

HS-C²MOS™ INTEGRATED CIRCUITS

041933



PRELIMINARY DATA

DUAL 4-INPUT NAND GATE

DESCRIPTION

The M54/74HC20 is a high speed CMOS DUAL 4-INPUT NAND 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 enables high noise immunity and stable output. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

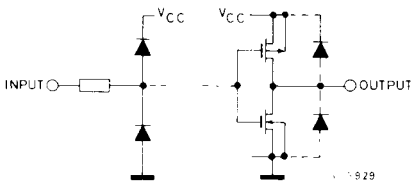
B1 Plastic Package **F1** Ceramic Package **C1** Chip Carrier

ORDERING NUMBERS: M54HC20 F1
M74HC20 B1
M74HC20 F1
M74HC20 C1

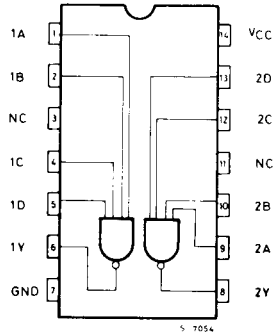
FEATURES

- High Speed
 $t_{PD} = 10 \text{ ns}$ (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
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (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 54/74LS20

INPUT AND OUTPUT EQUIVALENT CIRCUIT

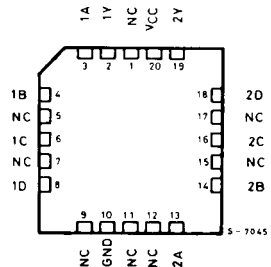


PIN CONNECTIONS (top view)



Dual in line

CHIP CARRIER

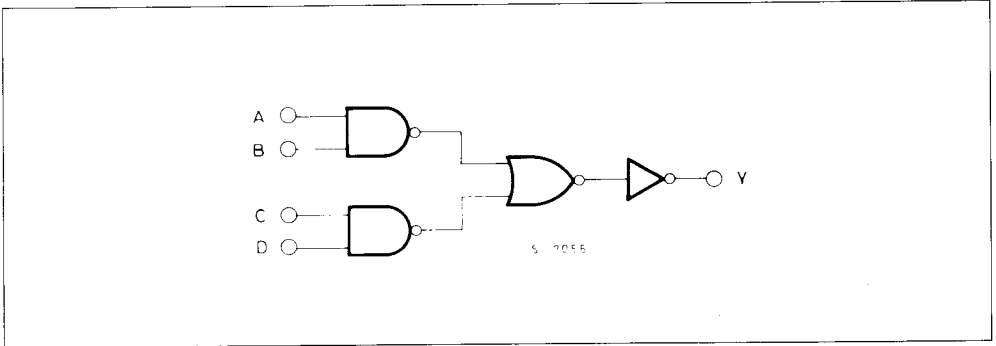


NC = No Internal Connection

M54HC20

M74HC20

LOGIC DIAGRAM (per Gate)



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	$^{\circ}C$	
t_r, t_f	Input Rise and Fall Time	V_{CC} { 2 V 4.5V 6 V	0 to 1000 0 to 500 0 to 400	ns



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}	- 20 μA	4.4	4.5	—	4.4	—		4.4	—
		6.0			or		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		- 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	0.1	—	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			4.0 mA	—	0.17	0.26	—	0.33	—		0.40	
6.0	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		± 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		11	18	ns

M54HC20**M74HC20****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	—	90			ns
		4.5		—	8	15	—	18			
		6.0		—	7	13	—	16			
t_{PLH} t_{PHL}	Propagation Delay Time	2.0		—	42	110	—	130			ns
		4.5		—	13	22	—	26			
		6.0		—	11	19	—	23			
C_{IN}	Input Capacitance			—	5	10	—	10			pF
$C_{PD} (*)$	Power Dissipation Capacitance			—	28	—	—	—			

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.

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per Gate).}$$