SGS-THOMSON MICROELECTRONICS

M54HCU04
M74HCU04

HEX INVERTER (SINGLE STAGE)

- HIGH SPEED
  t_{PD} = 5ns (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION
  I_{CC} = 1 μA (MAX.) at T_A = 25°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

B1N
Plastic Package

F1
Ceramic Frit Seal Package

M1
Micro Package

C1
Plastic Chip Carrier

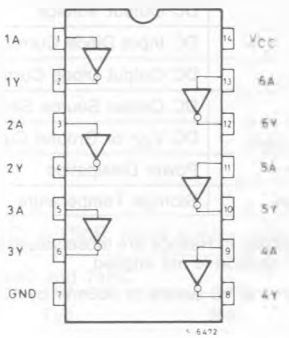
ORDERING NUMBERS:

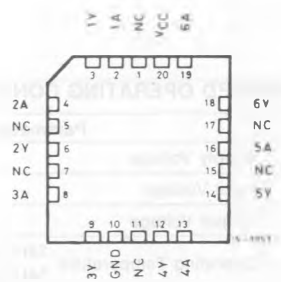
M54HCU04 F1
M74HCU04 B1N
M74HCU04 F1
M74HCU04 M1
M74HCU04 C1

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.

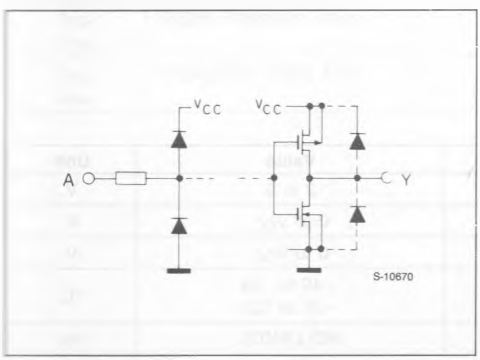
PIN CONNECTION (top view)



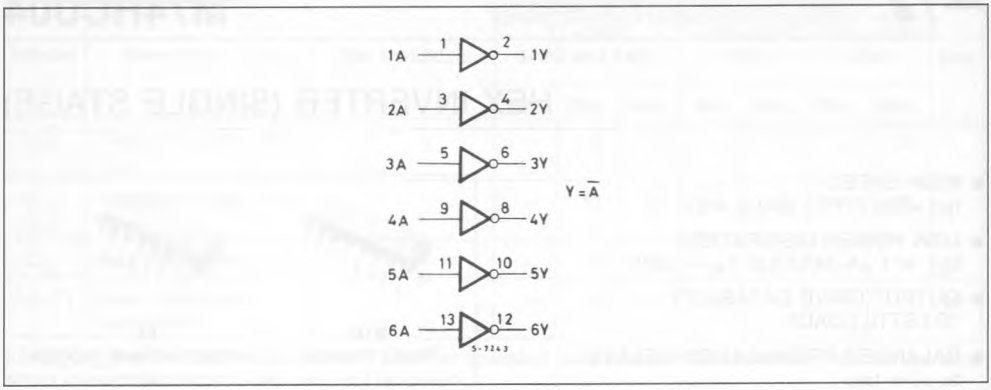


NC = No Internal Connection

CIRCUIT SCHEMATIC (Per Gate)



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	°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 = 65°C derate to 300mW by 10 mW/°C: 65 to 85°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 54HC Series	−40 to 85 −55 to 125	°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	− 20 μA	4.0	4.5	—	4.0	—	4.0	—	
		6.0	V_{IL}		5.5	5.9	—	5.5	—	5.5	—	
		4.5	V_{CC} or	− 4.0 mA	4.18	4.31	—	4.13	—	4.10	—	
		6.0	GND	− 5.2 mA	5.68	5.8	—	5.63	—	5.60	—	
V_{OL}	Low Level Output Voltage	2.0			—	0.0	0.2	—	0.2	—	0.2	V
		4.5	V_{IH} or	20 μA	—	0.0	0.5	—	0.5	—	0.5	
		6.0	V_{IL}		—	0.1	0.5	—	0.5	—	0.5	
		4.5	V_{CC} or	4.0 mA	—	0.17	0.26	—	0.33	—	0.40	
		6.0	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 $t_r = t_f = 6ns$)

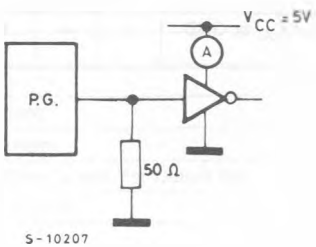
Symbol	Parameter	54HC and 74HC			Unit
		Min.	Typ.	Max.	
t_{TLH} t_{THL}	Output Transition Time		4	8	ns
t_{PLH} t_{PHL}	Propagation Delay Time		7	12	ns

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

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

TEST CIRCUIT I_{CC} (Opr)



INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.

SWITCHING CHARACTERISTICS TEST CIRCUIT