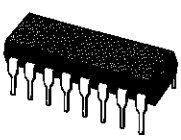
SGS-THOMSON MICROELECTRONICS

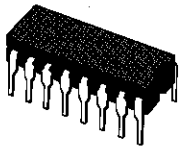
M54HC4094
M74HC4094

8 BIT SIPO SHIFT LATCH REGISTER (3-STATE)

- HIGH SPEED
  f_{MAX} = 73 MHz (TYP.) AT V_{CC} = 5 V
- LOW POWER DISSIPATION
  I_{CC} = 4 µA (MAX.) AT T_A = 25 °C
- 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 4094B



B1R
(Plastic Package)



F1R
(Ceramic Package)

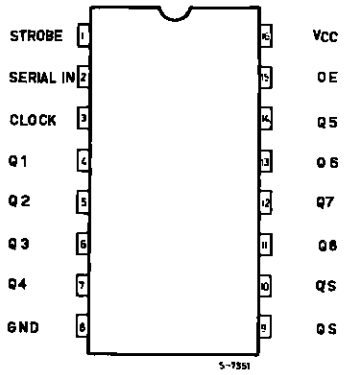
M1R
(Micro Package)

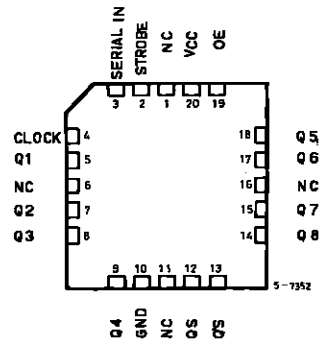
C1R
(Chip Carrier)

ORDER CODES :

M54HC4094F1R M74HC4094M1R
M74HC4094B1R M74HC4094C1R

PIN CONNECTIONS (top view)





NC =
No Internal
Connection

DESCRIPTION

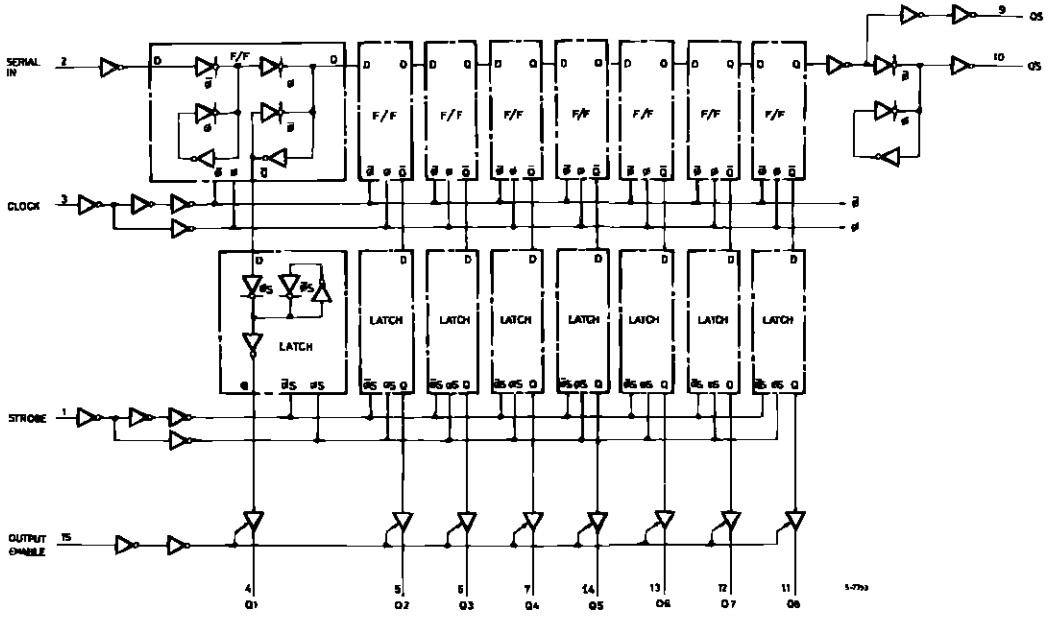
The M54/74HC4094 is a high speed CMOS 8 BIT SIPO SHIFT LATCH REGISTER fabricated with silicon gate C^2MOS technology.

It has the same high speed performance of LSTTL combined with true CMOS low power consumption. This device consists of an 8-bit shift register and an 8-bit latch with 3-state output buffer. Data is shifted serially through the shift register on the positive going transition of the clock input signal. The output of the last stage (Qs) can be used to cascade several devices.

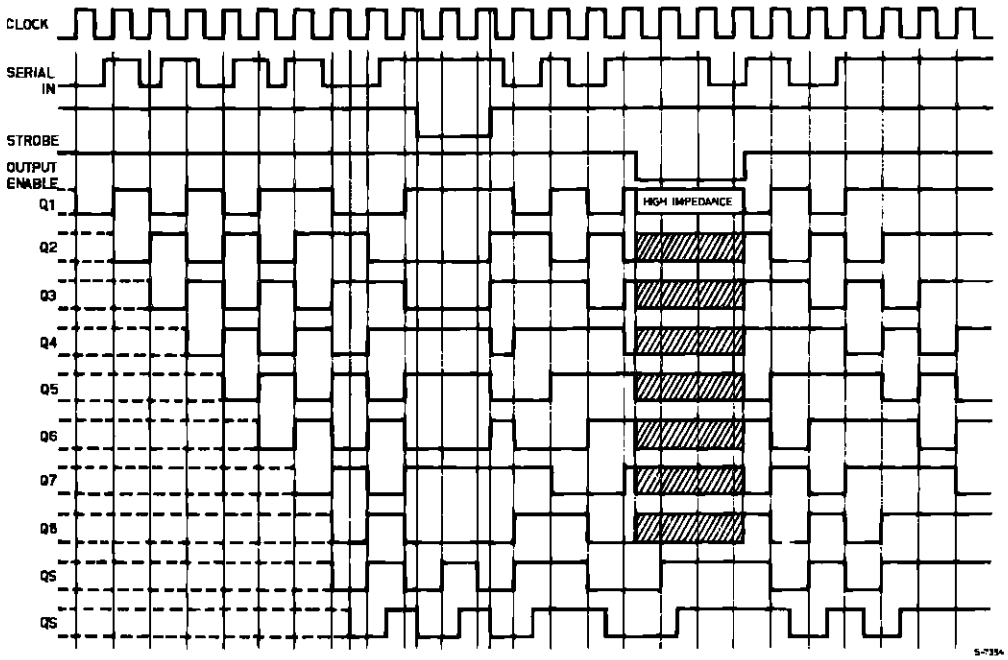
Data on the Qs output is transferred to a second output (Qs') on the following negative transition of the clock input signal. The data of each stage of the shift register is provided with a latch, which latches data on the negative going transition of the STROBE input signal. When the STROBE input is held high, data propagates through the latch to a 3-state output buffer.

This buffer is enabled when OUTPUT ENABLE input is taken high. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

LOGIC DIAGRAM



LOGIC DIAGRAM

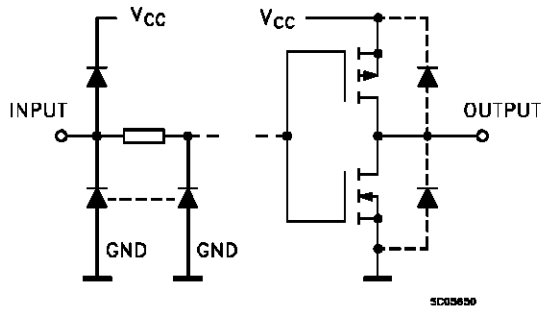


TRUTH TABLE

CK	OE	ST	SI	PARALLEL OUTPUT		SERIAL OUTPUT	
				Q1	Qn	Qs	Qs'
⌐└	H	H	L	L	Qn-1	Q7	NC
⌐└	H	H	H	H	Qn-1	Q7	NC
⌐└	H	L	X	NC	NC	Q7	NC
⌐└	L	X	X	Z	Z	Q7	NC
_⌐	H	X	X	NC	NC	NC	Qs
_⌐	L	X	X	Z	Z	NC	Qs

X: Don't Care Z: High Impedance NC: No Change

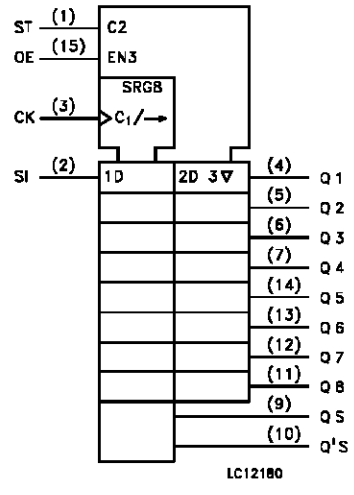
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1	STROBE	Strobe Input
2	SERIAL IN	Serial Input
3	CLOCK	Clock Input
4, 5, 6, 7, 14, 13, 12, 11	Q1 to Q7	Parallel Outputs
9, 10	QS Q'S	Serial Outputs
15	OE	Output Enable Input
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

IEC LOGIC SYMBOL



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

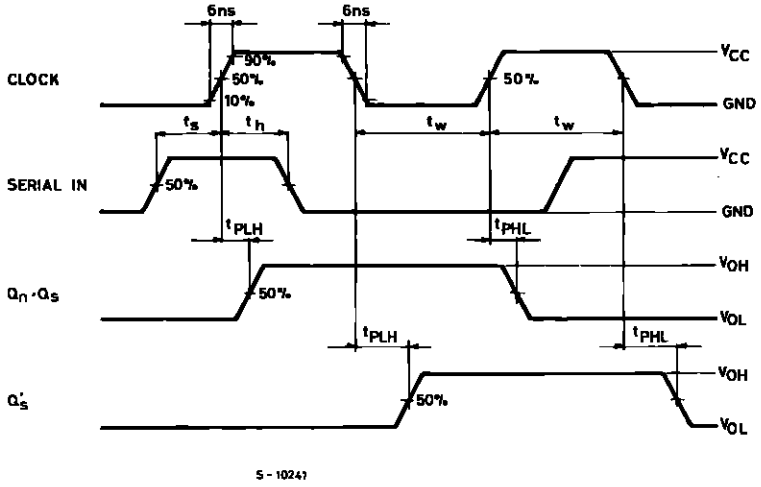
Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)			T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0			1.5			1.5		1.5		V
		4.5			3.15			3.15		3.15		
		6.0			4.2			4.2		4.2		
V_{IL}	Low Level 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		0.37		0.40	
		6.0		I_O= 5.2 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				±0.5		±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)

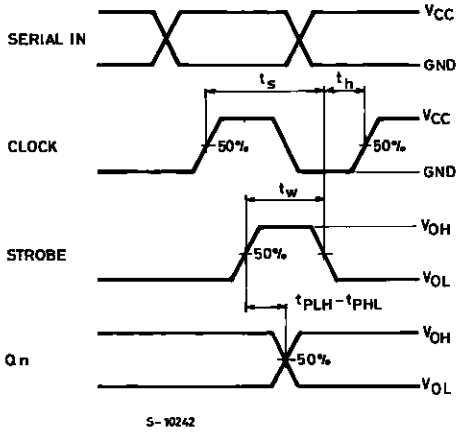
Symbol	Parameter	Test Conditions		Value							Unit
		V_{CC} (V)		T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t_{PLH} t_{PHL}	Propagation Delay Time (CLOCK - Qn)	2.0			92	200		250		300	ns
		4.5			26	40		50		60	
		6.0			20	34		43		51	
t_{PLH} t_{PHL}	Propagation Delay Time (CLOCK - QS, Q'S)	2.0			65	150		190		225	ns
		4.5			19	30		38		45	
		6.0			15	26		32		38	
t_{PLH} t_{PHL}	Propagation Delay Time (STROBE - Qn)	2.0			75	160		200		240	ns
		4.5			20	32		40		48	
		6.0			16	27		34		41	
t_{PZL} t_{PZH}	3 State Output Enable Time	2.0			58	150		190		225	ns
		4.5			16	30		38		45	
		6.0			13	26		32		38	
t_{PHZ} t_{PLZ}	3 State Output Disable Time	2.0			35	150		190		225	ns
		4.5			16	30		38		45	
		6.0			13	26		32		38	
f_{MAX}	Maximum Clock Frequency	2.0		6	16		4.8		4		MHz
		4.5		30	66		24		20		
		6.0		35	80		28		24		
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width	2.0			17	75		95		110	ns
		4.5			7	15		19		22	
		6.0			6	13		16		19	
$t_{W(L)}$	Minimum Pulse Width	2.0			28	75		95		110	ns
		4.5			6	15		19		22	
		6.0			6	13		16		19	
t_s	Minimum Set-up Time (SI)	2.0			30	75		95		110	ns
		4.5			7	15		19		22	
		6.0			5	13		16		19	
t_s	Minimum Set-up Time (ST)	2.0			45	100		125		145	ns
		4.5			10	20		25		29	
		6.0			8	17		21		25	
t_h	Minimum Hold Time (SI, ST)	2.0				0		0		0	ns
		4.5				0		0		0	
		6.0				0		0		0	
C_{IN}	Input Capacitance				5	10		10		10	pF
C_{PD} (*)	Power Dissipation Capacitance				140						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. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}/2$ (per FLIP/FLOP)

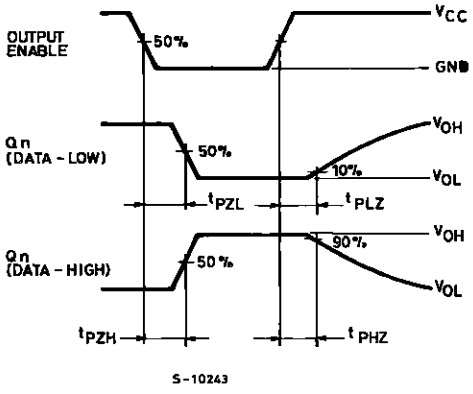
SWITCHING CHARACTERISTICS TEST WAVEFORM



S-10241

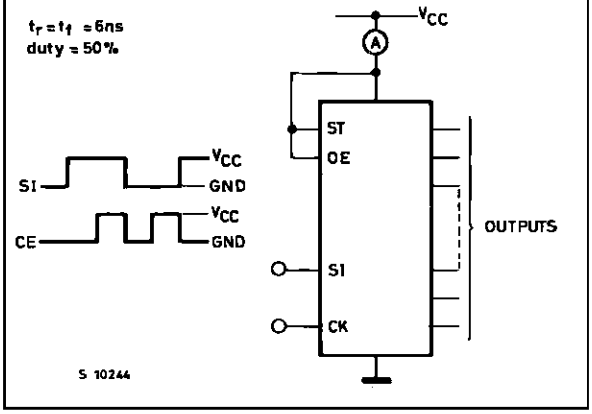


S-10242



S-10243

TEST WAVEFORM I_{CC} (Opr.)



S 10244

C_{PD} CALCULATION

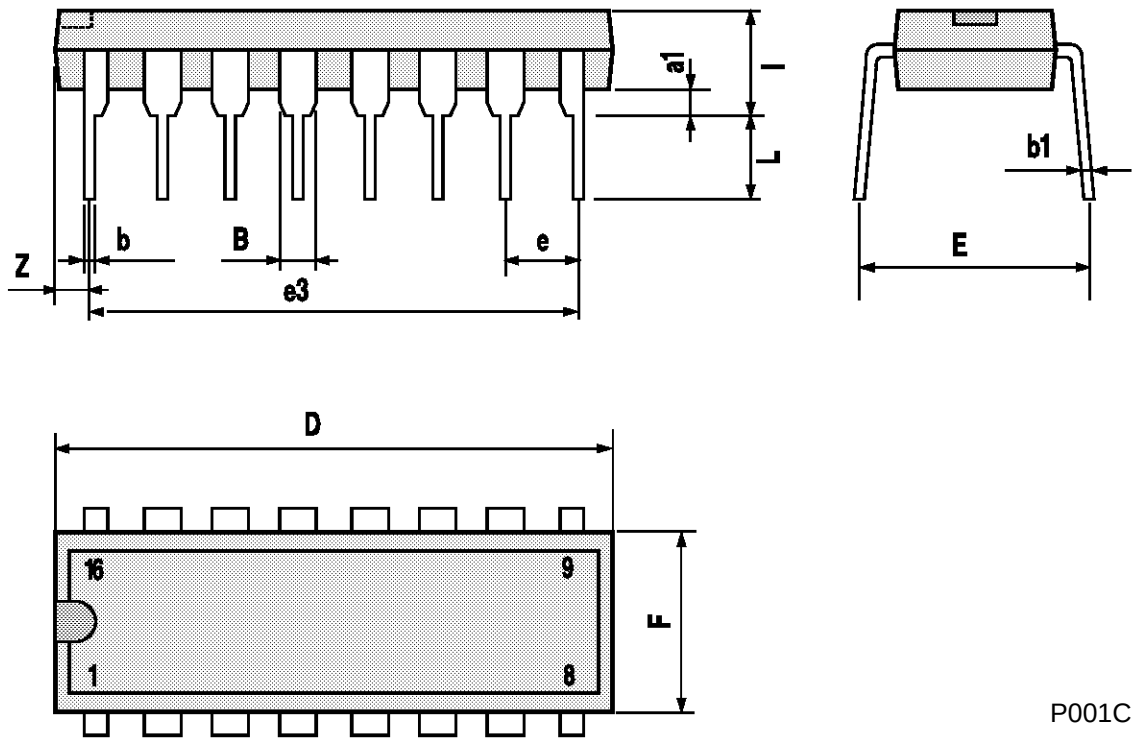
C_{PD} is to be calculated with the following formula by using the measured value of I_{CC} (Opr.) in the test circuit opposite.

$$C_{PD} = \frac{I_{CC}\,(Opr)}{f_{IN} \times V_{CC}}$$

In determining the typical value of C_{PD}, a relatively high frequency of 1 MHz was applied to f_{IN}, in order to eliminate any error caused by the quiescent supply current.

Plastic DIP16 (0.25) MECHANICAL DATA

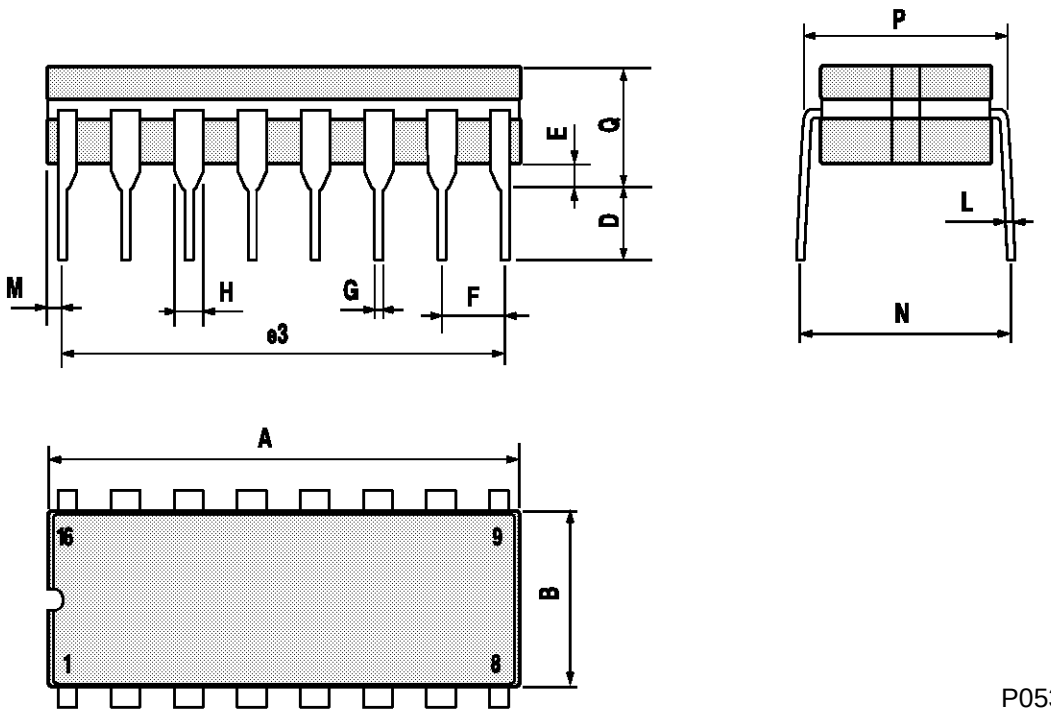
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

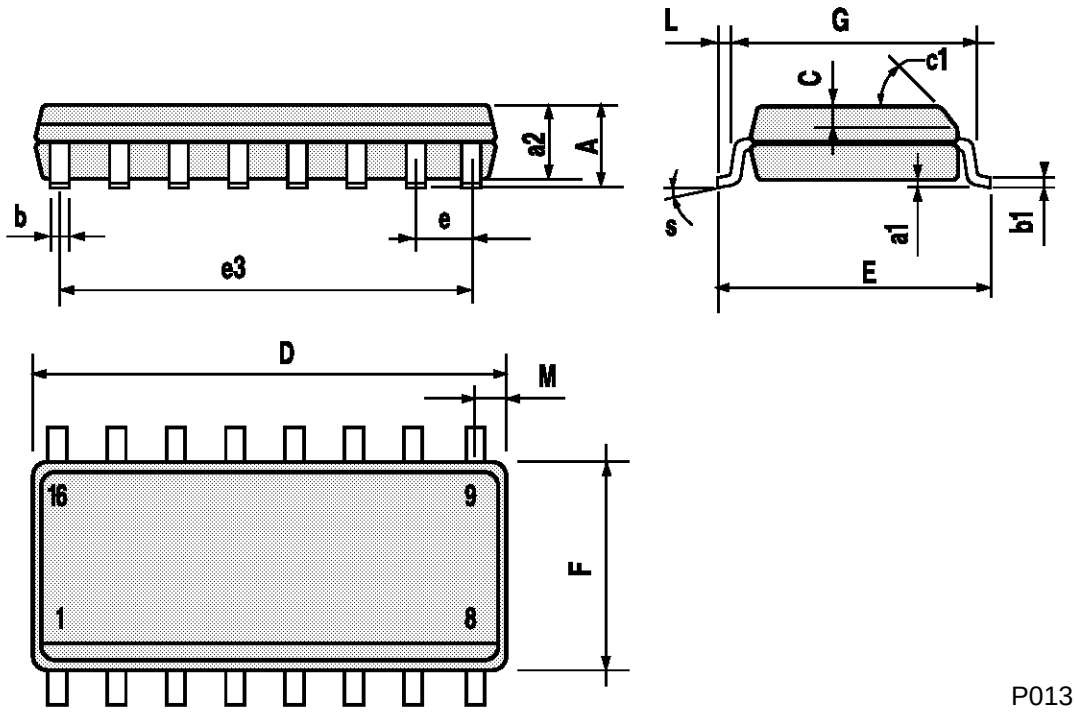
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q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



P053D

SO16 (Narrow) MECHANICAL DATA

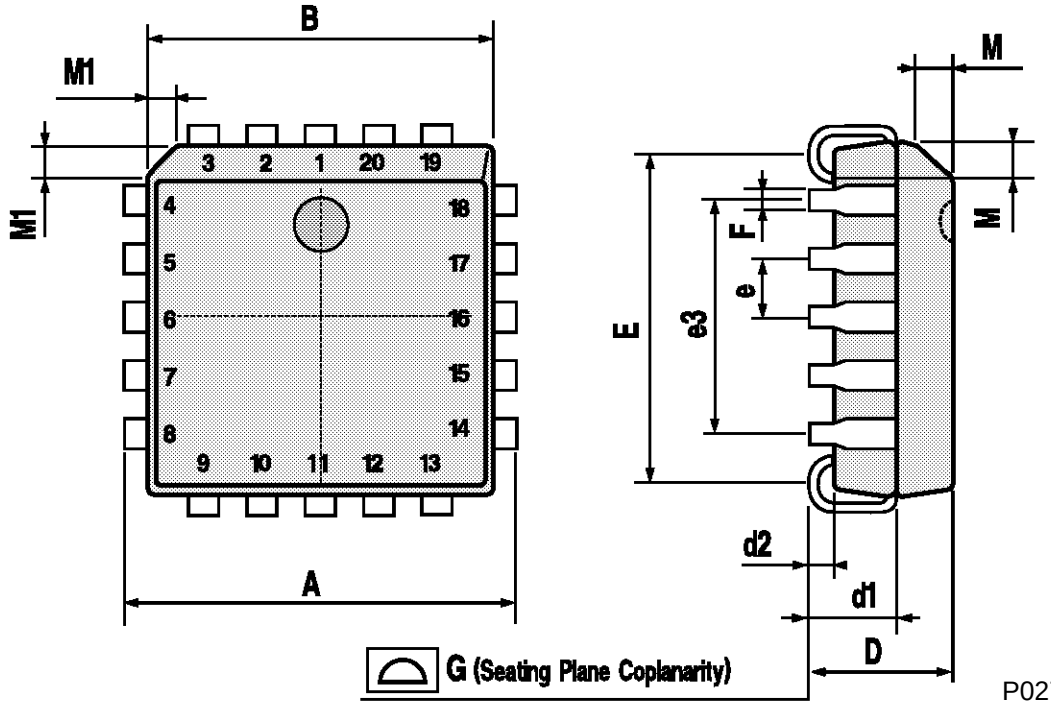
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.004		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157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