

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7S04F, TC7S04FU

INVERTER

The TC7S04 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 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.

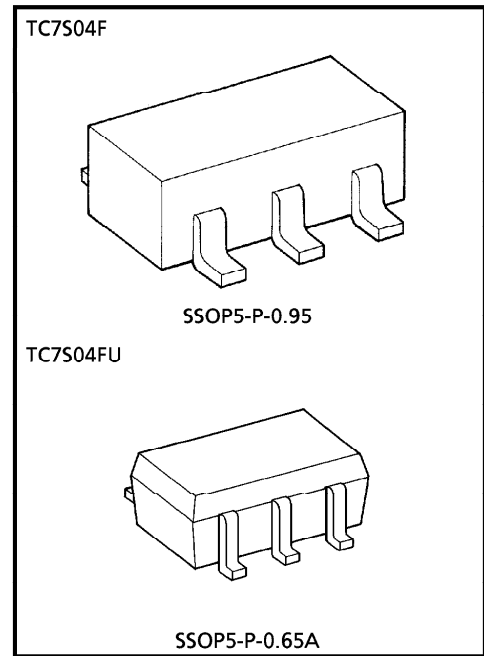
Output currents are 1/2 compared to TC74HC series models.

FEATURES

- High Speed $t_{pd} = 7\text{ns}$ (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 $t_{pLH} \cong t_{pHL}$
- Wide Operating Voltage Range ... $V_{CC}(\text{opr}) = 2\sim 6\text{V}$

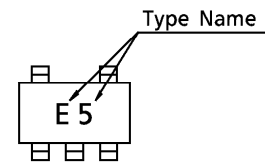
MAXIMUM RATINGS

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	$^\circ\text{C}$
Lead Temperature (10s)	T_L	260	$^\circ\text{C}$

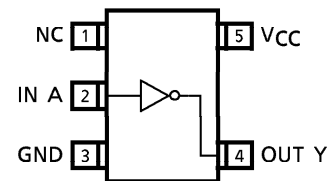


Weight SSOP5-P-0.95 : 0.016g (Typ.)
SSOP5-P-0.65A : 0.006g (Typ.)

MARKING



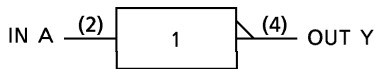
PIN ASSIGNMENT (TOP VIEW)



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CIRCUIT 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
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	Ta = 25°C			Ta = -40~85°C		UNIT					
			V _{CC}	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} = -20μA	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	—				
Low-Level Output Voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 20μA	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				
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.

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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 $t_r = t_f = 6\text{ns}$)

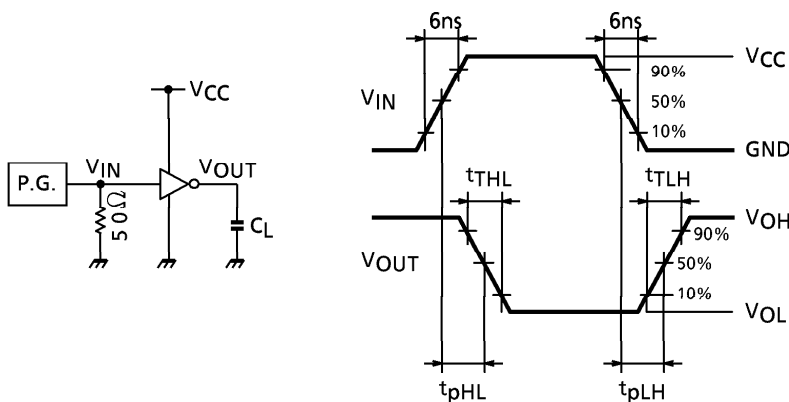
CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			VCC	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	t_{TLH}	—	2.0	—	50	125	—	155	ns
	t_{THL}		4.5	—	14	25	—	31	
			6.0	—	12	21	—	26	
Propagation Delay Time	t_{pLH}	—	2.0	—	48	100	—	125	ns
	t_{pHL}		4.5	—	12	20	—	25	
			6.0	—	9	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).

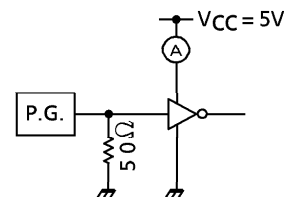
Average operating current can be obtained by the equation hereunder.

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

SWITCHING CHARACTERISTICS TEST CIRCUIT



I_{CC(opr)} TEST CIRCUIT



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