

Inverter

The TC7S04 is a high speed CMOS Inverter fabricated with silicon gate CMOS technology.

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

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The input are compatible with TTL, NMOS and CMOS output voltage levels.

The internal circuit is composed of 3-stages including buffer output, which provide high noise immunity and stable output.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

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

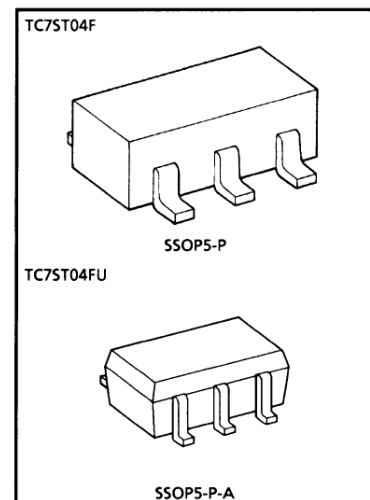
Some AC electrical characteristic is different from TC74HCT series models.

Features

- High speed
 - $t_{pd} = 10\text{ns}$ (Typ.) at $V_{CC} = 5\text{V}$
- Low Power Dissipation
 - $I_{CC} = 1\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs
 - $V_{IL} = 0.8\text{V}$ (Max.), $V_{IH} = 2.0\text{V}$ (Min.)
- Output Drive Capability
 - 5 LSTTL Loads
- Symmetrical Output Impedance
 - $|I_{OH}| = I_{OL} = 2\text{mA}$

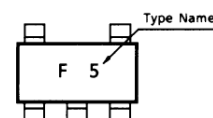
Maximum Ratings

Characteristics	Symbol	Condition	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 : 0.016g (Typ.)
SSOP5-P-A : 0.006g (Typ.)

Marking



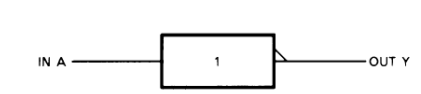
Truth Table

A	Y
L	H
H	L

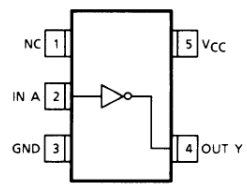
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Logic Diagram



Pin Assignment (Top View)



Recommended Operating Conditions

Characteristics	Symbol	Condition	Unit
Supply Voltage	V_{CC}	4.5~5.5	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~ 500 ($V_{CC} = 5.0V$)	ns

DC Electrical Characteristics

Characteristic	Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
				V _{CC} (V)	Min.	Typ.	Max.	Min.		Max
High-Level Input Voltage	V _{IH}	—		4.5~5.5	2.0	—	—	2.0	—	V
Low-Level Input Voltage	V _{IL}	—		4.5~5.5	—	—	0.8	—	0.8	V
High-Level Output Voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -20 μA	4.5	4.4	4.5	—	4.4	—	V
			I _{OH} = -2mA	4.5	4.18	4.31	—	4.13	—	
Low-Level Output Voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 μA	4.5	—	0.0	0.1	—	0.1	V
			I _{OL} = 2mA	4.5	—	0.17	0.26	—	0.33	
Input Leakage Current	I _{IN}	V _{IN} = V _{CC} or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	1.0	—	10.0	μA
	I _C	Per Input: V _{IN} = 0.5V or 2.4V		5.5	—	—	2.0	—	2.9	mA

Output currents are 1/2 compared to TC74HC series models.
Some AC electrical characteristic is different from TC74HC series models.

AC Electrical Characteristics ($C_L = 15\text{pF}$, $V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Output Transition Time	t_{TLH} t_{THL}	—	—	5	10	ns
Propagation Delay Time	t_{PLH} t_{PHL}	—	—	10	17	ns

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	tTLH tTHL	—	4.5 5.5	— —	14 12	25 21	— —	31 26	ns
Propagation Delay Time	tPLH tPHL	—	4.5 5.5	— —	16 15	27 26	— —	31 33	ns
Input Capacitance	CIN	—		—	5	10	—	10	pF
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.

Average operating current can be obtained by the equation hereunder.

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

Switching Characteristics Test Circuit