

## 8 BIT REGISTER BINARY COUNTER

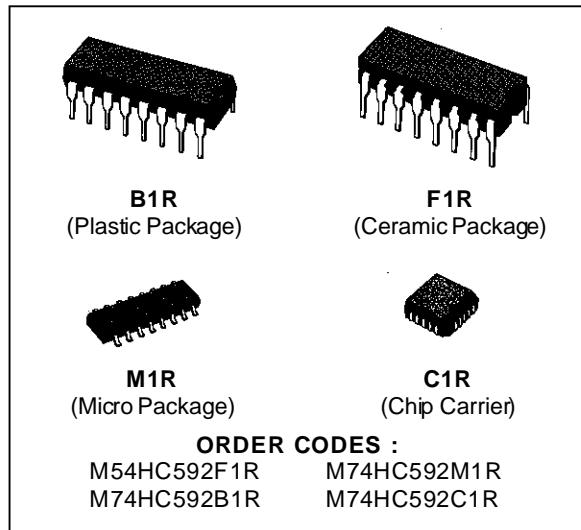
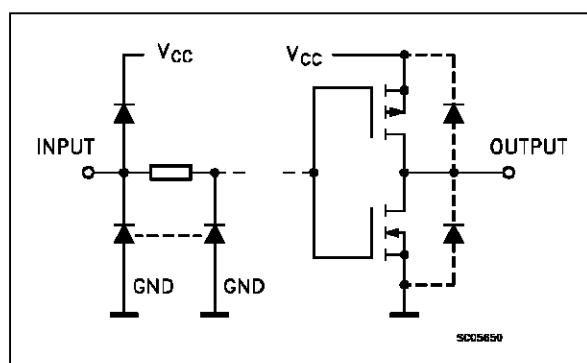
- HIGH SPEED  
 $f_{MAX} = 35 \text{ MHz (TYP.)}$  AT  $V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION  
 $I_{CC} = 4 \mu\text{A (MAX.)}$  AT  $T_A = 25^\circ\text{C}$
- OUTPUT DRIVE CAPABILITY  
 10 LSTTL LOADS
- BALANCED PROPAGATION DELAYS  
 $t_{PLH} = t_{PHL}$
- SYMMETRICAL OUTPUT IMPEDANCE  
 $|I_{OL}| = |I_{OH}| = 4 \text{ mA (MIN.)}$
- HIGH NOISE IMMUNITY  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC}$  (MIN.)
- WIDE OPERATING VOLTAGE RANGE  
 $V_{CC} (\text{OPR}) = 2 \text{ V TO } 6 \text{ V}$
- PIN AND FUNCTION COMPATIBLE  
 WITH 54/74LS592

### DESCRIPTION

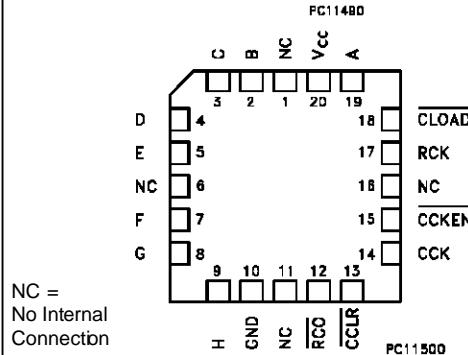
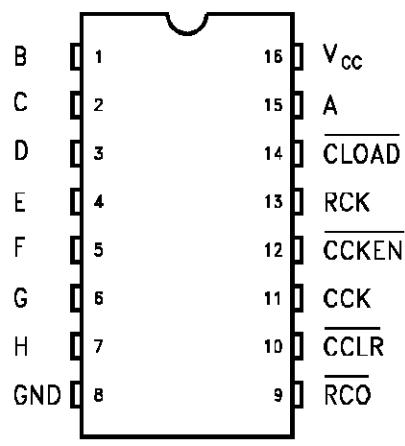
The M54/74HC592 is a high speed CMOS 8 BIT REGISTER COUNTER fabricated in silicon gate C<sup>2</sup>MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

The M54/74HC592 is a parallel input, 8 bit storage register feeding an 8 bit binary counter. Both the register and the counter have individual positive edge triggered clock. In addition, the counter has direct load and clear functions. Expansion is easily accomplished by connecting RCO of the first stage to the count enable of the second stage. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### INPUT AND OUTPUT EQUIVALENT CIRCUIT



### PIN CONNECTIONS (top view)



## M54/M74HC592

### TRUTH TABLE

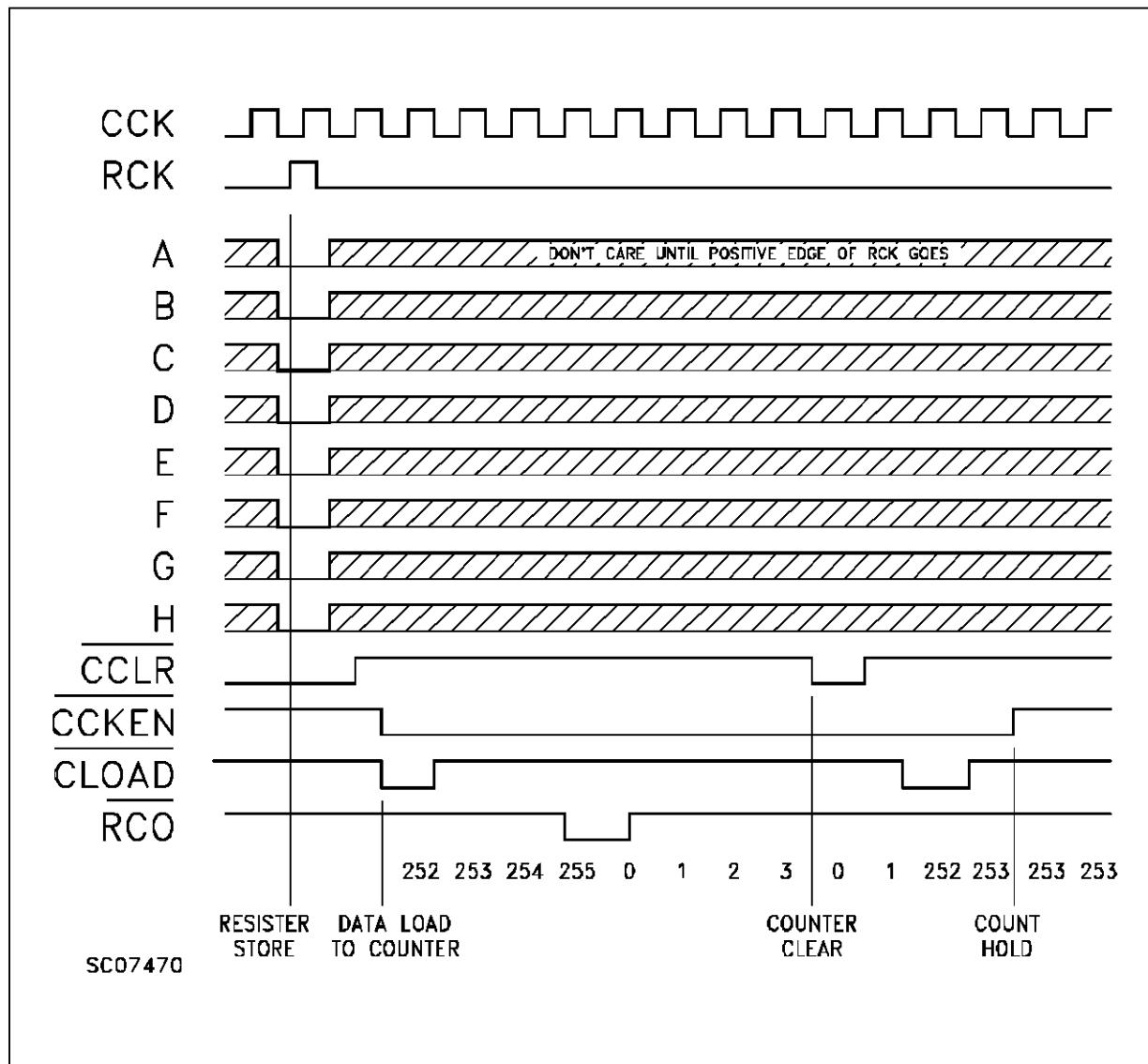
INPUTS					FUNCTION
RCK	CLOAD	CCLR	CCKEN	CCK	
X	L	H	X	X	REGISTER DATA IS LOADED INTO COUNTER
X	H	L	X	X	COUNTER CLEAR
$\bar{L}$	H	H	X	X	THE DATA OF A THRU H INPUTS IS STORED INTO REGISTER
$\bar{L}$	H	H	X	X	REGISTER STATE IS NOT CHANGED
X	H	H	L	$\bar{L}$	COUNTER ADVANCES THE COUNT
X	H	H	L	$\bar{L}$	NO COUNT
X	H	H	H	X	NO COUNT

X: Don't Care

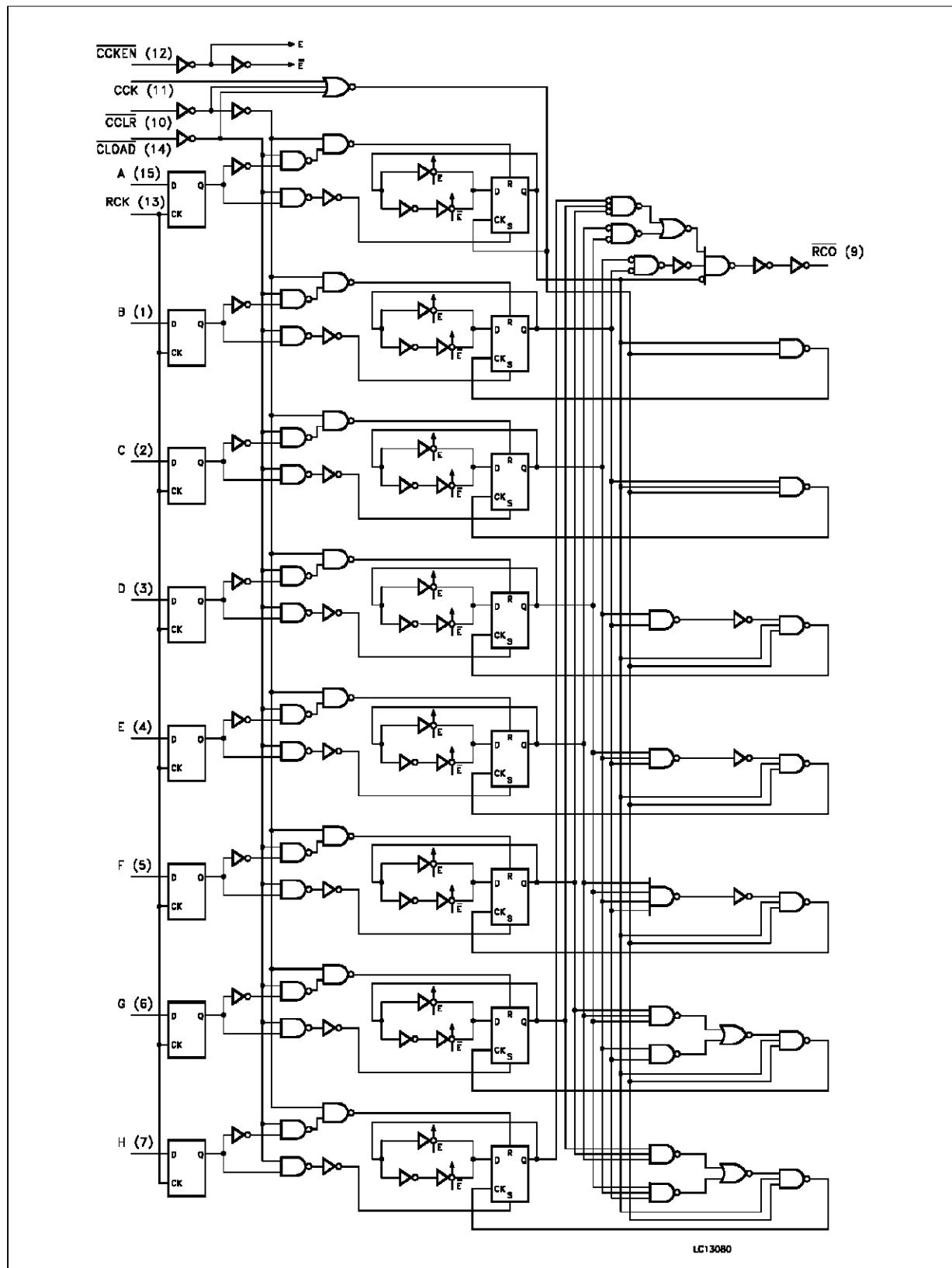
RCO = QA' • QB' • QC' • QD' • QE' • QF' • QG' • QH'

(QA' to QH': Internal outputs of the counter)

### TIMING CHART



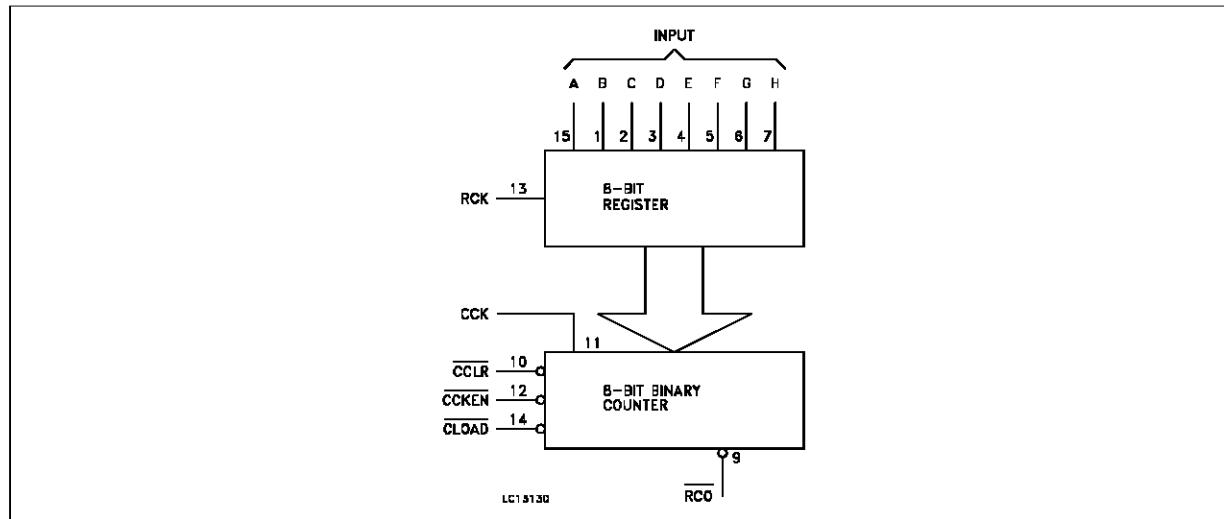
## LOGIC DIAGRAM



LC13080

## M54/M74HC592

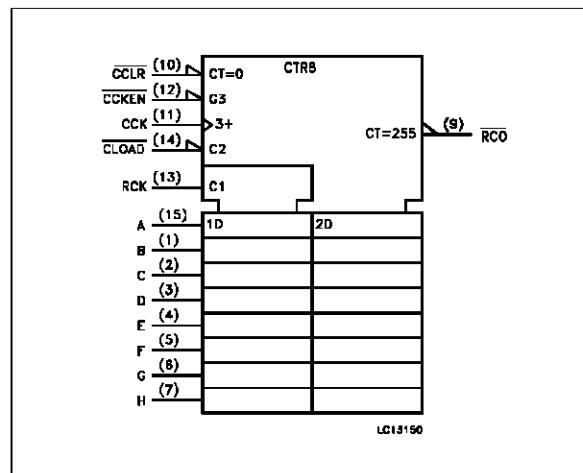
### BLOCK DIAGRAM



### PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1 to 7, 15	A to H	Data Inputs
9	$\overline{RCO}$	Ripple Counter Output
10	$\overline{CCLR}$	Counter Clear Input
11	CCK	Counter Clock Input
12	$\overline{CCKEN}$	Counter Clock Enable Input
13	RCK	Register Clock Input
14	CLOAD	Counter Load Input
8	GND	Ground (0V)
16	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	$\pm 20$	mA
I <sub>OK</sub>	DC Output Diode Current	$\pm 20$	mA
I <sub>O</sub>	DC Output Source Sink Current Per Output Pin	$\pm 25$	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current	$\pm 50$	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:  $\leq 65$  °C derate to 300 mW by 10mW/°C: 65 °C to 85 °C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value			Unit	
V <sub>CC</sub>	Supply Voltage	2 to 6			V	
V <sub>I</sub>	Input Voltage	0 to V <sub>CC</sub>			V	
V <sub>O</sub>	Output Voltage	0 to V <sub>CC</sub>			V	
T <sub>op</sub>	Operating Temperature: M54HC Series M74HC Series	-55 to +125 -40 to +85		-55 to +125 -40 to +85	°C °C	
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time	V <sub>CC</sub> = 2 V	0 to 1000		ns	
		V <sub>CC</sub> = 4.5 V	0 to 500			
		V <sub>CC</sub> = 6 V	0 to 400			

## DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V <sub>IH</sub>	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 <sub>IL</sub>	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 <sub>OH</sub>	High Level Output Voltage	2.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	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 <sub>O</sub> =-4.0 mA	4.18	4.31		4.13		4.10		
		6.0		5.68	5.8		5.63		5.60		
V <sub>OL</sub>	Low Level Output Voltage	2.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		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 <sub>O</sub> = 4.0 mA		0.17	0.26		0.33		0.40	
		6.0			0.18	0.26		0.33		0.40	
I <sub>I</sub>	Input Leakage Current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND			±0.1		±1		±1	µA
I <sub>CC</sub>	Quiescent Supply Current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		80	µA

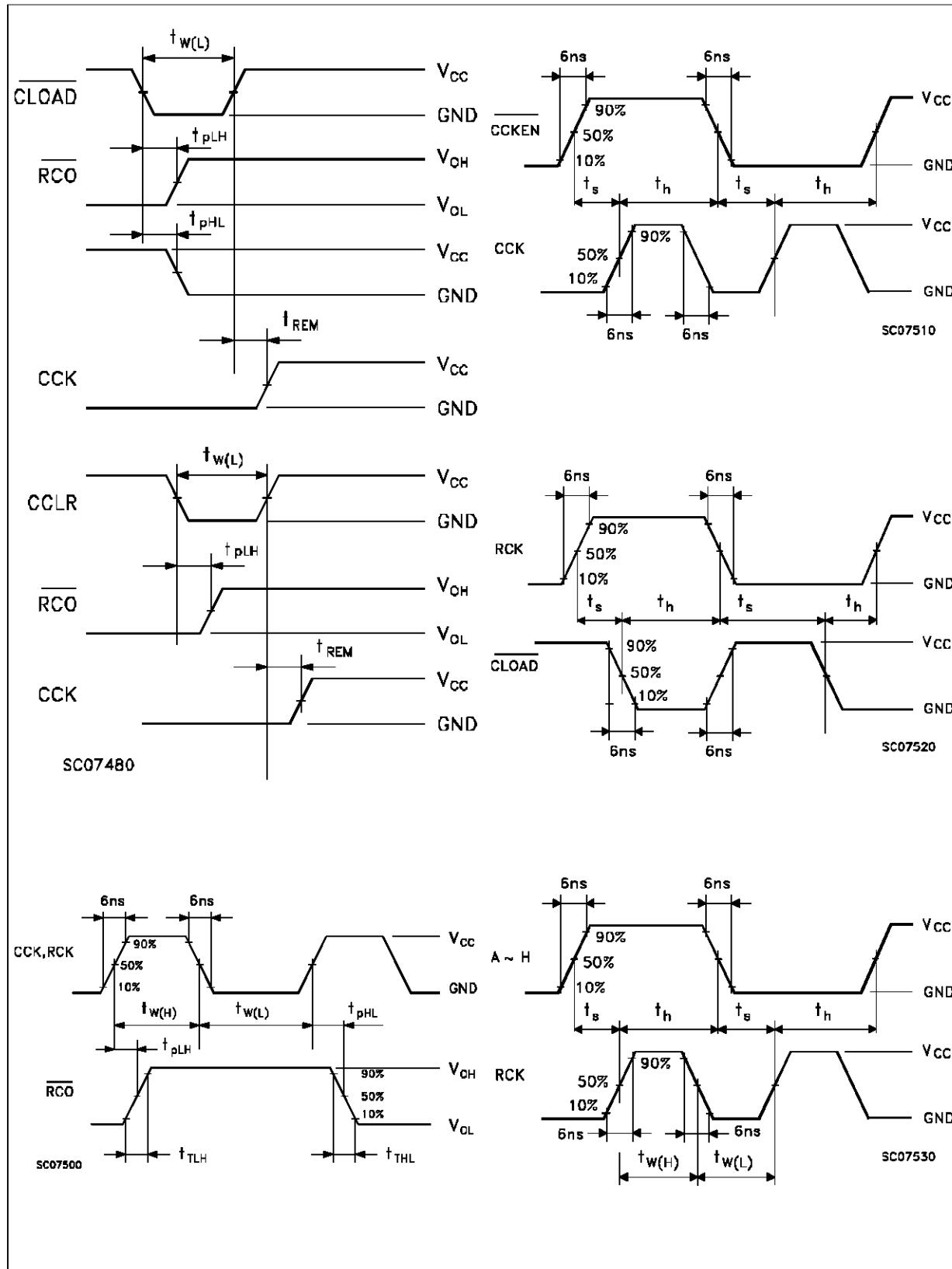
## M54/M74HC592

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

Symbol	Parameter	Test Conditions			Value				Unit	
		V <sub>CC</sub> (V)	$T_A = 25^\circ\text{C}$ 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
			Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t <sub>TLH</sub> t <sub>THL</sub>	Output Transition Time	2.0		30	75		95		110	ns
		4.5		8	15		19		22	
		6.0		7	13		16		19	
t <sub>P LH</sub> t <sub>P HL</sub>	Propagation Delay Time (CCK - RCO)	2.0		63	165		205		250	ns
		4.5		21	33		41		50	
		6.0		18	28		35		43	
t <sub>P LH</sub> t <sub>P HL</sub>	Propagation Delay Time (CLOAD - RCO)	2.0		110	235		295		355	ns
		4.5		30	47		59		71	
		6.0		26	40		50		60	
t <sub>P HL</sub>	Propagation Delay Time (CCLR - RCO)	2.0		70	160		200		240	ns
		4.5		20	32		40		48	
		6.0		17	27		34		41	
t <sub>P LH</sub> t <sub>P HL</sub>	Propagation Delay Time (RCK - RCO)	2.0		120	260		325		390	ns
		4.5		34	52		65		78	
		6.0		29	44		55		66	
f <sub>MAX</sub>	Maximum Clock Frequency	2.0	5.4	11		4.4		3.6		MHz
		4.5	27	45		22		18		
		6.0	32	53		26		21		
t <sub>W(H)</sub> t <sub>W(L)</sub>	Minimum Pulse Width	2.0		40	75		95		110	ns
		4.5		8	15		19		22	
		6.0		7	13		16		19	
t <sub>W(L)</sub>	Minimum Pulse Width (CCLR, CLOAD)	2.0		40	75		95		110	ns
		4.5		8	15		19		22	
		6.0		7	13		16		19	
t <sub>S</sub>	Minimum Set-up Time (CCKEN - CCK)	2.0		28	75		95		110	ns
		4.5		7	15		19		22	
		6.0		6	13		16		19	
t <sub>S</sub>	Minimum Set-up Time (RCK - CLOAD) (A ... H - RCK)	2.0		40	100		125		145	ns
		4.5		10	20		25		29	
		6.0		9	17		21		25	
t <sub>H</sub>	Minimum Hold Time	2.0		0		0		0		ns
		4.5		0		0		0		
		6.0		0		0		0		
t <sub>REM</sub>	Minimum Removal Time	2.0		28	75		95		110	ns
		4.5		7	15		19		22	
		6.0		6	13		16		19	
C <sub>IN</sub>	Input Capacitance			5	10		10		10	pF
C <sub>PD (*)</sub>	Power Dissipation Capacitance			30						pF

(\*) C<sub>PD</sub> 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<sub>CC(Opr)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>IN</sub> + I<sub>CC</sub>

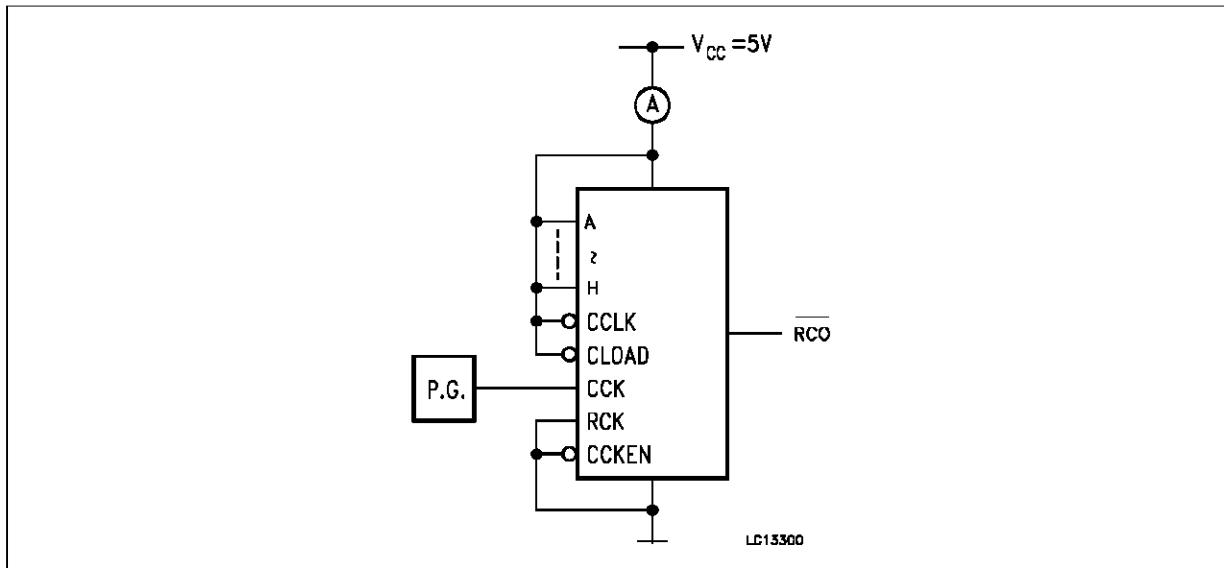
## SWITCHING CHARACTERISTICS TEST WAVEFORM



## M54/M74HC592

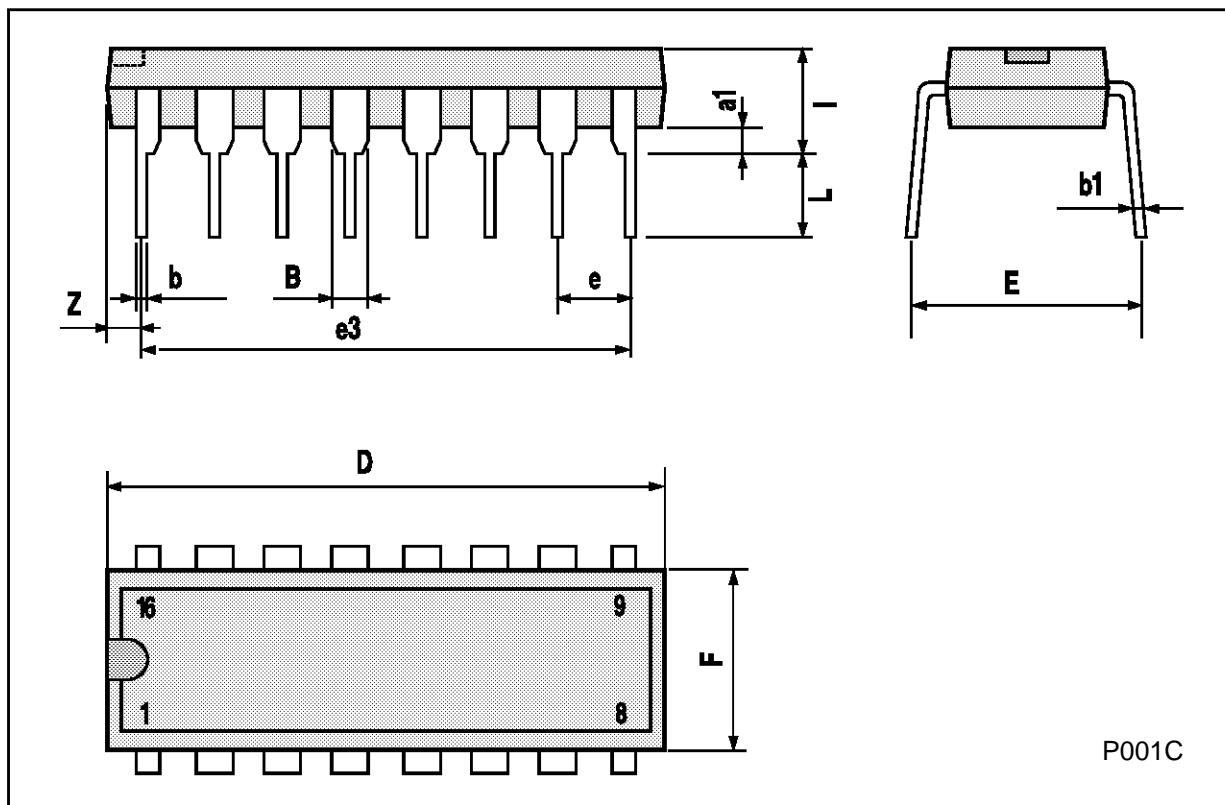
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### I<sub>cc</sub> (Opr.) TEST CIRCUIT



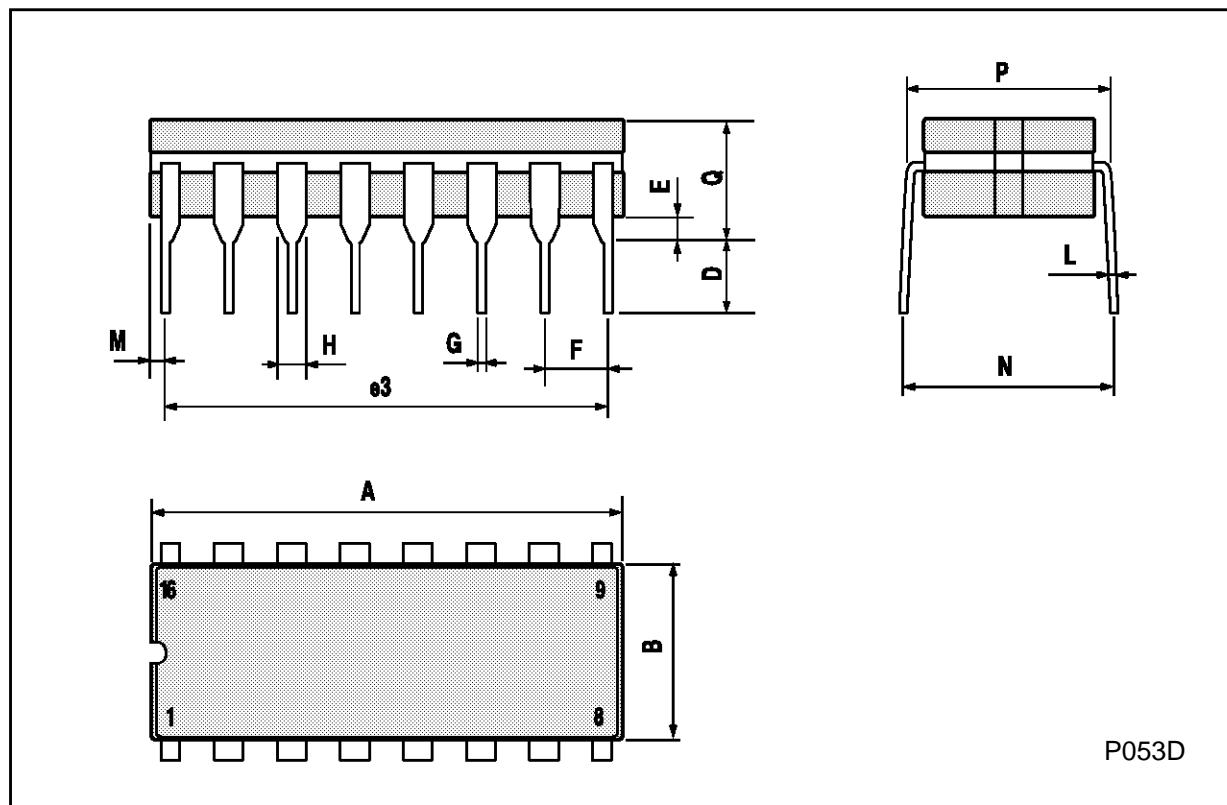
## Plastic DIP16 (0.25) MECHANICAL DATA

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



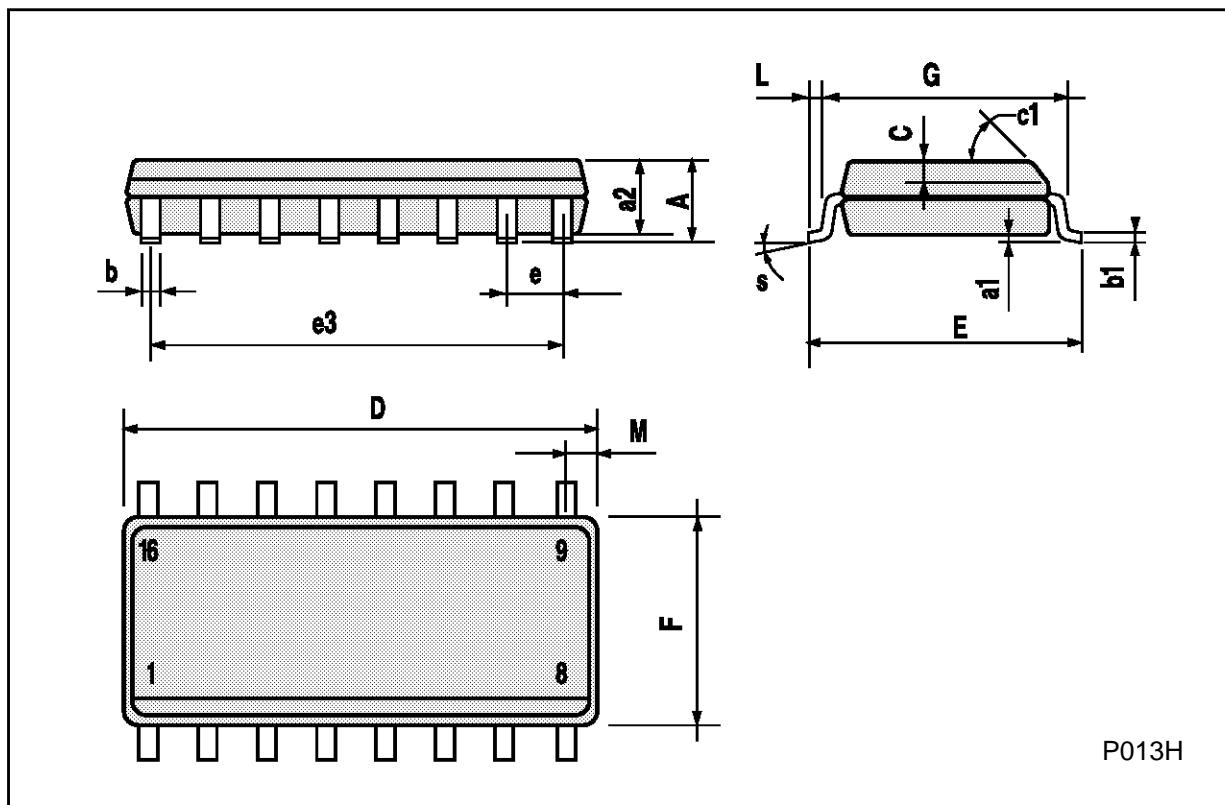
Ceramic DIP16/1 MECHANICAL DATA

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



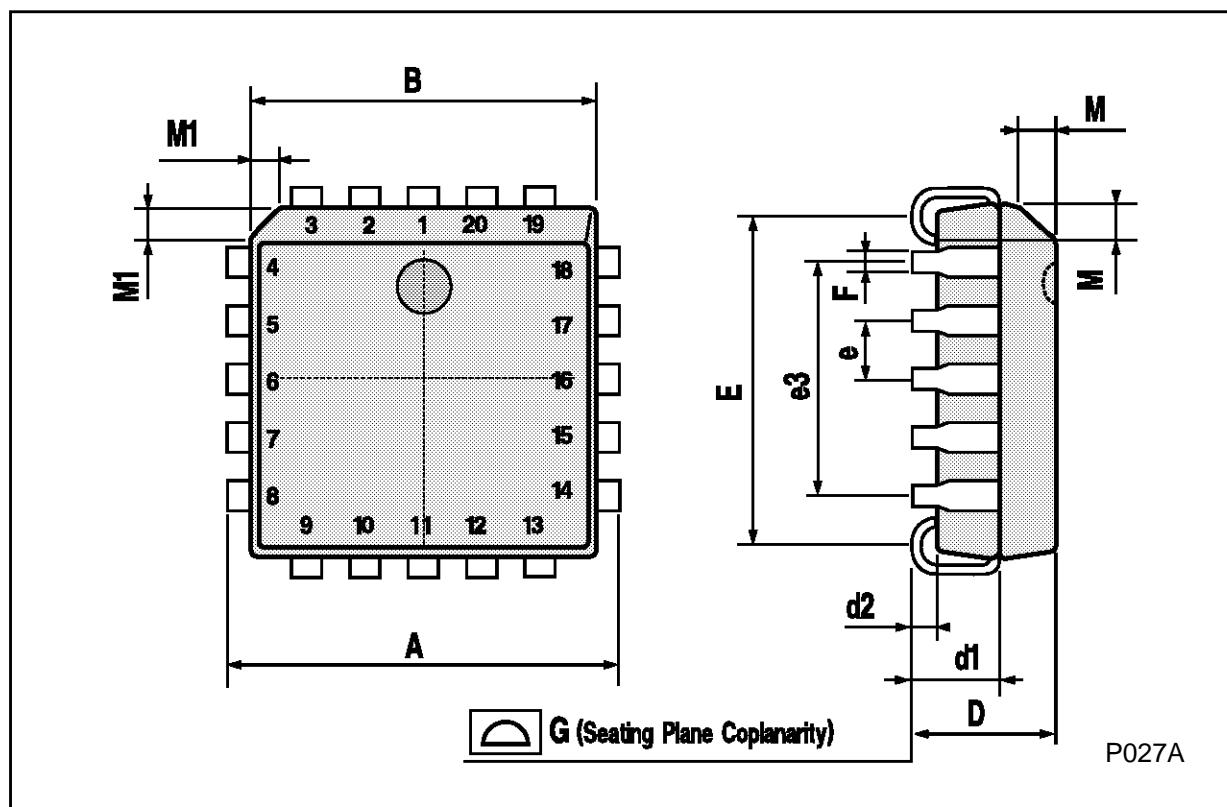
## SO16 (Narrow) MECHANICAL DATA

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.)			



**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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