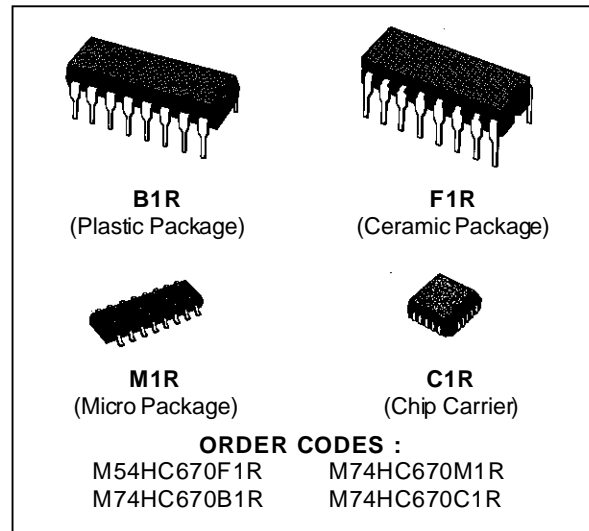


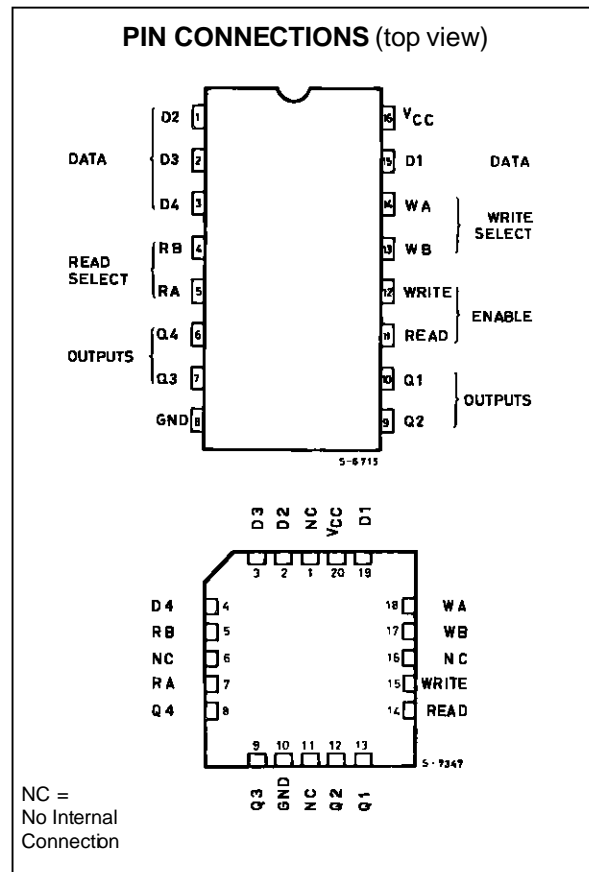
**4 WORD X 4 BIT REGISTER FILE (3 STATE)**

- HIGH SPEED  
t<sub>PD</sub> = 23 ns (TYP.) AT V<sub>CC</sub> = 5 V
- LOW POWER DISSIPATION  
I<sub>CC</sub> = 4 μA (MAX.) AT T<sub>A</sub> = 25 °C
- HIGH NOISE IMMUNITY  
V<sub>NIH</sub> = V<sub>NIL</sub> = 28 % V<sub>CC</sub> (MIN.)
- OUTPUT DRIVE CAPABILITY  
10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE  
|I<sub>OH</sub>| = I<sub>OL</sub> = 4 mA (MIN.)
- BALANCED PROPAGATION DELAYS  
t<sub>PLH</sub> = t<sub>PHL</sub>
- WIDE OPERATING VOLTAGE RANGE  
V<sub>CC</sub> (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE  
WITH 54/74LS670



**DESCRIPTION**

The M54/74HC670 is a high speed CMOS 4 WORD X 4 BIT REGISTER FILE (3-STATE) fabricated in silicon gate C<sup>2</sup>MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption. The M54HC/74HC670 is a 4 x 4 Register File organized as four words by four bits. Separate read and write inputs, both address and enable, allow simultaneous read and write operation. The 3-state outputs make it possible to connect up to 128 outputs to increase the word capacity up to 512 words. Any number of these devices can be operated in parallel to generate an n-bit length. All inputs are equipped with protection circuits against static discharge and transient excess voltage.



WRITE FUNCTION TABLE

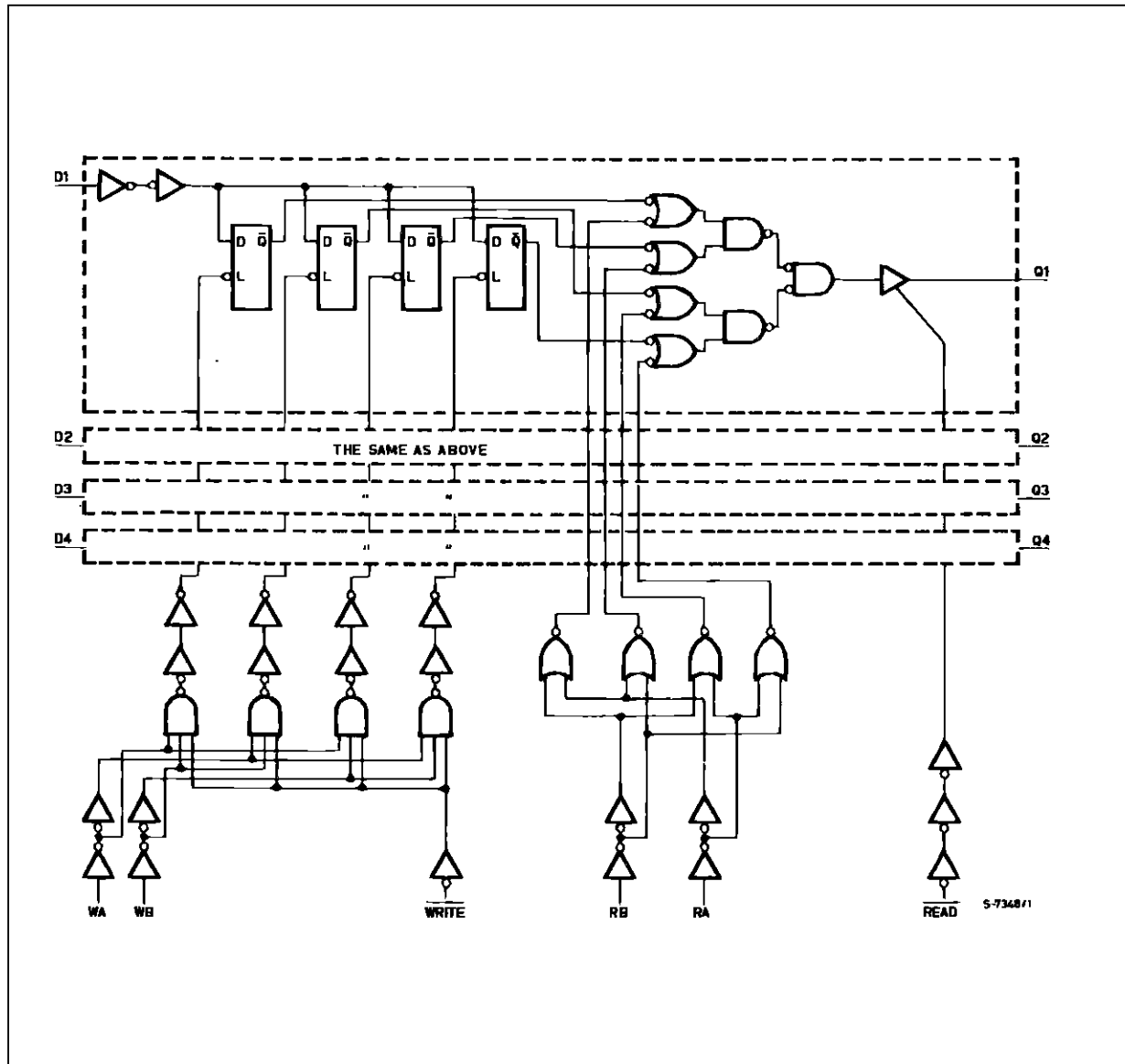
WRITE INPUTS			WORDS			
WB	WA	WE	0	1	2	3
L	L	L	Q = D	Q0	Q0	Q0
L	H	L	Q0	Q = D	Q0	Q0
H	L	L	Q0	Q0	Q = D	Q0
H	H	L	Q0	Q0	Q0	Q = D
X	X	H	Q0	Q0	Q0	Q0

READ FUNCTION TABLE

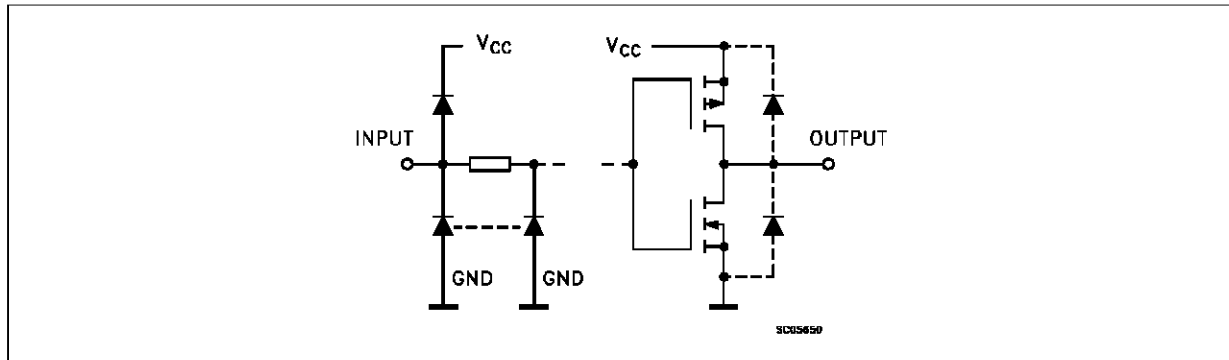
READ INPUTS			OUTPUTS			
RB	RA	RE	Q0	Q1	Q2	Q3
L	L	L	W0B1	W0B2	W0B3	W0B4
L	H	L	W1B1	W1B2	W1B3	W1B4
H	L	L	W2B1	W2B2	W2B3	W2B4
H	H	L	W3B1	W3B2	W3B3	W3B4
X	X	H	Z	Z	Z	Z

Notes: 1 \*: DON'T CARE Z: HIGH IMPEDANCE  
 2 (Q = D) = THE FOUR SELECT INTERNAL FLIP FLOP OUTPUTS WILL ASSUME THE STATES APPLIED TO THE FOUR EXTERNAL DATA INPUTS.  
 3 Q0 = THE LEVEL OF Q BEFORE THE INDICATED INPUT CONDITIONS WERE ESTABLISHED.  
 4 W0B1 = THE FIRST BIT OF WORD 0, ETC.

LOGIC DIAGRAM



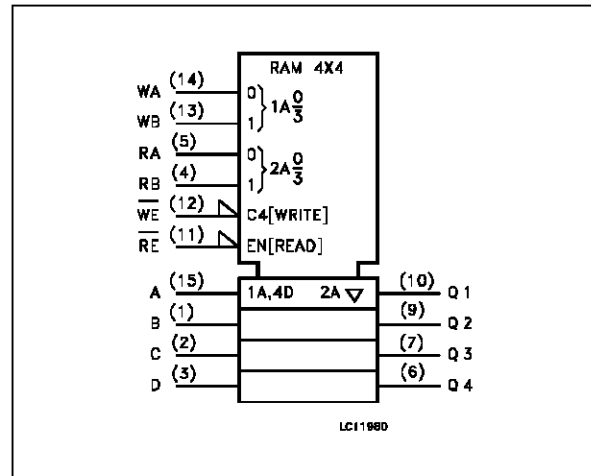
**INPUT AND OUTPUT EQUIVALENT CIRCUIT**



**PIN DESCRIPTION**

PIN No	SYMBOL	NAME AND FUNCTION
5, 4	RA, RB	Read Address Inputs
10, 9, 7, 6	Q1 to Q4	Data Outputs
11	$\overline{RE}$	3 State Output Read Enable Input (Active LOW)
12	$\overline{WE}$	Write Enable Input (Active LOW)
14, 13	WA, WB	Write Address Inputs
15, 1, 2, 3	D1 to D4	Data Inputs
7	GND	Ground (0V)
14	V <sub>CC</sub>	Positive Supply Voltage

**IEC LOGIC SYMBOL**



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply Voltage	-0.5 to +7	V
V <sub>I</sub>	DC Input Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
V <sub>O</sub>	DC Output Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	± 20	mA
I <sub>OK</sub>	DC Output Diode Current	± 20	mA
I <sub>O</sub>	DC Output Source Sink Current Per Output Pin	± 25	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	± 50	mA
P <sub>D</sub>	Power Dissipation	500 (*)	mW
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C
T <sub>L</sub>	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

## M54/M74HC670

### 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: <b>M54HC Series</b> <b>M74HC Series</b>	-55 to +125 -40 to +85	°C °C	
$t_r, t_f$	Input Rise and Fall Time	$V_{CC} = 2\text{ V}$	0 to 1000	ns
		$V_{CC} = 4.5\text{ V}$	0 to 500	
		$V_{CC} = 6\text{ V}$	0 to 400	

### DC SPECIFICATIONS

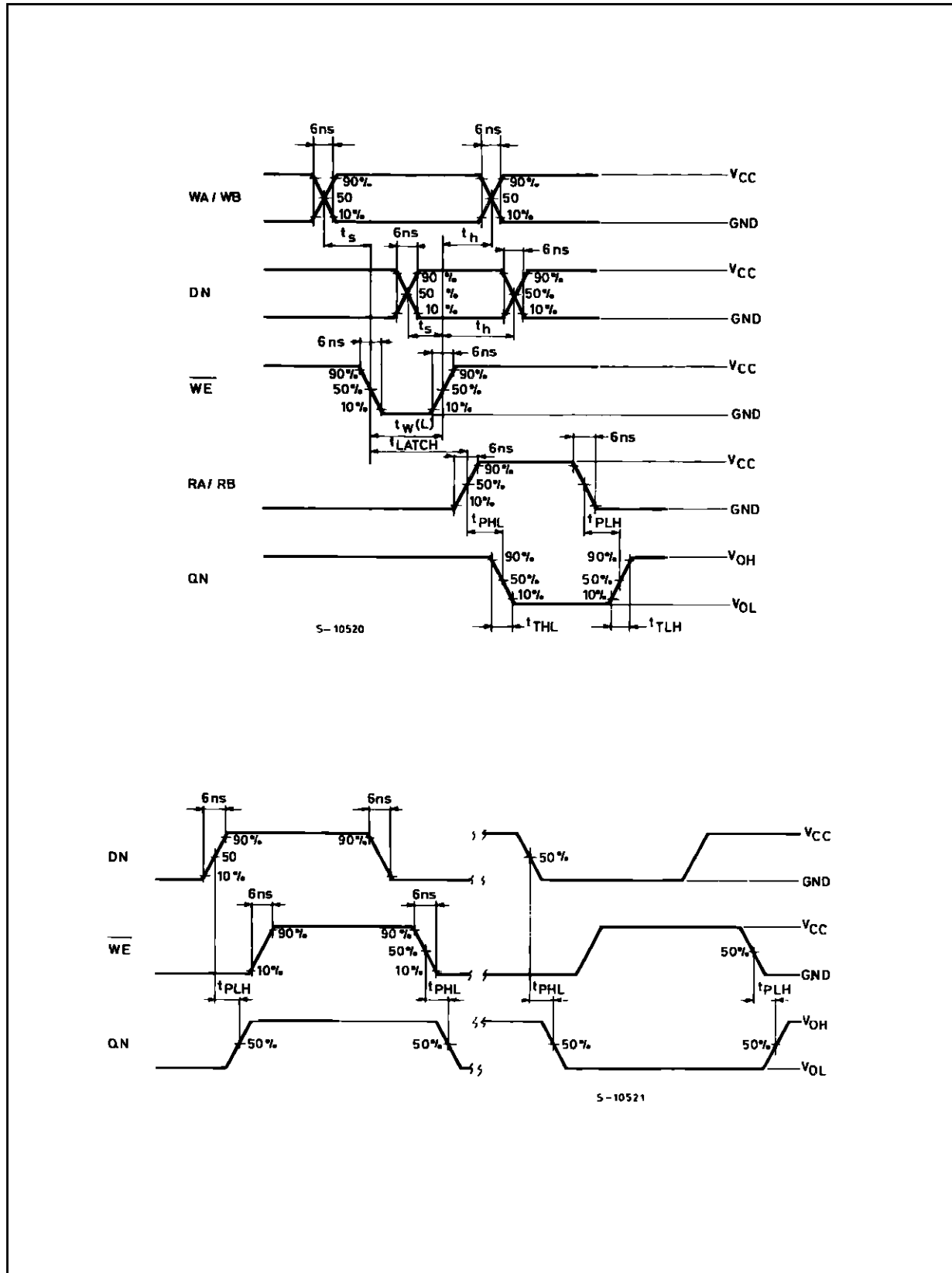
Symbol	Parameter	Test Conditions		Value						Unit		
				$T_A = 25\text{ °C}$ 54HC and 74HC			$-40\text{ to }85\text{ °C}$ 74HC		$-55\text{ to }125\text{ °C}$ 54HC			
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.	
$V_{IH}$	High Level Input Voltage	$V_{CC}$ (V)		1.5			1.5		1.5		V	
				4.5			3.15		3.15			
				6.0			4.2		4.2			
$V_{IL}$	Low Level Input Voltage	$V_{CC}$ (V)				0.5		0.5		0.5	V	
						1.35		1.35		1.35		
						1.8		1.8		1.8		
$V_{OH}$	High Level Output Voltage	$V_{CC}$ (V)	$V_I = V_{IH}$ or $V_{IL}$	$I_O = -20\text{ }\mu\text{A}$	1.9	2.0		1.9		1.9	V	
					4.4	4.5		4.4		4.4		
					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
$V_{OL}$	Low Level Output Voltage	$V_{CC}$ (V)	$V_I = V_{IH}$ or $V_{IL}$	$I_O = 20\text{ }\mu\text{A}$		0.0	0.1		0.1		0.1	V
						0.0	0.1		0.1		0.1	
						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			$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu\text{A}$	
$I_{OZ}$	3 State Output Off State Current	6.0	$V_I = V_{IH}$ or $V_{IL}$ $V_O = V_{CC}$ or GND			$\pm 0.5$		$\pm 5$		$\pm 5$	$\mu\text{A}$	
$I_{CC}$	Quiescent Supply Current	6.0	$V_I = V_{CC}$ or GND			4		40		80	$\mu\text{A}$	

AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ )

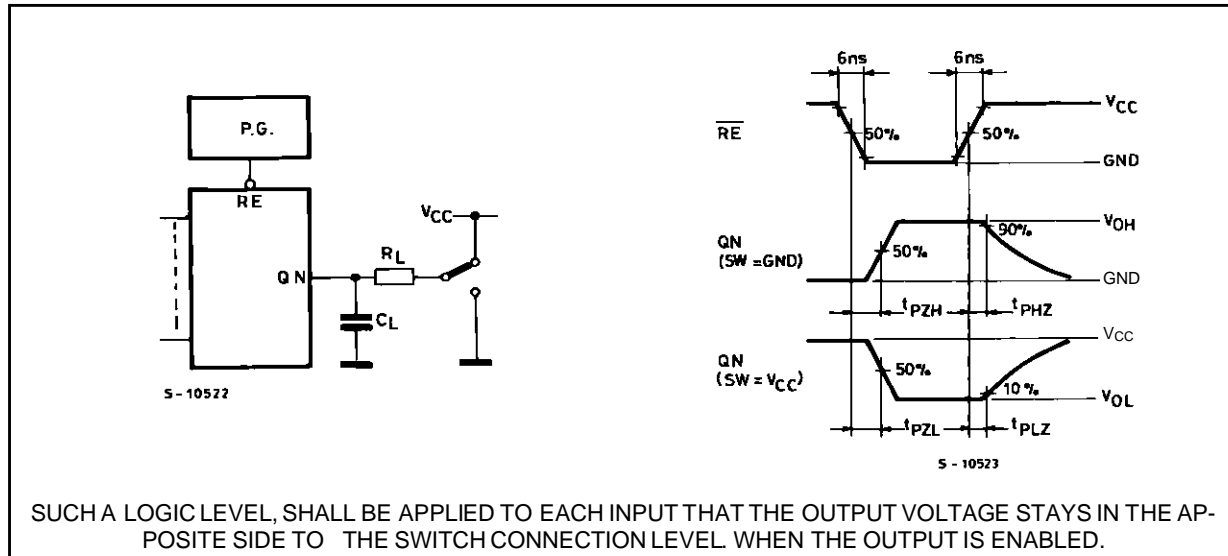
Symbol	Parameter	Test Conditions		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25 \text{ }^\circ\text{C}$ 54HC and 74HC			$-40 \text{ to } 85 \text{ }^\circ\text{C}$ 74HC		$-55 \text{ to } 125 \text{ }^\circ\text{C}$ 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{TLH}$ $t_{THL}$	Output Transition Time	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 (RA, RB - Qn)	2.0			96	185		230		280	ns
		4.5			24	37		46		56	
		6.0			20	31		39		48	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time (WE - Qn)	2.0			108	220		275		330	ns
		4.5			27	44		55		66	
		6.0			23	37		47		56	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time (Dn - Qn)	2.0			104	185		230		280	ns
		4.5			26	37		46		56	
		6.0			22	31		39		48	
$t_{PZL}$ $t_{PZH}$	Output Disable Time	2.0	$R_L = 1 \text{ K}\Omega$		42	110		140		165	ns
		4.5			13	22		28		33	
		6.0			11	19		24		28	
$t_{PLZ}$ $t_{PHZ}$	Output Disable Time	2.0	$R_L = 1 \text{ K}\Omega$		25	95		120		145	ns
		4.5			13	19		24		29	
		6.0			11	16		20		25	
$t_{W(L)}$	Minimum Pulse Width (WE)	2.0			16	75		95		110	ns
		4.5			4	15		19		22	
		6.0			3	13		16		19	
$t_s$	Minimum Set-up Time (Dn - WE) (WA, WB - WE)	2.0			12	50		65		75	ns
		4.5			3	10		13		15	
		6.0			3	9		11		13	
$t_h$	Minimum Hold Time (Dn - WE)	2.0				0		0		0	ns
		4.5				0		0		0	
		6.0				0		0		0	
$t_h$	Minimum Hold Time (WA, WB - WE)	2.0				5		5		5	ns
		4.5				5		5		5	
		6.0				5		5		5	
$t_{latch}$	Minimum Latch Time (WE - RA, RB)	2.0				5		5		5	ns
		4.5				5		5		5	
		6.0				5		5		5	
$C_{IN}$	Input Capacitance				5	10		10		10	pF
$C_{PD} (*)$	Power Dissipation Capacitance				96						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.  $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

SWITCHING CHARACTERISTICS TEST WAVEFORM

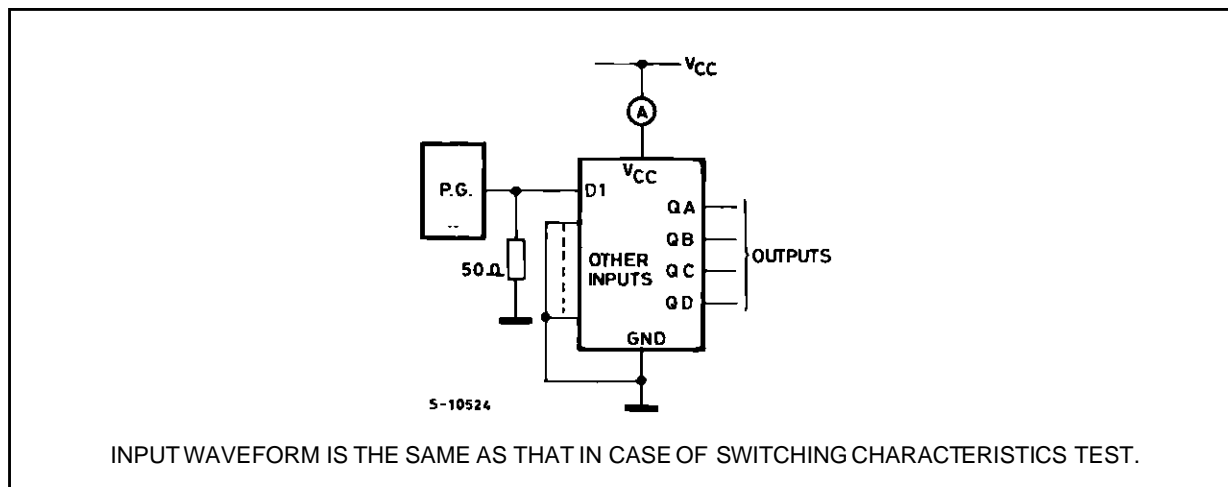


SWITCHING CHARACTERISTICS TEST WAVEFORM (continued)



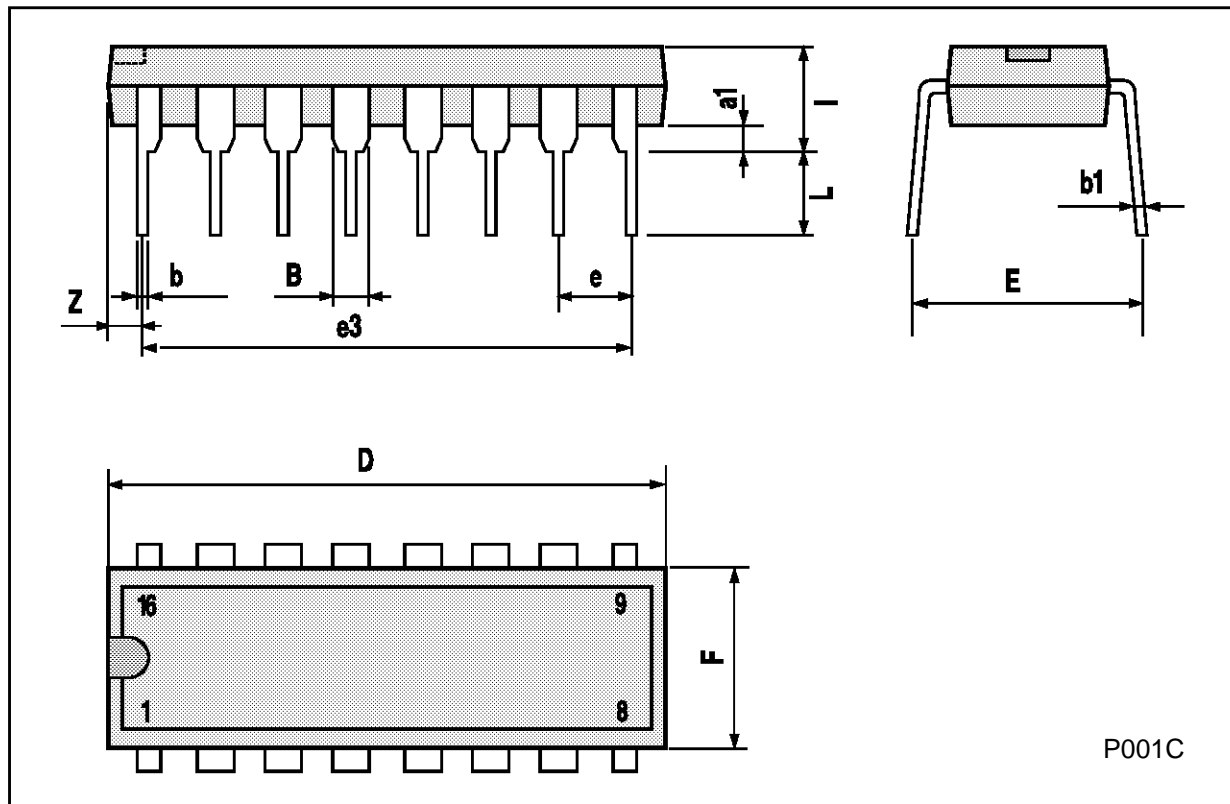
SUCH A LOGIC LEVEL, SHALL BE APPLIED TO EACH INPUT THAT THE OUTPUT VOLTAGE STAYS IN THE APPOSITE SIDE TO THE SWITCH CONNECTION LEVEL WHEN THE OUTPUT IS ENABLED.

TEST CIRCUIT I<sub>CC</sub> (Opr.)



Plastic DIP16 (0.25) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		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		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050

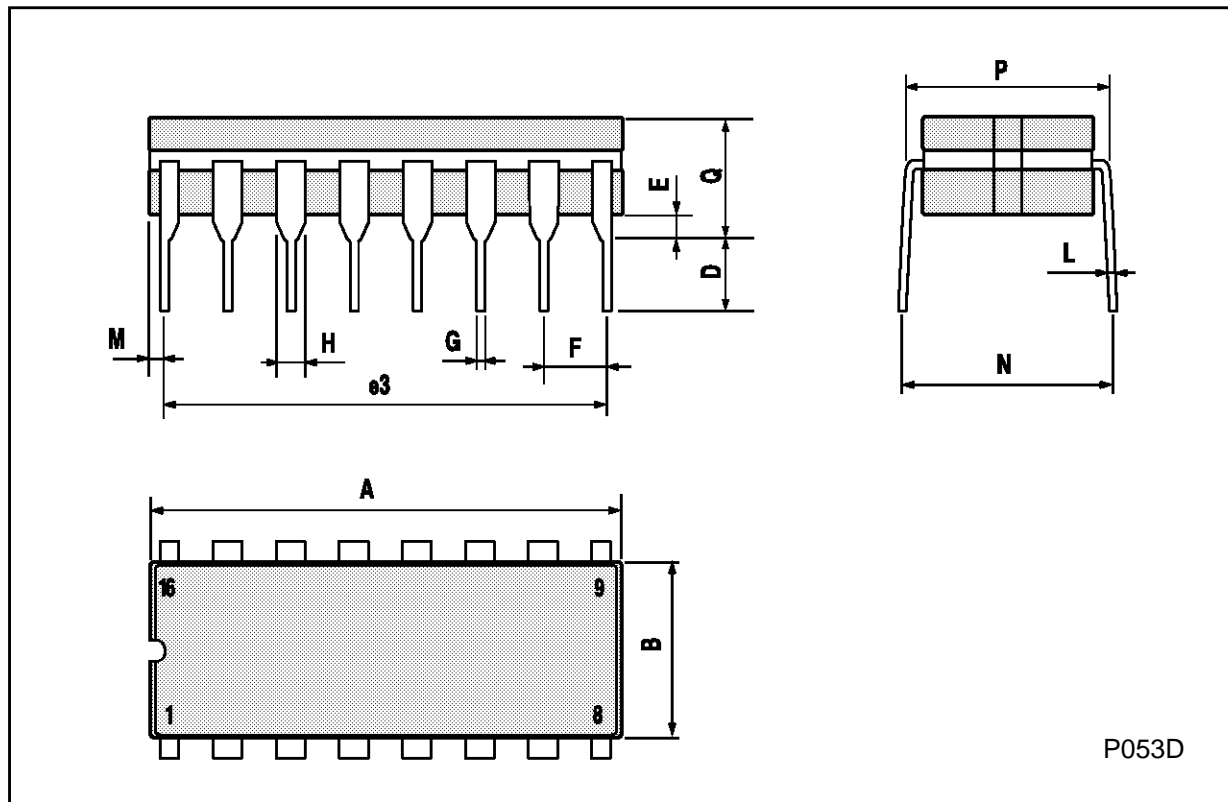


P001C



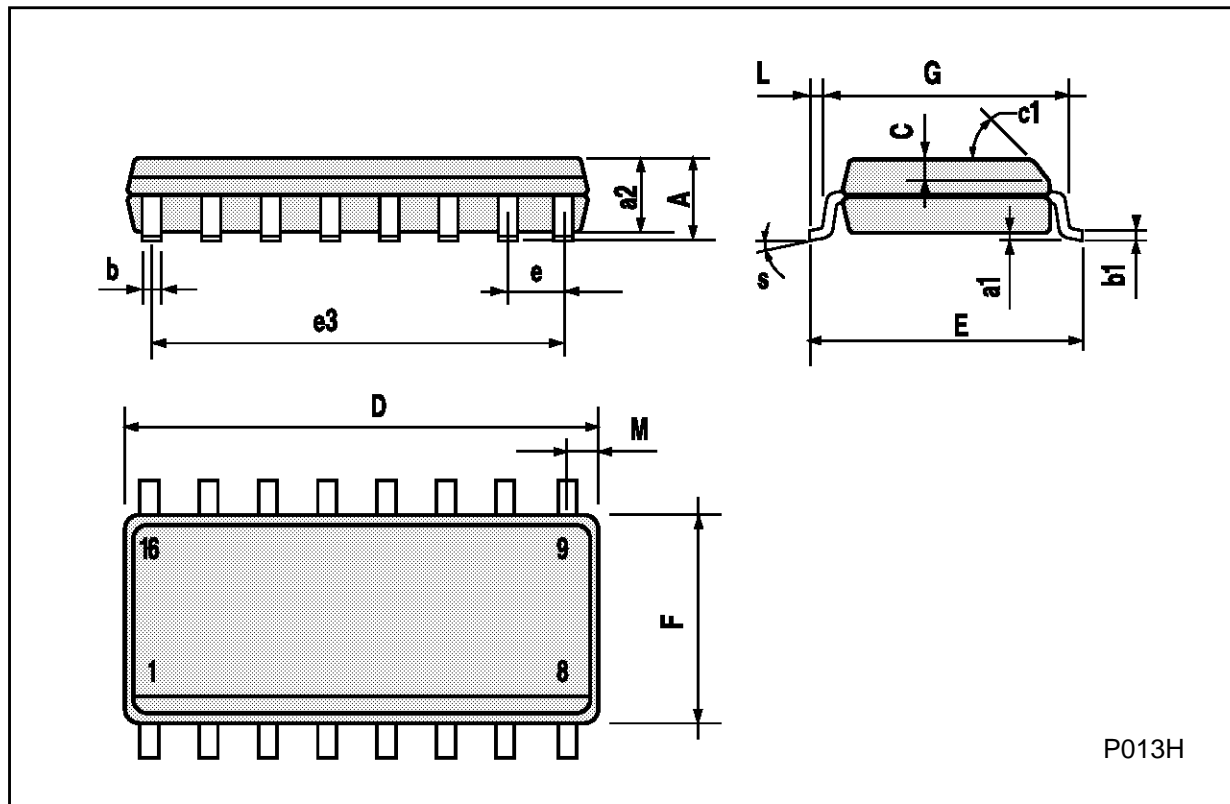
## Ceramic DIP16/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
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	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



SO16 (Narrow) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		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	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
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			0.62			0.024
S	8° (max.)					



P013H

## 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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