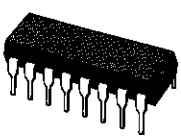
SGS-THOMSON MICROELECTRONICS

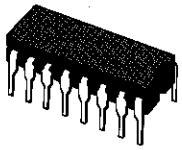
M54HC182
M74HC182

FUNCTION LOOK AHEAD CARRY GENERATOR

- HIGH SPEED
  t_{PD} = 14 ns (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 54/74LS182



B1R
(Plastic Package)



F1R
(Ceramic Package)

M1R
(Micro Package)

C1R
(Chip Carrier)

ORDER CODES :

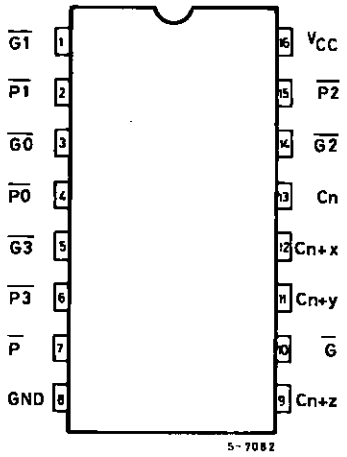
M54HC182F1R	M74HC182M1R
M74HC182B1R	M74HC182C1R

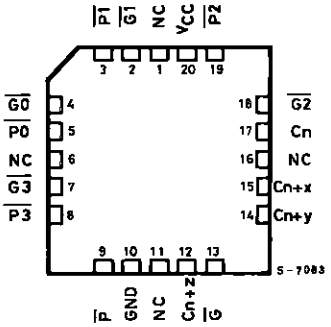
DESCRIPTION

The M54/74HC182 is a high speed CMOS FUNCTION LOOK AHEAD CARRY GENERATOR fabricated in silicon gate C^2MOS technology. It has the same high speed performance of LSTTL combined with true CMOS low power consumption. These circuit are capable of anticipating a carry across four binary adders or group of adders. They are cascadable to perform full look-ahead across n-bit adders. Carry, generate-carry, and propagate-carry functions are provided as shown in the pin connection table. When used in conjunction with the HC181 arithmetic logic unit, these generators provide high-speed carry look-ahead capability for any word length. Each HC182 generates the look-ahead (anticipated carry) across a group of four ALU's and, in addition, other carry look-ahead circuits may be employed to anticipate carry across sections of four look-ahead packages up to n-bits. The method of cascading circuits to perform multi-level look-ahead is illustrated under typical application data.

Carry input and output of the ALUs are in their true form, and the carry propagate (P) and carry generate (G) are in negated form ; therefore, the carry functions (inputs, outputs, generate, and propagate) of the look-ahead generators are implemented in the compatible forms for direct connection to the ALU. Reinterpretation of carry functions as explained on the HC181 data sheet are also applicable to and compatible with the look-ahead generator. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

PIN CONNECTIONS (top view)





NC =
No Internal
Connection

FUNCTION TABLES

FOR $\overline{G}$ OUTPUT

INPUTS							OUTPUT
$\overline{G3}$	$\overline{G2}$	$\overline{G1}$	$\overline{G0}$	$\overline{P3}$	$\overline{P2}$	$\overline{P1}$	$\overline{G}$
L	X	X	X	X	X	X	L
X	L	X	X	L	X	X	L
X	X	L	X	L	L	X	L
X	X	X	L	L	L	L	L
ALL OTHER COMBINATIONS							H

FOR $\overline{P}$ OUTPUT

INPUTS				OUTPUT
$\overline{P3}$	$\overline{P2}$	$\overline{P1}$	$\overline{P0}$	$\overline{P}$
L	L	L	L	L
ALL OTHER COMBINATIONS				H

FOR Cn+x OUTPUT

INPUTS			OUTPUT
$\overline{G0}$	$\overline{P0}$	Cn	Cn+x
L	X	X	H
X	L	H	H
ALL OTHER COMBINATIONS			L

FOR Cn+y OUTPUT

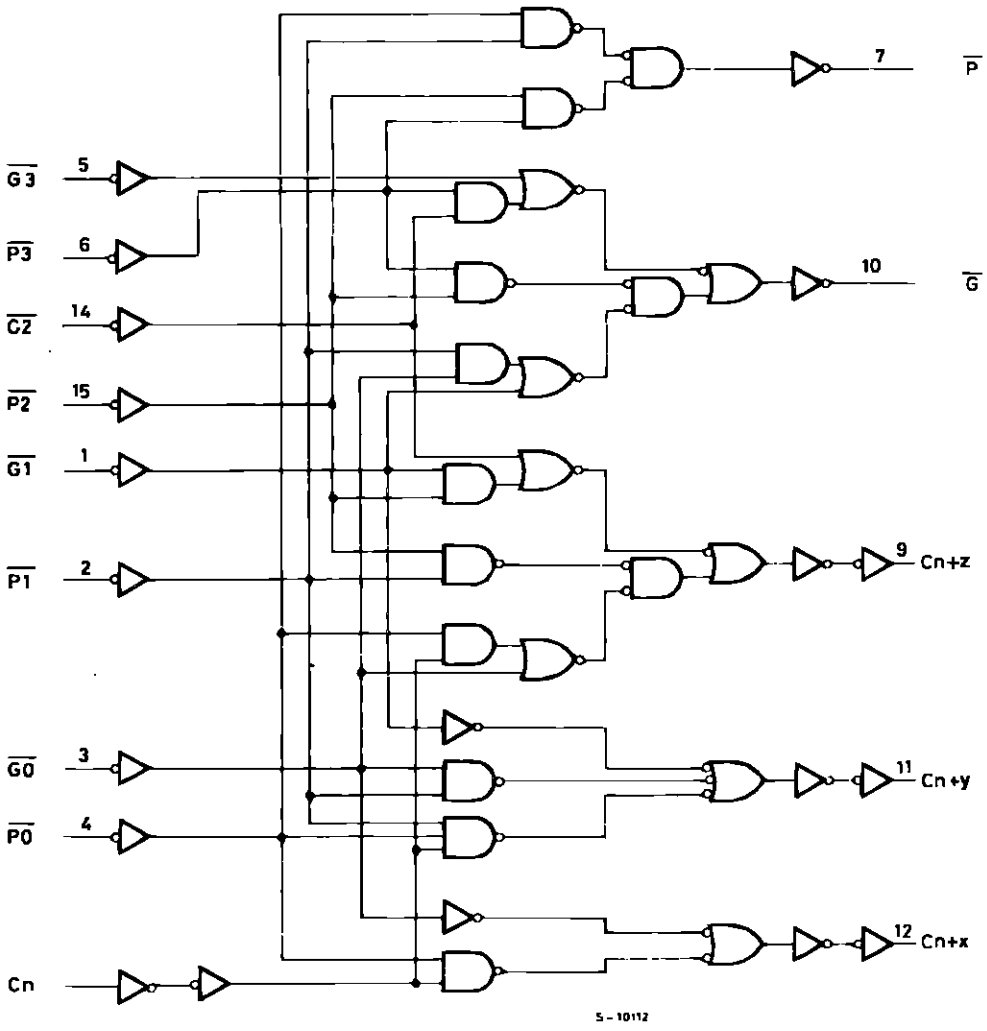
INPUTS					OUTPUT
$\overline{G1}$	$\overline{G0}$	$\overline{P1}$	$\overline{P0}$	Cn	Cn+y
L	X	X	X	X	H
X	L	L	X	X	H
X	X	L	L	H	H
ALL OTHER COMBINATIONS					L

FOR Cn+z OUTPUT

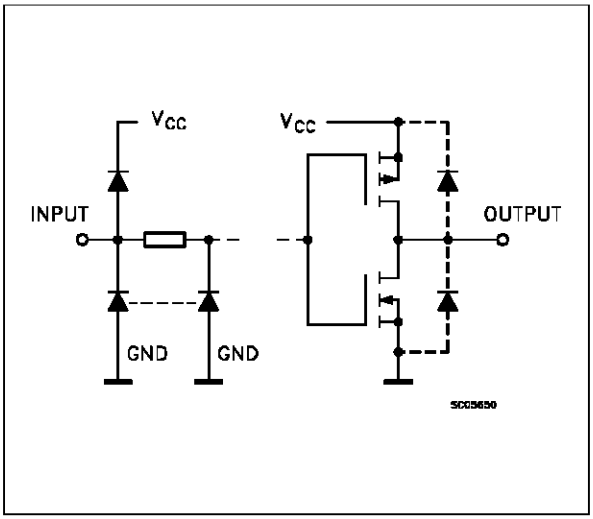
INPUTS							OUTPUT
$\overline{G2}$	$\overline{G1}$	$\overline{G0}$	$\overline{P2}$	$\overline{P1}$	$\overline{P0}$	Cn	Cn+z
L	X	X	X	X	X	X	H
X	L	X	L	X	X	X	H
X	X	L	L	L	X	X	H
X	X	X	L	L	L	H	H
ALL OTHER COMBINATIONS							L

$Cn+x = G0 + P0Cn$
$Cn+y = G1 + P1G0 + P1P0Cn$
$Cn+z = \overline{G2 + P2G1 + P2P1G0 + P2P1P0Cn}$
$G = \overline{G3 + G3 + P3G2 + P3P2G1 + P3P2P1G0}$
$P = \overline{P3P2P1P0}$
or
$\overline{Cn+x} = \overline{Y0 + (X0 + Cn)}$
$\overline{Cn+y} = \overline{Y1 + [X1 + Y0(X0 + Cn)]}$
$\overline{Cn+z} = Y2 + \{X2 + Y1[X1 + Y0(X0 + Cn)]\}$
$G = Y3 + (X3 + Y2)(X3 + X2 + Y1)(X3 + X2 + X1 + Y0)$
$P = X3 + X2 + X1 + X0$

LOGIC DIAGRAM



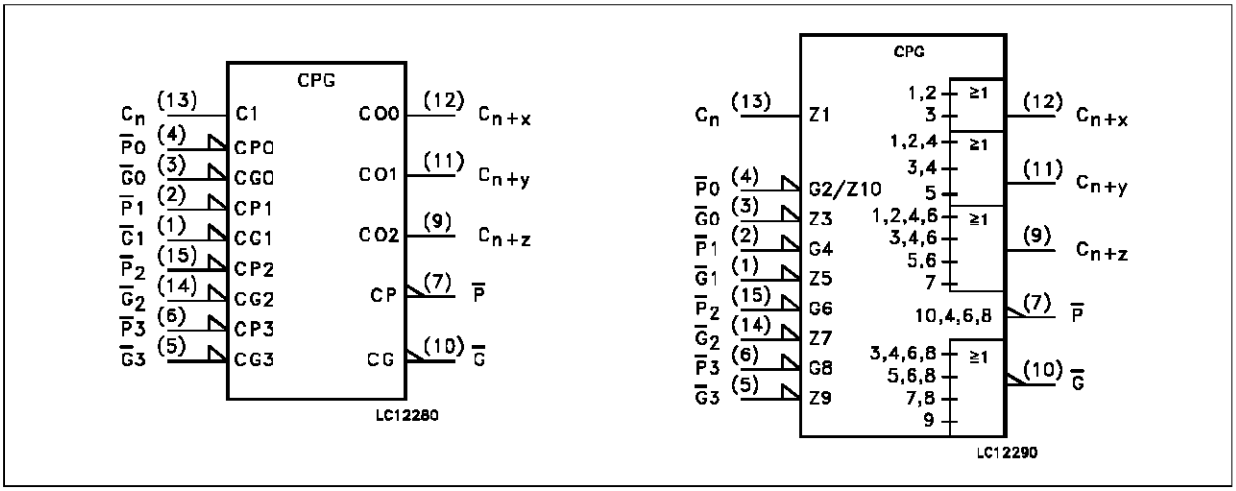
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
3, 1, 14, 5	G0 to G3	Carry Generate Inputs (Active LOW)
4, 2, 15, 6	P0 to P3	Carry Propagate Inputs (Active LOW)
7	P	Carry Propagate Output (Active LOW)
9	Cn+z	Function Output
10	G	Carry Generate Output (Active LOW)
11	Cn+y	Function Output
12	Cn+x	Function Output
13	Cn	
8	GND	Ground (0V)
16	V_{CC}	Positive Supply Voltage

IEC LOGIC SYMBOLS



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	^oC ^oC
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

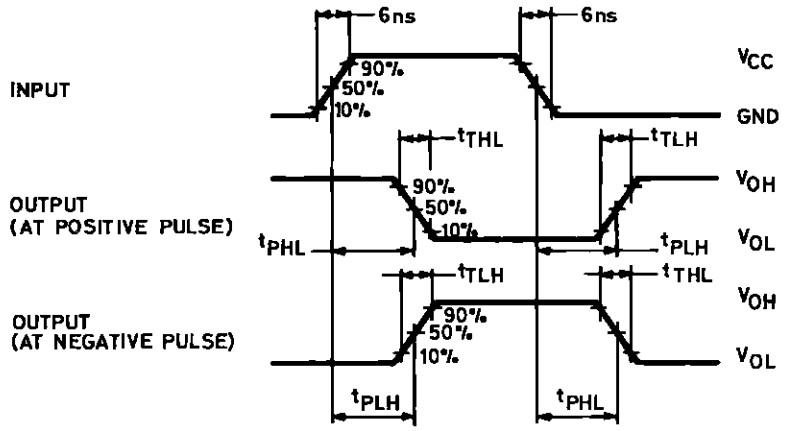
Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)			T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	2.0			1.5			1.5		1.5		V
		4.5			3.15			3.15		3.15		
		6.0			4.2			4.2		4.2		
V_{IL}	Low Level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

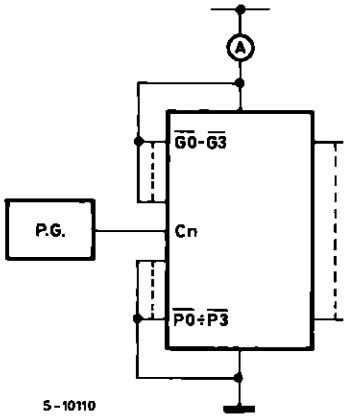
Symbol	Parameter	Test Conditions		Value							Unit
		V_{CC} (V)		T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time	2.0			30	75		95		110	ns
		4.5			8	15		19		22	
		6.0			7	13		16		19	
t_{PLH} t_{PHL}	Propagation Delay Time (Gn, Pn - Cn+xyz)	2.0			62	135		170		205	ns
		4.5			17	27		34		41	
		6.0			13	23		29		35	
t_{PLH} t_{PHL}	Propagation Delay Time (Gn, Pn - G)	2.0			72	150		190		225	ns
		4.5			19	30		38		45	
		6.0			14	26		32		38	
t_{PLH} t_{PHL}	Propagation Delay Time (Pn - P)	2.0			62	135		170		205	ns
		4.5			17	27		34		41	
		6.0			13	23		29		35	
t_{PLH} t_{PHL}	Propagation Delay Time (Cn - Cn+xyz)	2.0			62	135		170		205	ns
		4.5			17	27		34		41	
		6.0			13	23		29		35	
C_{IN}	Input Capacitance				5	10		10		10	pF
C_{PD} (*)	Power Dissipation Capacitance				61						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

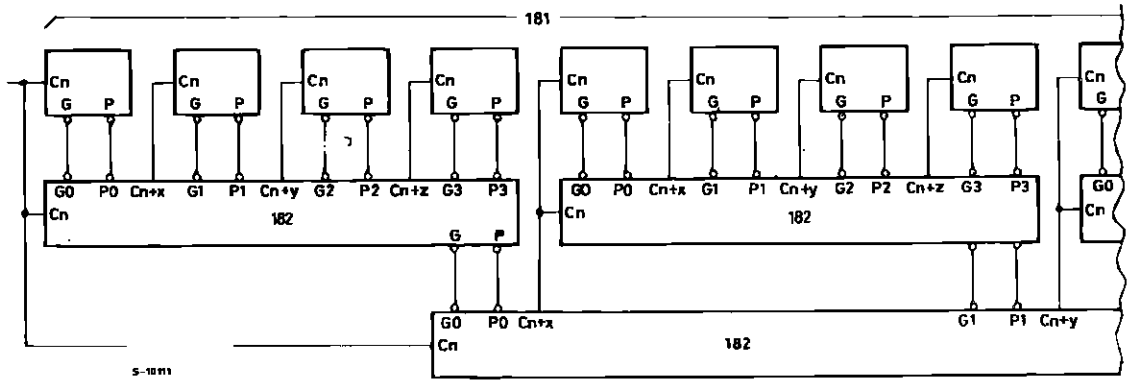


TEST CIRCUIT Icc (Opr.)



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

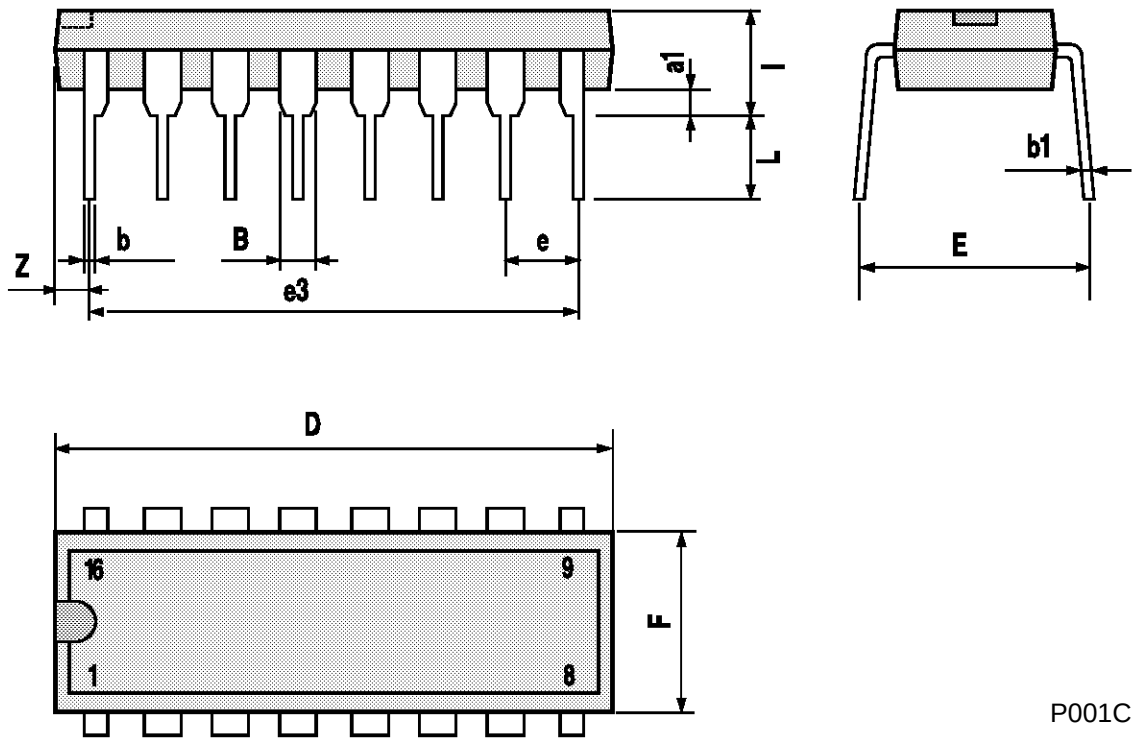
TYPICAL APPLICATION



64-BIT ALU, FULL-CARRY LOOK-AHEAD IN THREE LEVELS.

Plastic DIP16 (0.25) MECHANICAL DATA

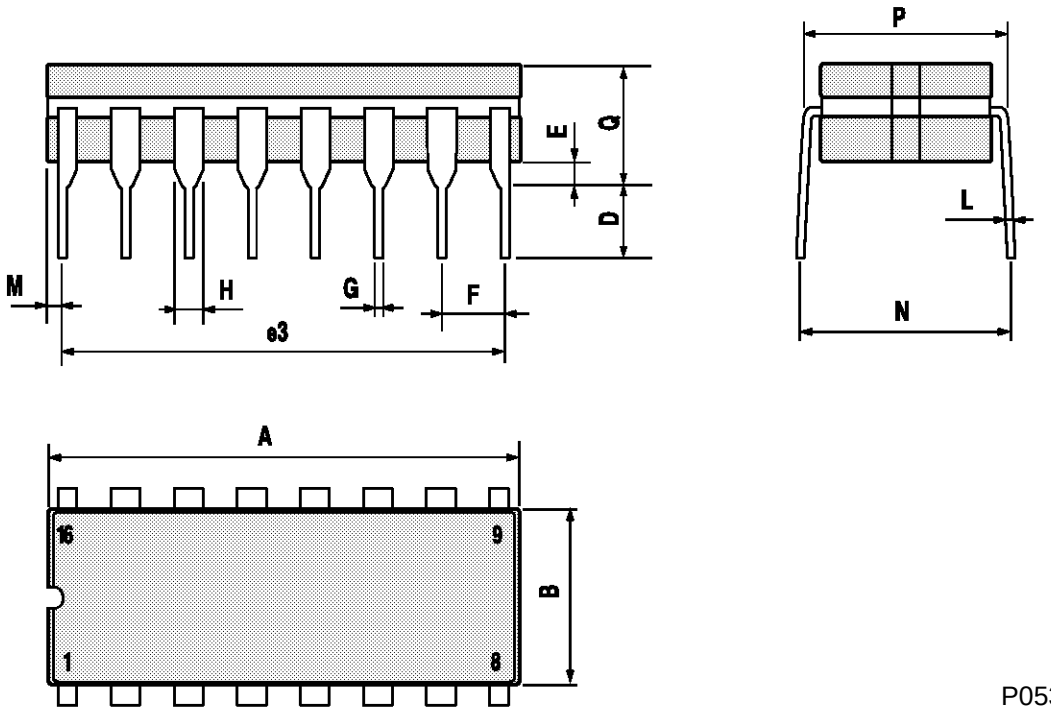
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

Ceramic DIP16/1 MECHANICAL DATA

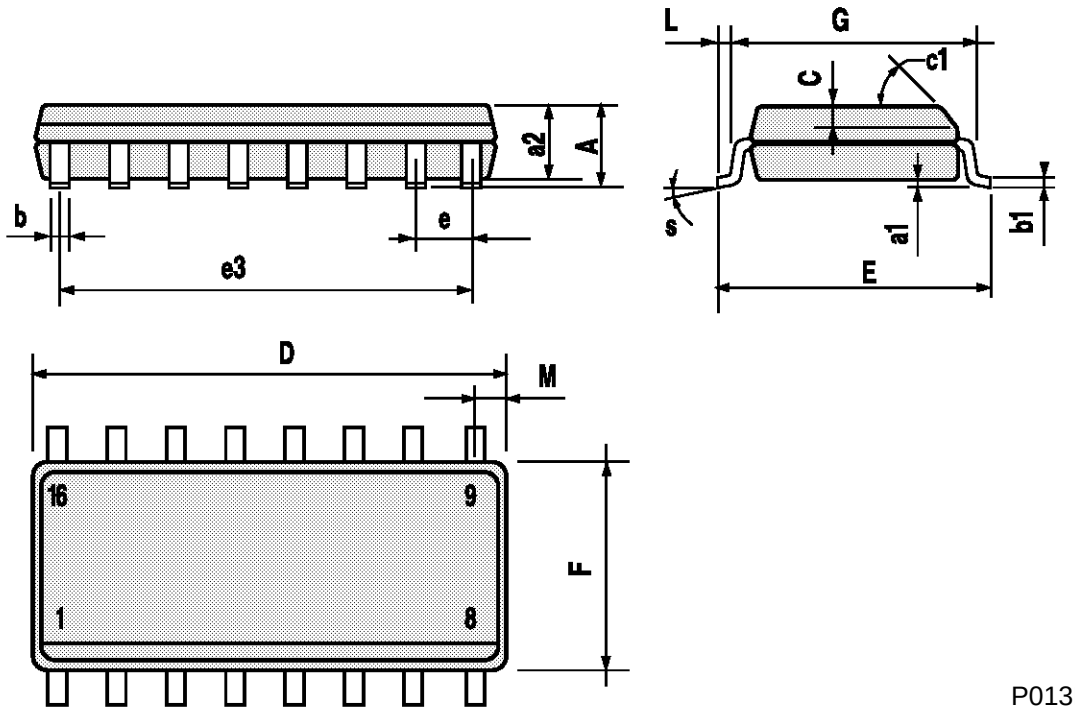
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		17.78			0.700	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
H	1.17		1.52	0.046		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q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