



M54HC166
M74HC166

8 BIT PISO SHIFT REGISTER

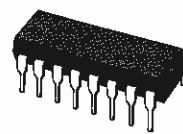
- HIGH SPEED
 $f_{MAX} = 57 \text{ MHz (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION
 $I_{CC} = 4 \mu\text{A (MAX.) AT } T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY
 $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY
10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- 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
54/74LS166

DESCRIPTION

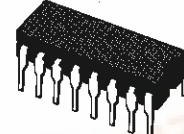
The M54/74HC166 is a high speed C^2 MOS 8 BIT PISO SHIFT REGISTER fabricated in silicon gate C^2 MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

It consists of parallel or serial inputs and a serial-out 8-bit shift register with gated clock inputs and an overriding clear input. The parallel-in or serial-in modes are controlled by the $\overline{\text{SHIFT/LOAD}}$ input. When the $\overline{\text{SHIFT/LOAD}}$ input is held high, the serial data input is enabled and the eight flip-flops perform serial shifting with each clock pulse. When held low, the parallel data inputs are enabled and synchronous loading occurs on the next clock pulse. Clocking is accomplished on the low-to-high level edge of the clock pulse. The CLOCK-INHIBIT input should be changed to the high only while the CLOCK input is held high. A direct clear input overrides all other inputs, including the clock, and sets all flip-flops to zero. Functional details are shown in the truth table and the timing chart.

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



B1R
(Plastic Package)



F1R
(Ceramic Package)



M1R
(Micro Package)

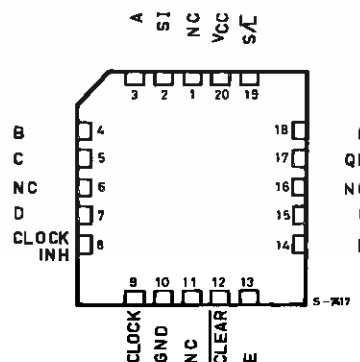
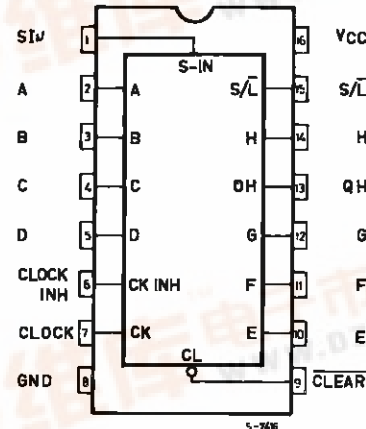


C1R
(Chip Carrier)

ORDER CODES :

M54HC166F1R	M74HC166M1R
M74HC166B1R	M74HC166C1R

PIN CONNECTIONS (top view)

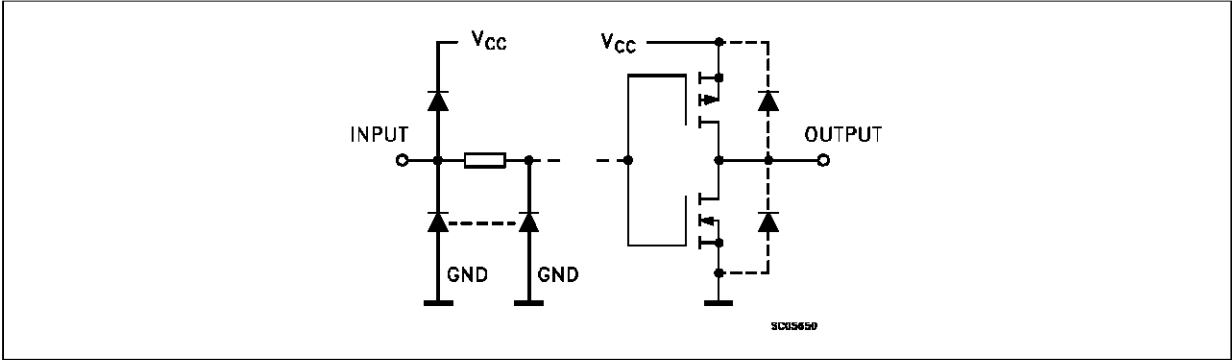


NC =
No Internal Con-



M54/M74HC166

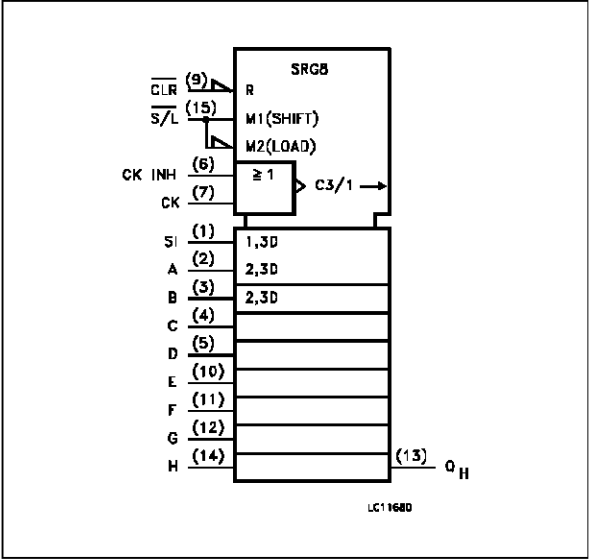
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1	SI	Serial Data Inputs
2, 3, 4, 5, 10, 11, 12, 14	A to H	Parallel Data Inputs
6	CK INH	Clock Enable Input (Active LOW)
7	CK	Clock Input (LOW to HIGH edge-triggered)
9	CLEAR	Asynchronous Master reset Input (Active LOW)
13	QH	Serial Output from the Last Stage
15	S/L	Parallel Enable Input (Active LOW)
8	GND	Ground (0V)
16	Vcc	Positive Supply Voltage

IEC LOGIC SYMBOL

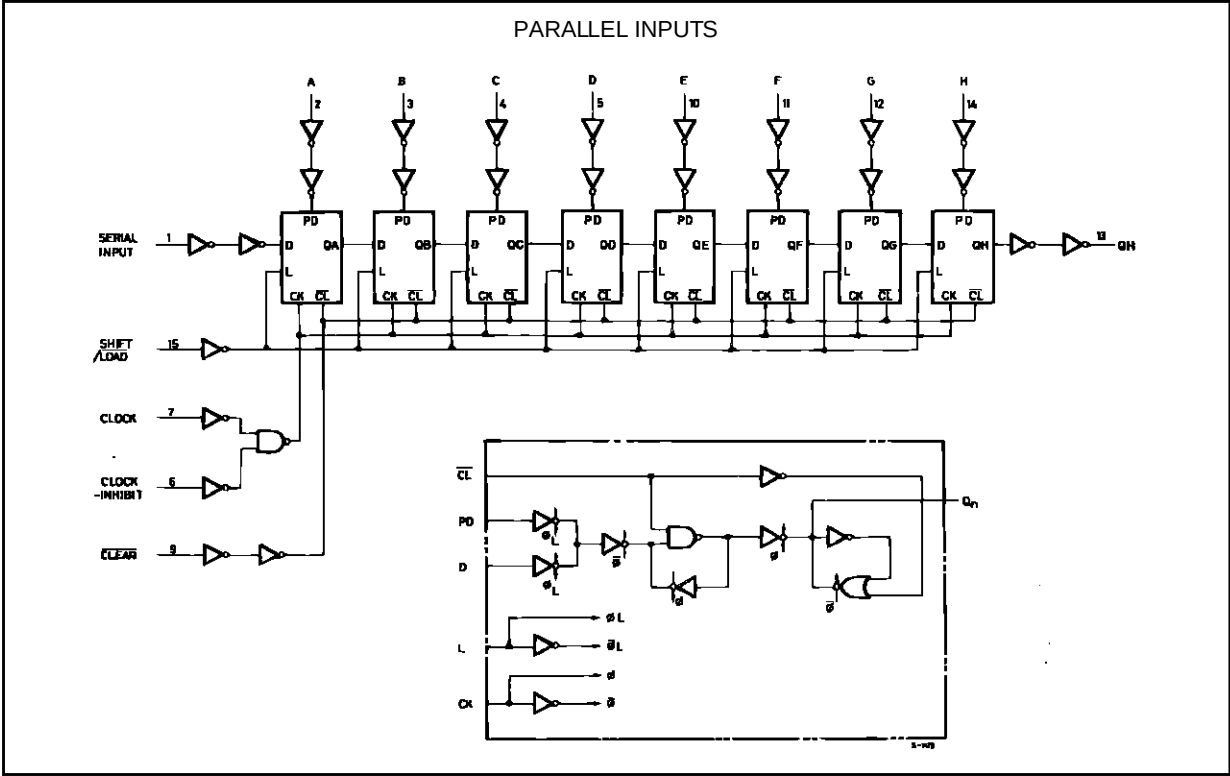


TRUTH TABLE

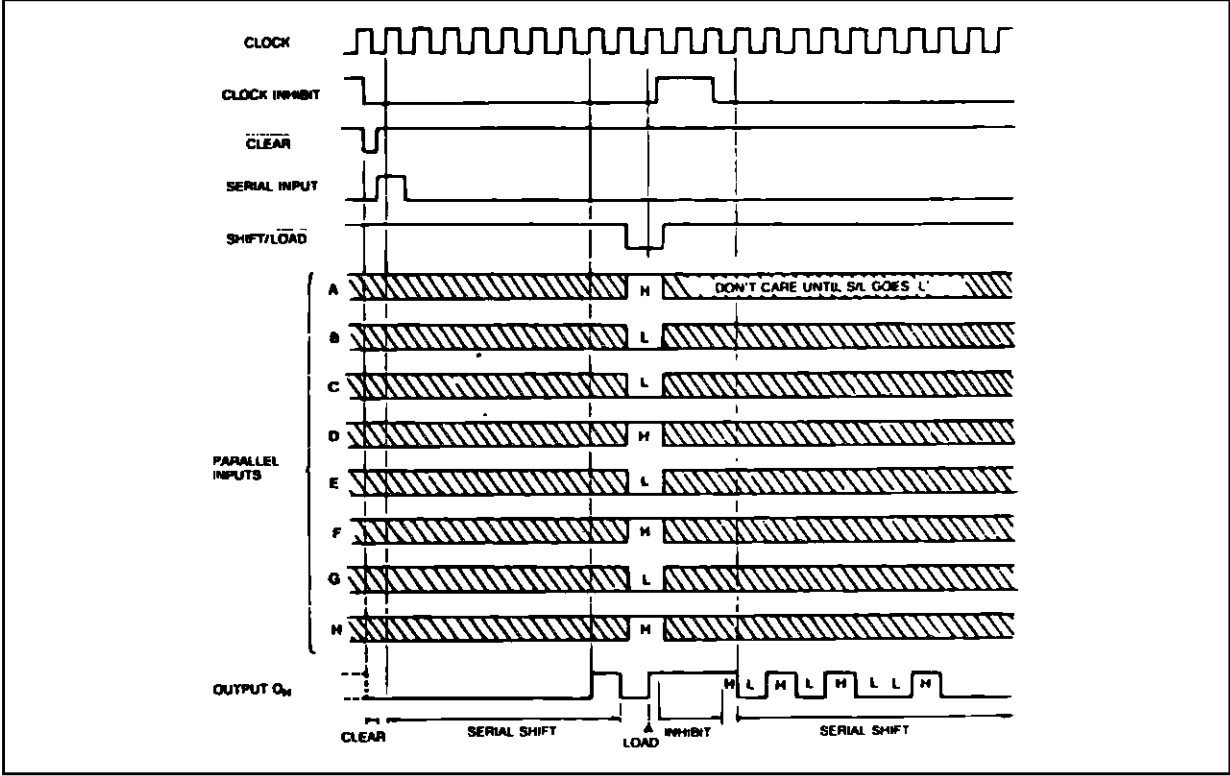
INPUTS						INTERNAL OUTPUTS		OUTPUTS
CLEAR	SHIFT/LOAD	CLOCK INH	CLOCK	SERIAL IN	PARALLEL A.....H	QA	QB	QH
L	X	X	X	X	X	L	L	L
L	X	X		X	X	NO CHANGE		
H	L	L		X	a.....h	a	b	h
H	H	L		H	X	H	QAn	QGn
H	H	L		L	X	L	QAn	QGn
H	X	H	X	X	X	NO CHANGE		

X: Don't Care
a.....h : The level of steady state input voltage at inputs a trough h respectively

LOGIC DIAGRAM



TIMING CHART



M54/M74HC166

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 V	ns
		V _{CC} = 4.5 V	
		V _{CC} = 6 V	

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
		4.4			4.5		4.4		4.4			
		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
					0.0	0.1		0.1		0.1		
					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			4		40		80	µA	

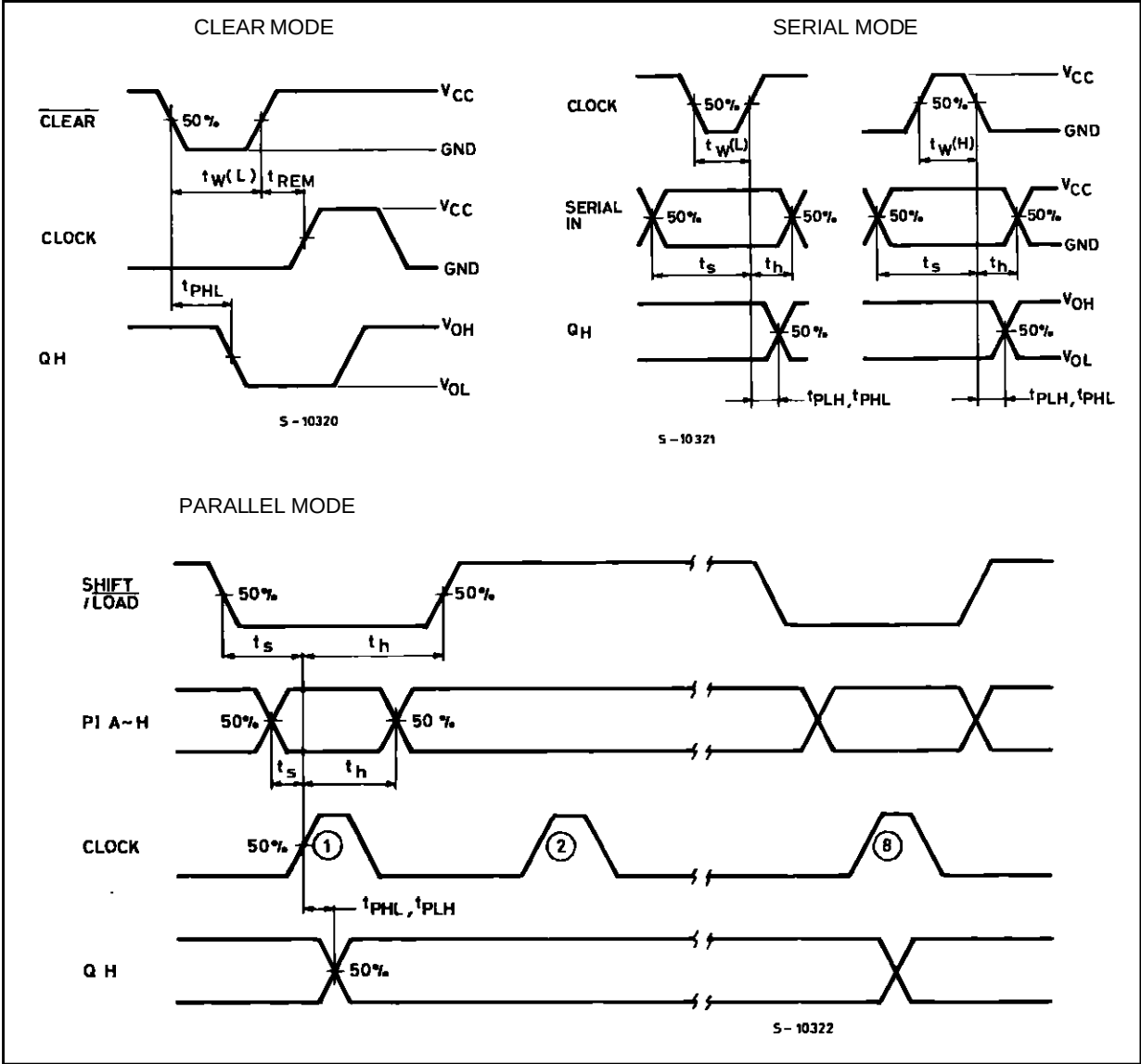
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AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

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 (CLOCK - QH)	2.0			70	150		190		225	ns
		4.5			20	30		38		45	
		6.0			16	26		32		38	
t _{PHL}	Propagation Delay Time (CLEAR - QH)	2.0			60	135		170		205	ns
		4.5			18	27		34		41	
		6.0			14	23		29		35	
f _{MAX}	Maximum Clock Frequency	2.0		6.2	14		5.0		4.2		MHz
		4.5		31	50		25		21		
		6.0		37	63		30		25		
t _{w(H)} t _{w(L)}	Minimum Pulse Width (CLOCK)	2.0			28	75		95		110	ns
		4.5			6	15		19		22	
		6.0			5	13		16		19	
t _{w(L)}	Minimum Pulse Width (CLEAR)	2.0			28	75		95		110	ns
		4.5			6	15		19		22	
		6.0			5	13		16		19	
t _s	Minimum Set-up Time (SI, PI)	2.0			20	75		95		110	ns
		4.5			4	15		19		22	
		6.0			3	13		16		19	
t _s	Minimum Set-up Time (S/L)	2.0			25	75		95		110	ns
		4.5			5	15		19		22	
		6.0			3	13		16		19	
t _h	Minimum Hold Time	2.0				0		0		0	ns
		4.5				0		0		0	
		6.0				0		0		0	
t _{REM}	Minimum Removal Time	2.0			12	50		65		75	ns
		4.5			3	10		13		15	
		6.0			3	9		11		13	
C _{IN}	Input Capacitance				5	10		10		10	pF
C _{PD} (*)	Power Dissipation Capacitance				60						pF

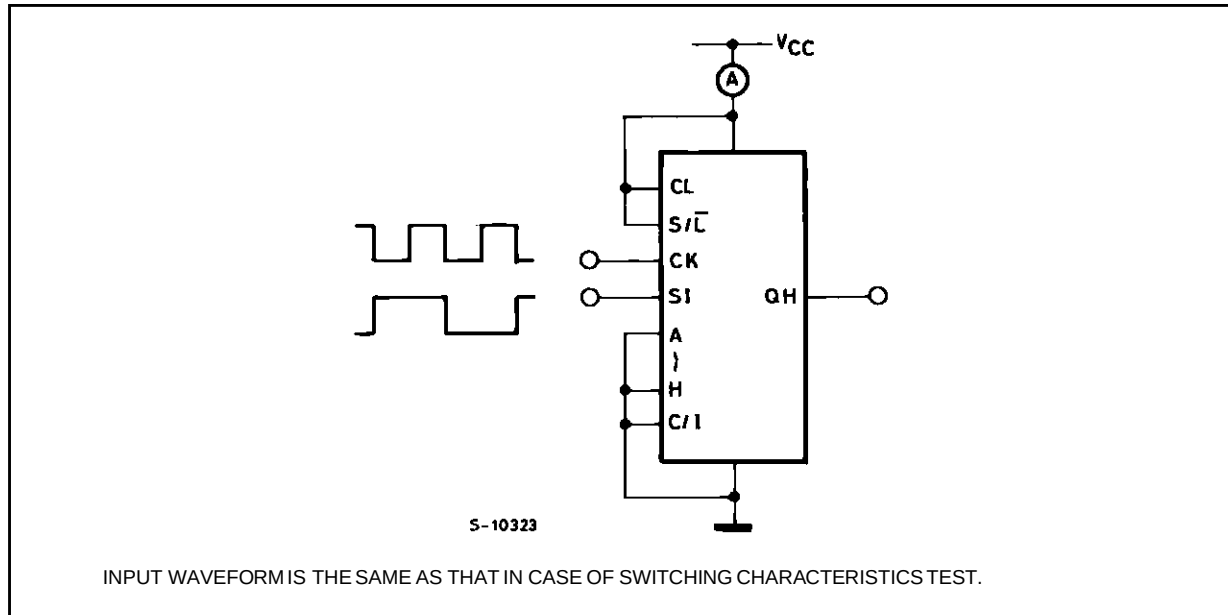
(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I_{CC(opr)} = C_{PD} • V_{CC} • f_{IN} + I_{CC}

SWITCHING CHARACTERISTICS TEST WAVEFORM



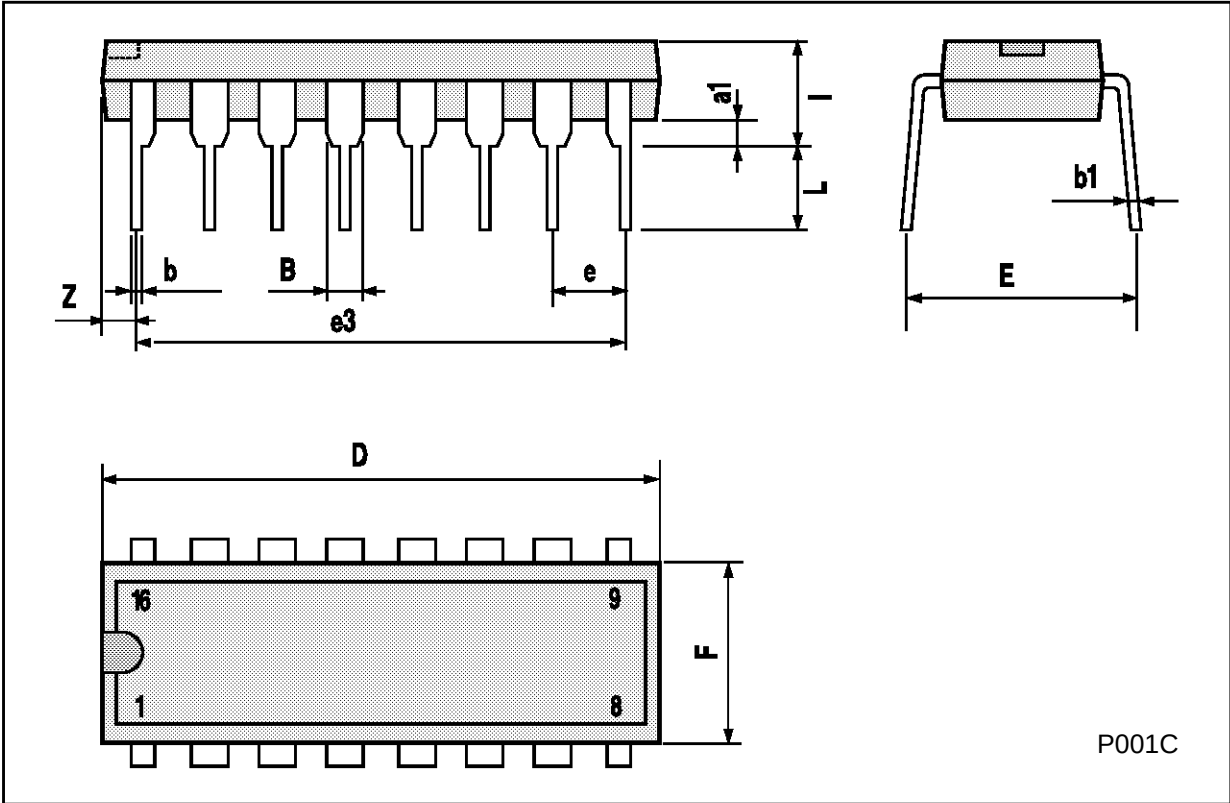
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TEST CIRCUIT I_{CC} (Opr.)



Plastic DIP16 (0.25) MECHANICAL DATA

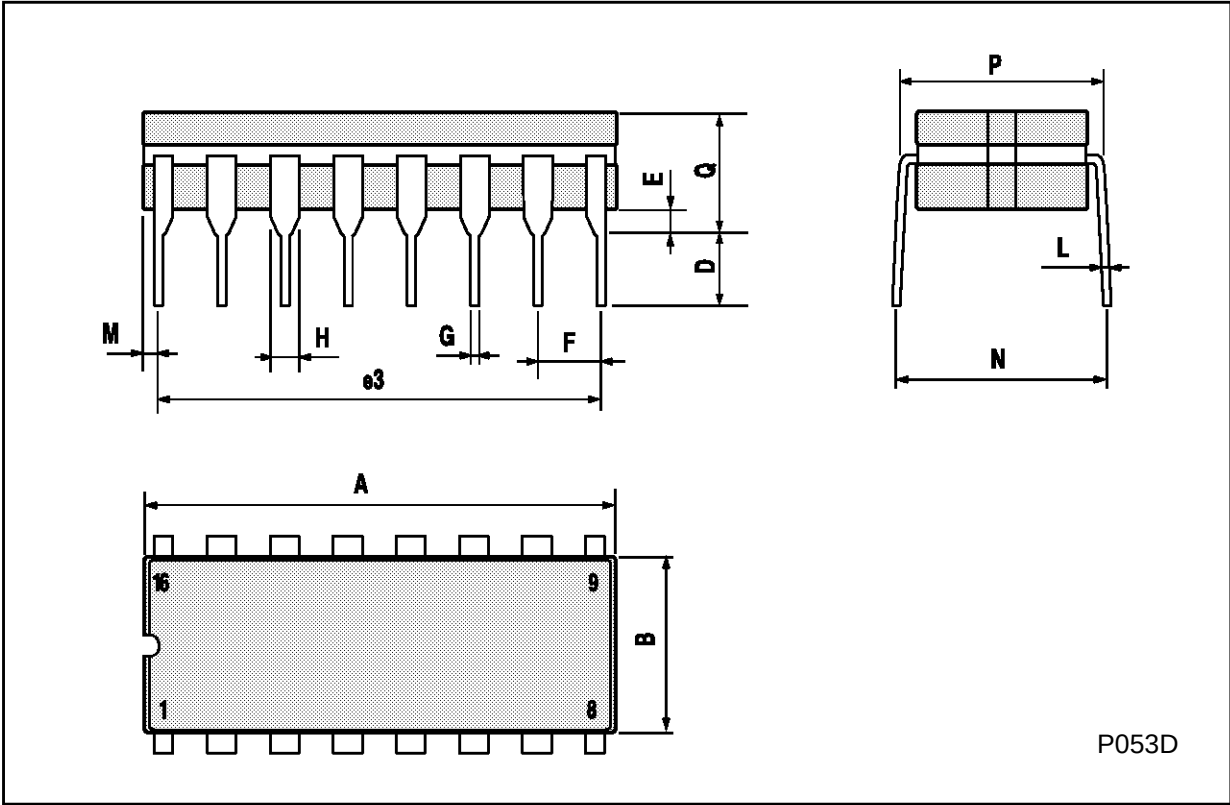
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



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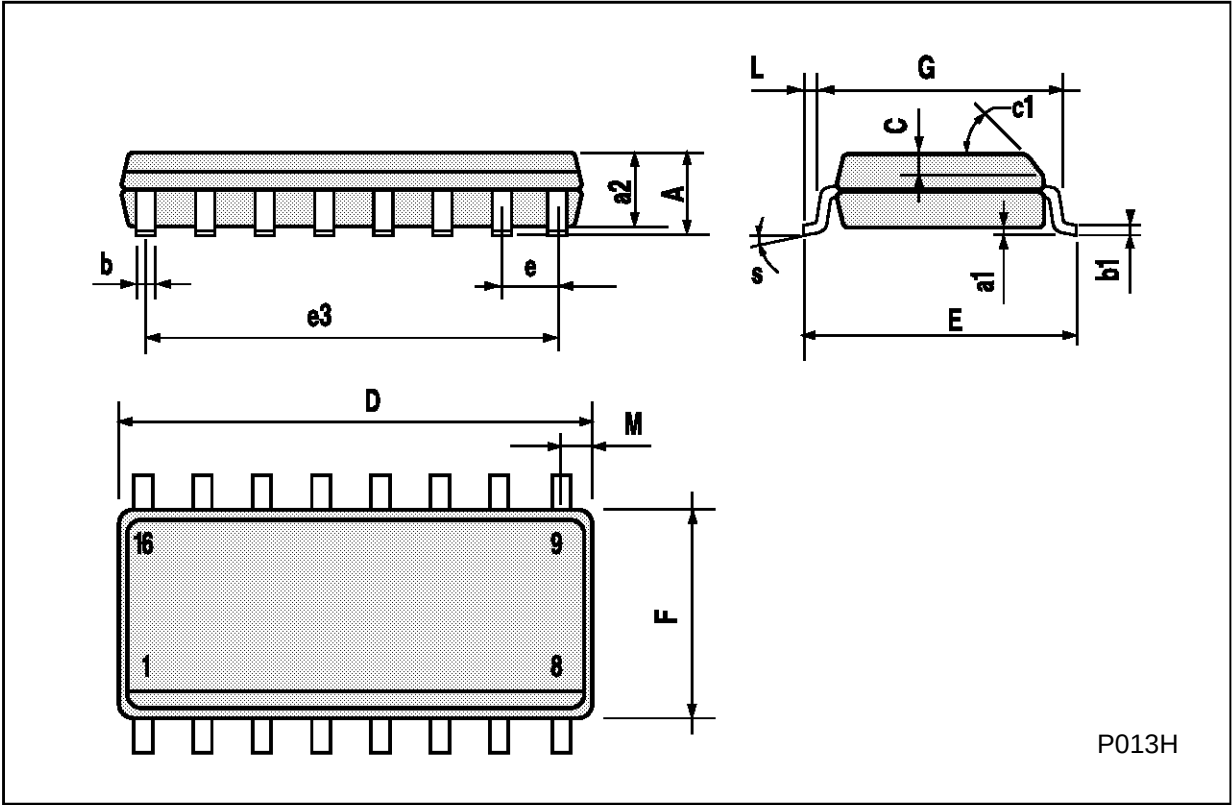
Ceramic DIP16/1 MECHANICAL DATA

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



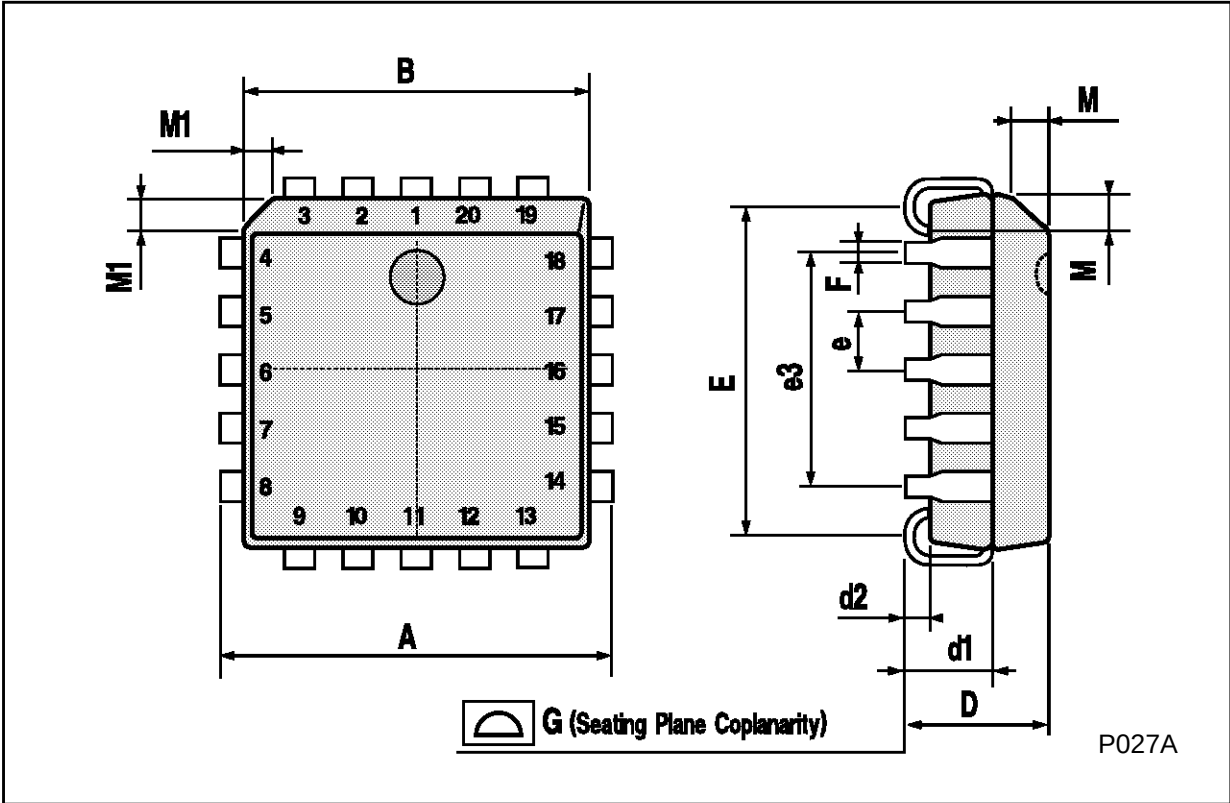
SO16 (Narrow) MECHANICAL DATA

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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