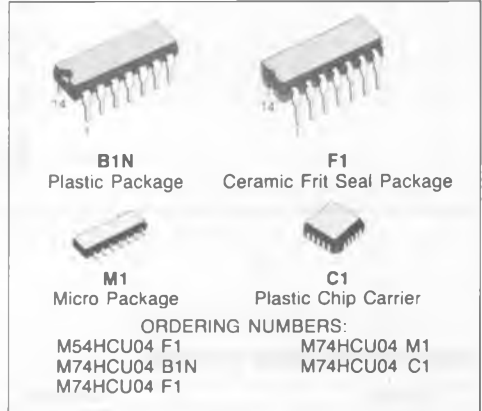


HEX INVERTER (SINGLE STAGE)

- **HIGH SPEED**
 $t_{PD} = 5\text{ns}$ (TYP.) at $V_{CC} = 5\text{V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 1\ \mu\text{A}$ (MAX.) at $T_A = 25^\circ\text{C}$
- **OUTPUT DRIVE CAPABILITY**
 10 LSTTL LOADS
- **BALANCED PROPAGATION DELAYS**
 $t_{PLH} = t_{PHL}$
- **HIGH NOISE IMMUNITY**
 $V_{NIH} = V_{NIL} = 10\% V_{CC}$ (MIN.)
- **WIDE OPERATING VOLTAGE RANGE**
 V_{CC} (opr) = 2V to 6V
- **PIN AND FUNCTION COMPATIBLE**
 WITH 54/74LS04

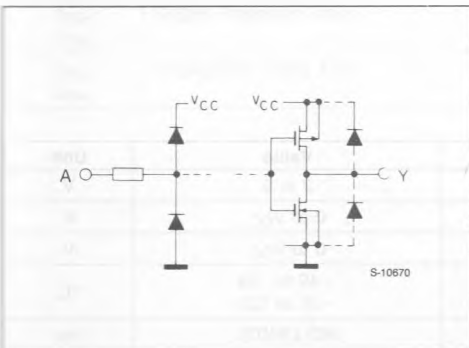


DESCRIPTION

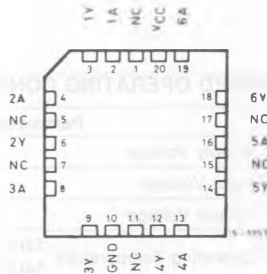
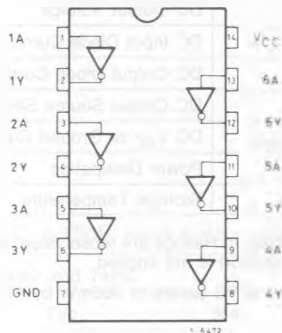
The M54/74HCU04 is a high speed CMOS HEX INVERTER (SINGLE STAGE) fabricated in silicon gate C²MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

As the internal circuit is composed of a single stage inverter, it can be used in crystal oscillators. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

CIRCUIT SCHEMATIC (Per Gate)

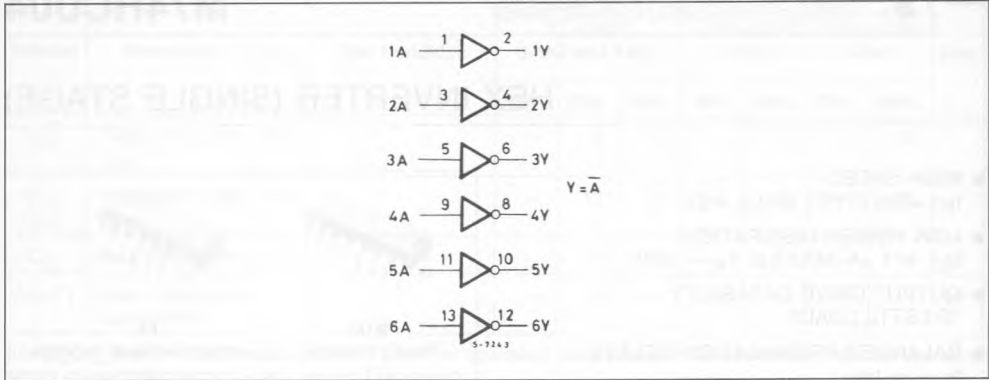


PIN CONNECTION (top view)



NC =
 No Internal
 Connection

LOGIC DIAGRAM



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	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Source Sink Current Per Output Pin	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	mA
P_D	Power Dissipation	500 (*)	mW
T_{stg}	Storage Temperature	- 65 to 150	$^{\circ}C$

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

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2 to 6	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 - 40 to 85 54HC Series - 55 to 125	$^{\circ}C$
t_r, t_f	Input Rise and Fall Time	NO LIMITS	ns

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V _{CC}	Test Condition	T _A = 25°C 54HC and 74HC			- 40 to 85°C 74HC		- 55 to 125°C 54HC		Unit	
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
V _{IH}	High Level Input Voltage	2.0		1.7	—	—	1.7	—	1.7	—	V	
		4.5		3.6	—	—	3.6	—	3.6	—		
		6.0		4.8	—	—	4.8	—	4.8	—		
V _{IL}	Low Level Input Voltage	2.0		—	—	0.3	—	0.3	—	0.3	V	
		4.5		—	—	0.9	—	0.9	—	0.9		
		6.0		—	—	1.2	—	1.2	—	1.2		
V _{OH}	High Level Output Voltage	2.0	V _I	I _O	1.8	2.0	—	1.8	—	1.8	—	V
		4.5	V _{IH} or V _{IL}	- 20 μA	4.0	4.5	—	4.0	—	4.0	—	
		6.0	V _{IH} or V _{IL}	- 20 μA	5.5	5.9	—	5.5	—	5.5	—	
V _{OL}	Low Level Output Voltage	2.0	V _{CC} or GND	- 4.0 mA	4.18	4.31	—	4.13	—	4.10	—	V
		4.5	V _{CC} or GND	- 5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
		6.0	V _{CC} or GND	- 5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
V _{OL}	Low Level Output Voltage	2.0	V _{IH} or V _{IL}	20 μA	—	0.0	0.2	—	0.2	—	0.2	V
		4.5	V _{IH} or V _{IL}	20 μA	—	0.0	0.5	—	0.5	—	0.5	
		6.0	V _{IH} or V _{IL}	20 μA	—	0.1	0.5	—	0.5	—	0.5	
I _I	Input Leakage Current	2.0	V _{CC} or GND	4.0 mA	—	0.17	0.26	—	0.33	—	0.40	μA
		4.5	V _{CC} or GND	5.2 mA	—	0.18	0.26	—	0.33	—	0.40	
		6.0	V _{CC} or GND	5.2 mA	—	0.18	0.26	—	0.33	—	0.40	
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND		—	—	± 0.1	—	± 1.0	—	± 1.0	μA
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND		—	—	1	—	10	—	20	μA

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5V, T_A = 25°C, C_L = 15pF, Input t_r = t_f = 6ns)

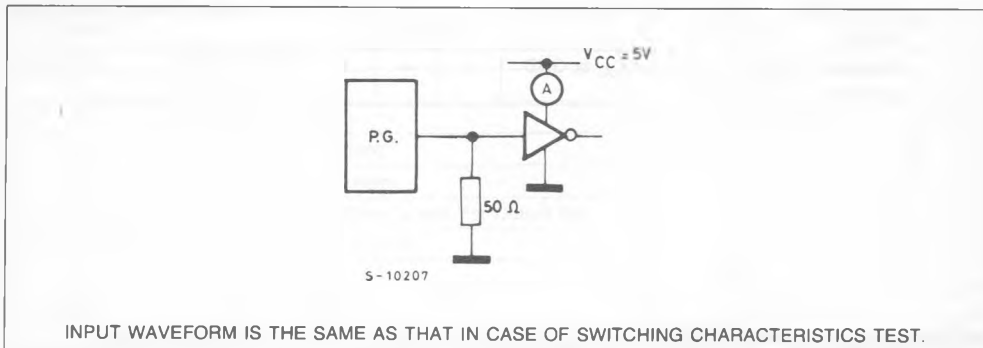
Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t _{TLH} t _{THL}	Output Transition Time		4	8	ns
t _{PLH} t _{PHL}	Propagation Delay Time		7	12	ns

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

Symbol	Parameter	V_{CC}	Test Condition	$T_A = 25^\circ\text{C}$ 54HC and 74HC			-40 to 85°C 74HC		-55 to 125°C 54HC		Unit
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0		—	30	75	—	95		110	ns
		4.5		—	8	15	—	19		22	
		6.0		—	7	13	—	16		19	
t_{PLH} t_{PHL}	Propagation Delay Time	2.0		—	32	75	—	95		115	ns
		4.5		—	8	15	—	19		23	
		6.0		—	7	13	—	16		20	
C_{IN}	Input Capacitance			—	9	15	—	15		15	pF
$C_{PD} (*)$	Power Dissipation Capacitance			—	14	—	—	—			pF

Note (*) C_{PD} 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)

$$\text{Average operating current is: } I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

TEST CIRCUIT I_{CC} (Opr)

SWITCHING CHARACTERISTICS TEST CIRCUIT

