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## NTE74HC04 Integrated Circuit TTL – High Speed CMOS, Hex Inverter

**Description:**

The NTE74HC04 is a logic function hex inverter in a 14-Lead plastic DIP type package fabricated using advanced silicon-gate CMOS technology which provides the inherent benefits of CMOS – low quiescent power and wide power supply range. This device is input and output characteristic and pinout compatible with standard NTE74LS logic families. The NTE74HC04 triple buffered, hex inverter features low power dissipation and fast switching times. All inputs are protected from static discharge damage by internal diodes to  $V_{CC}$  and ground.

The NTE74HC04 is intended to interface between TTL and NMOS components and standard CMOS devices. This device is also a plug-in replacement for LS-TTL devices and can be used to reduce power consumption in existing designs.

**Features:**

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage range: 2V to 6V
- Low Input Current: 1.0 $\mu$ A
- High Noise Immunity Characteristics of CMOS Devices

**Absolute Maximum Ratings:** (Note 1, Note 2)

Supply Voltage, $V_{CC}$ .....	-0.5 to +7.0V
DC Input Voltage, $V_{IN}$ .....	-1.5 to $V_{CC} + 1.5V$
DC Output Voltage, $V_{OUT}$ .....	-0.5 to $V_{CC} + 0.5V$
Clamp Diode Current, $I_{IK}, I_{OK}$ .....	$\pm 20mA$
DC Output Current (Per Pin), $I_{OUT}$ .....	$\pm 25mA$
DC $V_{CC}$ or GND Current (Per Pin), $I_{CC}$ .....	$\pm 50mA$
Power Dissipation (Note 3), $P_D$ .....	600mW
Storage Temperature Range, $T_{stg}$ .....	-65°C to +150°C
Lead Temperature (During Soldering, 10sec), $T_L$ .....	+260°C

Note 1. Stresses exceeding the Absolute Maximum Ratings may damage the device. The device may not function or be operable above the Recommended Operating Conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the Recommended Operating Conditions may effect device reliability. The Absolute Maximum Ratings are stress ratings only.

Note 2. Unless otherwise specified, all voltages are referenced to GND.

Note 3. Power Dissipation temperature derating: 12mW/°C from +65°C to +85°C.

### Recommended Operating Conditions:

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$		2.0	5.0	6.0	V
DC Input or Output Voltage	$V_{IN}, V_{OUT}$		0	-	$V_{CC}$	V
Operating Temperature Range	$T_A$		-40	-	+125	°C
Input Rise or Fall Times	$t_r, t_f$	$V_{CC} = 2.0V$	-	-	1000	ns
		$V_{CC} = 4.5V$	-	6.0	500	ns
		$V_{CC} = 6.0V$	-	-	400	ns

### DC Electrical Characteristics: (Note 2)

Parameter	Symbol	Test Conditions	$V_{CC}$ (V)	Guaranteed Limits			Unit	
				-40 to +25°C	≤ 85°C	≤ 125°C		
Minimum High Level Input Voltage	$V_{IH}$		2.0	1.50	1.50	1.50	V	
			4.5	3.15	3.15	3.15	V	
			6.0	4.20	4.20	4.20	V	
Maximum Low Level Input Voltage	$V_{IH}$		2.0	0.50	0.50	0.50	V	
			4.5	1.35	1.35	1.35	V	
			6.0	1.80	1.80	1.80	V	
Minimum High Level Output Voltage	$V_{OH}$	$V_{IN} = V_{IH} \text{ or } V_{IL},  I_{OUT}  \leq 20\mu A$	2.0	1.9	1.9	1.9	V	
			4.5	4.4	4.4	4.4	V	
			6.0	5.9	5.9	5.9	V	
		$V_{IN} = V_{IH}$ or $V_{IL}$	$ I_{OUT}  \leq 4.0mA$	4.5	3.98	3.84	3.70	V
			$ I_{OUT}  \leq 5.2mA$	6.0	5.48	5.34	5.20	V
Maximum Low Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH} \text{ or } V_{IL},  I_{OUT}  \leq 20\mu A$	2.0	0.1	0.1	0.1	V	
			4.5	0.1	0.1	0.1	V	
			6.0	0.1	0.1	0.1	V	
		$V_{IN} = V_{IH}$ or $V_{IL}$	$ I_{OUT}  \leq 4.0mA$	4.5	0.26	0.33	0.40	V
			$ I_{OUT}  \leq 5.2mA$	6.0	0.26	0.33	0.40	V
Maximum Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC} \text{ or } GND$	6.0	±0.1	±1.0	±1.0	μA	
Maximum Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC} \text{ or } GND, I_{OUT} = 0\mu A$	6.0	2.0	20	40	μA	

Note 2. Unless otherwise specified, all voltages are referenced to GND.

### AC Electrical Characteristics: ( $t_r = t_f = 6ns, C_L = 50pF$ unless otherwise specified)

Parameter	Symbol	Test Conditions	$V_{CC}$ (V)	Guaranteed Limits			Unit
				-55 to +25°C	≤ 85°C	≤ 125°C	
Maximum Propagation Delay, Input A or B to Output Y	$t_{PLH},$ $t_{PHL}$		2.0	75	95	110	ns
			3.0	30	40	55	ns
			4.5	15	19	22	ns
			6.0	13	16	19	ns

**AC Electrical Characteristics (Cont'd):** ( $t_r = t_f = 6\text{ns}$ ,  $C_L = 50\text{pF}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	V <sub>CC</sub> (V)	Guaranteed Limits			Unit
				-55 to +25°C	≤ 85°C	≤ 125°C	
Maximum Output Transition Time, Any Output	t <sub>TLH</sub> , t <sub>THL</sub>		2.0	75	95	110	ns
			3.0	27	32	36	ns
			4.5	15	19	22	ns
			6.0	13	16	19	ns
Maximum Input Capacitance	C <sub>in</sub>		-	10	10	10	pF
Parameter	Symbol	Test Conditions	Typical @ +25°C, V <sub>CC</sub> = 5V, V <sub>EE</sub> = 0V			Unit	
Power Dissipation Capacitance (Per Buffer)	C <sub>PD</sub>	Note 4	20			pF	

Note 4. C<sub>PD</sub> determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$

**Function Table:**

Inputs	Outputs
A	Y
L	H
H	L

**Pin Connection Diagram**



