SGS-THOMSON
MICROELECTRONICS

M54HC20
M74HC20

DUAL 4-INPUT NAND GATE

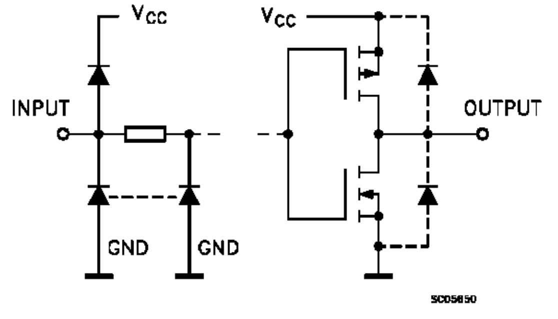
- HIGH SPEED
  t_{PD} = 8 ns (TYP.) AT V_{CC} = 5 V
- LOW POWER DISSIPATION
  I_{CC} = 1 µA (MAX.) AT T_A = 25 °C
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28 % V_{CC} (MIN.)
- OUTPUT DRIVE CAPABILITY
  10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 4 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE WITH 54/74LS20

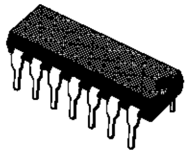
DESCRIPTION

The M54/74HC20 is a high speed CMOS DUAL 4-INPUT NAND GATE fabricated in silicon gate C^2MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

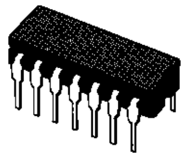
The internal circuit is composed of 3 stages including buffered output, which gives high noise immunity and a stable output. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

INPUT AND OUTPUT EQUIVALENT CIRCUIT



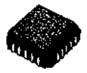


B1R
(Plastic Package)



F1R
(Ceramic Package)

M1R
(Micro Package)

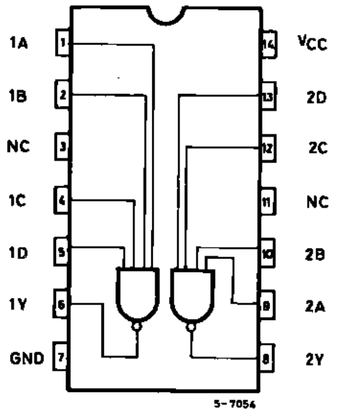


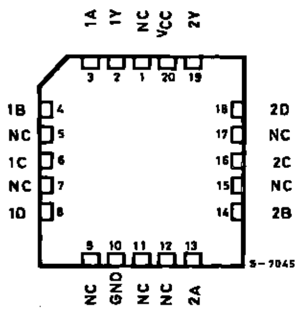
C1R
(Chip Carrier)

ORDER CODES :

M54HC20F1R	M74HC20M1R
M74HC20B1R	M74HC20C1R

PIN CONNECTIONS (top view)



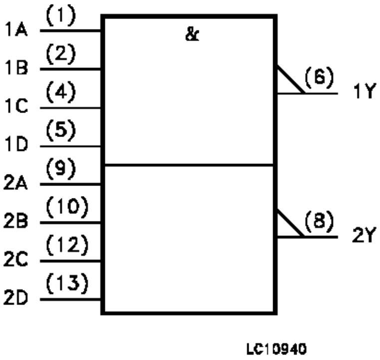


NC =
No Internal
Connection

TRUTH TABLE

A	B	C	D	Y
L	X	X	X	H
X	L	X	X	H
X	X	L	X	H
X	X	X	L	H
H	H	H	H	L

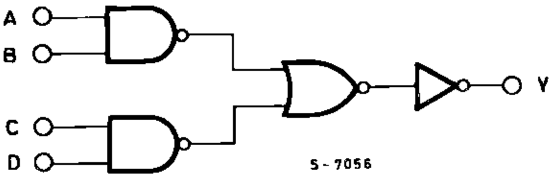
IEC LOGIC SYMBOL



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 9	1A to 2A	Data Inputs
2, 10	1B to 2B	Data Inputs
3, 11	N. C.	Not Connected
4, 12	1C, 2C	Data Inputs
5, 13	1D, 2D	Data Inputs
6, 8	1Y to 2Y	Data Outputs
7	GND	Ground (0V)
14	V_{CC}	Positive Supply Voltage

SCHEMATIC CIRCUIT (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	^oC
T_L	Lead Temperature (10 sec)	300	^oC

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 ^oC derate to 300 mW by 10mW/^oC: 65 ^oC to 85 ^oC

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_{op}	Operating Temperature: **M54HC** Series **M74HC** Series		-55 to +125 -40 to +85	°C °C
t_r, t_f	Input Rise and Fall Time	V_{CC} = 2 V	0 to 1000	ns
		V_{CC} = 4.5 V	0 to 500	
		V_{CC} = 6 V	0 to 400	

DC SPECIFICATIONS

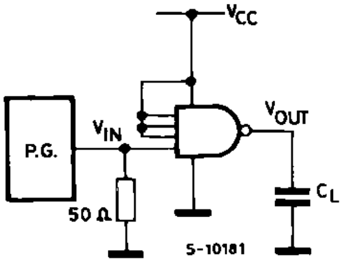
Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)			T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0			1.5			1.5		1.5		V
		4.5			3.15			3.15		3.15		
		6.0			4.2			4.2		4.2		
V_{IL}	Low Level 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 = V_{IH} or V_{IL}	I_O=-20 µA	1.9	2.0		1.9		1.9		V
		4.5			4.4	4.5		4.4		4.4		
		6.0			5.9	6.0		5.9		5.9		
		4.5		I_O=-4.0 mA	4.18	4.31		4.13		4.10		
		6.0		I_O=-5.2 mA	5.68	5.8		5.63		5.60		
V_{OL}	Low Level Output Voltage	2.0	V_I = V_{IH} or V_{IL}	I_O= 20 µA		0.0	0.1		0.1		0.1	V
		4.5				0.0	0.1		0.1		0.1	
		6.0				0.0	0.1		0.1		0.1	
		4.5		I_O= 4.0 mA		0.17	0.26		0.33		0.40	
		6.0		I_O= 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

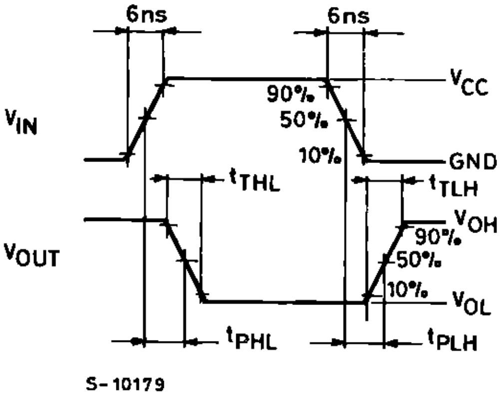
AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

Symbol	Parameter	Test Conditions		Value							Unit
		V_{CC} (V)		T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				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			30	80		100		120	ns
		4.5			10	16		20		24	
		6.0			9	14		17		20	
C_{IN}	Input Capacitance				5	10		10		10	pF
C_{PD} (*)	Power Dissipation Capacitance				27						pF

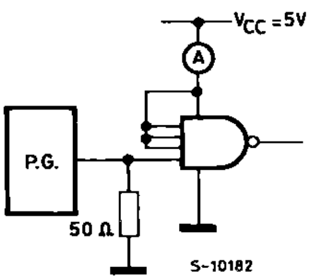
(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/2$ (per Gate)

SWITCHING CHARACTERISTICS TEST CIRCUIT





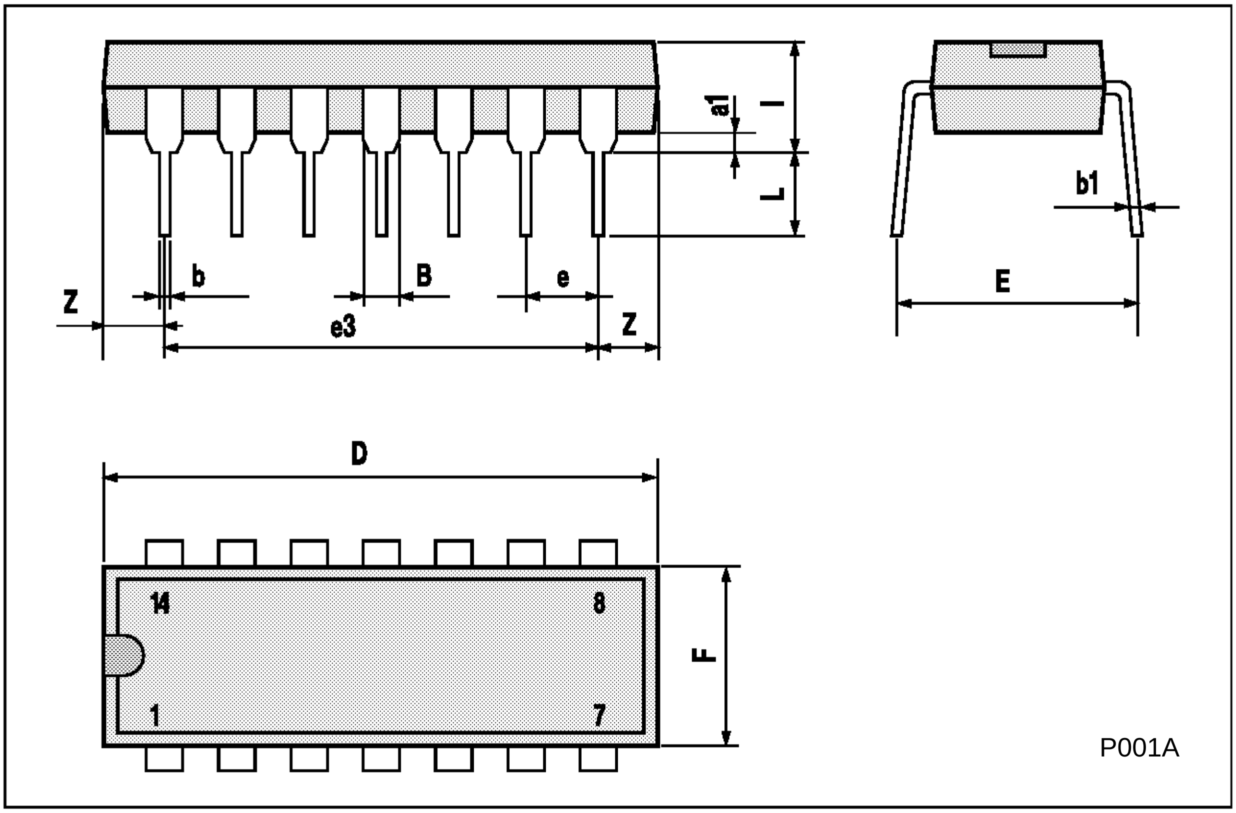
TEST CIRCUIT I_{CC} (Opr.)



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

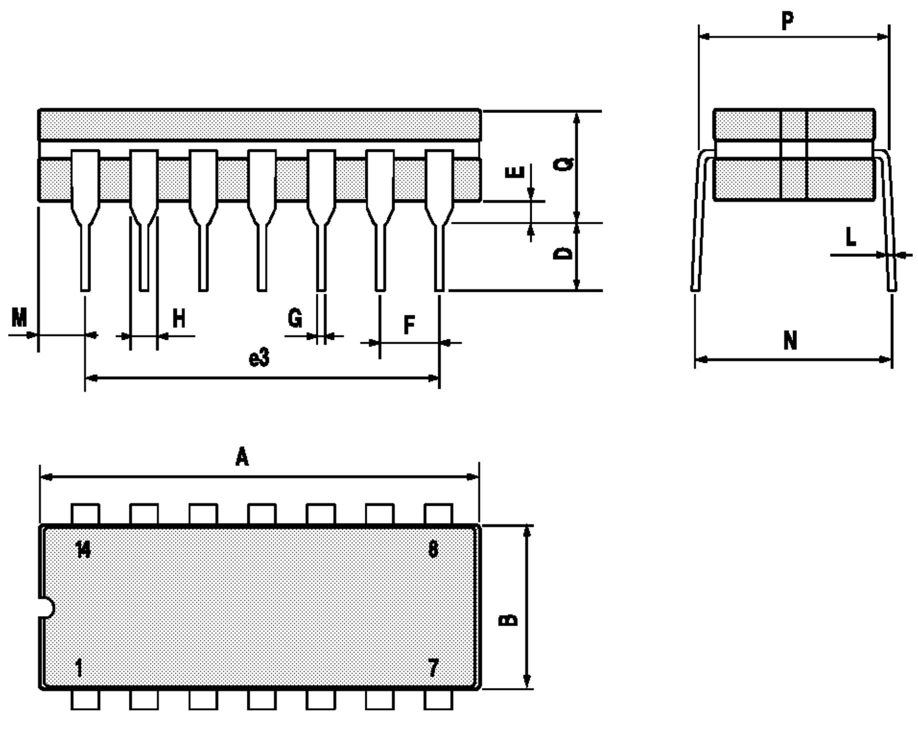
Plastic DIP14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



Ceramic DIP14/1 MECHANICAL DATA

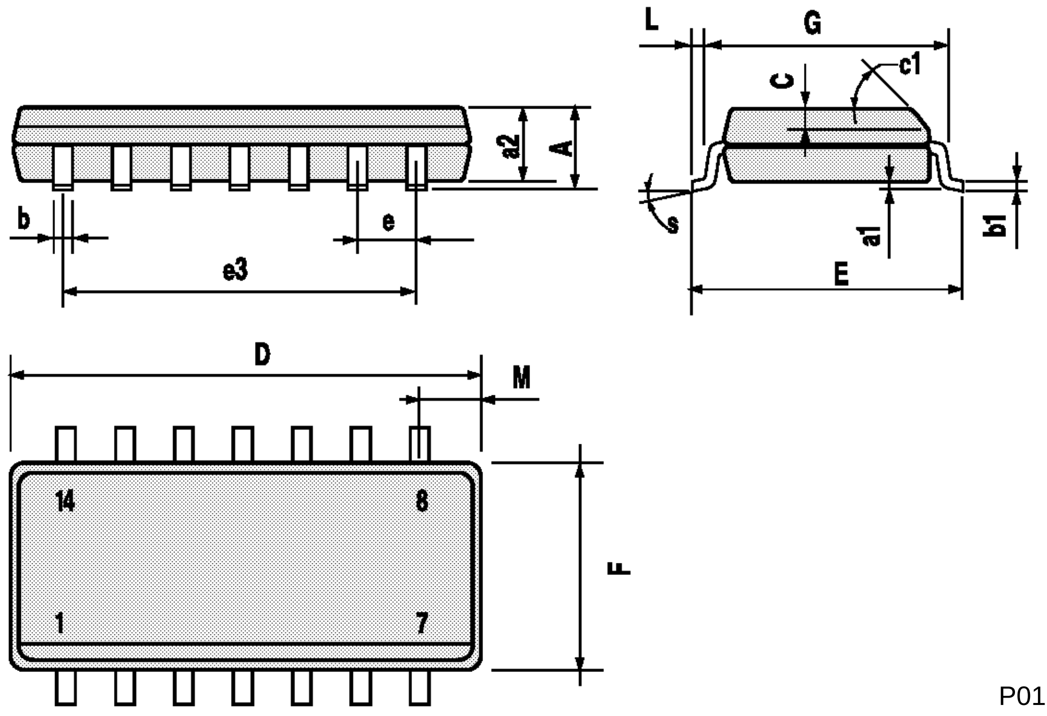
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7.0			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		15.24			0.600	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	1.52		2.54	0.060		0.100
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



P053C

SO14 MECHANICAL DATA

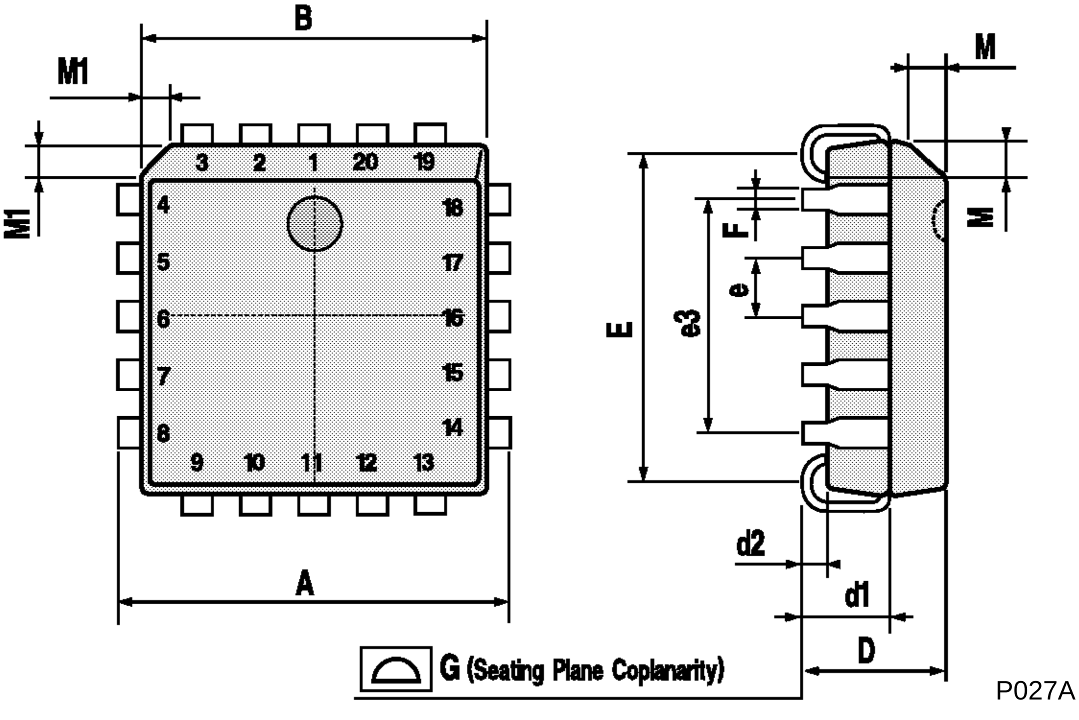
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					



P013G

PLCC20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	9.78		10.03	0.385		0.395
B	8.89		9.04	0.350		0.356
D	4.2		4.57	0.165		0.180
d1		2.54			0.100	
d2		0.56			0.022	
E	7.37		8.38	0.290		0.330
e		1.27			0.050	
e3		5.08			0.200	
F		0.38			0.015	
G			0.101			0.004
M		1.27			0.050	
M1		1.14			0.045	



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