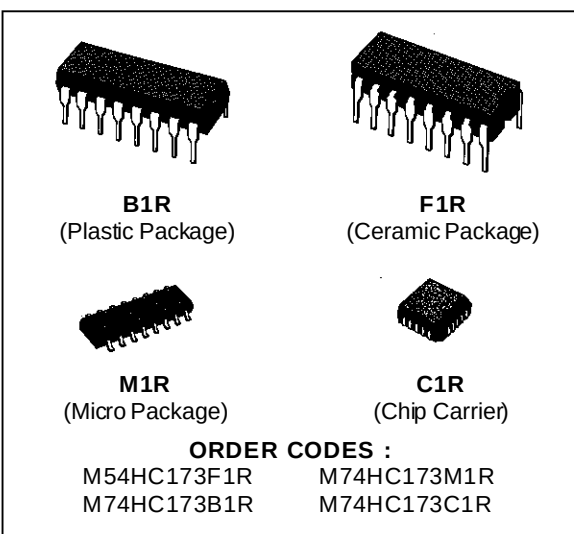


QUAD D-TYPE REGISTER (3-STATE)

- **HIGH SPEED**
 $f_{MAX} = 73 \text{ MHz (TYP.) at } V_{CC} = 5 \text{ V}$
- **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**
15 LSTTL LOADS
- **SYMMETRICAL OUTPUT IMPEDANCE**
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.)}$
- **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**
54/74LS 173



DESCRIPTION

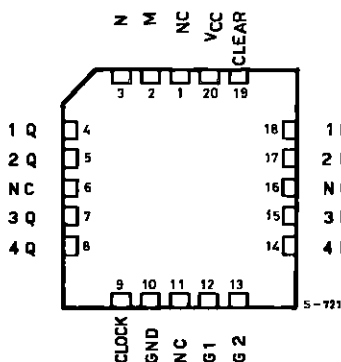
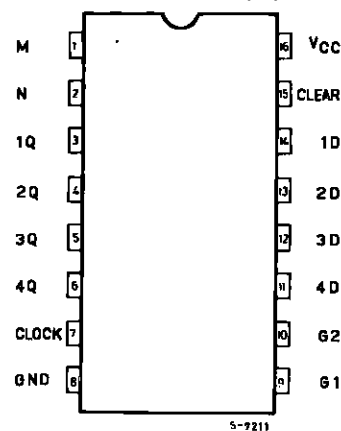
The M54/74HC173 is a high speed CMOS QUAD D-TYPE REGISTER (3-STATE) fabricated in silicon gate C²MOS technology.

It has the same high speed performance of LSTTL combined with true CMOS low power consumption. This device is composed of a four-bit register including D-type flip-flops and 3-state buffers. The four flip-flops are controlled by a common clock input (CLOCK) and a common reset input (CLEAR). Signals applied to the data inputs (D₁-D₄) are stored at the respective flip-flops on the positive going transition of the clock input, only when both clock control inputs (G₁ and G₂) are held low.

The reset feature is asynchronous and active high. The stored data are provided on each output only when both output control inputs (M and N) are held low, otherwise the outputs go to the high-impedance state.

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

PIN CONNECTIONS (top view)

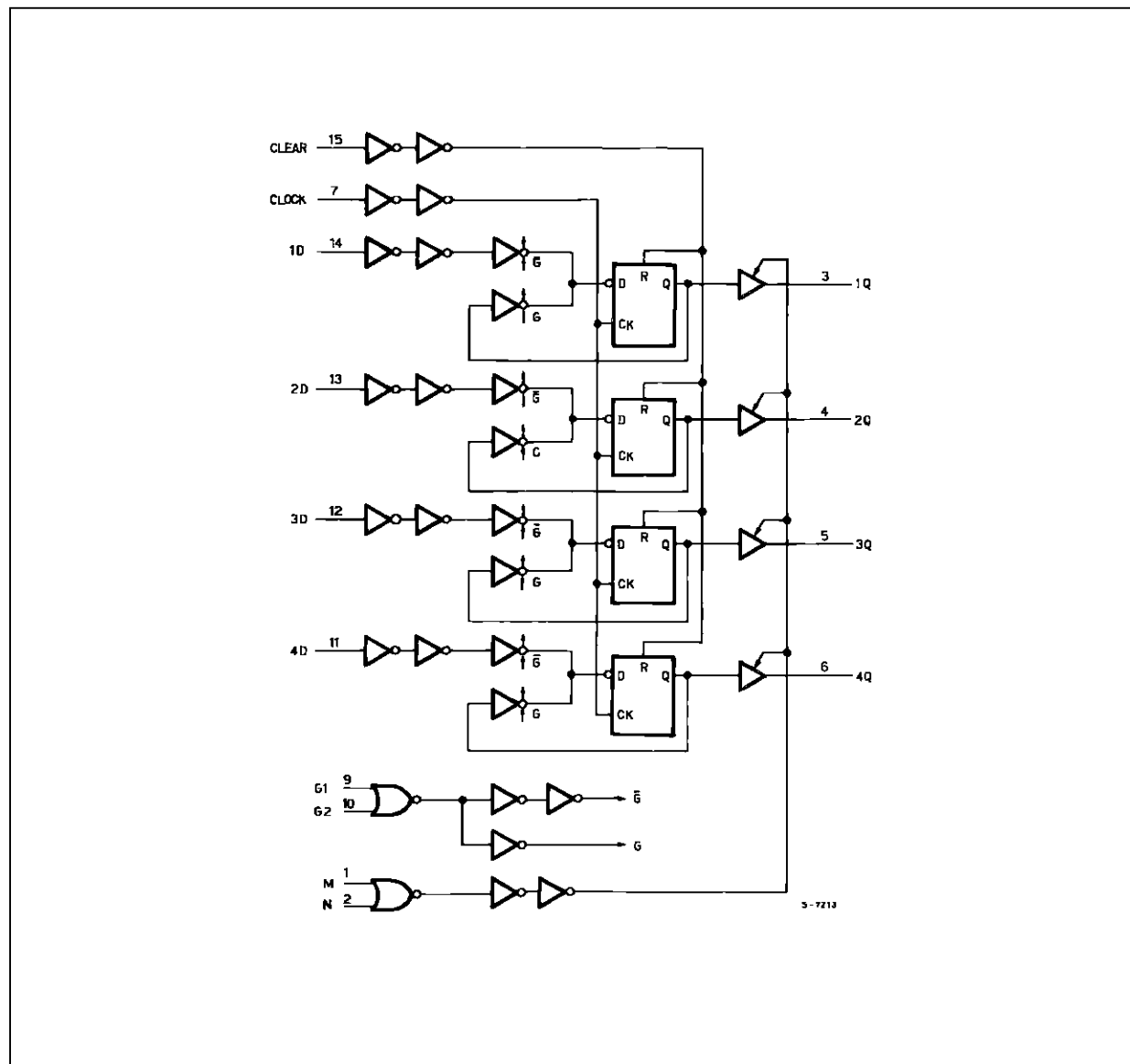


TRUTH TABLE

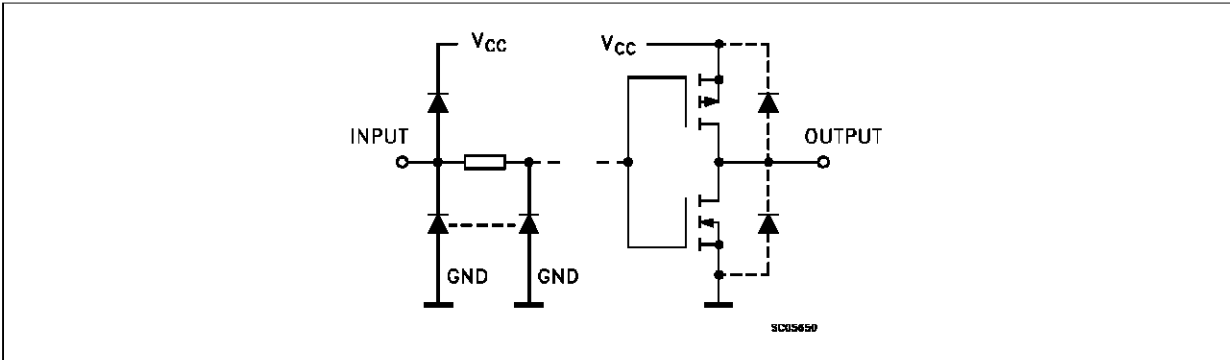
CLEAR	CLOCK	DATA ENABLE		Dn	OUTPUT CONTROL		Qn
		G1	G2		M	N	
X	X	X	X	X	H	X	Z
X	X	X	X	X	X	H	Z
H	X	X	X	X	L	L	L
L		X	X	X	L	L	Q0
L		H	X	X	L	L	Q0
L		X	H	X	L	L	Q0
L		L	L	H	L	L	H
L		L	L	L	L	L	L

X: Don't Care Z: High Impedance

LOGIC DIAGRAM



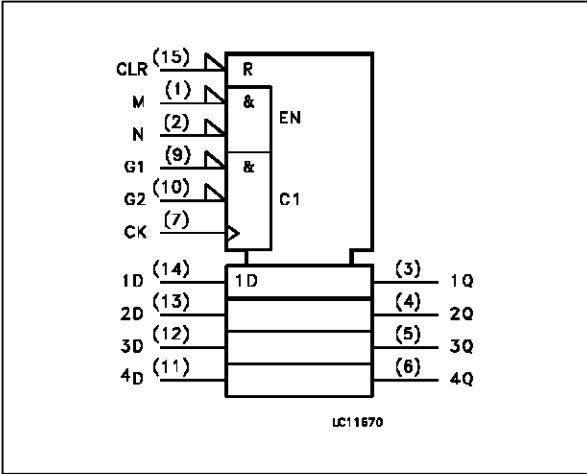
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 2	M, N	Output Enable Input (Active LOW)
3, 4, 5, 6	1Q to 4Q	3-State Flip-flop Outputs
7	CLOCK	Clock Input (LOW to HIGH, Edge-triggered)
9, 10	G1, G2	Data Enable Inputs (Active LOW)
14, 13, 12, 11	1D to 4D	Data Inputs
15	CLEAR	Asynchronous Master Reset (Active HIGH)
8	GND	Ground (0V)
16	Vcc	Positive Supply Voltage

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATING

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	± 35	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 70	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	
		4.5			4.4	4.5		4.4		4.4			
		6.0			5.9	6.0		5.9		5.9			
		4.5		I _O =-6.0 mA	4.18	4.31		4.13		4.10			
		6.0		I _O =-7.8 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 = 6.0 mA		0.17	0.26		0.37		0.40		
		6.0		I _O = 7.8 mA		0.18	0.26		0.37		0.40		
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND			±0.1		±1		±1	μA		
I _{OZ}	3 State Output Off State Current	6.0	V _I = V _{IH} or V _{IL} V _O = V _{CC} or GND			æ0.5		±5.0		±10	μA		
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND			4		40		80	μA		

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

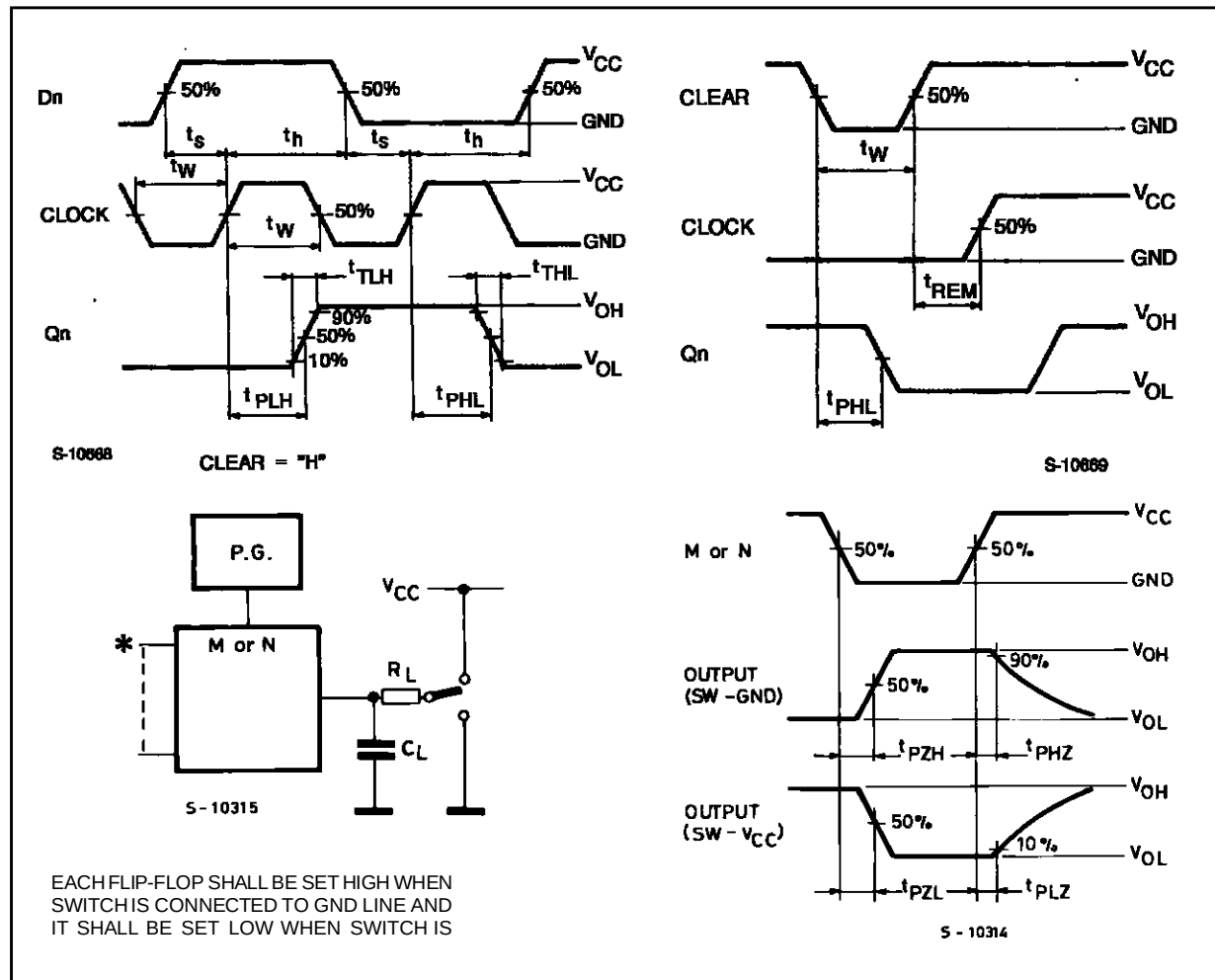
Symbol	Parameter	Test Conditions			Value						Unit	
		V _{CC} (V)	C _L (pF)		T _A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t _{TLH} t _{THL}	Output Transition Time	2.0 4.5 6.0	50			25 7 6	60 12 10		75 15 13		90 18 15	ns
t _{PLH} t _{PHL}	Propagation Delay Time (CLOCK - Q)	2.0 4.5 6.0 2.0 4.5 6.0	50 150			50 14 12 65 18 15	115 23 20 145 29 25		145 29 25 180 36 31		175 35 30 220 44 37	ns ns
t _{PLH} t _{PHL}	Propagation Delay Time (CLEAR - Q)	2.0 4.5 6.0 2.0 4.5 6.0	50 150			50 14 12 65 18 15	115 23 20 145 29 25		145 29 25 180 36 31		175 35 30 220 44 37	ns ns
f _{MAX}	Maximum Clock Frequency	2.0 4.5 6.0	50		8.6 43 51	20 67 84		6.8 34 40		5.8 29 34		MHz
t _{PZL} t _{PZH}	Output Enable Time	2.0 4.5 6.0 2.0 4.5 6.0	50 150	R _L = 1KΩ		50 14 12 65 18 15	115 23 20 145 29 25		145 29 25 180 36 31		175 35 30 220 44 37	ns ns
t _{PLZ} t _{PHZ}	Output Disable Time	2.0 4.5 6.0	50	R _L = 1KΩ		36 15 13	105 21 18		130 26 22		160 32 27	ns
t _{W(H)} t _{W(L)}	Minimum Pulse Width (CLOCK)	2.0 4.5 6.0	50			16 4 3	75 15 13		95 19 16		110 22 19	ns
t _{W(L)}	Minimum Pulse Width (CLEAR)	2.0 4.5 6.0	50			16 4 3	75 15 13		95 19 16		110 22 19	ns
t _s	Minimum Set-up Time (G1, G2)	2.0 4.5 6.0	50			40 10 9	100 20 17		125 25 21		150 30 26	ns
t _s	Minimum Set-up Time (D)	2.0 4.5 6.0	50			24 6 5	75 15 13		95 19 16		110 22 19	ns
t _h	Minimum Hold Time (G1, G2, D)	2.0 4.5 6.0	50				0 0 0		0 0 0		0 0 0	ns

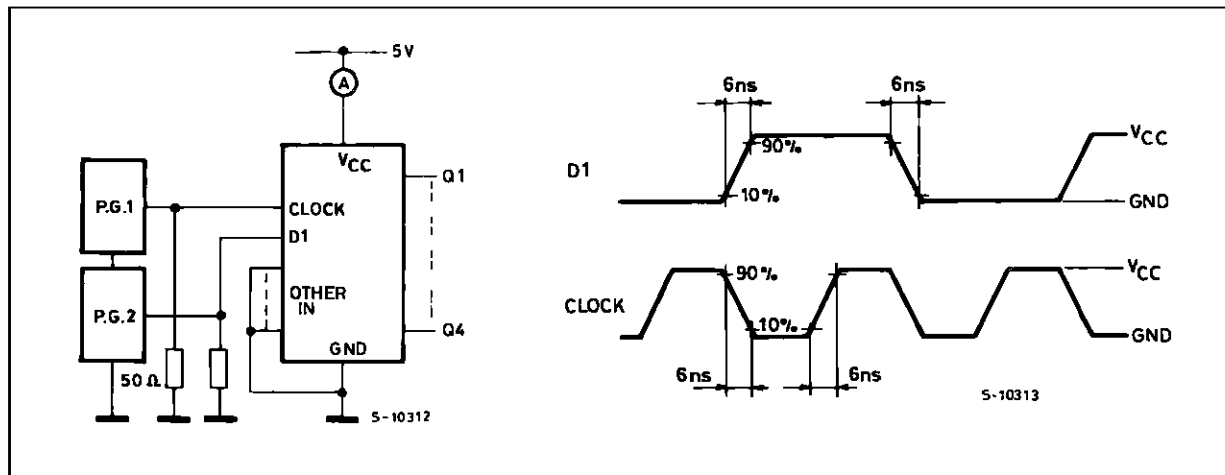
AC ELECTRICAL CHARACTERISTICS ($C_L = 50 \text{ pF}$, Input $t_r = t_f = 6 \text{ ns}$)

Symbol	Parameter	Test Conditions			Value						Unit	
		V _{CC} (V)	C _L (pF)		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 _{REM}	Minimum Removal Time	2.0	50				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					50						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. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4$ (per circuit)

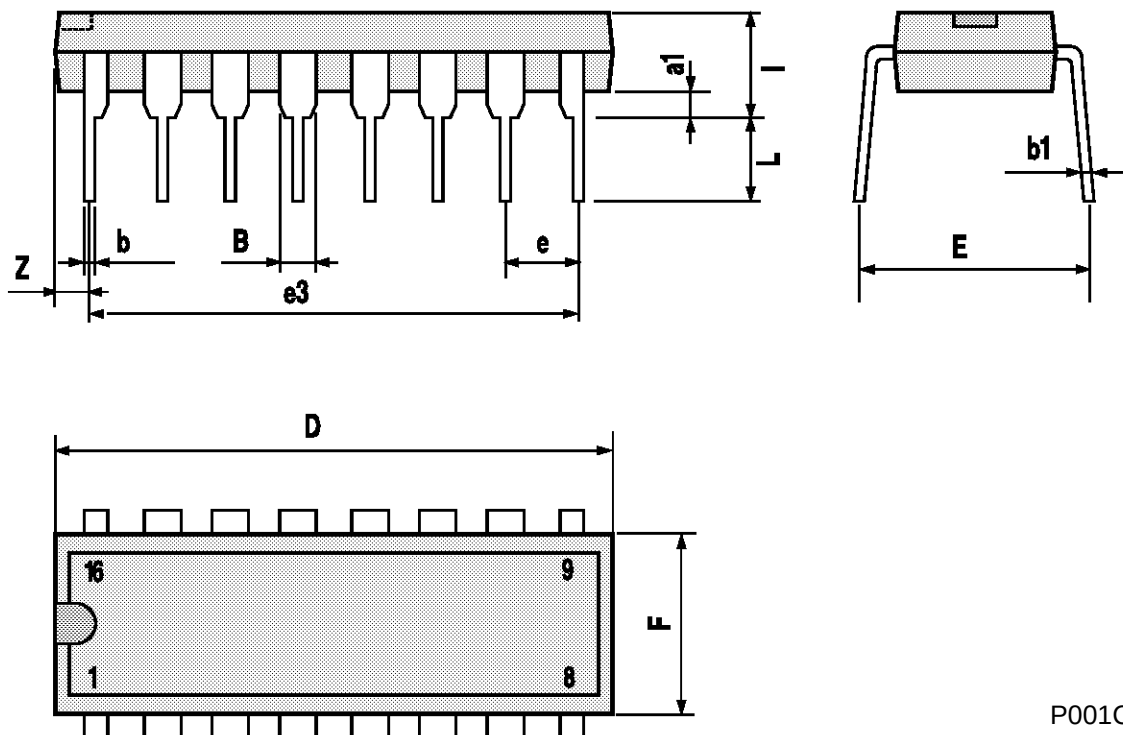
SWITCHING CHARACTERISTICS TEST WAVEFORM



TEST CIRCUIT I_{CC} (Opr.)

Plastic DIP16 (0.25) MECHANICAL DATA

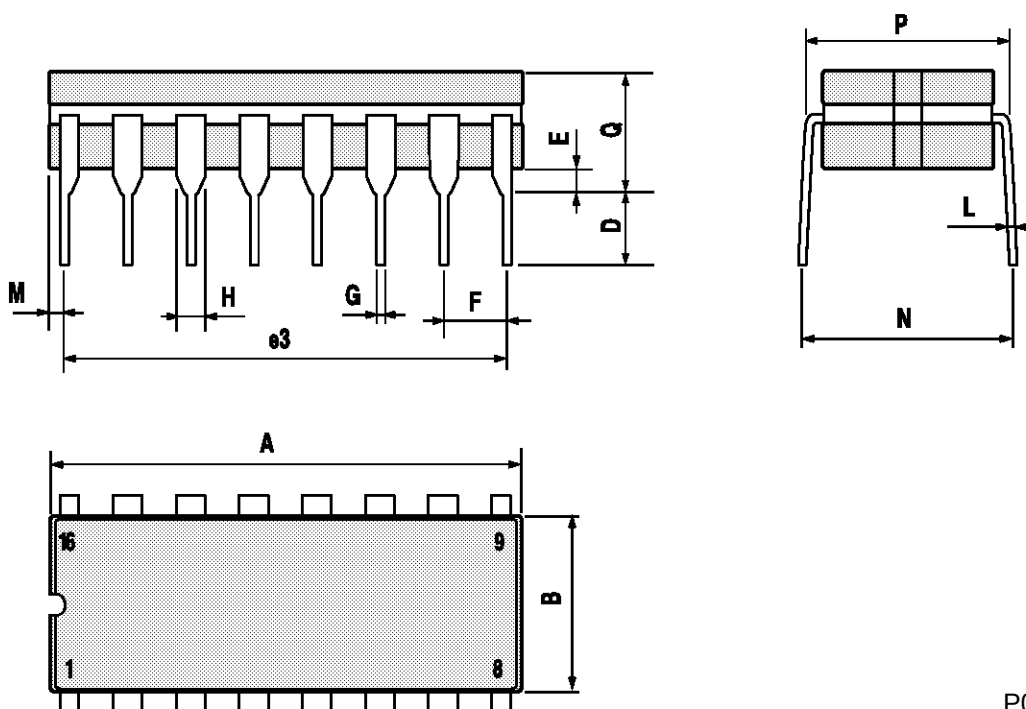
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

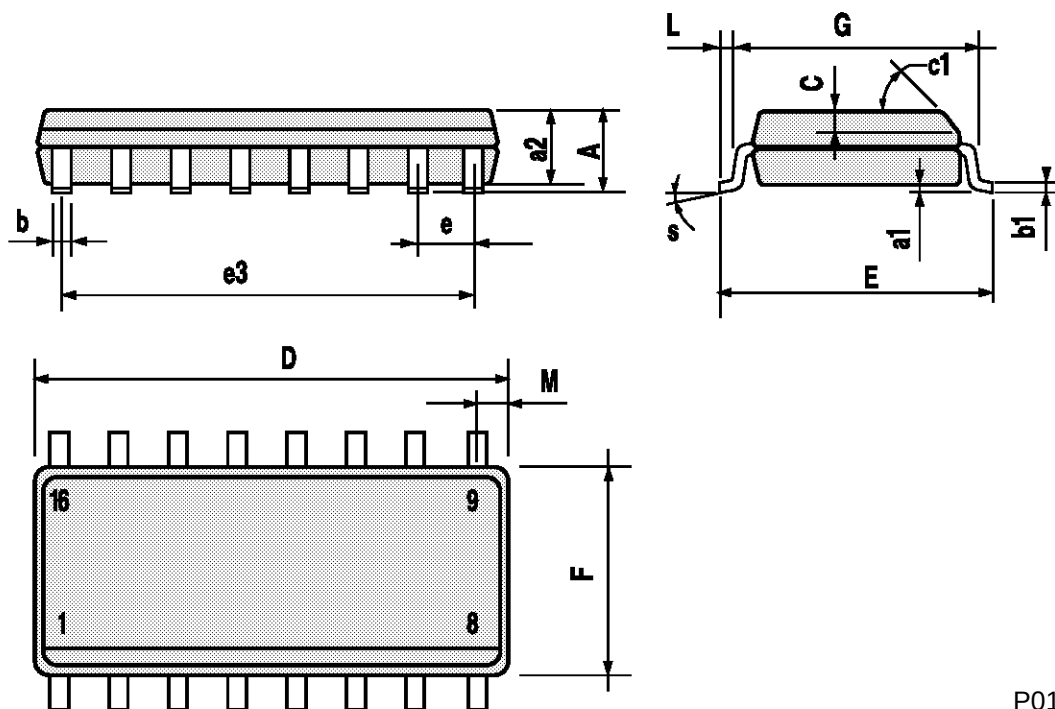
Ceramic DIP16/1 MECHANICAL DATA

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

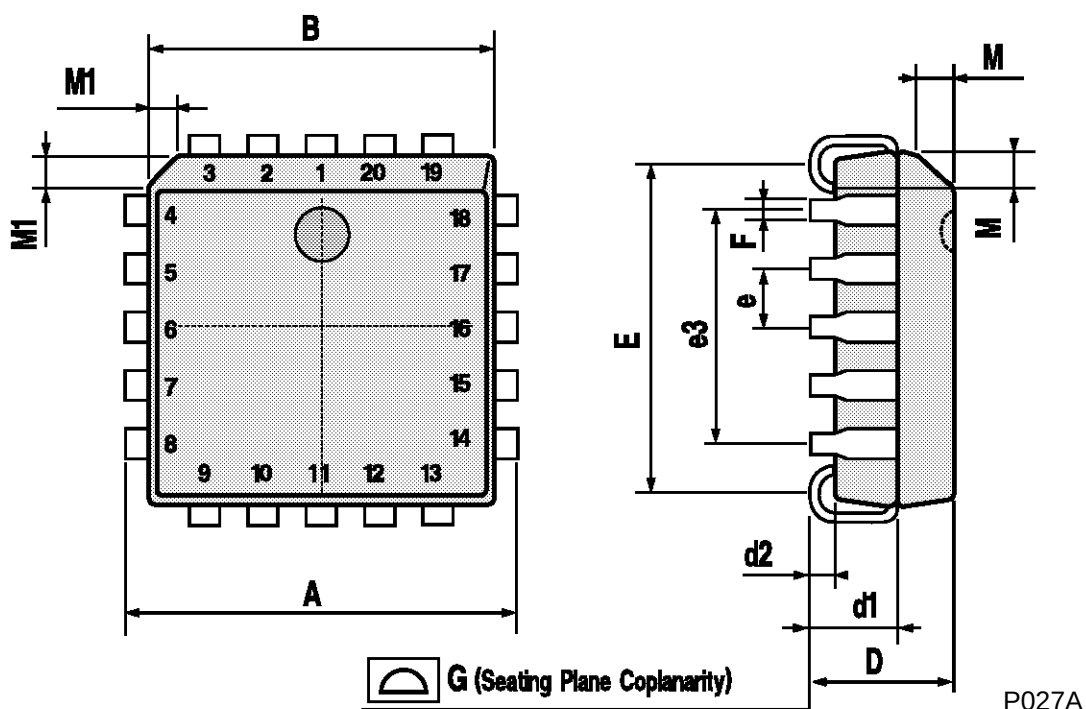
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
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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