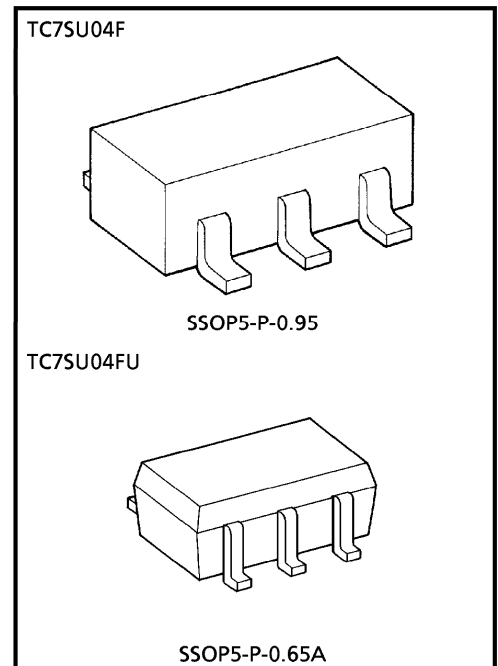
Output currents are 1/2 compared to TC74HC series models.

FEATURES

- High Speed $t_{pd} = 7\text{ns}$ (Typ.) at $V_{CC} = 5\text{V}$
- Low Power Dissipation $I_{CC} = 1\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- High Noise Immunity $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Output Drive Capability 5 LSTTL Loads
- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL} = 2\text{mA}$ (Min.)
- Balanced Propagation Delays $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range ... $V_{CC}(\text{opr}) = 2\sim 6\text{V}$

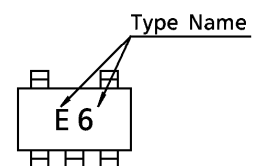
MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{CC}	-0.5~7	V
DC Input Voltage	V_{IN}	-0.5~ $V_{CC} + 0.5$	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}	± 12.5	mA
DC V_{CC} /Ground Current	I_{CC}	± 25	mA
Power Dissipation	P_D	200	mW
Storage Temperature	T_{stg}	-65~150	°C
Lead Temperature (10s)	T_L	260	°C

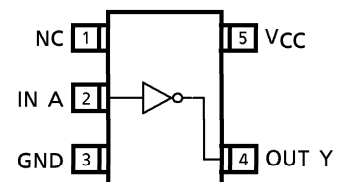


Weight SSOP5-P-0.95 : 0.016g (Typ.)
 SSOP5-P-0.65A : 0.006g (Typ.)

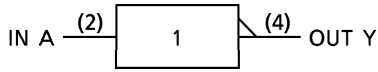
MARKING



PIN ASSIGNMENT (TOP VIEW)



LOGIC DIAGRAM



RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	2~6	V
Input Voltage	V_{IN}	0~ V_{CC}	V
Output Voltage	V_{OUT}	0~ V_{CC}	V
Operating Temperature	T_{opr}	-40~85	°C

DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION	$T_a = 25^{\circ}\text{C}$			$T_a = -40\sim 85^{\circ}\text{C}$		UNIT				
			V_{CC}	MIN.	TYP.	MAX.	MIN.		MAX.			
High-Level Input Voltage	V_{IH}	—	2.0	1.7	—	—	1.7	—	V			
			4.5	3.6	—	—	3.6	—				
			6.0	4.8	—	—	4.8	—				
Low-Level Input Voltage	V_{IL}	—	2.0	—	—	0.3	—	0.3	V			
			4.5	—	—	0.9	—	0.9				
			6.0	—	—	1.2	—	1.2				
High-Level Output Voltage	V_{OH}	$V_{IN} = V_{IL}$	$I_{OH} = -20\mu\text{A}$	2.0	1.8	2.0	—	1.8	—	V		
				4.5	4.0	4.5	—	4.0	—			
				6.0	5.5	5.9	—	5.5	—			
Low-Level Output Voltage	V_{OL}	$V_{IN} = V_{IH}$	$I_{OL} = 20\mu\text{A}$	2.0	—	0.0	0.2	—	0.2	V		
				4.5	—	0.0	0.2	—	0.5			
				6.0	—	0.0	0.5	—	0.5			
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	± 0.1	—	± 1.0	μA			
			Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC}$ or GND	4.5	—	0.17		0.26	—	0.33
						6.0	—	0.18		0.26	—	0.33

Output currents are 1/2 compared to TC74HC series models.

AC ELECTRICAL CHARACTERISTICS ($C_L = 15\text{pF}$, Input $t_r = t_f = 6\text{ns}$, $V_{CC} = 5\text{V}$)

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C			UNIT
			MIN.	TYP.	MAX.	
Output Transition Time	t_{TLH}	—	—	5	10	ns
	t_{THL}					
Propagation Delay Time	t_{pLH}	—	—	7	15	ns
	t_{pHL}					

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

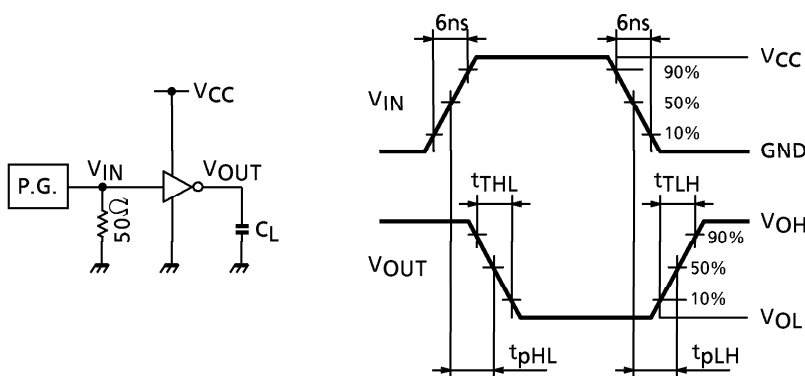
CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{CC}	Ta = 25°C			Ta = -40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t_{TLH}	—	2.0	—	50	125	—	155	ns
	t_{THL}		4.5	—	14	25	—	31	
			6.0	—	12	21	—	26	
Propagation Delay Time	t_{pLH}	—	2.0	—	48	100	—	125	ns
	t_{pHL}		4.5	—	12	20	—	25	
			6.0	—	9	17	—	21	
Input Capacitance	C_{IN}	—	—	5	10	—	10	pF	
Power Dissipation Capacitance	C_{pD}	(Note 1)	—	10	—	—	—		

Note 1 : C_{pD} defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit).

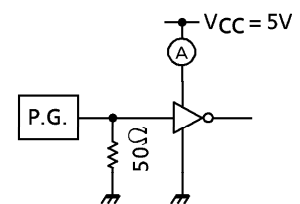
Average operating current can be obtained by the equation hereunder.

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

SWITCHING CHARACTERISTICS TEST CIRCUIT



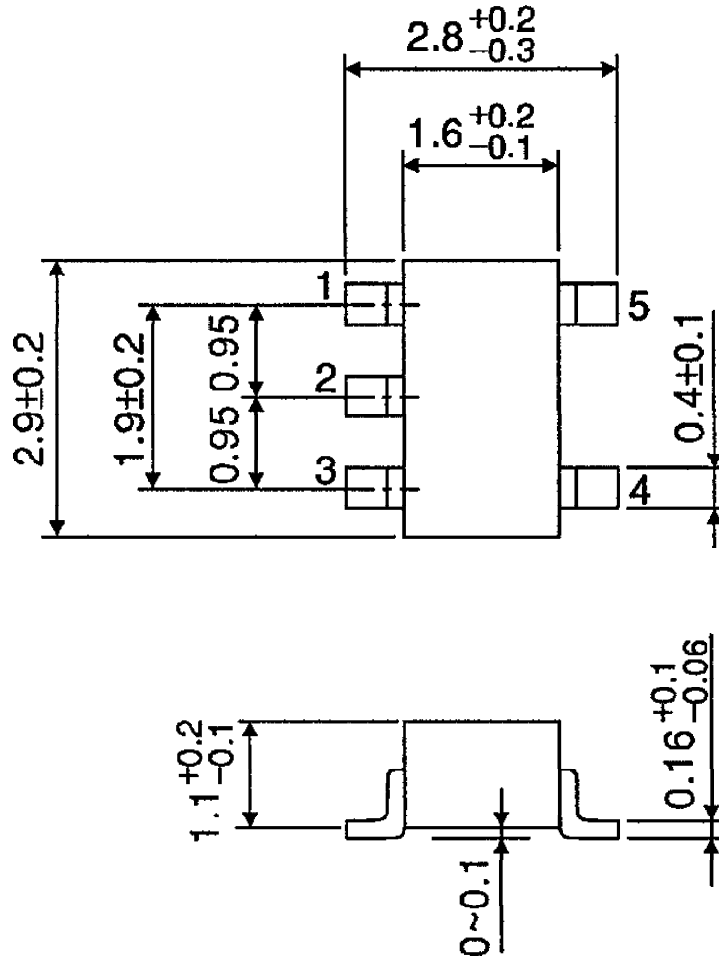
$I_{CC (opr)}$ TEST CIRCUIT



Input waveform is the same as that in case of switching characteristics test.

PACKAGE DIMENSIONS
SSOP5-P-0.95

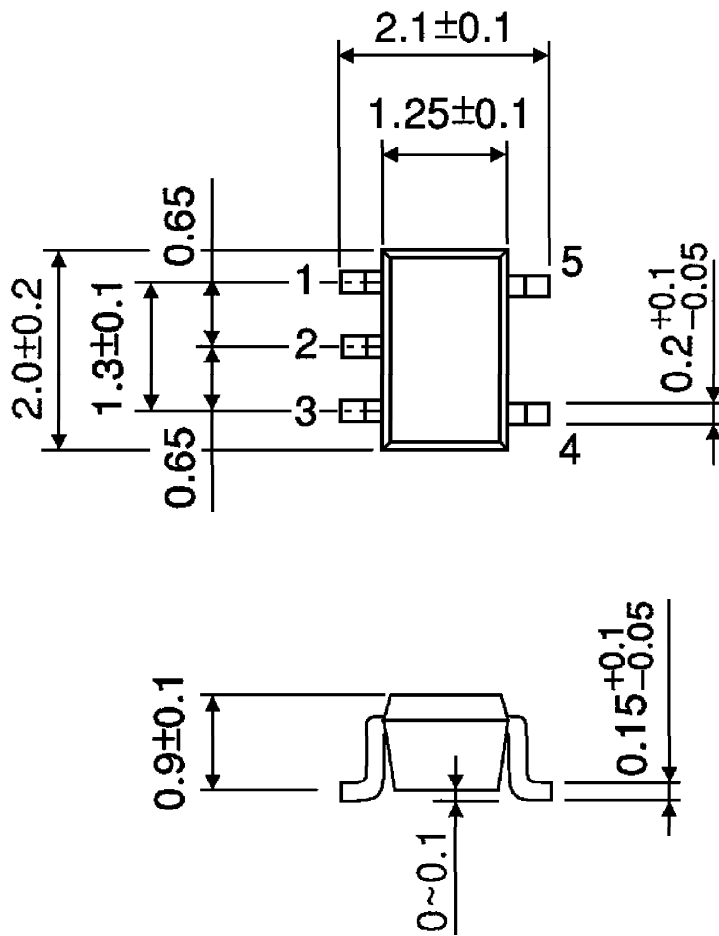
Unit : mm



Weight : 0.016g (Typ.)

PACKAGE DIMENSIONS
SSOP5-P-0.65A

Unit : mm



Weight : 0.006g (Typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.