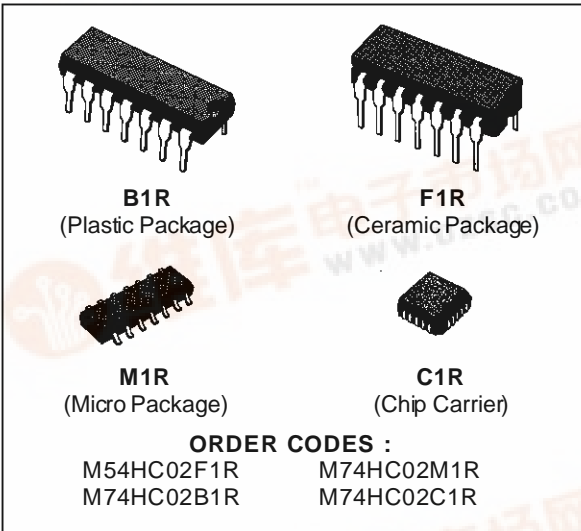




M54HC02
M74HC02

QUAD 2-INPUT NOR GATE

- **HIGH SPEED**
 $t_{PD} = 6 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- **LOW POWER DISSIPATION**
 $I_{CC} = 1 \mu\text{A (MAX.) AT } T_A = 25 \text{ }^\circ\text{C}$
- **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**
 $V_{CC} \text{ (OPR)} = 2 \text{ V TO } 6 \text{ V}$
- **PIN AND FUNCTION COMPATIBLE**
WITH 54/74LS02



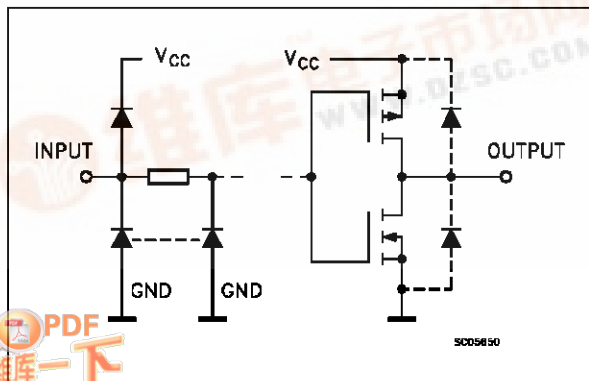
DESCRIPTION

The M54/74HC02 is a high speed CMOS QUAD 2-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.

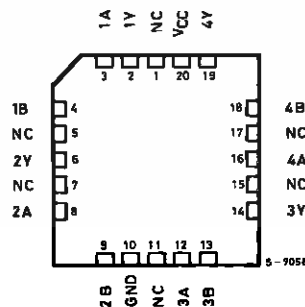
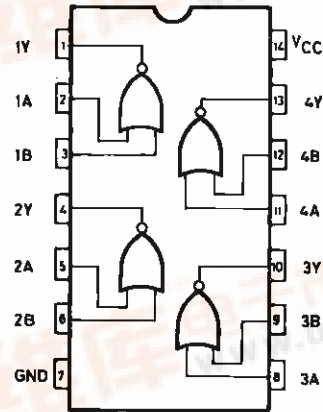
The internal circuit is composed of 3 stages including buffer output, which gives high noise immunity and stable output.

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

INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN CONNECTIONS (top view)



NC =
No Internal
Connection



M54/M74HC02

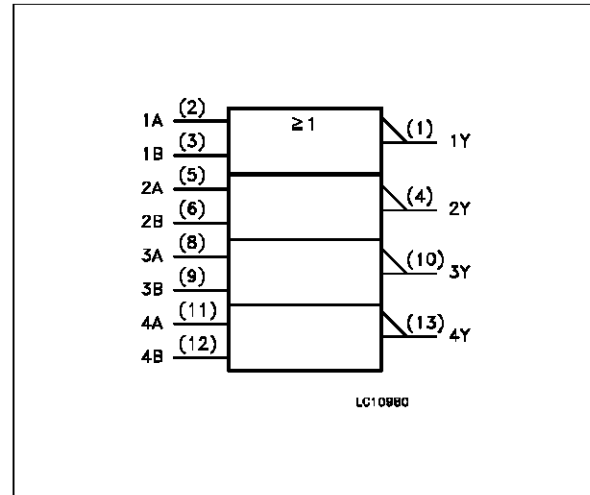
TRUTH TABLE

A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L

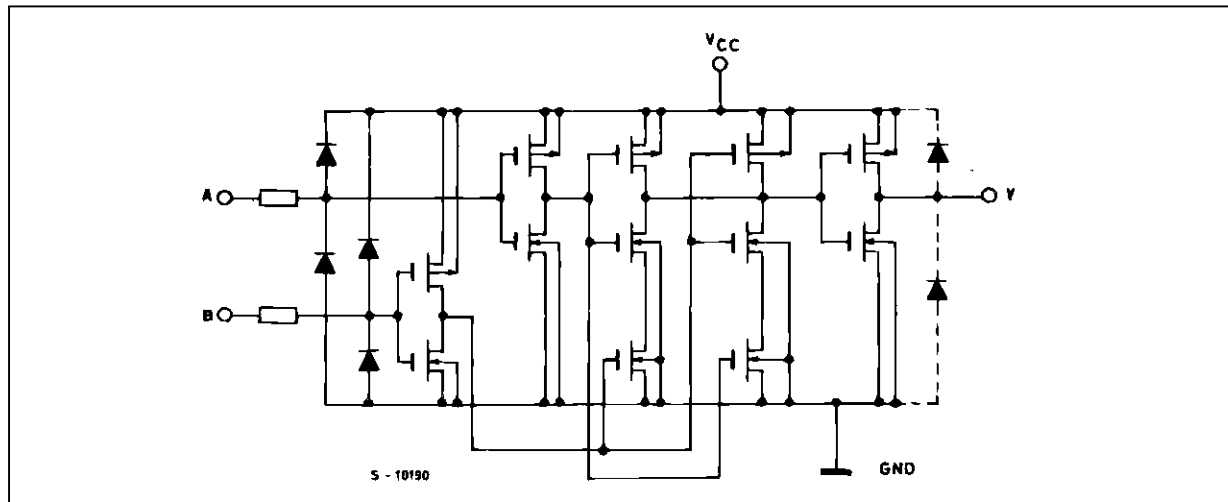
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
2, 5, 8, 11	1A to 4A	Data Inputs
3, 6, 9, 12	1B to 4B	Data Inputs
1, 4, 10, 12	1Y to 4Y	Data Outputs
7	GND	Ground (0V)
14	V _{CC}	Positive Supply Voltage

IEC LOGIC SYMBOL



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	°C
T _L	Lead Temperature (10 sec)	300	°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 300 mW by 10mW/°C: 65 °C 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_{op}	Operating Temperature: M54HC Series M74HC Series	-55 to +125 -40 to +85	°C °C	
t_r, t_f	Input Rise and Fall Time	$V_{CC} = 2\text{ V}$ $V_{CC} = 4.5\text{ V}$ $V_{CC} = 6\text{ V}$	0 to 1000 0 to 500 0 to 400	ns

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value						Unit		
				$T_A = 25\text{ °C}$ 54HC and 74HC			$-40\text{ to }85\text{ °C}$ 74HC		$-55\text{ to }125\text{ °C}$ 54HC			
		V_{CC} (V)		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}	$I_O = -20\text{ }\mu\text{A}$	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		$I_O = -4.0\text{ mA}$	4.18	4.31		4.13		4.10		
		6.0			$I_O = -5.2\text{ mA}$	5.68	5.8		5.63			5.60
V_{OL}	Low Level Output Voltage	2.0	$V_I = V_{IH}$ or V_{IL}	$I_O = 20\text{ }\mu\text{A}$		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		$I_O = 4.0\text{ mA}$		0.17	0.26		0.33		0.40	
		6.0			$I_O = 5.2\text{ mA}$		0.18	0.26		0.33		
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	

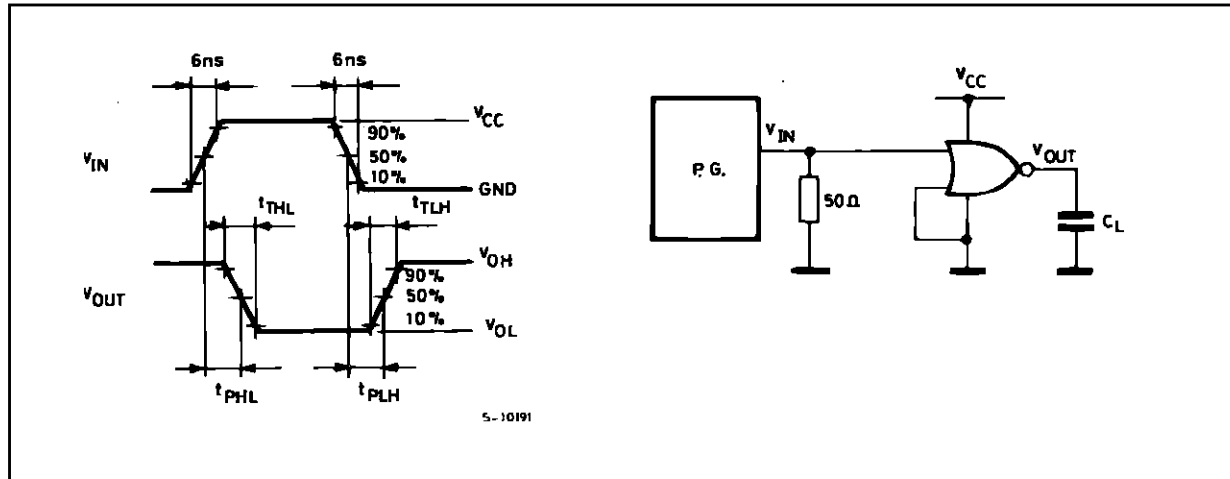
M54/M74HC02

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

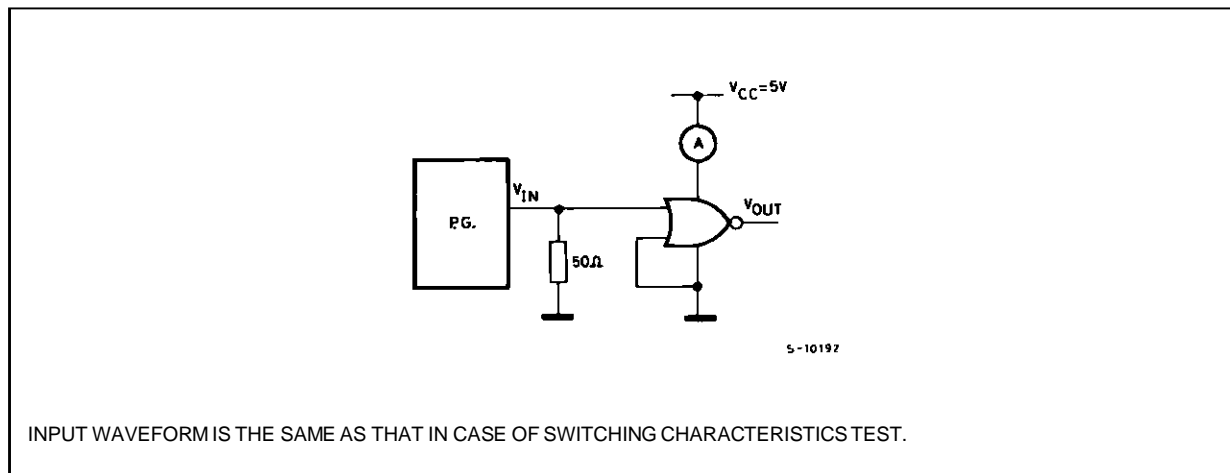
Symbol	Parameter	Test Conditions		Value						Unit	
		V _{CC} (V)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t _{TLH} t _{THL}	Output Transition Time	2.0		30	75		95		110	ns	
		4.5		8	15		19		22		
		6.0		7	13		16		19		
t _{PLH} t _{PHL}	Propagation Delay Time	2.0		27	75		95		110	ns	
		4.5		9	15		19		22		
		6.0		8	13		16		19		
C _{IN}	Input Capacitance			5	10		10		10	pF	
C _{PD} (*)	Power Dissipation Capacitance			21						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 operating current can be obtained by the following equation. I_{cc(opr)} = C_{PD} • V_{CC} • f_{IN} + I_{cc}/4 (per Gate)

SWITCHING CHARACTERISTICS TEST CIRCUIT



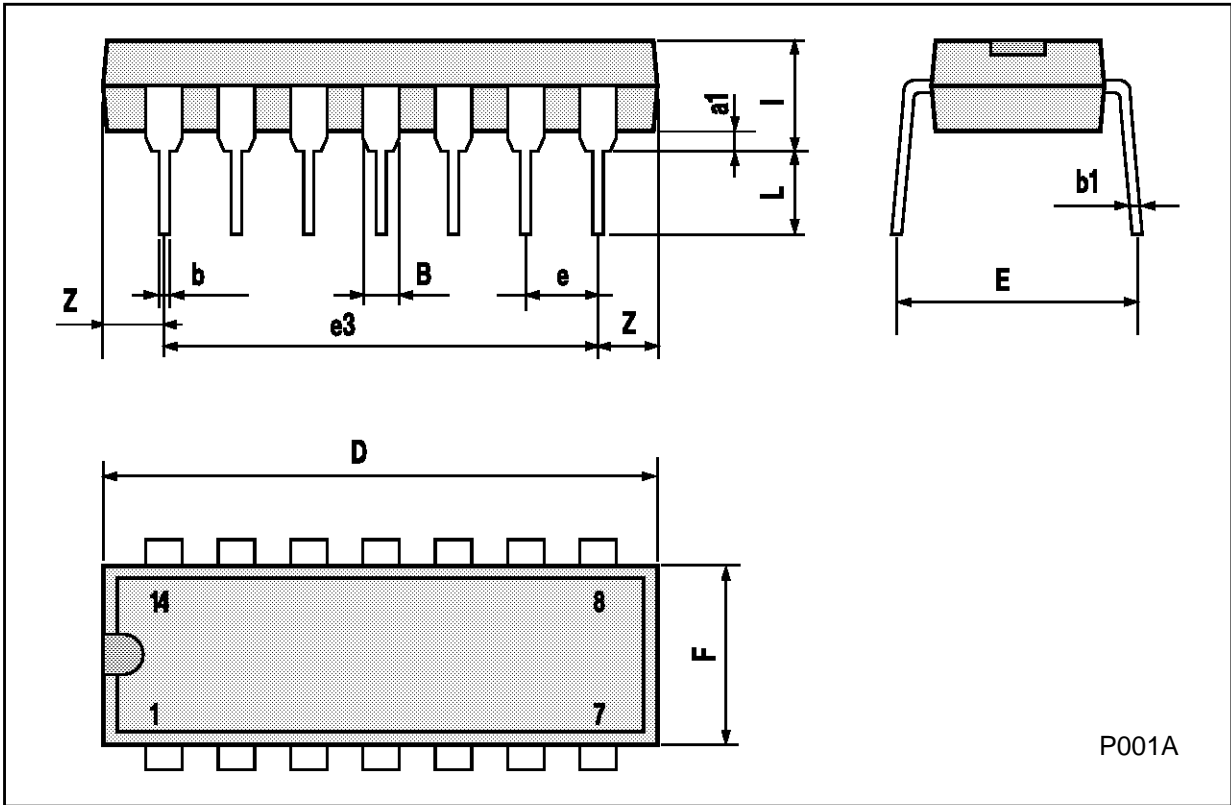
TEST CIRCUIT I_{cc} (Opr.)



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

Plastic DIP14 MECHANICAL DATA

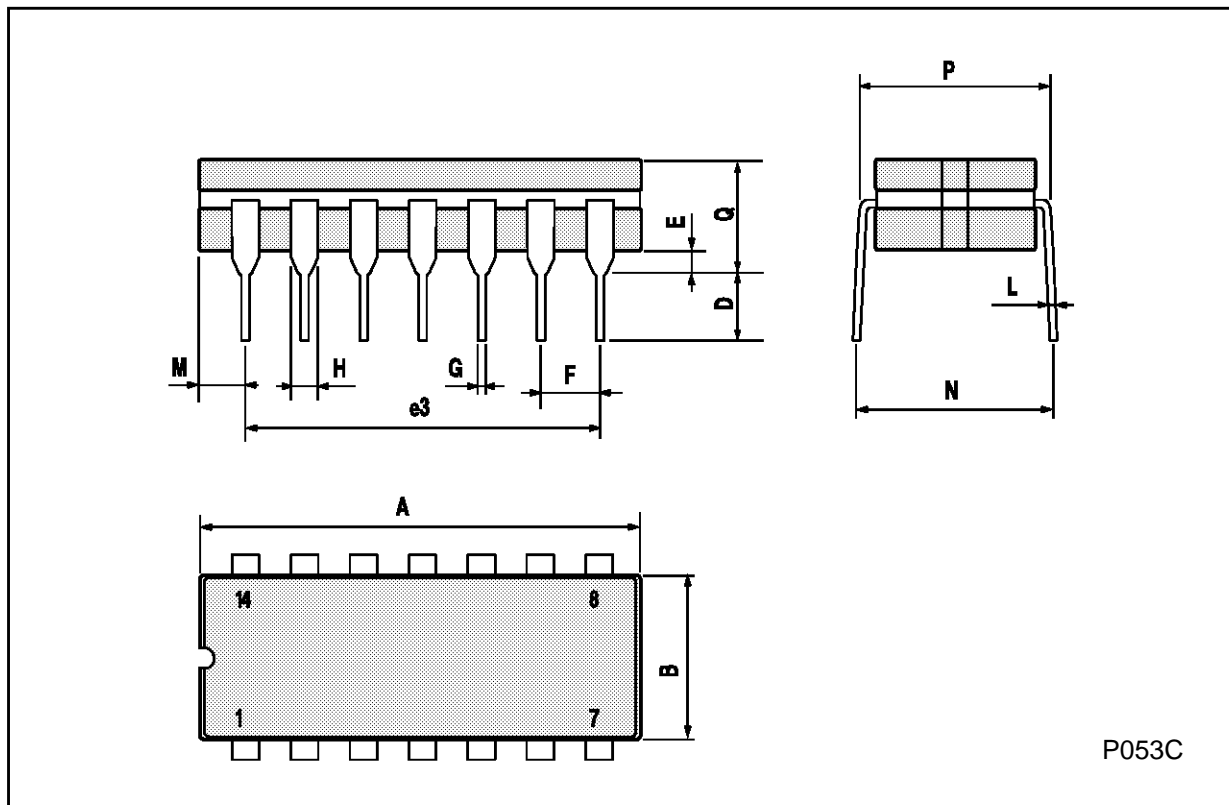
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



M54/M74HC02

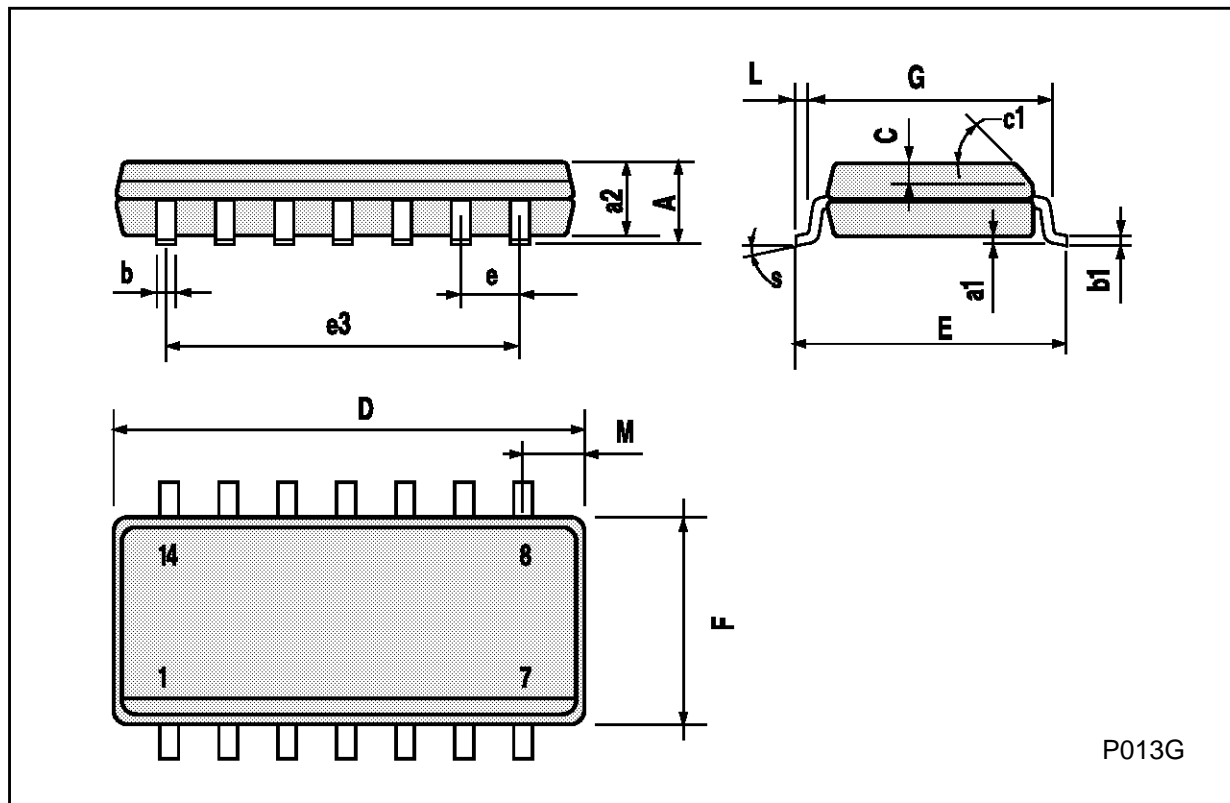
Ceramic DIP14/1 MECHANICAL DATA

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



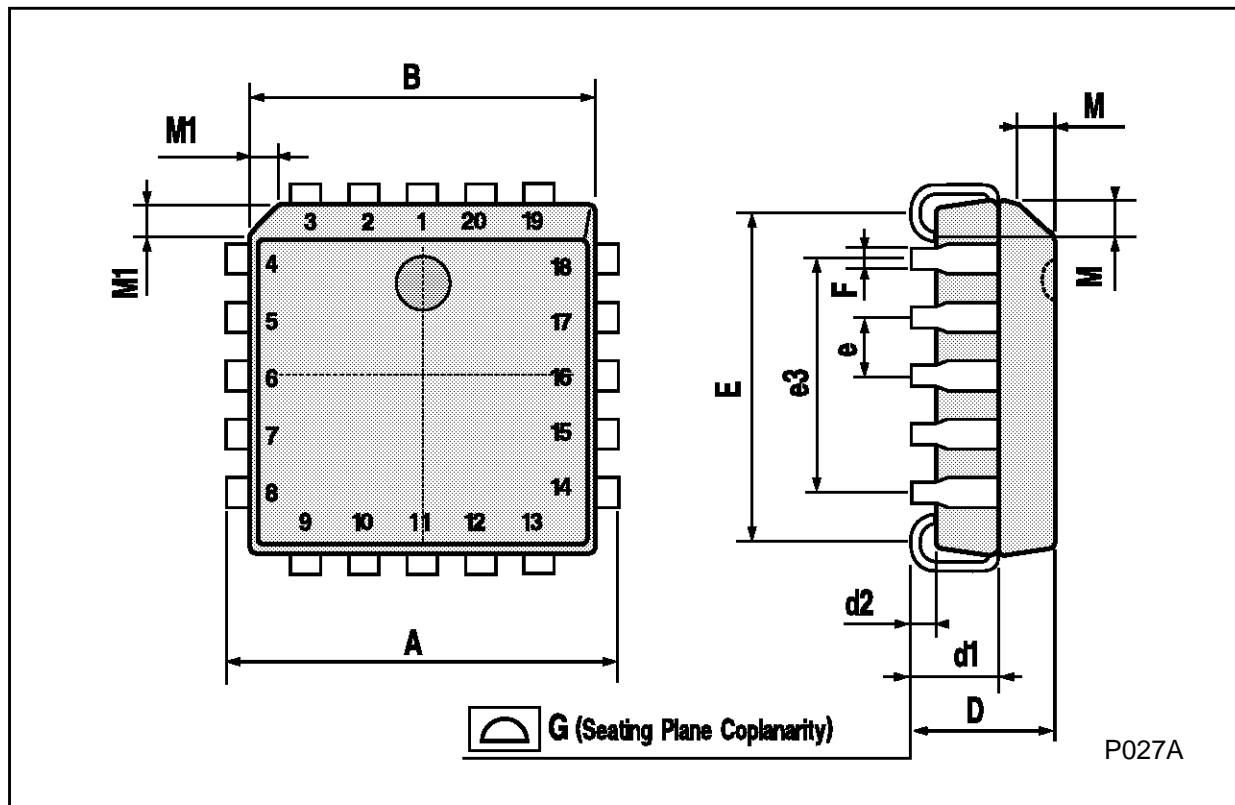
SO14 MECHANICAL DATA

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.)					



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	



P027A

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