

HS-C²MOS™ INTEGRATED CIRCUITS



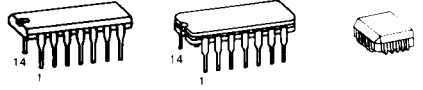
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DUAL 4-INPUT NOR GATE

DESCRIPTION

The M54/74HC02 is a high speed CMOS DUAL 4-INPUT OR GATE fabricated in silicon gate C²MOS 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 buffer output, which gives high noise immunity and stable output. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

PRELIMINARY DATA



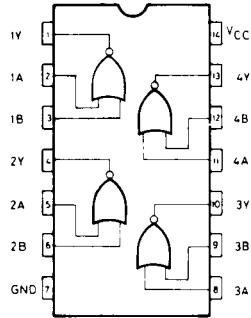
B1 Plastic Package **F1** Ceramic Package **C1** Chip Carrier

ORDERING NUMBERS: M54HC02 F1 /
M74HC02 B1 /
M74HC02 F1 /
M74HC02 C1

FEATURES

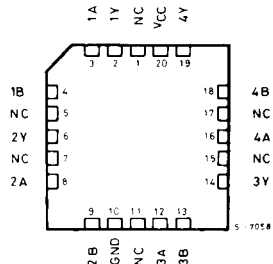
- High Speed
 $t_{PD} = 8 \text{ ns (Typ.) at } V_{CC} = 5V$
- Low Power Dissipation
 $I_{CC} = 1 \mu\text{A (Max.) at } T_A = 25^\circ\text{C}$
- High Noise Immunity
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (Min.)}$
- Output Drive Capability
10 LSTTL Loads
- Symmetrical Output Impedance
 $|I_{OH}| = I_{OL} = 4 \text{ mA (Min.)}$
- Balanced Propagation Delays
 $t_{PLH} = t_{PHL}$
- Wide Operating Voltage Range
 $V_{CC} \text{ (opr.)} = 2V \text{ to } 6V$
- Pin and Function compatible with 54/74LS02

PIN CONNECTIONS (top view)



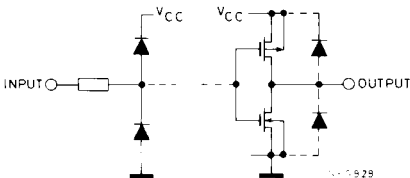
Dual in line

CHIP CARRIER



NC = No Internal Connection

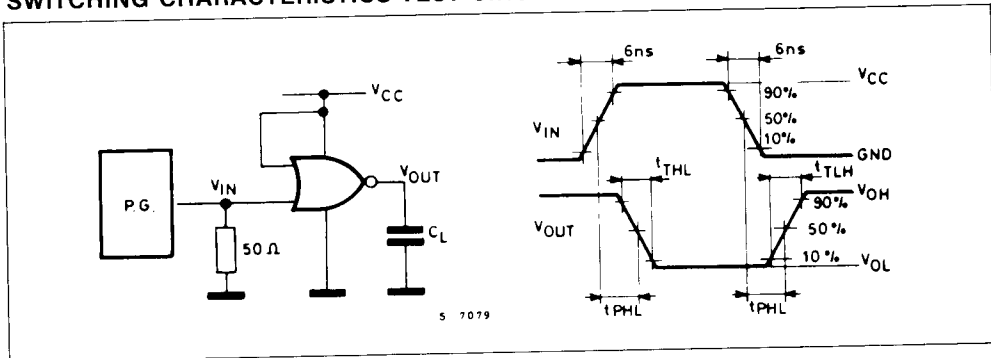
INPUT AND OUTPUT EQUIVALENT CIRCUIT





M54HC02
M74HC02

SWITCHING CHARACTERISTICS TEST CIRCUIT



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
PD	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: $\cong 65^{\circ}C$ 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	$^{\circ}C$
t_r, t_f	Input Rise and Fall Time	V_{CC} { 2 V 4.5V 6 V	ns
		0 to 1000 0 to 500 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			-20 μA	4.4	4.5	—	4.4	—		4.4
		6.0	V _{IH} or V _{IL}	5.9		6.0	—	5.9	—	5.9		—
		4.5	-4.0 mA -5.2 mA	4.18	4.31	—	4.13	—	4.10	—		
		6.0		5.68	5.8	—	5.63	—	5.60	—		
V _{OL}	Low Level Output Voltage	2.0	V _{IH} or V _{IL}	20 μA	—	0	0.1	—	0.1	—	0.1	V
		4.5			—	0	0.1	—	0.1	—	0.1	
		6.0	4.0 mA 5.2 mA	—	0.17	0.26	—	0.33	—	0.40		
		4.5		—	0.18	0.26	—	0.33	—	0.40		
		6.0	—	—	—	—	—	—	—	—		
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} t _{PHL}	Propagation Delay Time		9	15	ns



M54HC02

M74HC02

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°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		—	22	75	—	90			ns
		4.5		—	8	15	—	18			
		6.0		—	7	13	—	16			
t _{PLH} * t _{PHL}	Propagation Delay Time	2.0		—	33	90	—	110			ns
		4.5		—	10	18	—	22			
		6.0		—	9	16	—	19			
C _{IN}	Input Capacitance			—	5	10	—	10			pF
C _{PD} (*)	Power Dissipation Capacitance			—	27	—	—	—			

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.

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