

**HEX INVERTER**

- 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  
10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OHI}| = |I_{OL}| = 4 mA$  (MIN.)
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- PIN AND FUNCTION COMPATIBLE  
WITH 54/74LS04

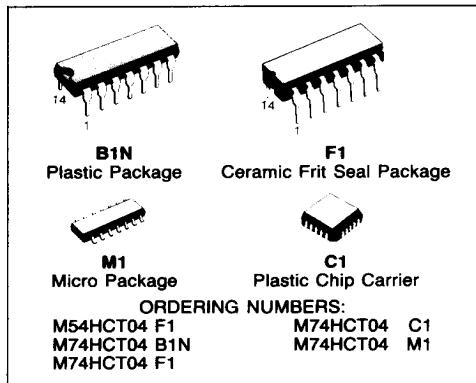
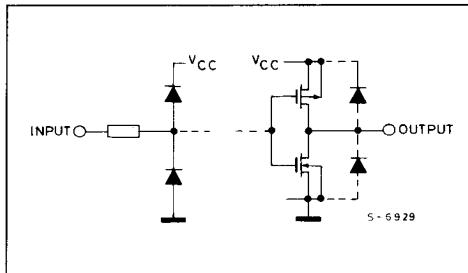
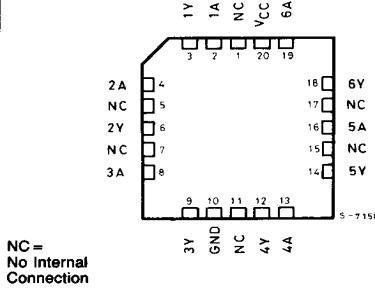
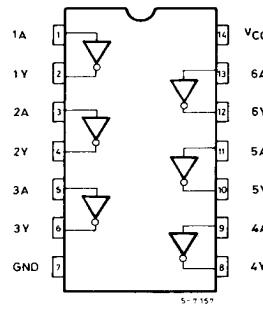
**DESCRIPTION**

The M54/74HCT04 is a high speed CMOS INVERTER fabricated in silicon gate C<sup>2</sup>MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

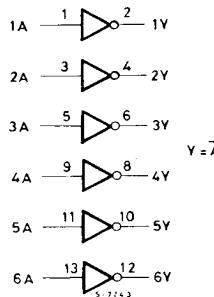
The internal circuit is composed of 3 stages including buffered output, which gives high noise immunity and a stable output.

All inputs are equipped with protection circuits against static discharge and transient excess voltage. This integrated circuit has input and output characteristic that are fully compatible with 54/74 LSTTL logic families.

M54HCT/74HCT devices are designed to directly interface HSC<sup>2</sup>MOS systems with TTL and NMOS components. They are also plug in replacements for LSTTL devices giving a reduction of power consumption.

**INPUT AND OUTPUT EQUIVALENT CIRCUIT****PIN CONNECTIONS (top view)**

## LOGIC DIAGRAM



$V_{CC}$  = Pin 14  
GND = Pin 7

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to 7	V
$V_I$	DC Input Voltage	-0.5 to $V_{CC} + 0.5$	V
$V_O$	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current	$\pm 20$	mA
$I_{OK}$	DC Output Diode Current	$\pm 20$	mA
$I_O$	DC Output Source Sink Current Per Output Pin	$\pm 25$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 50$	mA
$P_D$	Power Dissipation	500 (*)	mW
$T_{stg}$	Storage Temperature	-65 to 150	°C
$T_L$	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(\*) 500 mW:  $\equiv 65^{\circ}\text{C}$  derate to 300 mW by 10 mW/°C:  $65^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	4.5 to 5.5	V
$V_I$	Input Voltage	0 to $V_{CC}$	V
$V_O$	Output Voltage	0 to $V_{CC}$	V
$T_A$	Operating Temperature 74HC Series 54HC Series	-40 to 85 -55 to 125	°C
$t_r, t_f$	Input Rise and Fall Time	$V_{CC} = 4.5 \text{ to } 5.5\text{V}$ 0 to 500	ns

## DC SPECIFICATIONS

Symbol	Parameter	V <sub>CC</sub>	Test Condition	T <sub>A</sub> = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		Unit	
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
V <sub>IH</sub>	High Level Input Voltage	4.5 to 5.5		— 2.0 —	— — —	— — —	— 2.0 —	— — —	— 2.0 —	— — —	V	
V <sub>IL</sub>	Low Level Input Voltage	4.5 to 5.5		— — —	— — —	— 0.8 —	— — —	— 0.8 —	— — —	— 0.8 —	V	
V <sub>OH</sub>	High Level Output Voltage	4.5 4.5	V <sub>I</sub>	I <sub>O</sub>							V	
			V <sub>IH</sub> or V <sub>IL</sub>	- 20 μA - 4.0 mA	4.4 4.18	4.5 4.31	— —	4.4 4.13	— —	4.4 4.10		
			V <sub>I</sub>	I <sub>O</sub>								
V <sub>OL</sub>	Low Level Output Voltage	4.5 4.5	V <sub>IH</sub> or V <sub>IL</sub>	20 μA 4.0 mA	— —	0.0 0.17	0.1 0.26	— —	0.1 0.33	— —	0.1 0.40	V
			V <sub>I</sub>	I <sub>O</sub>								
I <sub>I</sub>	Input Leakage Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND	—	—	±0.1	—	±1.0	—	±1.0	μA	
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND	—	—	1	—	10	—	20	μA	
ΔI <sub>CC</sub>	Additional worst case supply current	5.5	Per Input pin V <sub>IN</sub> = 2.4V Other Inputs at V <sub>CC</sub> or GND I <sub>O</sub> = 0	—	—	2.0	—	2.9	—	3.0	mA	

AC ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5V, C<sub>L</sub> = 15pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns, T<sub>A</sub> = 25°C)

Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t <sub>TLH</sub> t <sub>THL</sub>	Output Transition Time		4	8	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time		10	17	ns

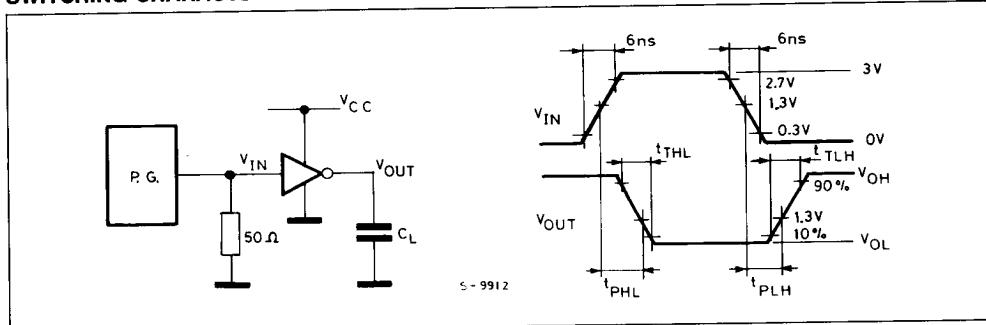
AC ELECTRICAL CHARACTERISTICS ( $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ )

Symbol	Parameter	V <sub>CC</sub>	Test Condition	T <sub>A</sub> = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t <sub>TLH</sub>	Output Transition Time	4.5		—	8	15	—	19	—	22	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	4.5		—	13	20	—	25	—	30	
C <sub>IN</sub>	Input Capacitance			—	5	10	—	10	—	10	pF
C <sub>PD</sub> (*)	Power Dissipation Capacitance			—	25	—	—	—	—	—	pF

Note (\*) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load (refer to Test circuit).

Average operating current can be obtained by the following equation:  $I_{CC(\text{opr.})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6$

## SWITCHING CHARACTERISTICS TEST CIRCUIT

TEST CIRCUIT I<sub>CC</sub> (Opr.)