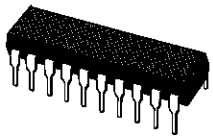
SGS-THOMSON MICROELECTRONICS

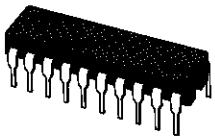
M54/74HC299
M54/74HC323

HC299 8 BIT PIPO SHIFT REGISTER WITH ASYNCHRONOUS CLEAR
HC323 8 BIT PIPO SHIFT REGISTER WITH SYNCHRONOUS CLEAR

- HIGH SPEED
  f_{MAX} = 42 MHz (TYP.) AT V_{CC} = 5V
- 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 FOR QA' TO QH'
  15 LSTTL LOADS FOR QA TO QH
- SYMMETRICAL OUTPUT IMPEDANCE
  $|I_{OH}| = I_{OL}$ = 6 mA (MIN.) FOR Q_A, TO Q_H,
  $|I_{OH}| = I_{OL}$ = 4 mA (MIN.) FOR Q_A, TO Q_H
- BALANCED PROPAGATION DELAYS
  $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
  V_{CC} (OPR) = 2 V TO 6 V
- PIN AND FUNCTION COMPATIBLE
  WITH 54/74LS299



B1R
(Plastic Package)



F1R
(Ceramic Package)



M1R
(Micro Package)

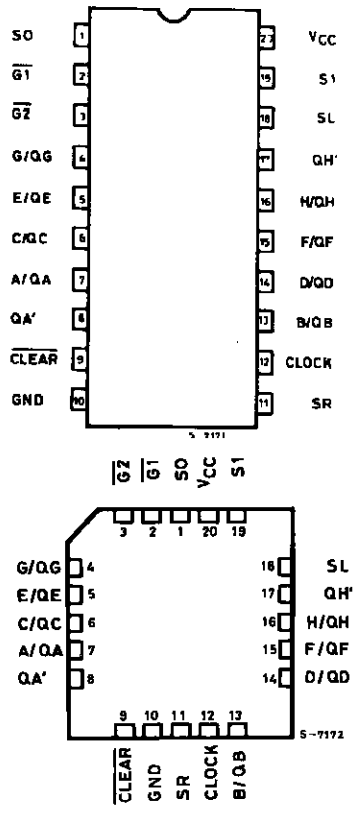


C1R
(Chip Carrier)

ORDER CODES :

M54HCXXXF1R	M74HCXXXM1R
M74HCXXXB1R	M74HCXXXC1R

PIN CONNECTIONS (top view)



NC =
No Internal
Connection

DESCRIPTION

The M54/74HC299/323 are high speed CMOS 8-BIT PIPO SHIFT REGISTERS (3-STATE) fabricated with silicon gate C^2MOS technology.

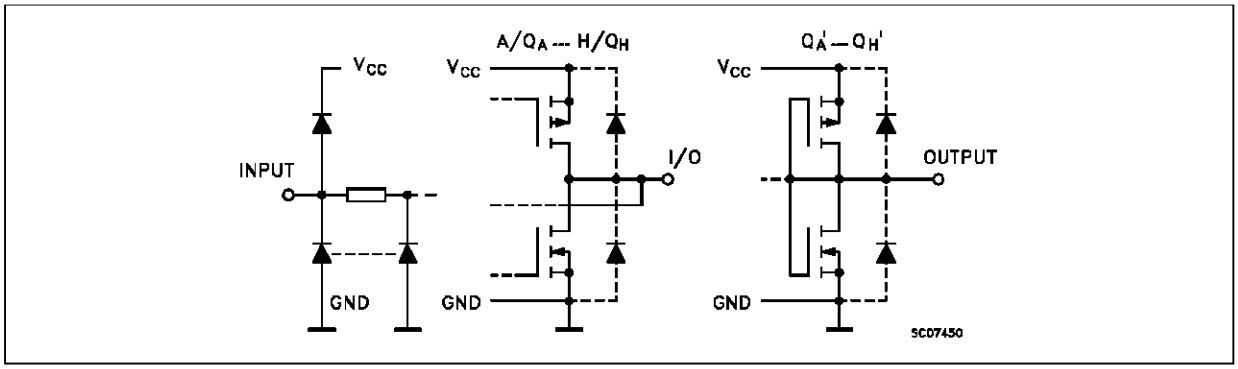
They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power consumption.

These devices have four modes (HOLD, SHIFT LEFT, SHIFT RIGHT and LOAD DATA). Each mode is chosen by two function select inputs (S0, S1). When one or both enable inputs, ($\overline{G1}$, $\overline{G2}$) are high, the eight input/output terminals are in the high-impedance state ; however sequential operation or clearing of the register is not affected.

Clear function on the HC299 is asynchronous to CLOCK, while the HC323 is cleared synchronous to clock.

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

INPUT AND OUTPUT EQUIVALENT CIRCUIT



TRUTH TABLE

MODE	INPUTS							INPUTS/OUTPUTS				OUTPUTS	
	$\overline{\text{CLEAR}}$	FUNCTION SELECTED		OUTPUT CONTROL		CLOCK		SERIAL		A/QA	H/QH	QA'	QH'
		S1	S0	$\overline{\text{G1}}$ *	$\overline{\text{G2}}$ *	(299)	(323)	SL	SR				
Z	L	H	H	X	X	X		X	X	Z	Z	L	L
CLEAR	L	L	X	L	L	X	⎍	X	X	L	L	L	L
	L	X	L	L	L	X	⎍	X	X	L	L	L	L
HOLD	H	L	L	L	L	X		X	X	QA0	QH0	QA0	QH0
SHIFT RIGHT	H	L	H	L	L	⎍		X	H	H	QGn	H	QGn
	H	L	H	L	L	⎍		X	L	L	QGn	L	QGn
SHIFT LEFT	H	H	L	L	L	⎍		H	X	QBn	H	QBn	H
	H	H	L	L	L	⎍		L	X	QBn	L	QBn	L
LOAD	H	H	H	X	X	⎍		X	X	a	h	a	h

* When one or both output controls are high, the eight, input/output terminals are in the high impedance state: however sequential operation or clearing of the register is not affected.

Z : HIGH IMPEDANCE

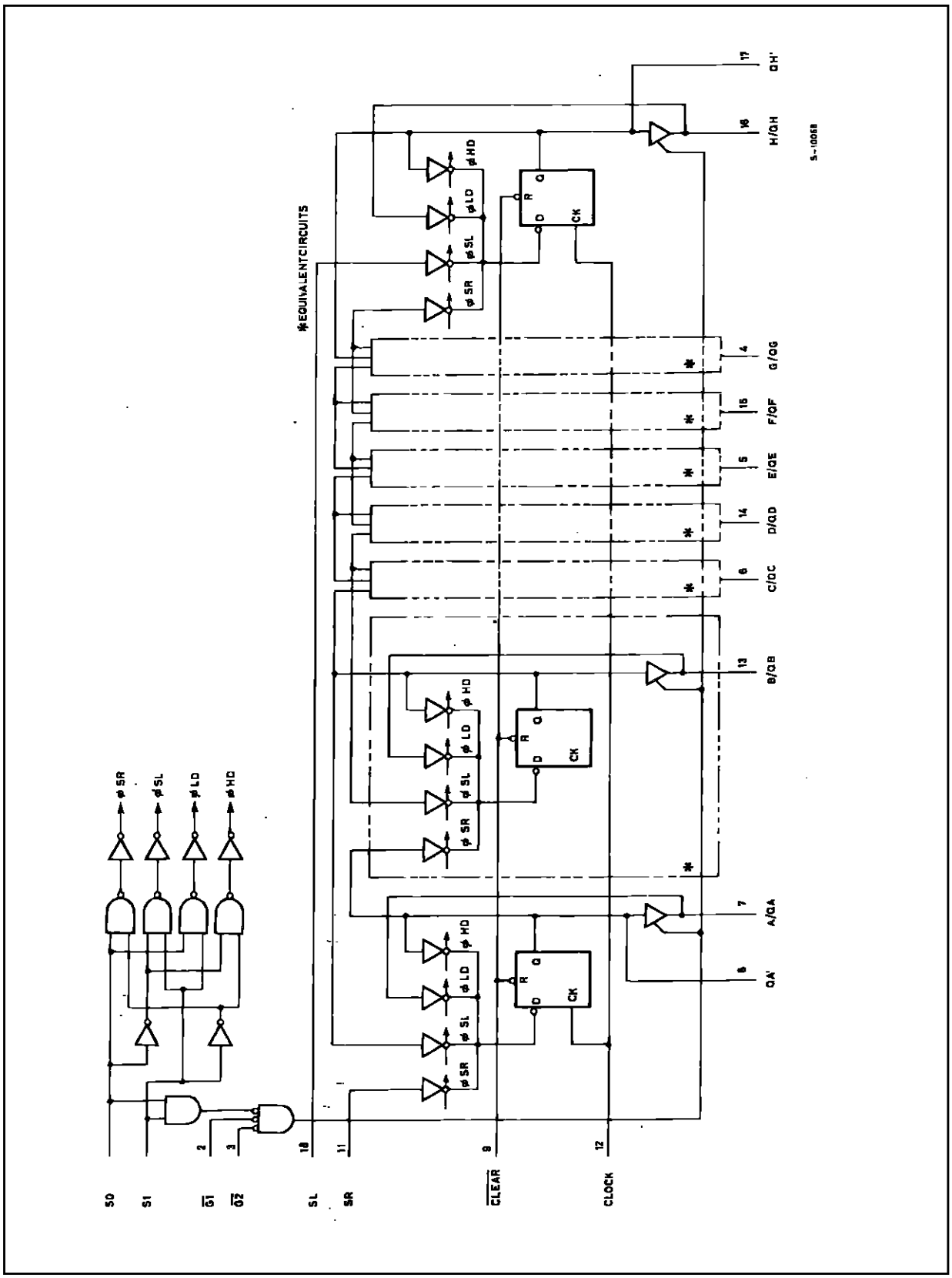
Qn0 : THE LEVEL OF An BEFORE THE INDICATED STEADY STATE INPUT CONDITIONS WERE ESTABLISHED.

Qnn : THE LEVEL ON Qn BEFORE THE MOST RECENT ACTIVE TRANSITION INDICATED BY ⎍ OR ⎍

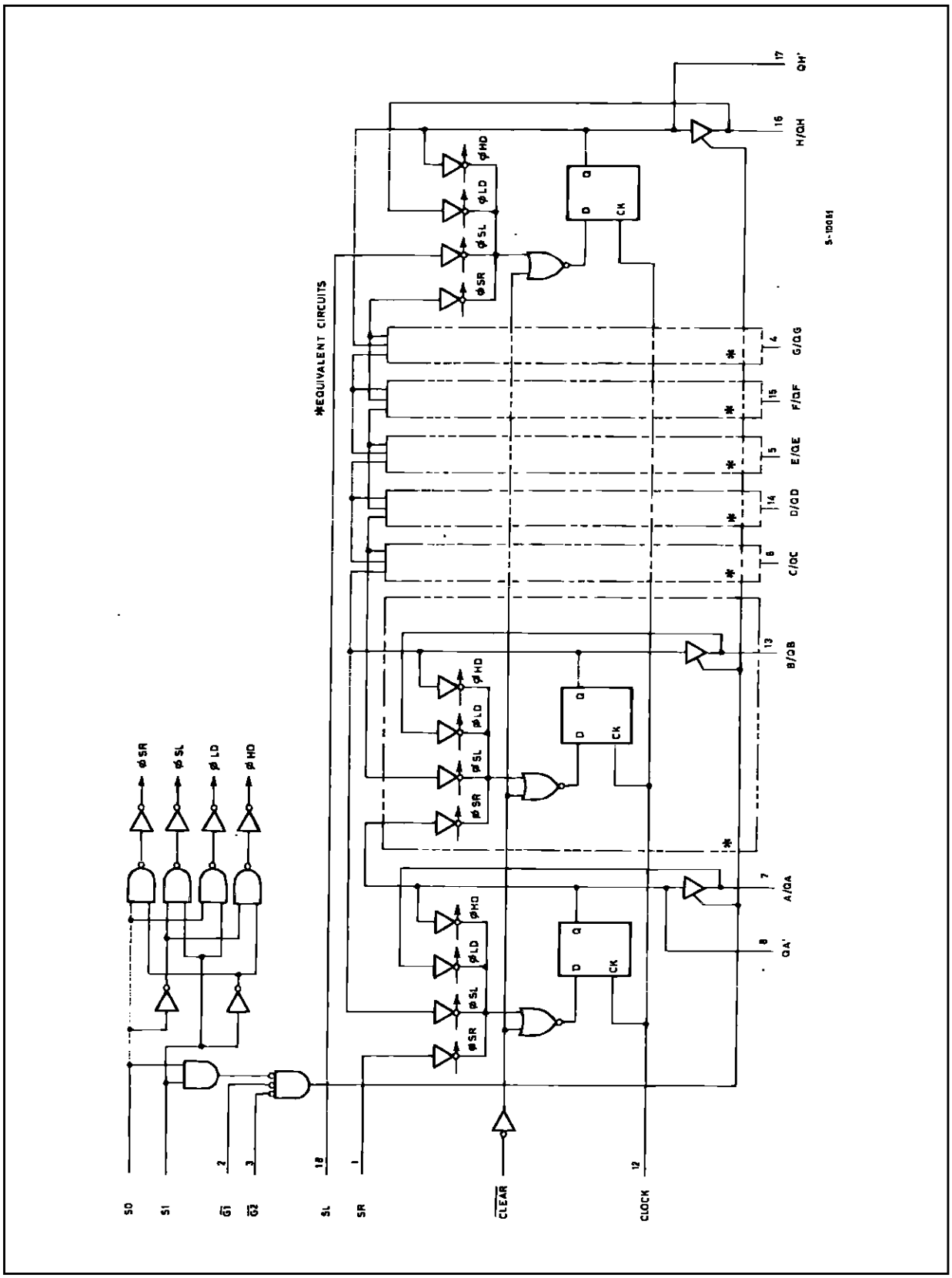
a, h : THE LEVEL OF THE STEADY STATE INPUTS A, H, RESPECTIVELY.

X : DON'T CARE

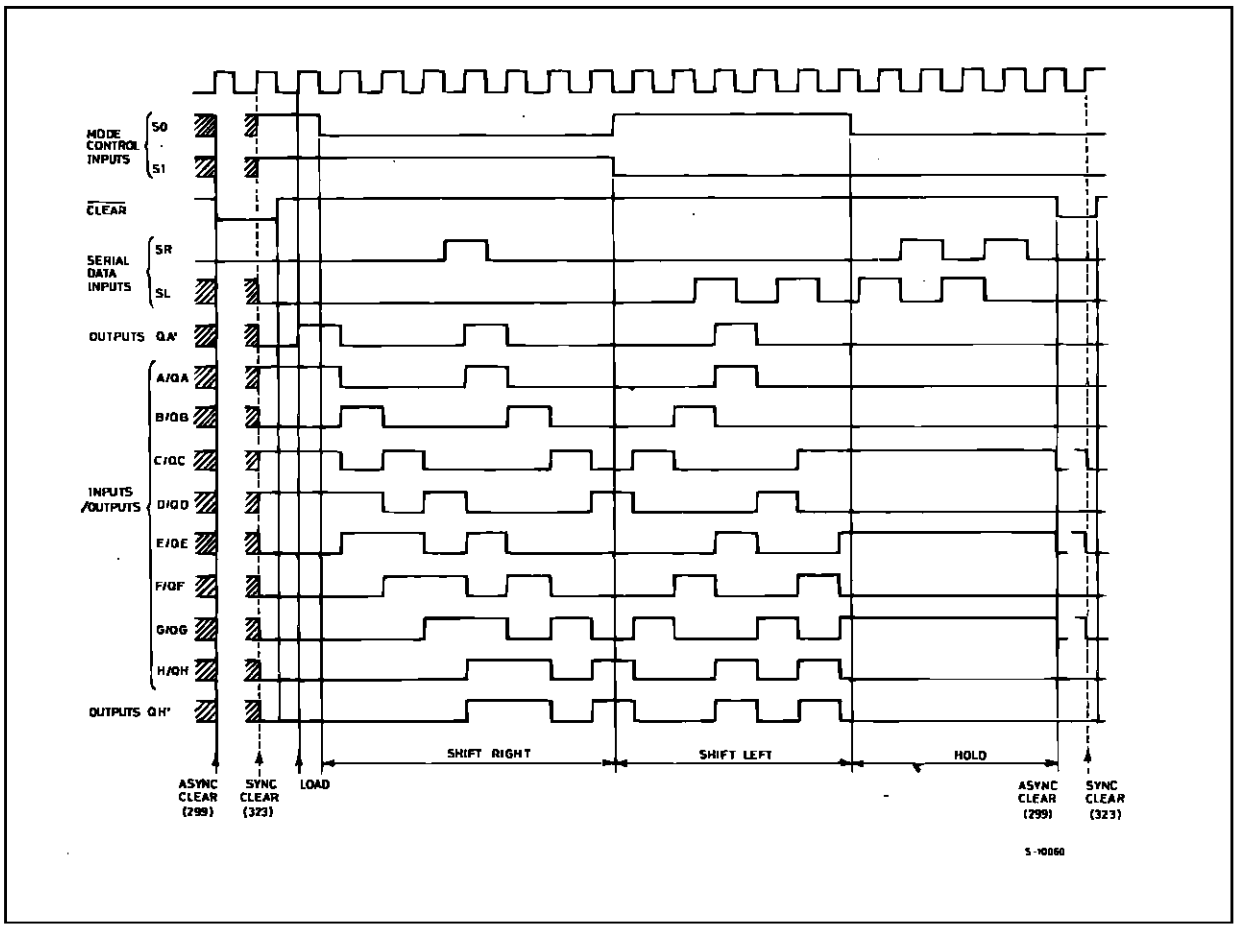
LOGIC DIAGRAM (HC299)



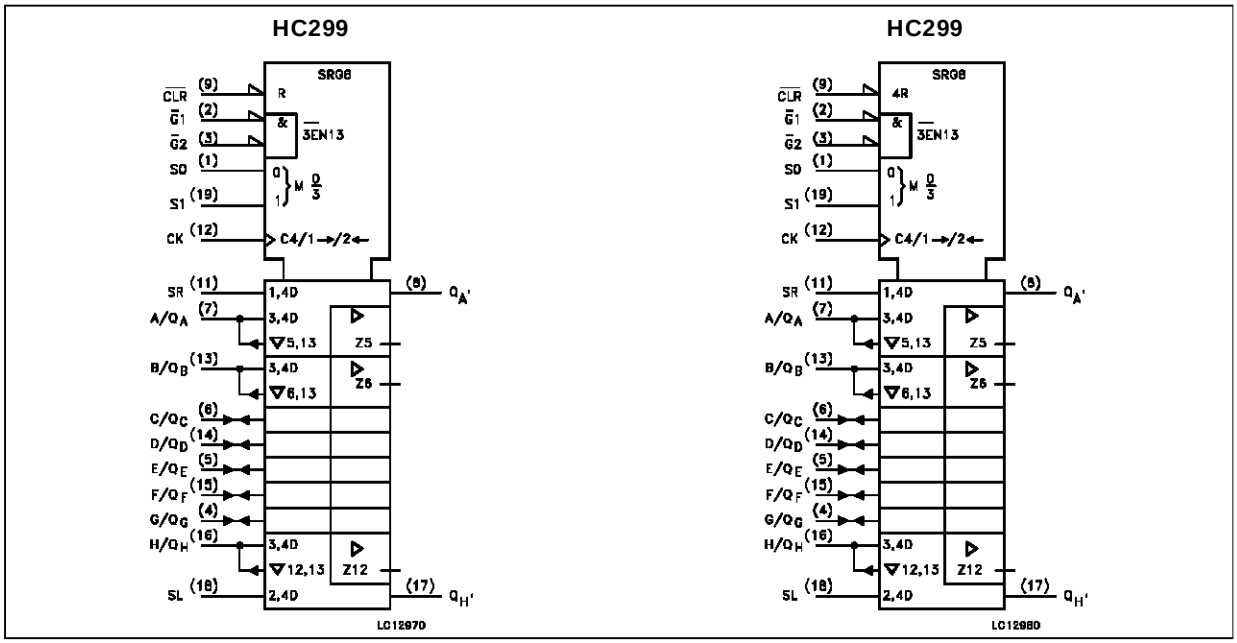
LOGIC DIAGRAM (HC323)



TIMING CHART



IEC LOGIC SYMBOLS



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 19	S0, S1	Mode Select Inputs
2, 3	$\overline{G1}$, $\overline{G2}$	3 State Output Enable Inputs (Active LOW)
7, 13, 6, 14, 5, 15, 4, 16	A/QA to H/QH	Parallel Data Inputs or 3 State Parallel Outputs (Bus Driver)
8, 17	QA' to QH'	Serial Outputs (Standard Output)
9	$\overline{CLEAR}$	Asynchronous Master Reset Input (Active LOW)
11	SR	Serial Data Shift Right Input
12	CLOCK	Clock Input (LOW to HIGH, Edge-triggered)
18	SL	Serial Data Shift Left Input
10	GND	Ground (0V)
20	V_{CC}	Positive Supply Voltage

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 (QA -QH)	± 35	mA
I_O	DC Output Source Sink Current Per Output Pin (QA' -QH')	±235	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	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		
	QA TO QH	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		
	QA' TO QH'	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	
	QA TO QH	4.5		I_O= 6.0 mA		0.17	0.26		0.33		0.40	
		6.0		I_O= 7.8 mA		0.18	0.26		0.33		0.40	
	QA' TO QH'	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_{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		±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)

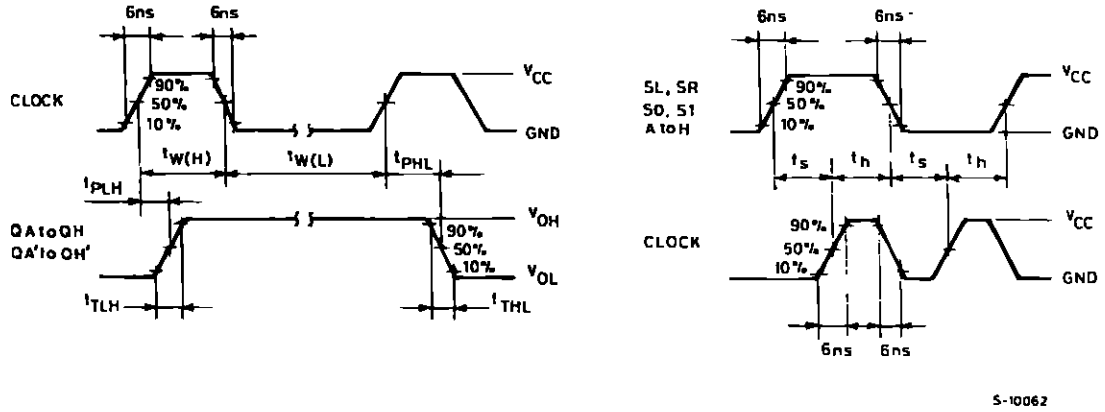
Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)	C_L (pF)		T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{TLH} t_{THL}	Output Transition Time (QA, QH)	2.0	50			25	60		75		90	ns
		4.5				7	12		15		18	
		6.0				6	10		13		15	
t_{TLH} t_{THL}	Output Transition Time (QA', QH')	2.0	50			30	75		95		110	ns
		4.5				8	15		19		22	
		6.0				7	13		16		19	
t_{PLH} t_{PHL}	Propagation Delay Time (CK - QA', QH')	2.0	50			85	170		215		255	ns
		4.5				23	34		43		51	
		6.0				18	29		37		43	
t_{PHL}	Propagation Delay Time (CLR - QA', QH')	2.0	50	for HC299		85	175		220		265	ns
		4.5				24	35		44		53	
		6.0				18	30		37		45	

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

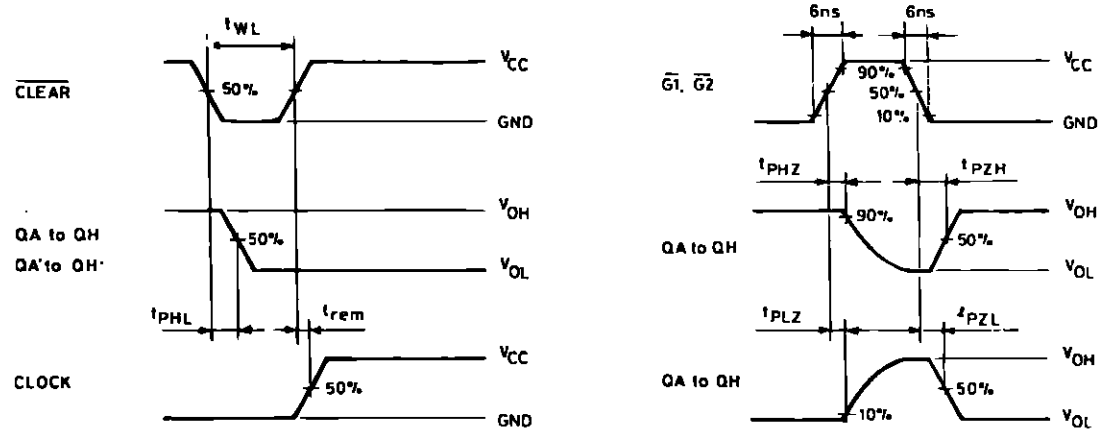
Symbol	Parameter	Test Conditions			Value							Unit
		V_{CC} (V)	C_L (pF)		T_A = 25 °C 54HC and 74HC			-40 to 85 °C 74HC		-55 to 125 °C 54HC		
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay Time (CK - QA, QH)	2.0	50			80	160		200		240	ns
		4.5				21	32		40		48	
		6.0				17	27		34		41	
		2.0	150			100	200		250		300	ns
		4.5				26	40		50		60	
		6.0				21	34		43		51	
t_{PHL}	Propagation Delay Time ($\overline{CLR}$ - QA, QH)	2.0	50	for HC323		85	190		240		285	ns
		4.5				24	38		48		57	
		6.0				18	32		41		48	
		2.0	150	for HC323		105	230		290		345	ns
		4.5				29	46		58		69	
		6.0				22	39		49		59	
t_{PZL} t_{PZH}	3 State Output Enable Time	2.0	50	R_L = 1 KΩ		60	130		165		195	ns
		4.5				17	26		33		39	
		6.0				13	22		28		33	
		2.0	150	R_L = 1 KΩ		78	170		15		255	ns
		4.5				23	34		43		51	
		6.0				17	29		37		43	
t_{PLZ} t_{PHZ}	3 State Output Disable Time	2.0	50	R_L = 1 KΩ		54	150		190		225	ns
		4.5				19	30		38		45	
		6.0				16	26		32		38	
f_{MAX}	Maximum Clock Frequency	2.0	50		6	12		4.8		4		ns
		4.5			30	58		24		20		
		6.0			35	80		28		24		
$t_{W(L)}$ $t_{W(H)}$	Minimum Pulse Width (CLOCK)	2.0	50				75		95		110	ns
		4.5					15		19		22	
		6.0					13		16		19	
$t_{W(L)}$	Minimum Pulse Width ($\overline{CLEAR}$)	2.0	50	for HC299			75		95		110	ns
		4.5					15		19		22	
		6.0					13		16		19	
t_s	Minimum Set-up Time (S0, S1) ($\overline{SL}$, $\overline{SR}$, A H) (CLEAR for 323)	2.0	50				100		125		150	ns
		4.5					20		25		30	
		6.0					17		21		26	
t_h	Minimum Hold Time (S0, S1) ($\overline{SL}$, $\overline{SR}$, A H) (CLEAR for 323)	2.0	50				0		0		0	ns
		4.5					0		0		0	
		6.0					0		0		0	
t_{REM}	Minimum Removal Time ($\overline{CLEAR}$)	2.0	50	for HC299			50		65		75	ns
		4.5					10		13		15	
		6.0					9		11		13	
C_{IN}	Input Capacitance					5	10		10		10	pF
C_{PD} (*)	Power Dissipation Capacitance					170						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. $I_{CC}(opr) = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$

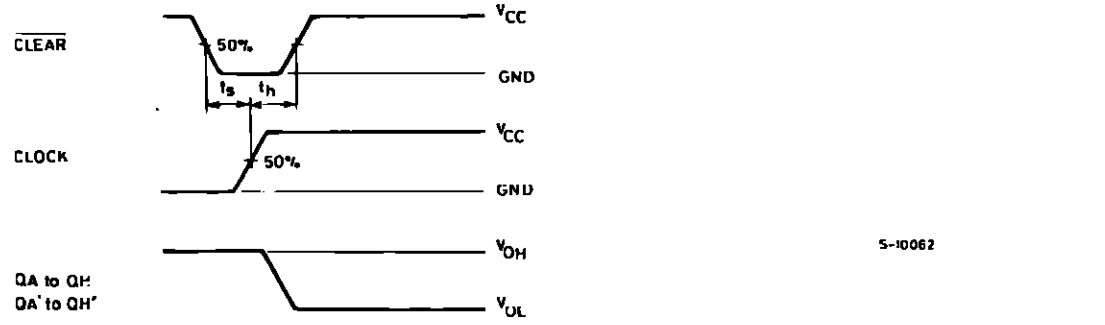
SWITCHING CHARACTERISTICS TEST WAVEFORM



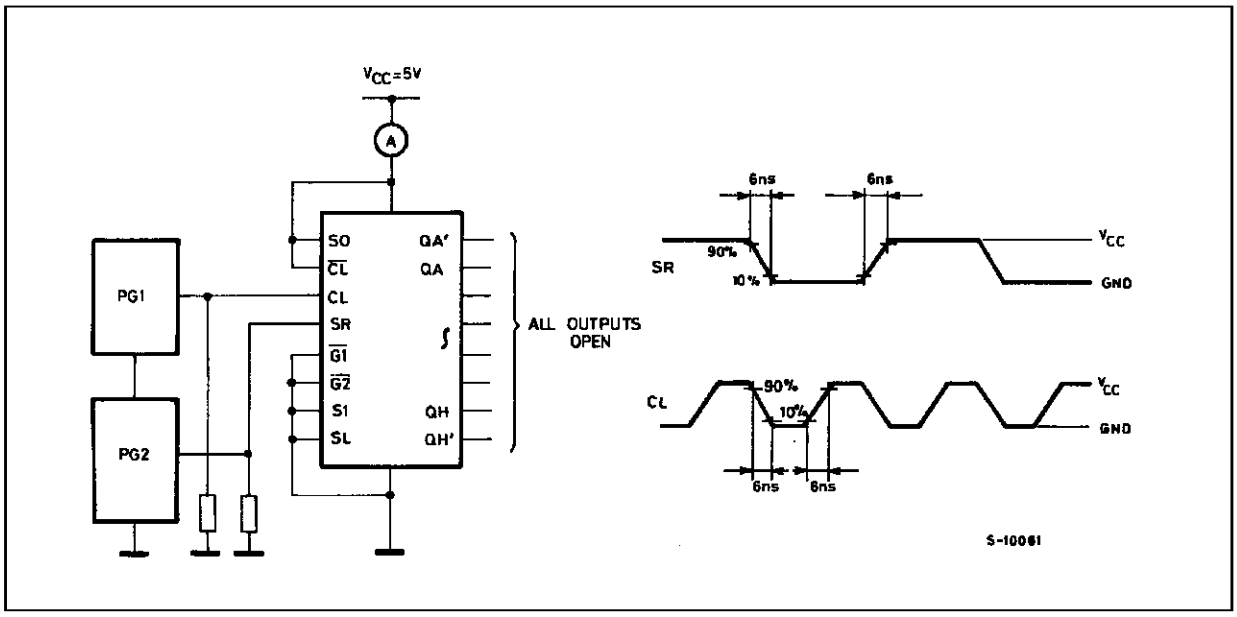
HC299



HC323

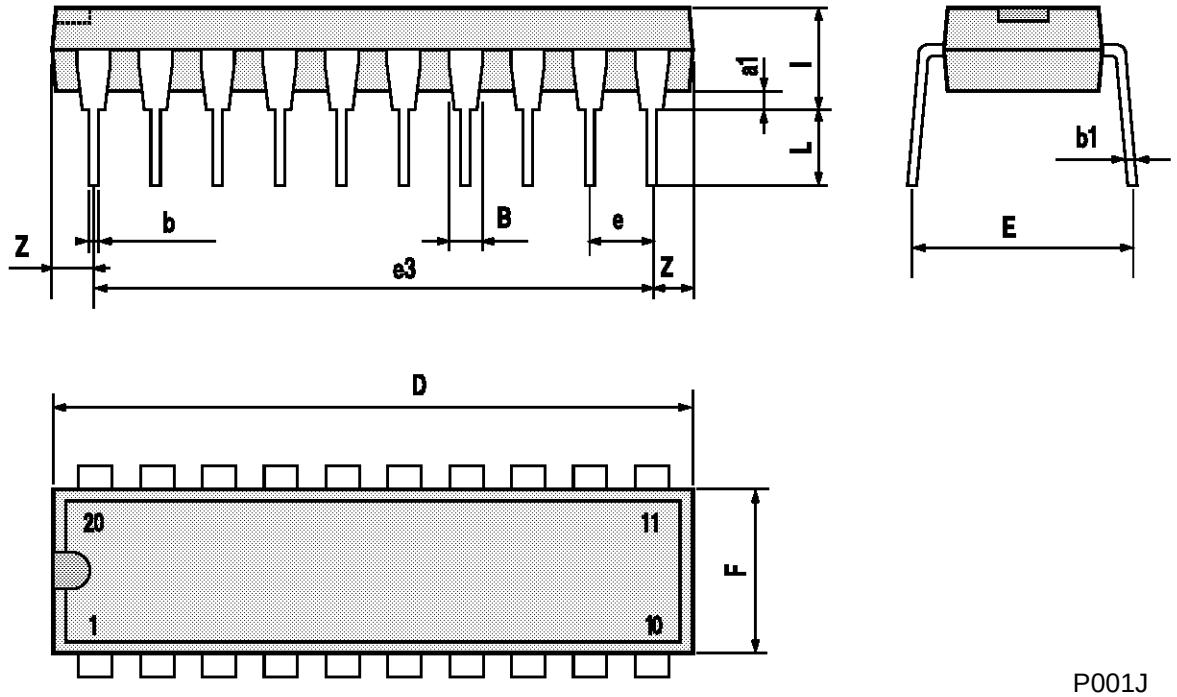


TEST CIRCUIT I_{CC} (Opr.)



Plastic DIP20 (0.25) MECHANICAL DATA

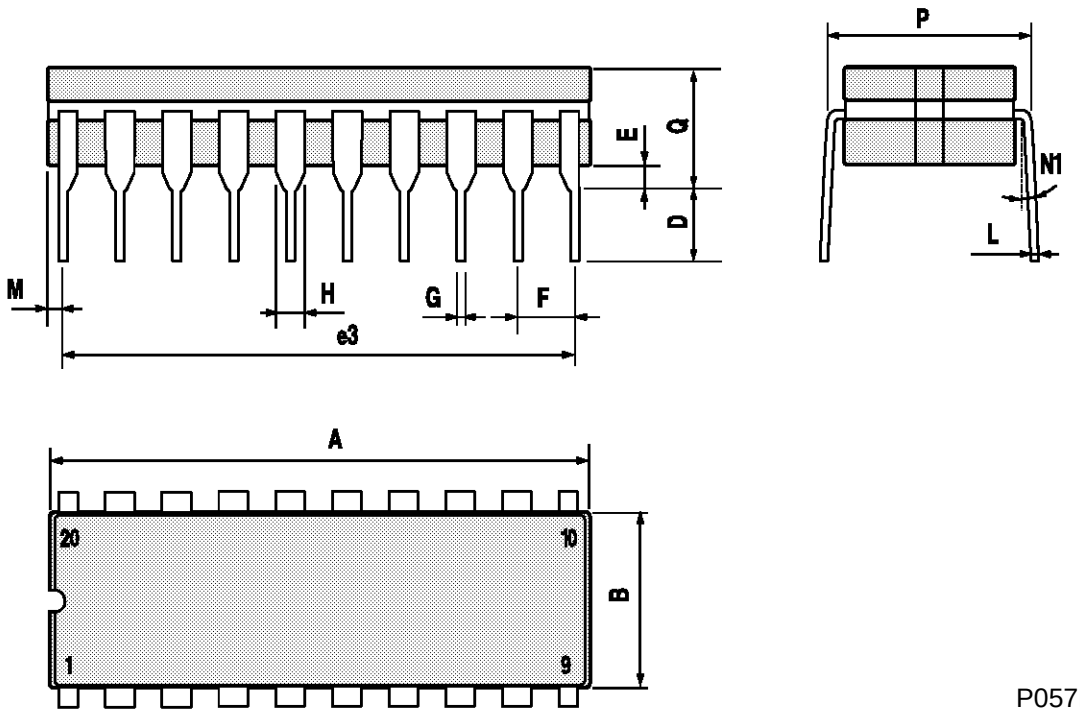
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053



P001J

Ceramic DIP20 MECHANICAL DATA

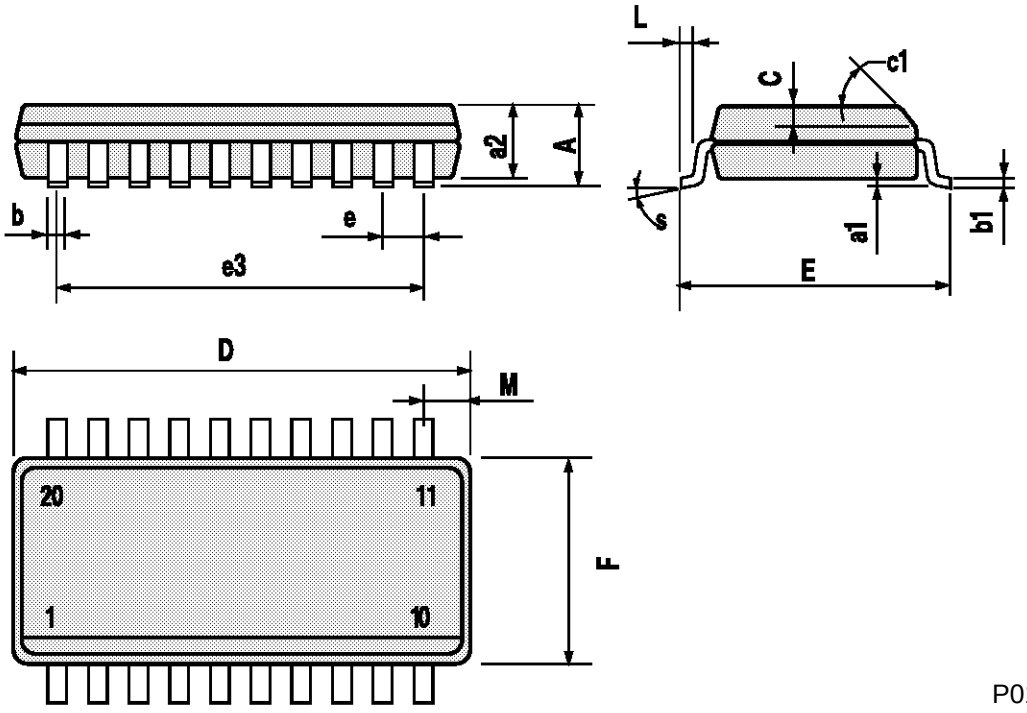
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			25			0.984
B			7.8			0.307
D		3.3			0.130	
E	0.5		1.78	0.020		0.070
e3		22.86			0.900	
F	2.29		2.79	0.090		0.110
G	0.4		0.55	0.016		0.022
I	1.27		1.52	0.050		0.060
L	0.22		0.31	0.009		0.012
M	0.51		1.27	0.020		0.050
N1	4° (min.), 15° (max.)					
P	7.9		8.13	0.311		0.320
Q			5.71			0.225



P057H

SO20 MECHANICAL DATA

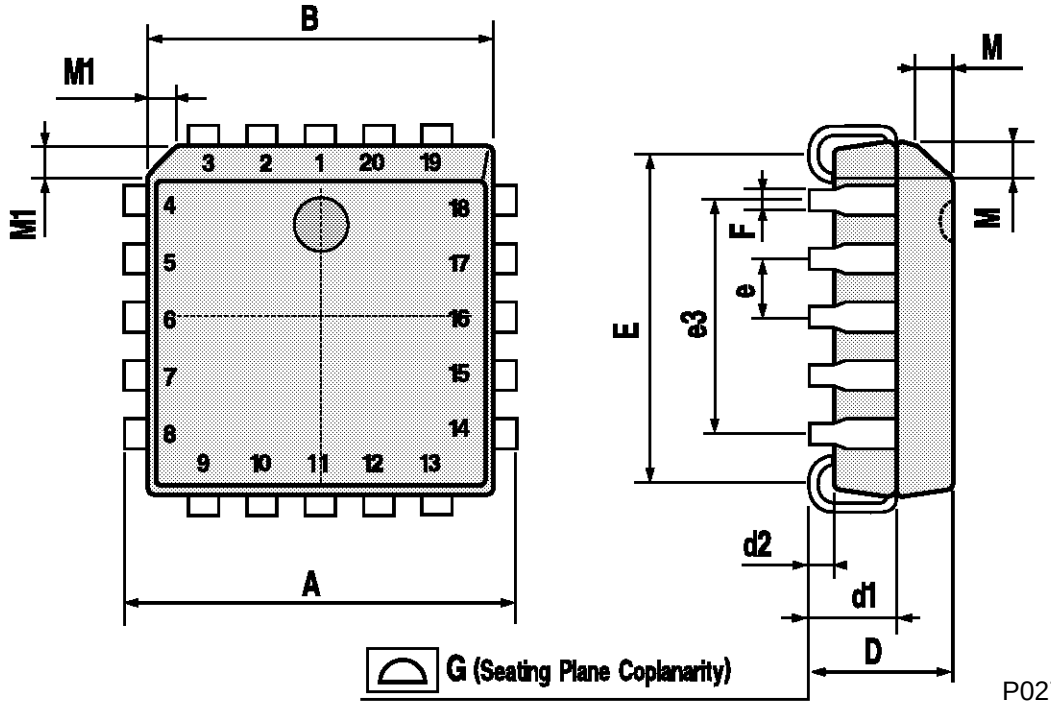
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.10		0.20	0.004		0.007
a2			2.45			0.096
b	0.35		0.49	0.013		0.019
b1	0.23		0.32	0.009		0.012
C		0.50			0.020	
c1	45° (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.299
L	0.50		1.27	0.19		0.050
M			0.75			0.029
S	8° (max.)					



P013L

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

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