

### 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.

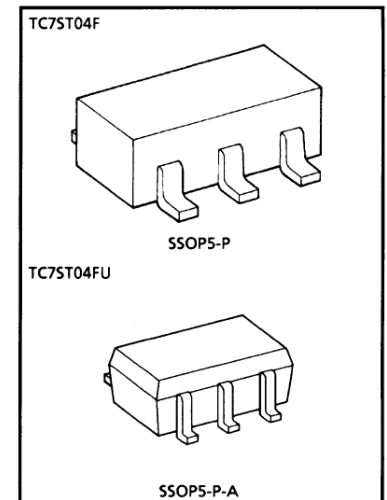
Some AC electrical characteristic is different from TC74HCT series models.

### 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
  - $|I_{OH}| = I_{OL} = 2\text{mA}$

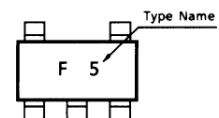
### Maximum Ratings

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	$I_{IK}$	$\pm 20$	mA
Output Diode Current	$I_{OK}$	$\pm 20$	mA
DC Output Current	$I_{OUT}$	$\pm 12.5$	mA
DC $V_{CC}$ / Ground Current	$I_{CC}$	$\pm 25$	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



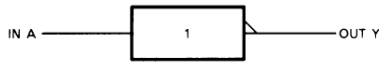
### Truth Table

A	Y
L	H
H	L

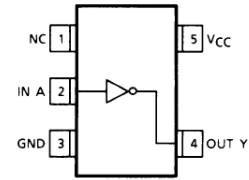
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Logic Diagram



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	$V_{CC}$ (V)	$T_a = 25^\circ C$			$T_a = -40 \sim 85^\circ C$		Unit	
				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 $V_{IL}$	$I_{OH} = -20 \mu A$	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 $V_{IL}$	$I_{OL} = 20 \mu A$	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	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu A$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	1.0	—	10.0	$\mu A$	
	$I_C$	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	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		Unit	
			$V_{CC}$	Min.	Typ.	Max.	Min.		Max.
Output Transition Time	$t_{TLH}$ $t_{THL}$	–	4.5 5.5	– –	14 12	25 21	– –	31 26	ns
Propagation Delay Time	$t_{pLH}$ $t_{pHL}$	–	4.5 5.5	– –	16 15	27 26	– –	31 33	ns
Input Capacitance	$C_{IN}$	–	–	–	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.

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

**Switching Characteristics Test Circuit**

