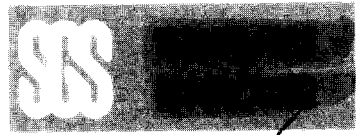


HS-C²MOS™ INTEGRATED CIRCUITS

040630



PRELIMINARY DATA

DUAL 4-INPUT NOR GATE

DESCRIPTION

The M54/74HC4002 is a high speed CMOS DUAL 4-INPUT NOR GATE fabricated in silicon gate C²MOS technology.

It has the same high speed performance of LSTTL combined with true CMOS low power consumption. The international circuit is composed of 3 stages including buffer output, which ensures high noise immunity and stable output.

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

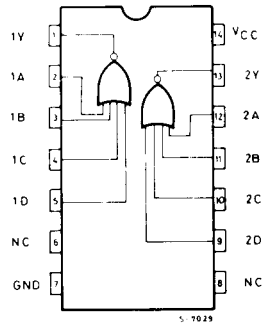
B1 Plastic Package **F1** Ceramic Package **C1** Chip Carrier

ORDERING NUMBERS: M54HC4002 F1
M74HC4002 B1
M74HC4002 F1
M74HC4002 C1

FEATURES

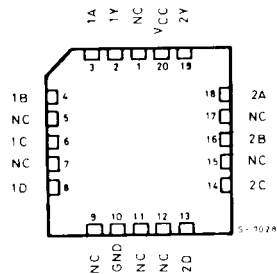
- High Speed
 $t_{PD} = 11 \text{ ns (Typ.) at } V_{CC} = 5V$
- Low Power Dissipation
 $I_{CC} = 1 \mu\text{A (Max.) at } T_A = 25^\circ\text{C}$
- High Noise Immunity
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (Min.)}$
- Output Drive Capability
10 LSTTL Loads
- Symmetrical Output Impedance
 $|I_{OH}| = I_{OL} = 4 \text{ mA (Min.)}$
- Balanced Propagation Delays
 $t_{PLH} = t_{PHL}$
- Wide Operating Voltage Range
 $V_{CC} \text{ (opr)} = 2V \text{ to } 6V$
- Pin and Function compatible with 4002 B

PIN CONNECTIONS (top view)



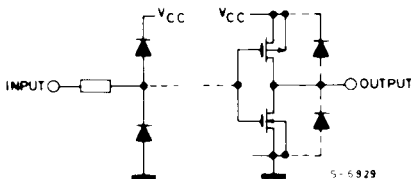
Dual in line'

CHIP CARRIER

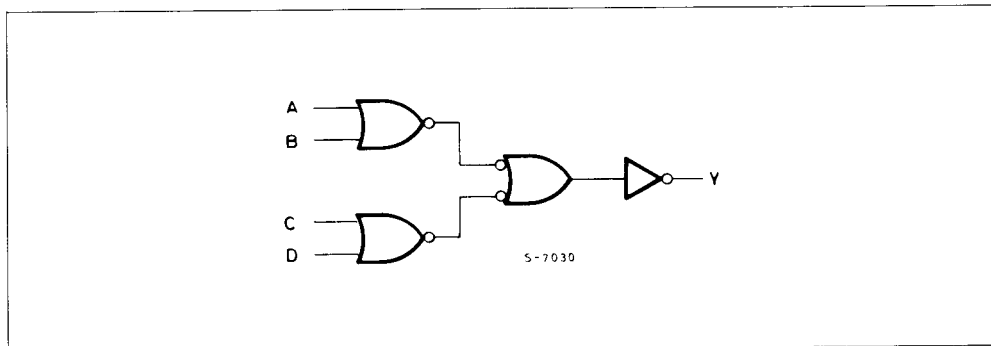


NC = No Internal Connection

INPUT AND OUTPUT EQUIVALENT CIRCUIT



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 condition is not implied.

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

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Limit	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	$^{\circ}C$						
t_r, t_f	Input Rise and Fall Time	V_{CC} <table style="display: inline-table; vertical-align: middle;"> <tr> <td>2 V</td> <td>0 to 1000</td> </tr> <tr> <td>4.5V</td> <td>0 to 500</td> </tr> <tr> <td>6 V</td> <td>0 to 400</td> </tr> </table>	2 V	0 to 1000	4.5V	0 to 500	6 V	0 to 400	ns
2 V	0 to 1000								
4.5V	0 to 500								
6 V	0 to 400								

DC SPECIFICATIONS

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		1.5	—	—	1.5	—	1.5	—	V	
		4.5		3.15	—	—	3.15	—	3.15	—		
		6.0		4.2	—	—	4.2	—	4.2	—		
V _{IL}	Low Level Input Voltage	2.0		—	—	0.5	—	0.5	—	0.5	V	
		4.5		—	—	1.35	—	1.35	—	1.35		
		6.0		—	—	1.8	—	1.8	—	1.8		
V _{OH}	High Level Output Voltage	2.0	V _I	I _O	1.9	2.0	—	1.9	—	1.9	—	V
		4.5	V _{IH} or	-20 μA	4.4	4.5	—	4.4	—	4.4	—	
		6.0	V _{IH} or	-20 μA	5.9	6.0	—	5.9	—	5.9	—	
		4.5	V _{IL}	-4.0 mA	4.18	4.31	—	4.13	—	4.10	—	
		6.0	V _{IL}	-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 4.0 mA 5.2 mA	—	0	0.1	—	0.1	—	0.1	V
		4.5			—	0	0.1	—	0.1	—	0.1	
		6.0			—	0	0.1	—	0.1	—	0.1	
		4.5			—	0.17	0.26	—	0.33	—	0.40	
		6.0			—	0.18	0.26	—	0.33	—	0.40	
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND		—	—	±0.1	—	±1	—	±1	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}	Propagation Delay Time		11	18	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 4.5 6.0		— — —	22 8 7	75 15 13	— — —	90 18 16			ns
t_{PLH} t_{PHL}	Propagation Delay Time	2.0 4.5 6.0		— — —	44 13 11	105 21 18	— — —	130 26 22			ns
C_{IN}	Input Capacitance			—	5	10	—	10			pF
$C_{PD} (*)$	Power Dissipation Capacitance			—	26	—	—	—			

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.

Average operating current can be obtained by the following equation.

$$I_{CC(oper)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per Gate)}$$