SGS-THOMSON MICROELECTRONICS

M54HC164
M74HC164
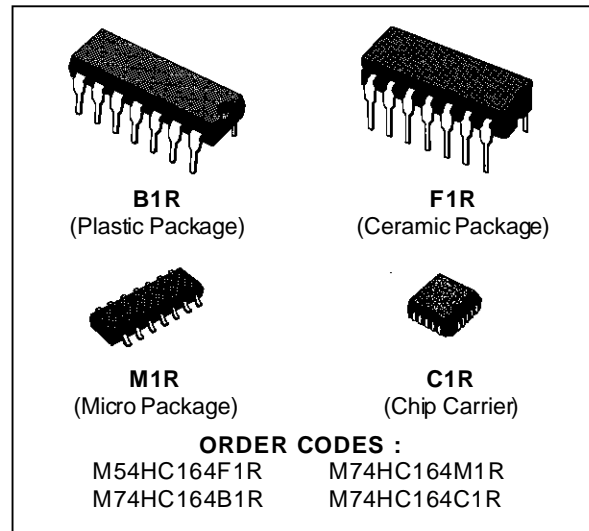
8 BIT SIPO SHIFT REGISTER

- HIGH SPEED
  t_{PD} = 15 ns (TYP.) AT V_{CC} = 5 V
- LOW POWER DISSIPATION
  I_{CC} = 4 μA (MAX.) AT T_A = 25 °C
- OUTPUT DRIVE CAPABILITY
  10 LSTTL LOADS
- BALANCED PROPAGATION DELAYS
  t_{PLH} = t_{PHL}
- SYMMETRICAL OUTPUT IMPEDANCE
  I_{OL} = $|I_{OH}|$ = 4 mA (MIN.)
- HIGH NOISE IMMUNITY
  V_{NIH} = V_{NIL} = 28 % V_{CC} (MIN.)
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE
  WITH 54/74LS164

B1R
(Plastic Package)

F1R
(Ceramic Package)

M1R
(Micro Package)

C1R
(Chip Carrier)

ORDER CODES :
M54HC164F1R   M74HC164M1R
M74HC164B1R   M74HC164C1R

DESCRIPTION

The M54/74HC164 is a high speed CMOS 8 BIT SIPO 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.

The HC164 is an 8 bit shift register with serial data entry and an output from each of the eight stages. Data is entered serially through one of two inputs (A or B), either of these inputs can be used as an active high enable for data entry through the other input. An unused input must be high, or both inputs connected together. Each low-to-high transition on the clock input shifts data one place to the right and enters into QA, the logic NAND of the two data inputs ($\overline{A \cdot B}$), the data that existed before the rising clock edge. A low level on the clear input overrides all other inputs and clears the register asynchronously, forcing all Q outputs low.

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

PIN CONNECTIONS (top view)
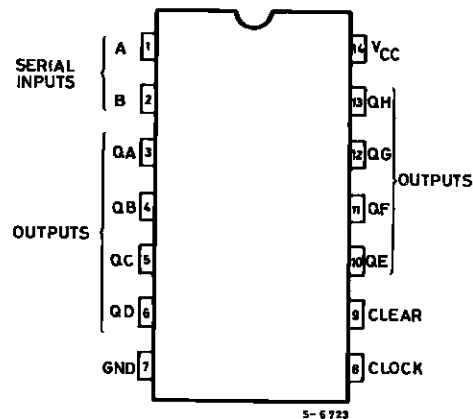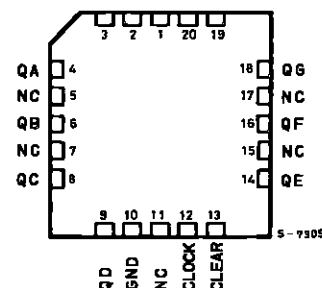
NC =
No Internal
Connection

INPUT AND OUTPUT EQUIVALENT CIRCUIT

TRUTH TABLE
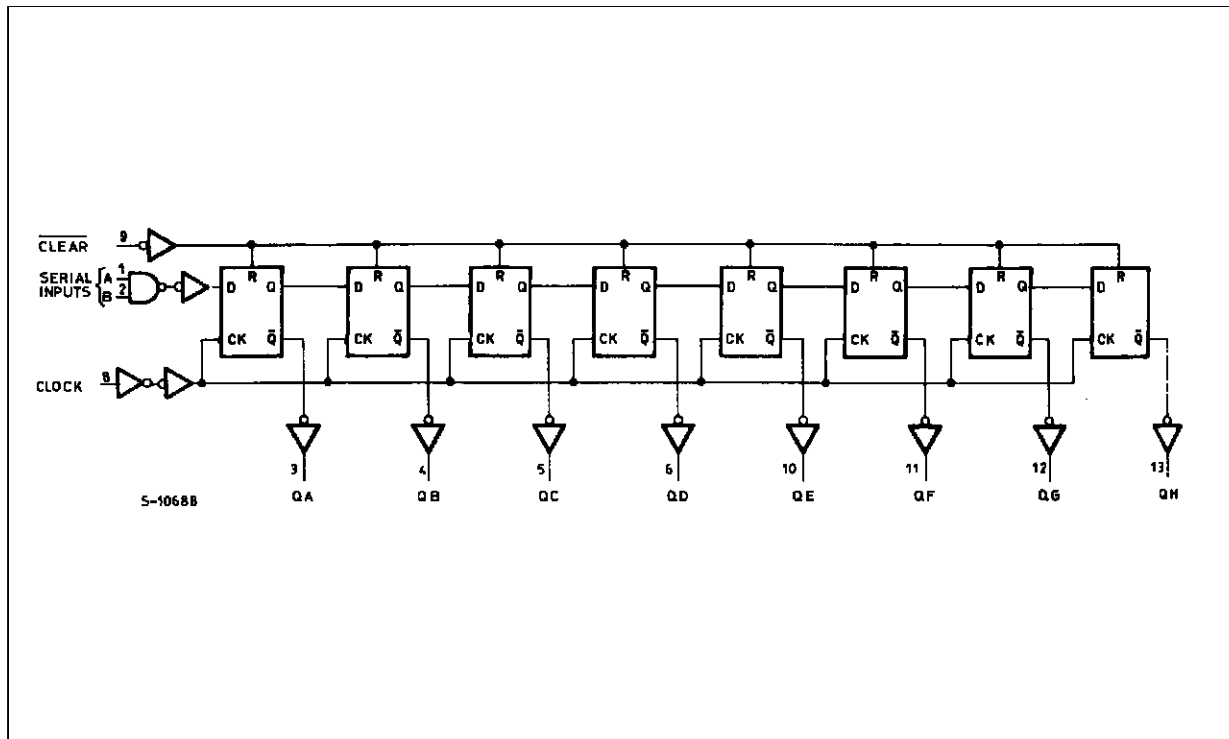
INPUTS				OUTPUS			
CLEAR	CLOCK	SERIAL IN		QA	QB	....	QH
		A	B				
L	X	X	X	L	L	....	L
H	⌐_	X	X	NO CHANGE			
H	_⌐	L	X	L	QAn	....	QGn
H	_⌐	X	L	L	QAn	....	QGn
H	_⌐	H	H	H	QAn	....	QGn

X: Don't Care

QAn - QGn : The level of QA -QG, respectively. before the most-recent transition of th clock.

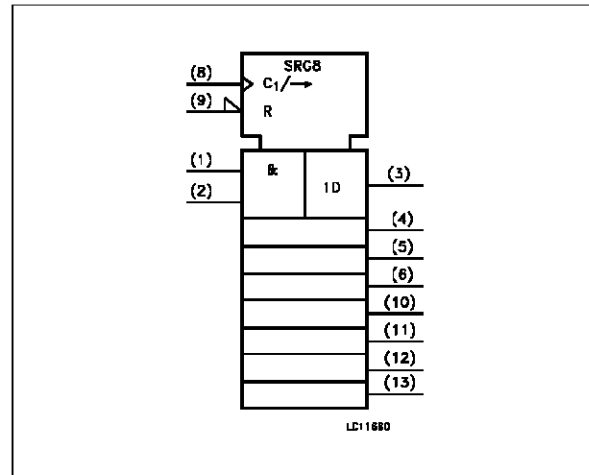## LOGIC DIAGRAM

PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 2	A, B	Data Inputs
3, 4, 5, 6, 10, 11, 12, 13	QA to QH	Outputs
8	CLOCK	Clock Input (LOW to HIGH, Edge-triggered)
9	$\overline{\text{CLEAR}}$	Master Reset Input
7	GND	Ground (0V)
14	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	^oC
T_L	Lead Temperature (10 sec)	300	^oC

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.
(*) 500 mW: $\cong$ 65 ^oC derate to 300 mW by 10mW/^oC: 65 ^oC to 85 ^oC

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		-55 to +125	^oC
	M74HC Series		-40 to +85	^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	

SGS-THOMSON
MICROELECTRONICS

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)			$T_A = 25\ ^oC$ 54HC and 74HC			-40 to 85 ^oC 74HC		-55 to 125 ^oC 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

SGS-THOMSON
MICROELECTRONICS

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

Symbol	Parameter	Test Conditions V_{CC} (V)		Value						Unit
				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 - Q)	2.0			57	160		200		240	ns
		4.5			19	32		40		48	
		6.0			16	27		34		41	
t_{PHL}	Propagation Delay Time (CLEAR - Q)	2.0			60	175		220		265	ns
		4.5			20	35		44		53	
		6.0			17	30		37		45	
f_{MAX}	Maximum Clock Frequency	2.0		6.2	18		5.0		4.2		MHz
		4.5		31	53		25		21		
		6.0		37	62		30		25		
$t_{W(H)}$ $t_{W(L)}$	Minimum Pulse Width (CLOCK)	2.0			24	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			40	75		95		110	ns
		4.5			10	15		19		22	
		6.0			9	13		16		19	
t_s	Minimum Set-up Time (A, B - CK)	2.0			16	50		65		75	ns
		4.5			4	10		13		15	
		6.0			3	9		11		13	
t_h	Minimum Hold Time (A, B - CK)	2.0				5		5		5	ns
		4.5				5		5		5	
		6.0				5		5		5	
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				99						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. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$
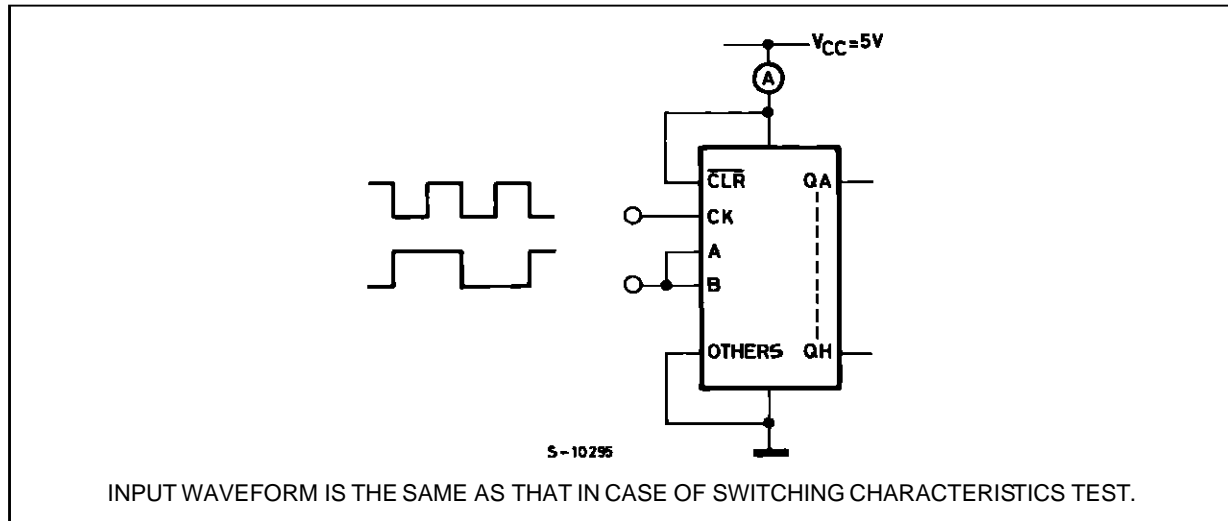
SGS-THOMSON
MICROELECTRONICS

TIMING CHART

SGS-THOMSON
MICROELECTRONICS
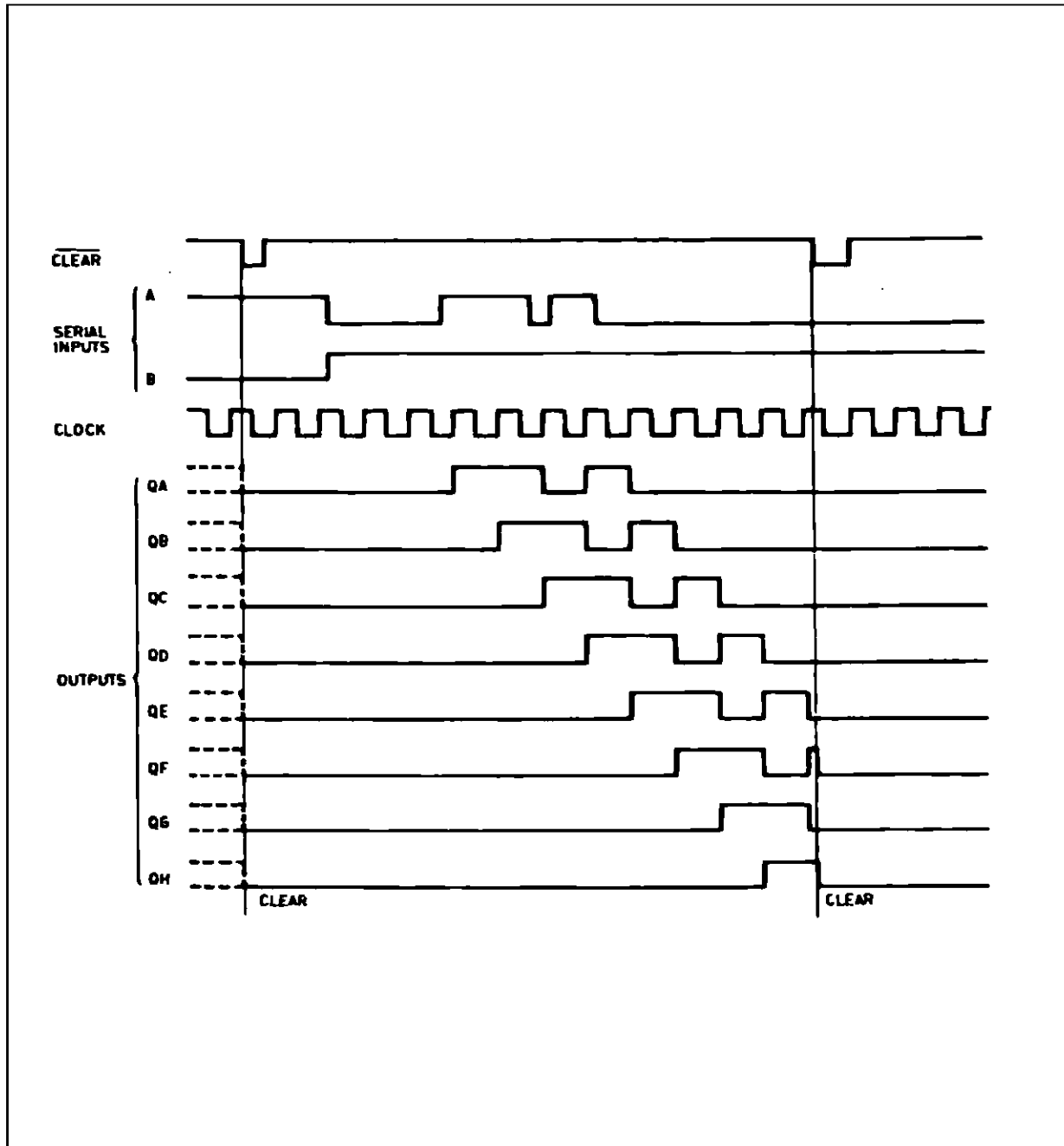
SWITCHING CHARACTERISTICS TEST WAVEFORM

CLEAR MODE   SERIAL MODE

S-10293   S-10294

TEST CIRCUIT I_CC (Opr.)

S-10295

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

SGS-THOMSON MICROELECTRONICS
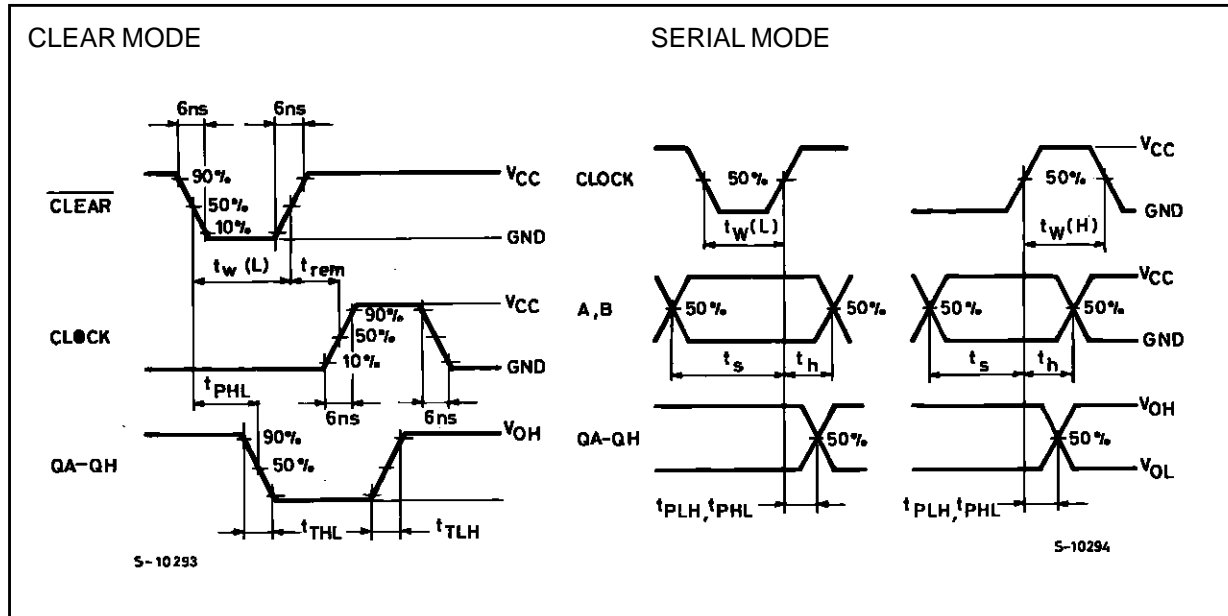
Plastic DIP14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		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		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

P001A

SGS-THOMSON
MICROELECTRONICS
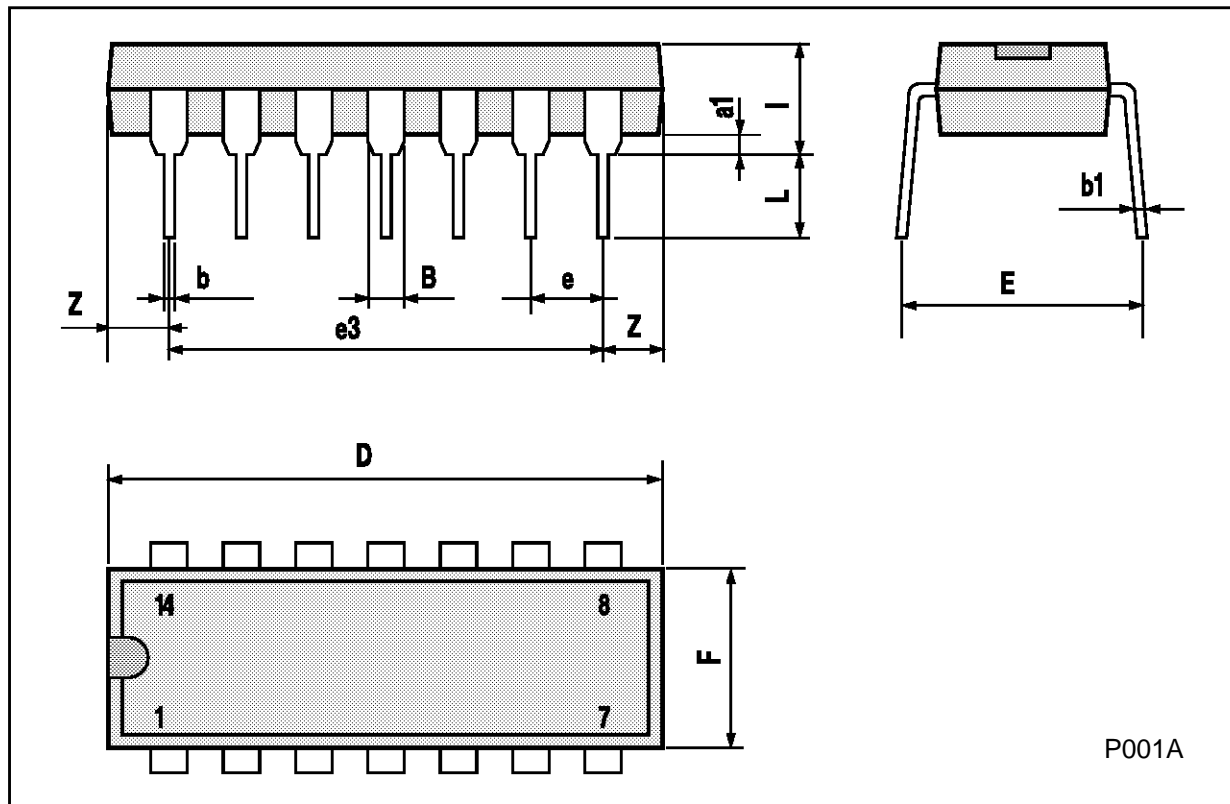
Ceramic DIP14/1 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			20			0.787
B			7.0			0.276
D		3.3			0.130	
E	0.38			0.015		
e3		15.24			0.600	
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	1.52		2.54	0.060		0.100
N			10.3			0.406
P	7.8		8.05	0.307		0.317
Q			5.08			0.200

P053C

SGS-THOMSON MICROELECTRONICS
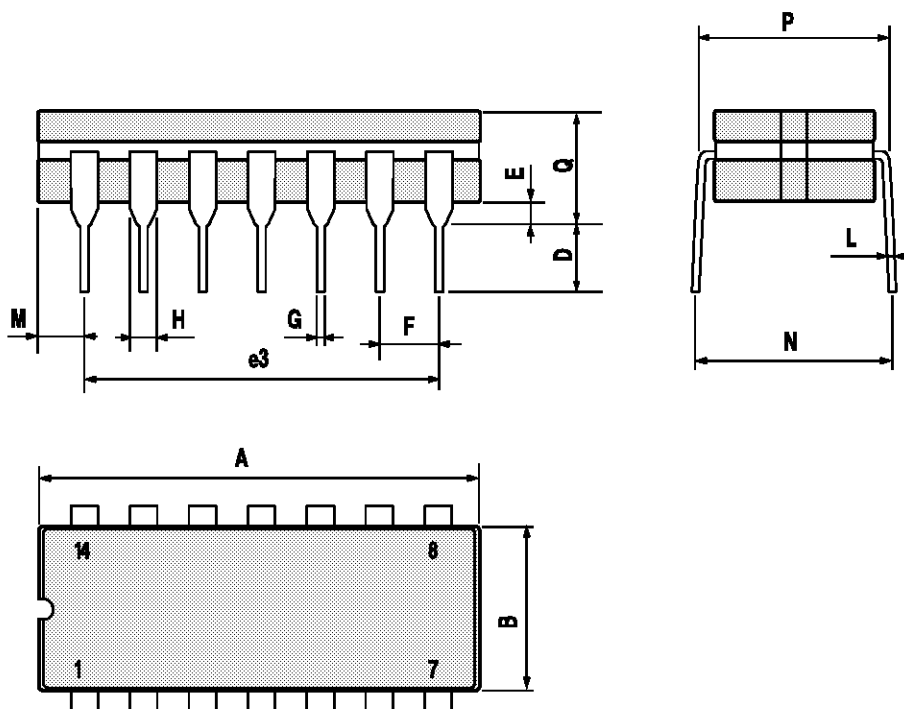
SO14 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		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	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
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			0.68			0.026
S	8° (max.)					

P013G

SGS-THOMSON
MICROELECTRONICS

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	

G (Seating Plane Coplanarity)

P027A

SGS-THOMSON
MICROELECTRONICS

SGS-THOMSON
MICROELECTRONICS