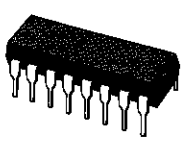
SGS-THOMSON MICROELECTRONICS

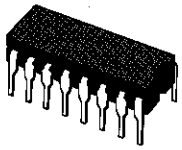
M54HC195
M74HC195

8 BIT PIPO SHIFT REGISTER

- HIGH SPEED
  t_{PD} = 13 ns (TYP.) at V_{CC} = 5 V
- LOW POWER DISSIPATION
  I_{CC} = 4 µA (MAX.) at T_A = 25 °C 6 V
- HIGH NOISE IMMUNITY
  $V_{NIH} = V_{NIL}$ = 28 % V_{CC} (MIN.)
- OUTPUT DRIVE CAPABILITY
  10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 4 mA (MIN.)
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2 V to 6 V
- PIN AND FUNCTION COMPATIBLE
  WITH 54/74LS195



B1R
(Plastic Package)



F1R
(Ceramic Package)

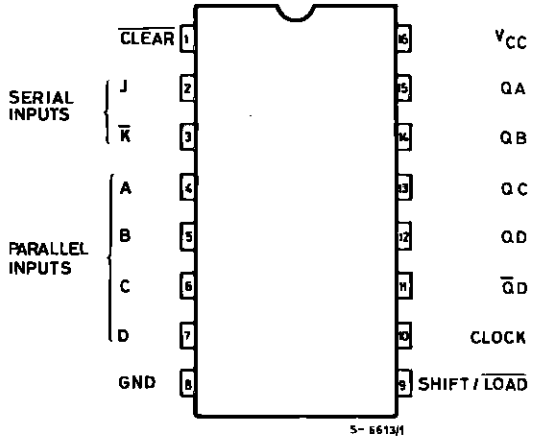
M1R
(Micro Package)

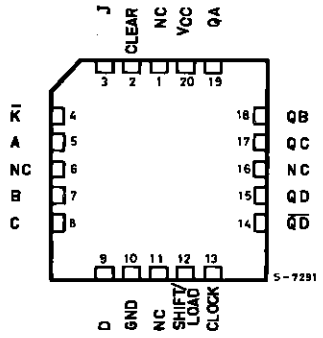
C1R
(Chip Carrier)

ORDER CODES :

M54HC195F1R M74HC195M1R
M74HC195B1R M74HC195C1R

PIN CONNECTIONS (top view)





NC =
No Internal
Connection

DESCRIPTION

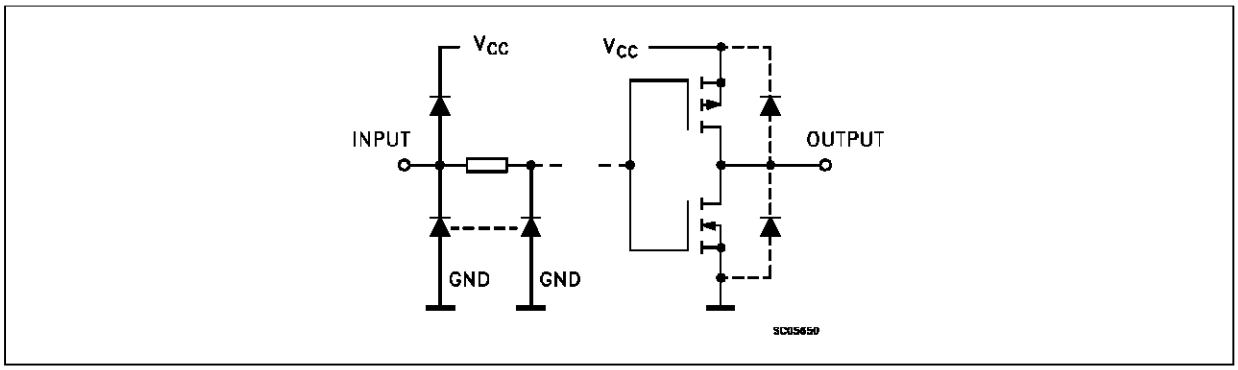
The M54/74HC195 is a high speed CMOS 4 BIT PIPO SHIFT REGISTER fabricated in silicon gate C^2MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption.

This shift register features parallel inputs, parallel outputs, J-$\overline{K}$ serial inputs, a SHIFT/$\overline{LOAD}$ control input, and a direct overriding $\overline{CLEAR}$. This shift register can operate in two modes : Parallel Load ; Shift from QA towards QD.

Parallel loading is accomplished by applying the four bits of data, and taking the SHIFT/$\overline{LOAD}$ control input low. The data is loaded into the associated flip flops and appears at the outputs after the positive transition of the clock input. During parallel loading, serial data flow is inhibited. Serial shifting occurs synchronously when the SHIFT/$\overline{LOAD}$ control input is high. Serial data for this mode is entered at the J-$\overline{K}$ inputs. These inputs allow the first stage to perform as a J-$\overline{K}$ or TOGGLE flip flop as shown in the truth-table.

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

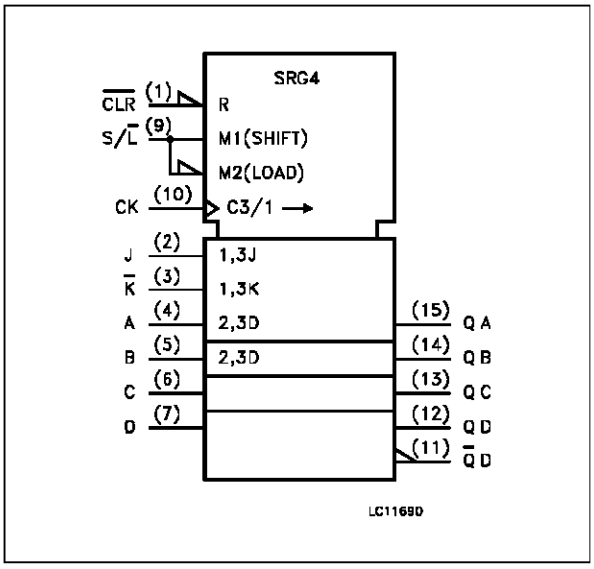
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{CLEAR}$	Reset Input (Active LOW)
2	J	First Stage J Input (Active LOW)
3	$\overline{K}$	First Stage $\overline{K}$ Input (Active LOW)
4, 5, 6, 7	A to D	Parallel Data Input
9	SHIFT/$\overline{LOAD}$	Control Input
10	CLOCK	Clock Input (LOW to HIGH Edge-triggered)
11	$\overline{QD}$	Inverted Output From The Last Stage
15, 14, 13, 12	QA to QD	Paralle Outputs
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

IEC LOGIC SYMBOL

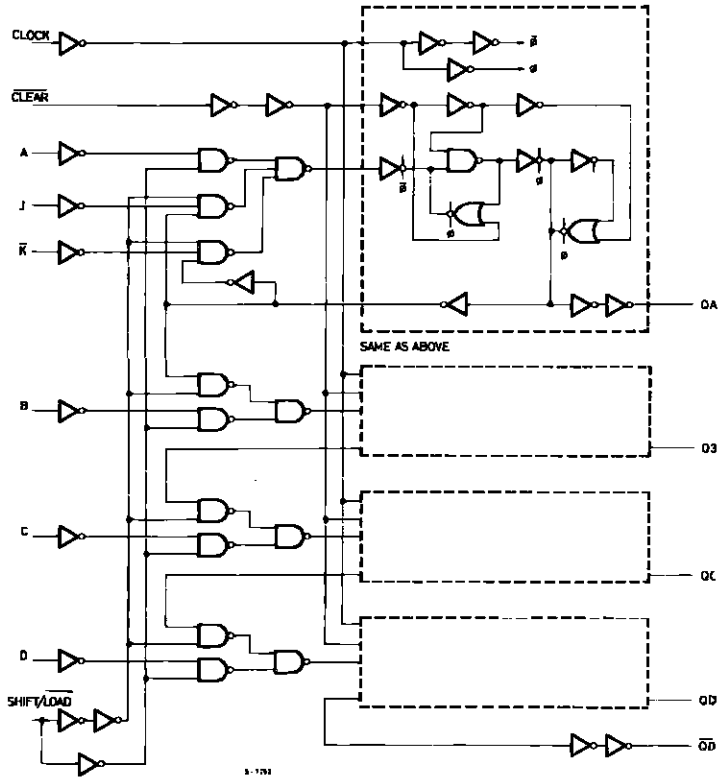


TRUTH TABLE

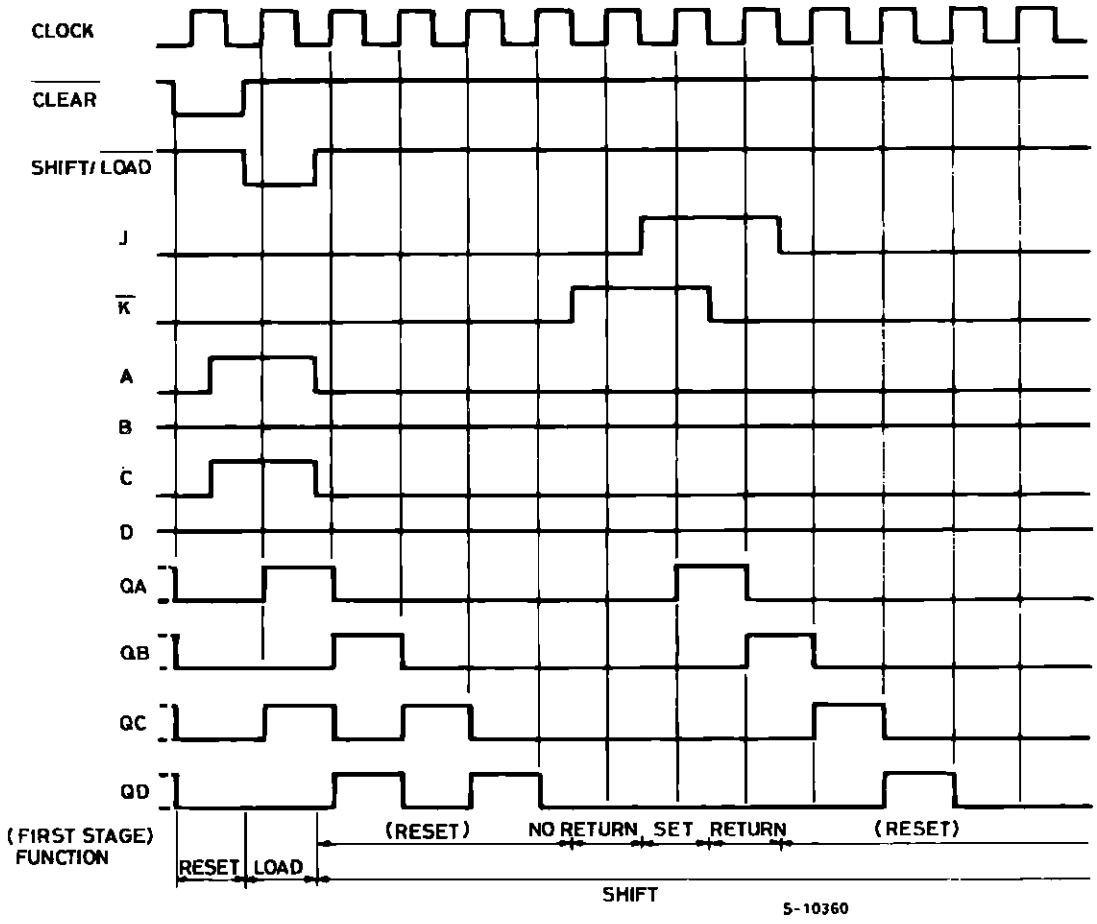
INPUTS									OUTPUS				
$\overline{CLEAR}$	SHIFT/$\overline{LOAD}$	CLOCK	SERIAL		PARALLEL				QA	QB	QC	QD	$\overline{QD}$
			J	$\overline{K}$	A	B	C	D					
L	X	X	X	X	X	X	X	X	L	L	L	L	L
H	L		X	X	a	b	c	d	a	b	c	d	d
H	H	⌐└	X	X	X	X	X	X	QA0	QB0	QC0	QD0	$\overline{QD0}$
H	H		L	H	X	X	X	X	QA0	QA0	QBn	QCn	$\overline{QCn}$
H	H		L	L	X	X	X	X	L	QAn	QBn	QCn	$\overline{QCn}$
H	H		H	H	X	X	X	X	H	QAn	QBn	QCn	$\overline{QCn}$
H	H		H	L	X	X	X	X	$\overline{QAn}$	QAn	QBn	QCn	$\overline{QCn}$

X: Don't Care: The level of QA, QB, QC, respectively, before the mst recent positive transition of the clock.

LOGIC DIAGRAM



TIMING CHART



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	0 to 1000	ns
		V_{CC} = 4.5 V	0 to 500	
		V_{CC} = 6 V	0 to 400	

DC SPECIFICATIONS

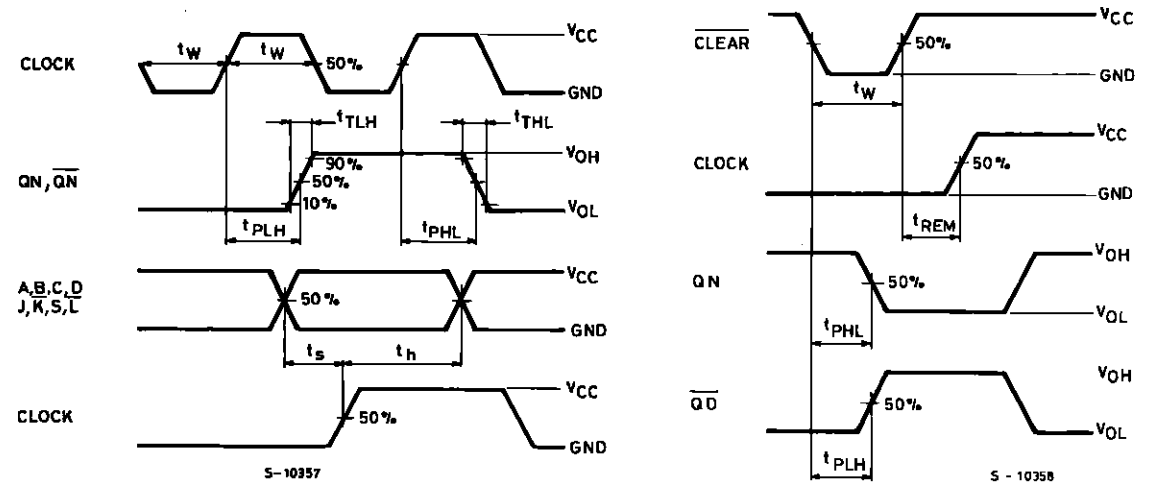
Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)			T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0			1.5			1.5		1.5		V
		4.5			3.15			3.15		3.15		
		6.0			4.2			4.2		4.2		
V_{IL}	Low Level 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=-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
		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 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

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

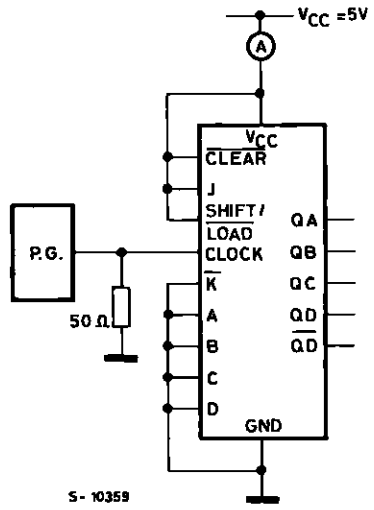
Symbol	Parameter	Test Conditions		Value							Unit
		V_{CC} (V)		T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0			30	75		95		115	ns
		4.5			8	15		19		23	
		6.0			7	13		16		20	
t_{PLH} t_{PHL}	Propagation Delay Time (CLOCK- Qn, $\overline{Q}$D)	2.0			48	125		155		190	ns
		4.5			16	25		31		38	
		6.0			14	21		26		32	
t_{PLH} t_{PHL}	Propagation Delay Time ($\overline{CLEAR}$- Qn, $\overline{Q}$D)	2.0			45	120		150		180	ns
		4.5			15	24		30		36	
		6.0			13	20		26		31	
f_{MAX}	Maximum Clock Frequency	2.0		7.6	15		6		5		MHz
		4.5		38	60		30		25		
		6.0		45	71		35		30		
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width (CLOCK)	2.0			20	75		95		115	ns
		4.5			5	15		19		23	
		6.0			4	13		16		20	
$t_{W(L)}$	Minimum Pulse Width (CLEAR)	2.0			20	75		95		115	ns
		4.5			5	15		19		23	
		6.0			4	13		16		20	
t_s	Minimum Set-up Time (PI)	2.0			28	75		95		115	ns
		4.5			7	15		19		23	
		6.0			6	13		16		20	
t_s	Minimum Set-up Time ($\overline{J}$, $\overline{K}$, $\overline{S/L}$)	2.0			28	75		95		115	ns
		4.5			7	15		19		23	
		6.0			6	13		16		20	
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				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				72						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 operting current can be obtained by the following equation. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$

SWITCHING CHARACTERISTICS TEST WAVEFORM



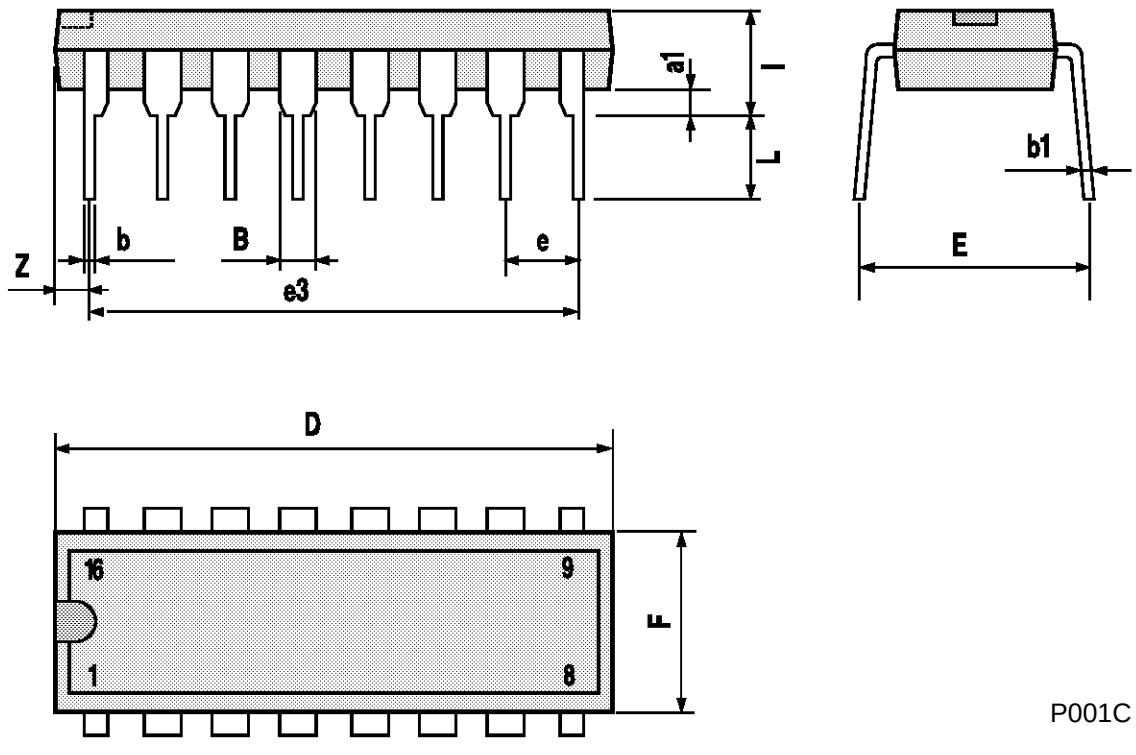
TEST CIRCUIT I_{CC} (Opr.)



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

Plastic DIP16 (0.25) MECHANICAL DATA

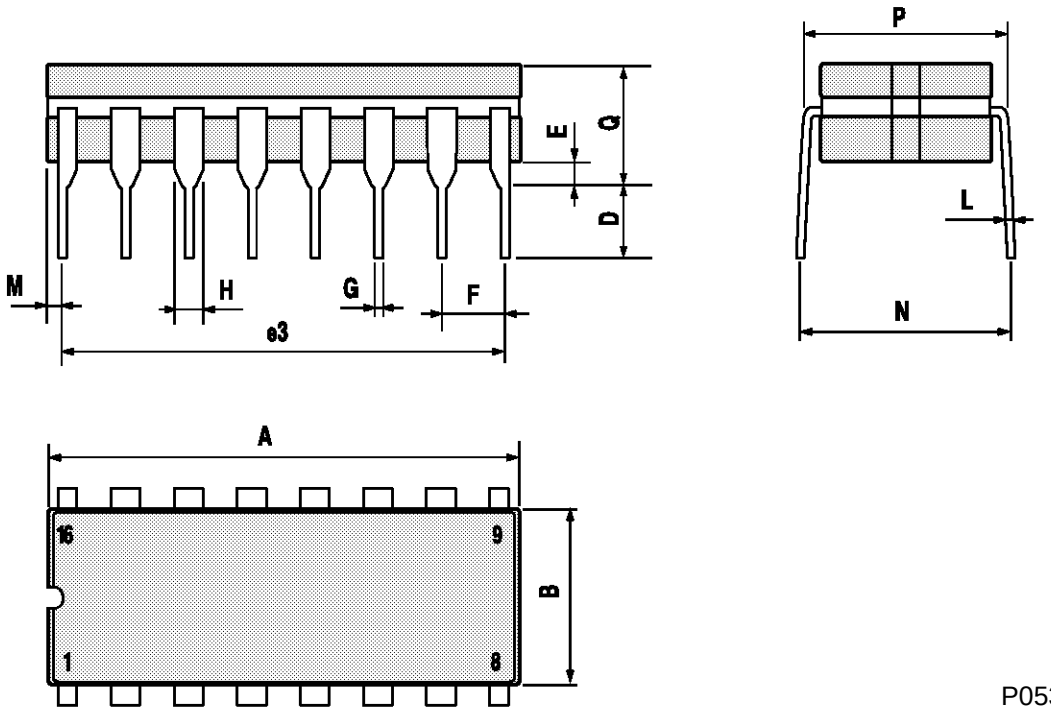
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

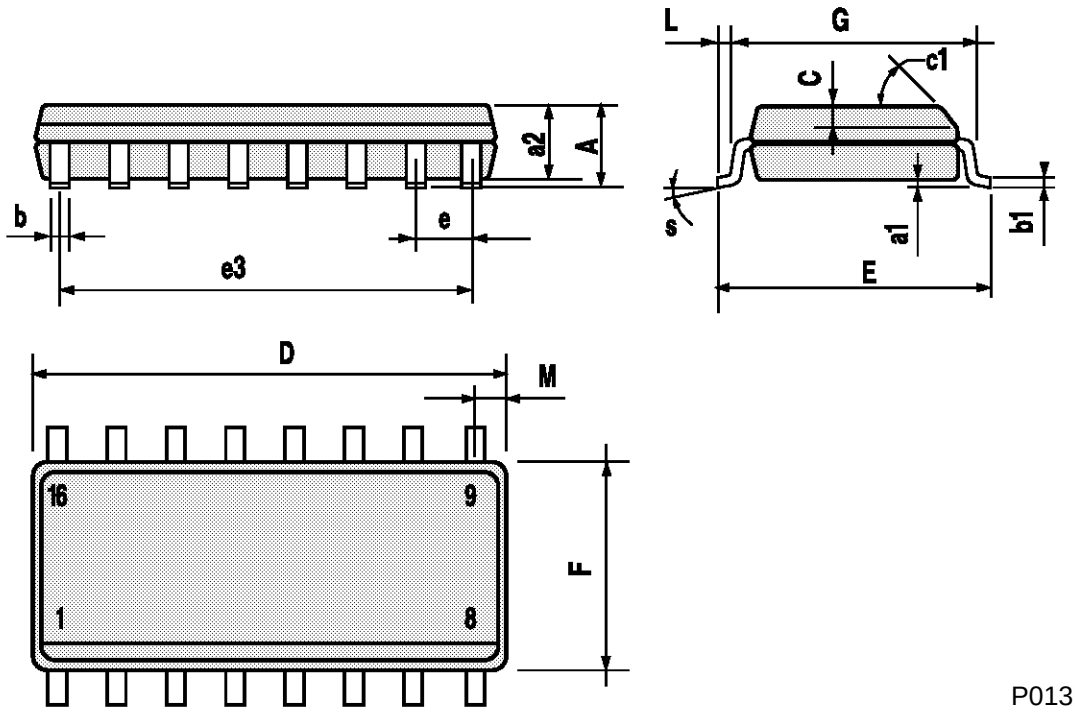
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200



P053D

SO16 (Narrow) MECHANICAL DATA

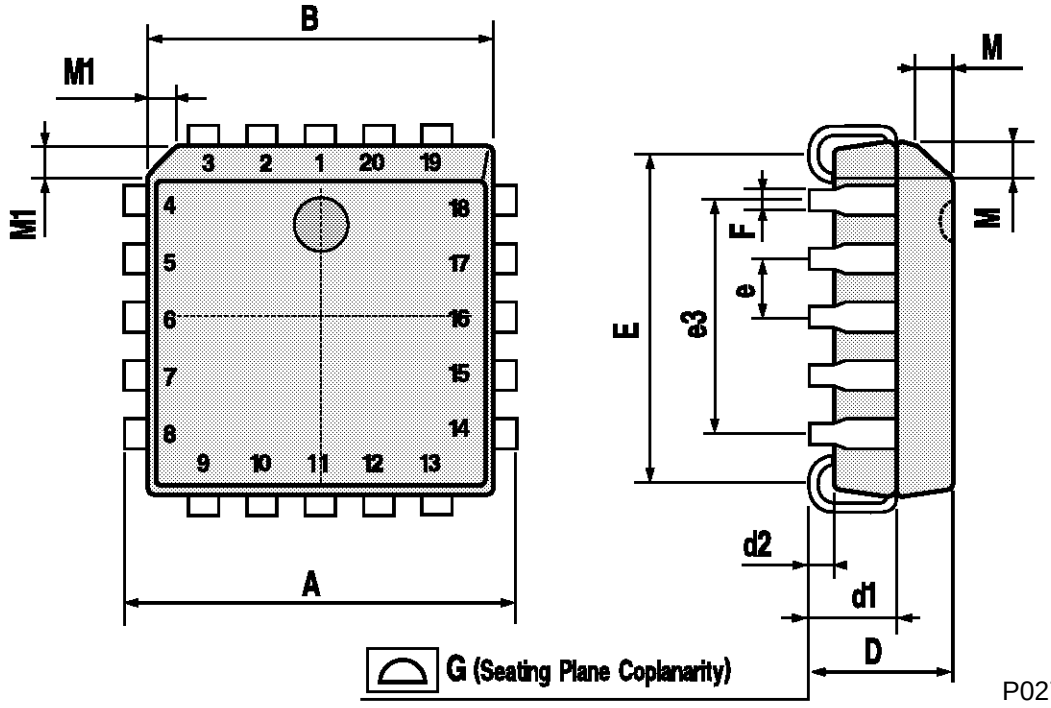
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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



P027A