

TC74HC04P HEX INVERTER

GENERAL DESCRIPTION

The TC74HC04 is a high speed CMOS INVERTER fabricated with silicon gate C²MOS technology.

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

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

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

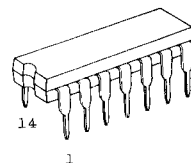
FEATURES

- High Speed $t_{pd}=8ns$ (Typ.) at $V_{CC}=5V$
- Low Power Dissipation $I_{CC}=1\mu A$ (Max.) at $T_a=25^\circ C$
- High Noise Immunity $V_{NIH}=V_{NIL}=28\% V_{CC}$ (Min.)
- Output Drive Capability 10LSTTL Loads
- Symmetrical Output Impedance ... $|I_{OH}|=I_{OL}=4mA$ (Min.)
- Balanced Propagation Delays $t_{pLH}=t_{pHL}$
- Wide Operating Voltage Range $V_{CC(opr)}=2V \sim 6V$
- Pin and Function Compatible with 74LS04

ABSOLUTE MAXIMUM RATINGS

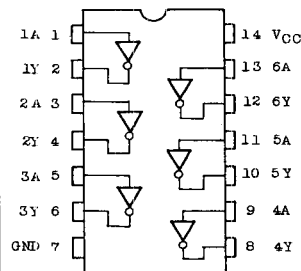
PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC}+0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC}+0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 25	mA
DC V_{CC} /Ground Current	I_{CC}	± 50	mA
Power Dissipation	P_D	500*	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^\circ C$
Lead Temperature 10sec	T_L	300	$^\circ C$

* 500mW in the range of $T_a=-40^\circ C \sim 65^\circ C$ and from $T_a=65^\circ C$ up to $85^\circ C$ derating factor of $-10mW/^\circ C$ shall be applied until 300mW.



DIP (5-21P)

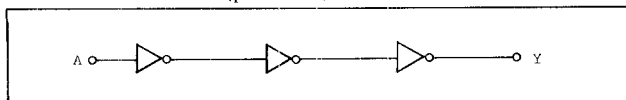
PIN ASSIGNMENT



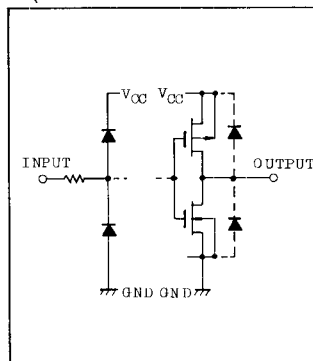
(TOP VIEW)

TC74HC04P

LOGIC DIAGRAM (per Gate)



INPUT and OUTPUT EQUIVALENT CIRCUIT



RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	LIMIT	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

PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	$T_a=25^{\circ}C$			$T_a=-40\sim 85^{\circ}C$		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}	$V_{IN}=V_{IL}$							V
			$I_{OH}=-20\mu A$	2.0	1.9	2.0	-	1.9	
				4.5	4.4	4.5	-	4.4	
				6.0	5.9	6.0	-	5.9	
			$I_{OH}=-4mA$	4.5	4.18	4.31	-	4.13	
			$I_{OH}=-5.2mA$	6.0	5.68	5.80	-	5.63	
Low-Level Output Voltage	V_{OL}	$V_{IN}=V_{IH}$							V
			$I_{OL}=20\mu A$	2.0	-	0.0	0.1	-	0.1
				4.5	-	0.0	0.1	-	0.1
				6.0	-	0.0	0.1	-	0.1
			$I_{OL}=4mA$	4.5	-	0.17	0.32	-	0.37
			$I_{OL}=5.2mA$	6.0	-	0.18	0.32	-	0.37
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	

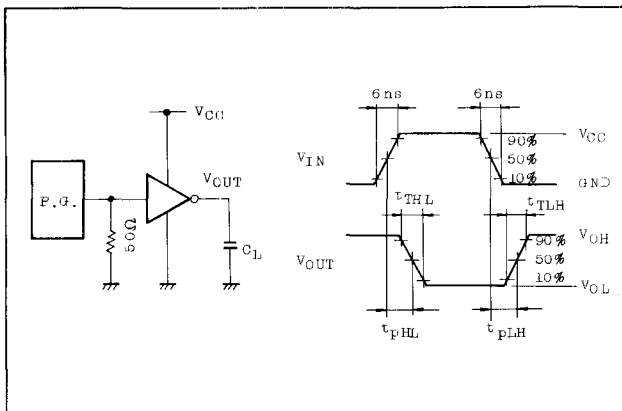
AC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	Ta=25°C				Ta=-40~85°C		UNIT
			V _{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t _{TLH}		2.0	-	30	75	-	90	ns
	t _{THL}		4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Propagation Delay Time	t _{PLH}		2.0	-	34	90	-	110	ns
	t _{PHL}		4.5	-	10	18	-	22	
			6.0	-	9	16	-	19	
Input Capacitance	C _{IN}		-	-	5	10	-	10	pF
Power Dissipation Capacitance	C _{PD} (1)		-	-	23	-	-	-	

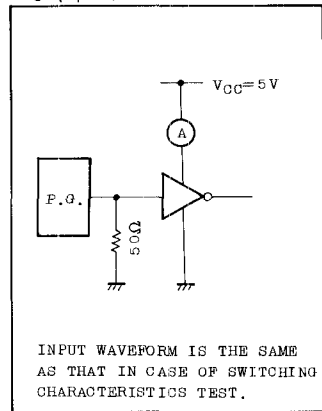
Note(1) C_{pd} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit). Average operating current can be obtained by the equation hereunder

$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6 \quad (\text{per Gate})$$

SWITCHING CHARACTERISTICS TEST CIRCUIT

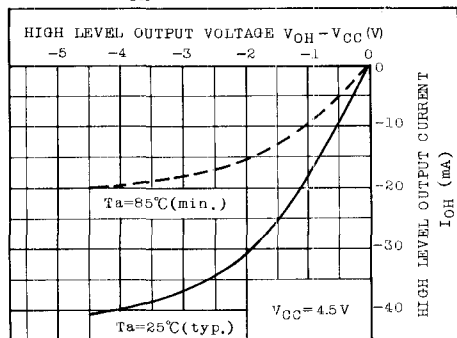


I_{CC(opr.)} TEST CIRCUIT

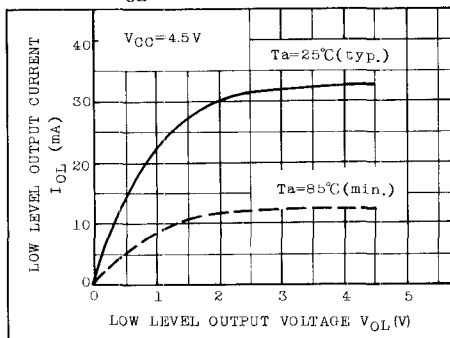


TC74HC04P

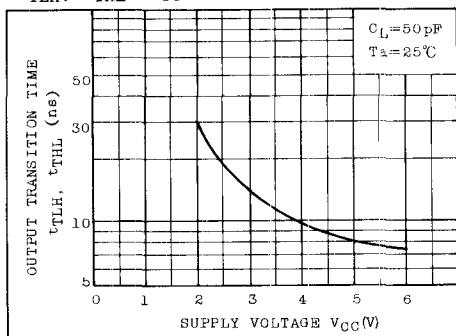
I_{OH} CHARACTERISTICS



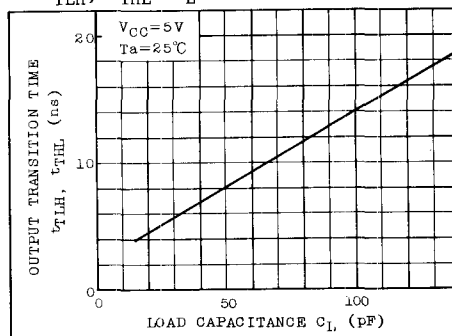
I_{OL} CHARACTERISTICS



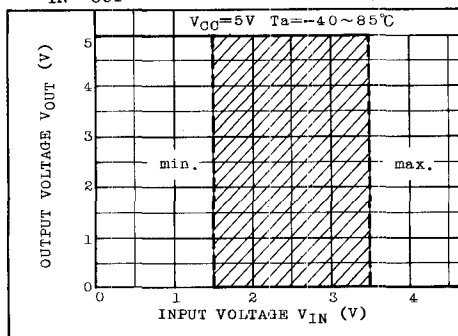
t_{TLH} , $t_{THL} - V_{CC}$ CHARACTERISTICS (TYP.)



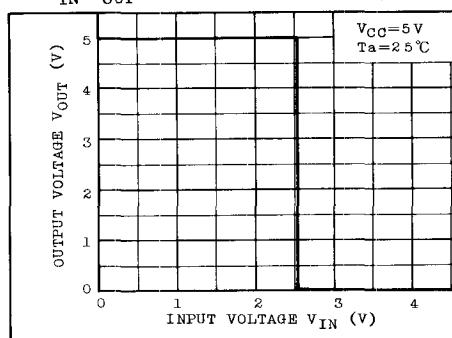
t_{TLH} , $t_{THL} - C_L$ CHARACTERISTICS (TYP.)



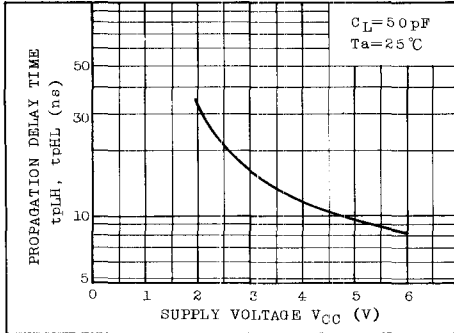
$V_{IN} - V_{OUT}$ CHARACTERISTICS (MIN., MAX.)



$V_{IN} - V_{OUT}$ CHARACTERISTICS (TYP.)



t_{PLH} , t_{PHL} - V_{CC} CHARACTERISTICS (TYP.)



t_{PLH} , t_{PHL} - C_L CHARACTERISTICS (TYP.)

