TOSHIBA

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT   SILICON MONOLITHIC

TC7S04F, TC7S04FU

INVERTER

The TC7S04 is a high speed C^2MOS INVERTER fabricated with silicon gate C^2MOS technology.
It achieves high speed operation similar to equivalent LSTTL while maintaining the C^2MOS low power dissipation.
The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.
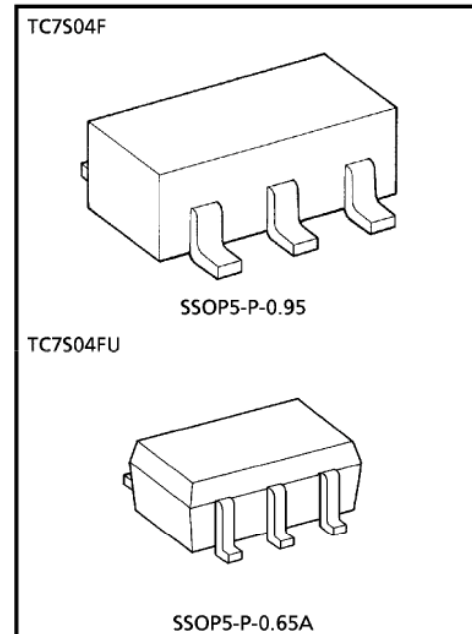The input is equipped with protection circuits against static discharge or transient excess voltage.
Output currents are 1 / 2 compared to TC74HC series models.

FEATURES

- High Speed .... $t_{pd} = 7ns$ (Typ.) at $V_{CC} = 5V$

- Low Power Dissipation .... $I_{CC} = 1\mu A$ (Max.) at $Ta = 25°C$

- High Noise Immunity .... $V_{NIH} = V_{NIL} = 28\%\ V_{CC}$ (Min.)

- Output Drive Capability .... 5 LSTTL Loads

- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL} = 2mA$ (Min.)

- Balanced Propagation Delays ...... $t_{pLH} \doteq t_{pHL}$

- Wide Operating Voltage Range ... $V_{CC\ (opr)} = 2\sim6V$

TC7S04F
SSOP5-P-0.95

TC7S04FU
SSOP5-P-0.65A

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

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{CC}	$-0.5\sim7$	V
DC Input Voltage	V_{IN}	$-0.5\sim V_{CC}+0.5$	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}	±12.5	mA
DC V_{CC} / Ground Current	I_{CC}	±25	mA
Power Dissipation	P_D	200	mW
Storage Temperature	T_{stg}	$-65\sim150$	°C
Lead Temperature (10s)	T_L	260	°C

MARKING

Type Name

E 5

PIN ASSIGNMENT (TOP VIEW)

NC [1]   [5] V_{CC}
IN A [2]   [4] OUT Y
GND [3]

CIRCUIT DIAGRAM

IN A —(2)— | 1 | —(4)— OUT Y
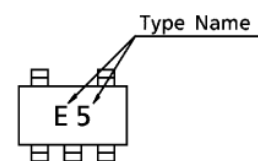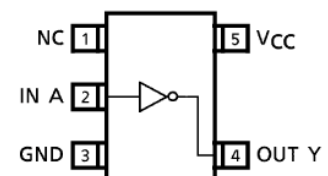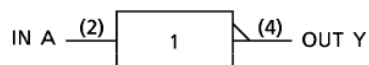
RECOMMENDED OPERATING CONDITIONS

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
Input Rise and Fall Time	t_r, t_f	0~1000 (V_{CC} = 2.0V) 0~ 500 (V_{CC} = 4.5V) 0~ 400 (V_{CC} = 6.0V)	ns

DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION		V_{CC}	Ta = 25°C			Ta = −40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V_{IH}	—		2.0	1.5	—	—	1.5	—	V
				4.5	3.15	—	—	3.15	—	
				6.0	4.2	—	—	4.2	—	
Low-Level Input Voltage	V_{IL}	—		2.0	—	—	0.5	—	0.5	V
				4.5	—	—	1.35	—	1.35	
				6.0	—	—	1.8	—	1.8	
High-Level Output Voltage	V_{OH}	$V_{IN} = V_{IL}$	$I_{OH} = -20\mu A$	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
				6.0	5.9	6.0	—	5.9	—	
			$I_{OH} = -2mA$	4.5	4.18	4.31	—	4.13	—	
			$I_{OH} = -2.6mA$	6.0	5.68	5.80	—	5.63	—	
Low-Level Output Voltage	V_{OL}	$V_{IN} = V_{IH}$	$I_{OL} = 20\mu A$	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
				6.0	—	0.0	0.1	—	0.1	
			$I_{OL} = 2mA$	4.5	—	0.17	0.26	—	0.33	
			$I_{OL} = 2.6mA$	6.0	—	0.18	0.26	—	0.33	
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		6.0	—	—	1.0	—	10.0	

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

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

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

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

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

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**
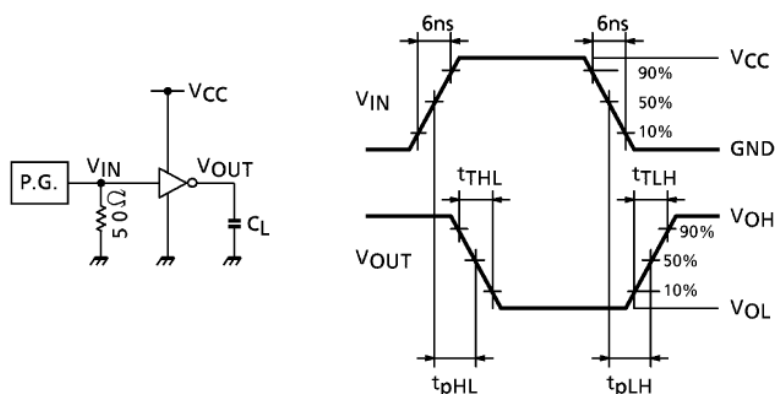
Input waveform is the same as that in case of switching characteristics test.
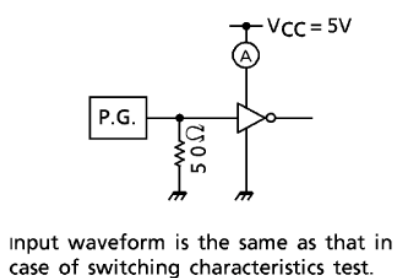
PACKAGE DIMENSIONS
  SSOP5-P-0.95   Unit : mm
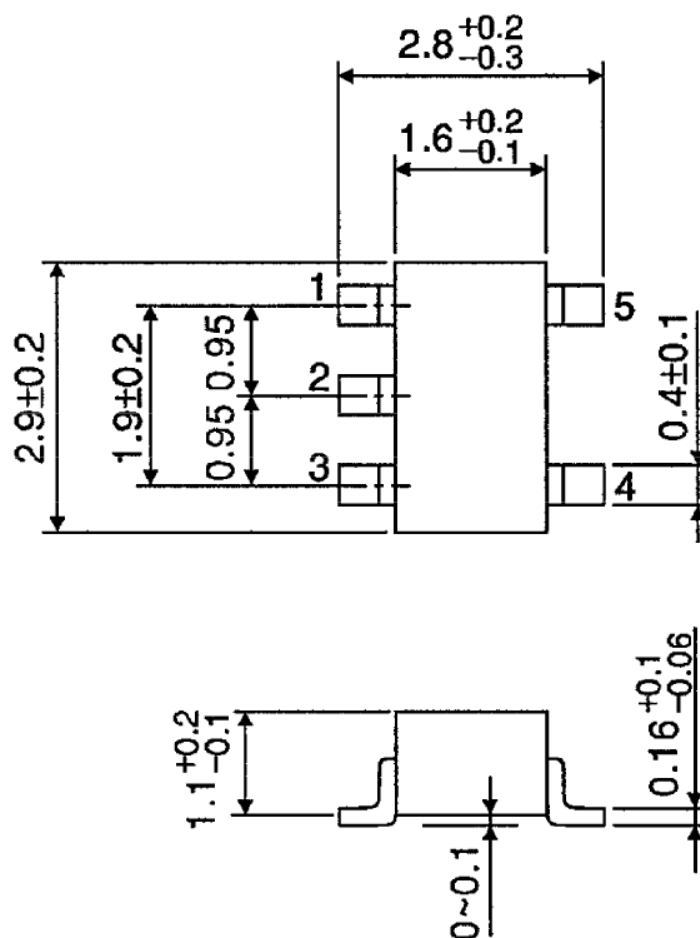
Weight : 0.016g (Typ.)

PACKAGE DIMENSIONS
SSOP5-P-0.65A

Unit : mm
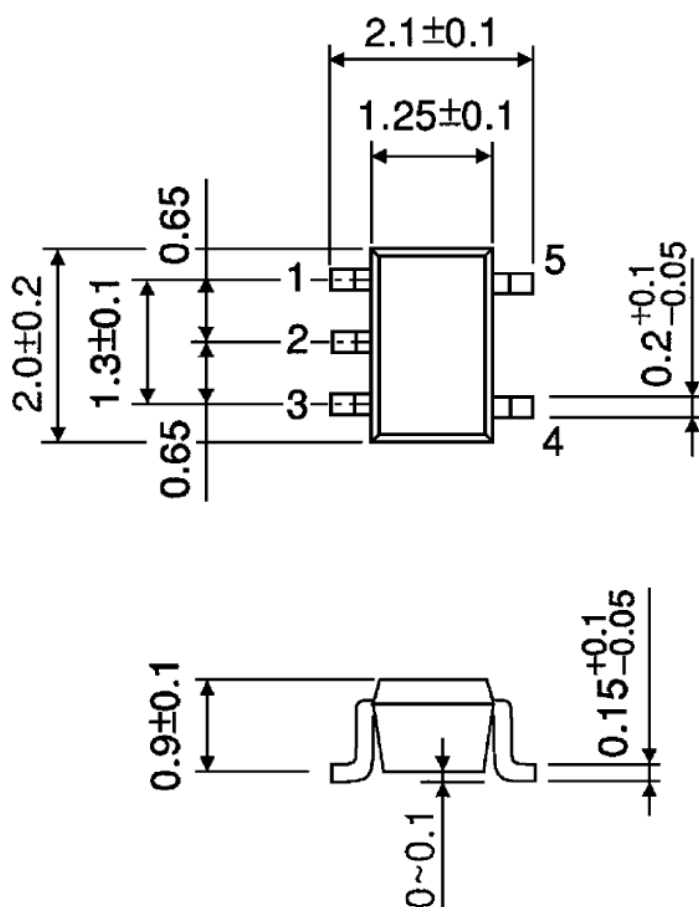
Weight : 0.006g (Typ.)

RESTRICTIONS ON PRODUCT USE