

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.

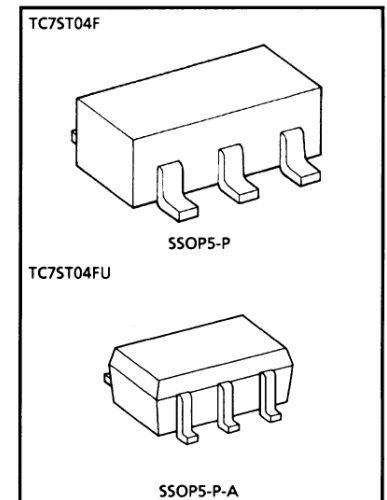
Some AC electrical characteristic is different from TC74HCT series models.

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

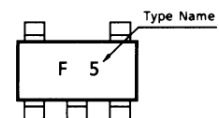
Maximum Ratings

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



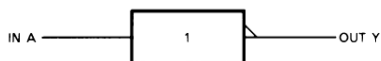
Truth Table

A	Y
L	H
H	L

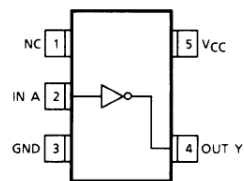
The information contained here is subject to change without notice.

The information contained herein is presented only as guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others. These TOSHIBA products are intended for usage in general electronic equipments (office equipment, communication equipment, measuring equipment, domestic electrification, etc.) Please make sure that you consult with us before you use these TOSHIBA products in equipments which require high quality and/or reliability, and in equipments which could have major impact to the welfare of human life (atomic energy control, spaceship, traffic signal, combustion control, all types of safety devices, etc.). TOSHIBA cannot accept liability to any damage which may occur in case these TOSHIBA products were used in the mentioned equipments without prior consultation with TOSHIBA.

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	—	—	± 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	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		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.

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

Switching Characteristics Test Circuit

