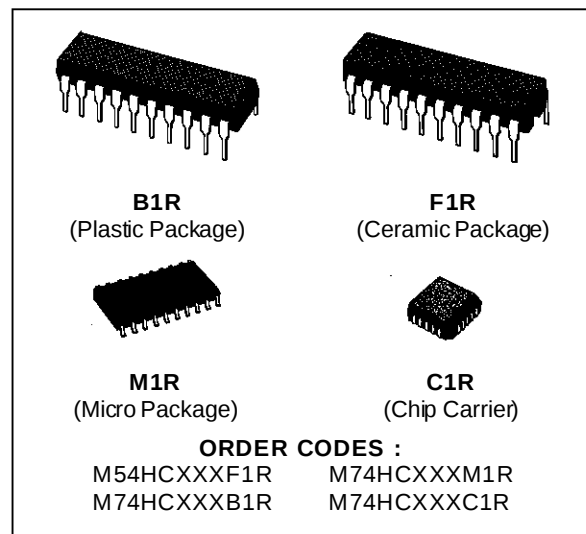


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**HC299 8 BIT PIPO SHIFT REGISTER WITH ASYNCHRONOUS CLEAR**  
**HC323 8 BIT PIPO SHIFT REGISTER WITH SYNCHRONOUS CLEAR**


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- **HIGH SPEED**  
 $f_{MAX} = 42 \text{ MHz (TYP.) AT } V_{CC} = 5V$
- **LOW POWER DISSIPATION**  
 $I_{CC} = 4 \mu A \text{ (MAX.) AT } T_A = 25^\circ C$
- **HIGH NOISE IMMUNITY**  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- **OUTPUT DRIVE CAPABILITY**  
 10 LSTTL LOADS FOR QA' TO QH'  
 15 LSTTL LOADS FOR QA TO QH
- **SYMMETRICAL OUTPUT IMPEDANCE**  
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.) FOR } Q_A, \text{ TO } Q_H,$   
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.) FOR } Q_A, \text{ TO } Q_H$
- **BALANCED PROPAGATION DELAYS**  
 $t_{PLH} = t_{PHL}$
- **WIDE OPERATING VOLTAGE RANGE**  
 $V_{CC} \text{ (OPR)} = 2 \text{ V TO } 6 \text{ V}$
- **PIN AND FUNCTION COMPATIBLE**  
 WITH 54/74LS299



### DESCRIPTION

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

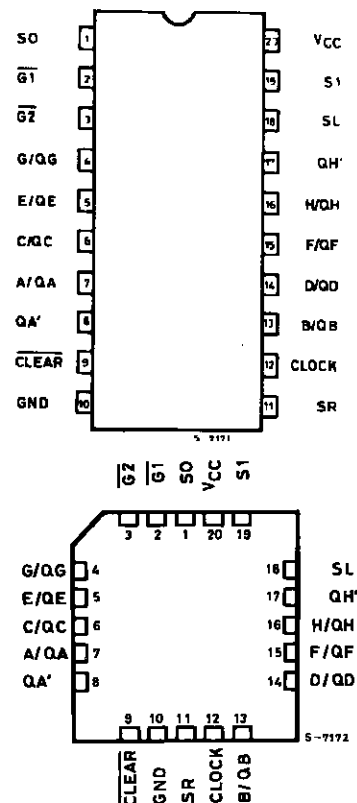
They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power consumption.

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.

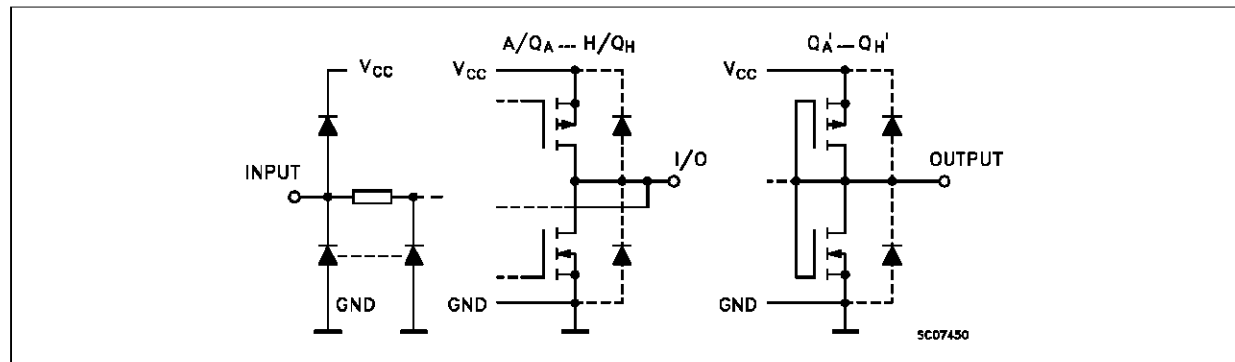
Clear function on the HC299 is asynchronous to CLOCK, while the HC323 is cleared synchronous to clock.

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

### PIN CONNECTIONS (top view)



# INPUT AND OUTPUT EQUIVALENT CIRCUIT



# TRUTH TABLE

| MODE           | INPUTS |                      |    |                   |      |       |       | INPUTS/OUTPUTS |    |      |      | OUTPUTS |     |
|----------------|--------|----------------------|----|-------------------|------|-------|-------|----------------|----|------|------|---------|-----|
|                | CLEAR  | FUNCTION<br>SELECTED |    | OUTPUT<br>CONTROL |      | CLOCK |       | SERIAL         |    | A/QA | H/QH | QA'     | QH' |
|                |        | S1                   | S0 | G1 *              | 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<br>RIGHT | H      | L                    | H  | L                 | L    |       |       | X              | H  | H    | QGn  | H       | QGn |
|                | H      | L                    | H  | L                 | L    |       |       | X              | L  | L    | QGn  | L       | QGn |
| SHIFT<br>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.

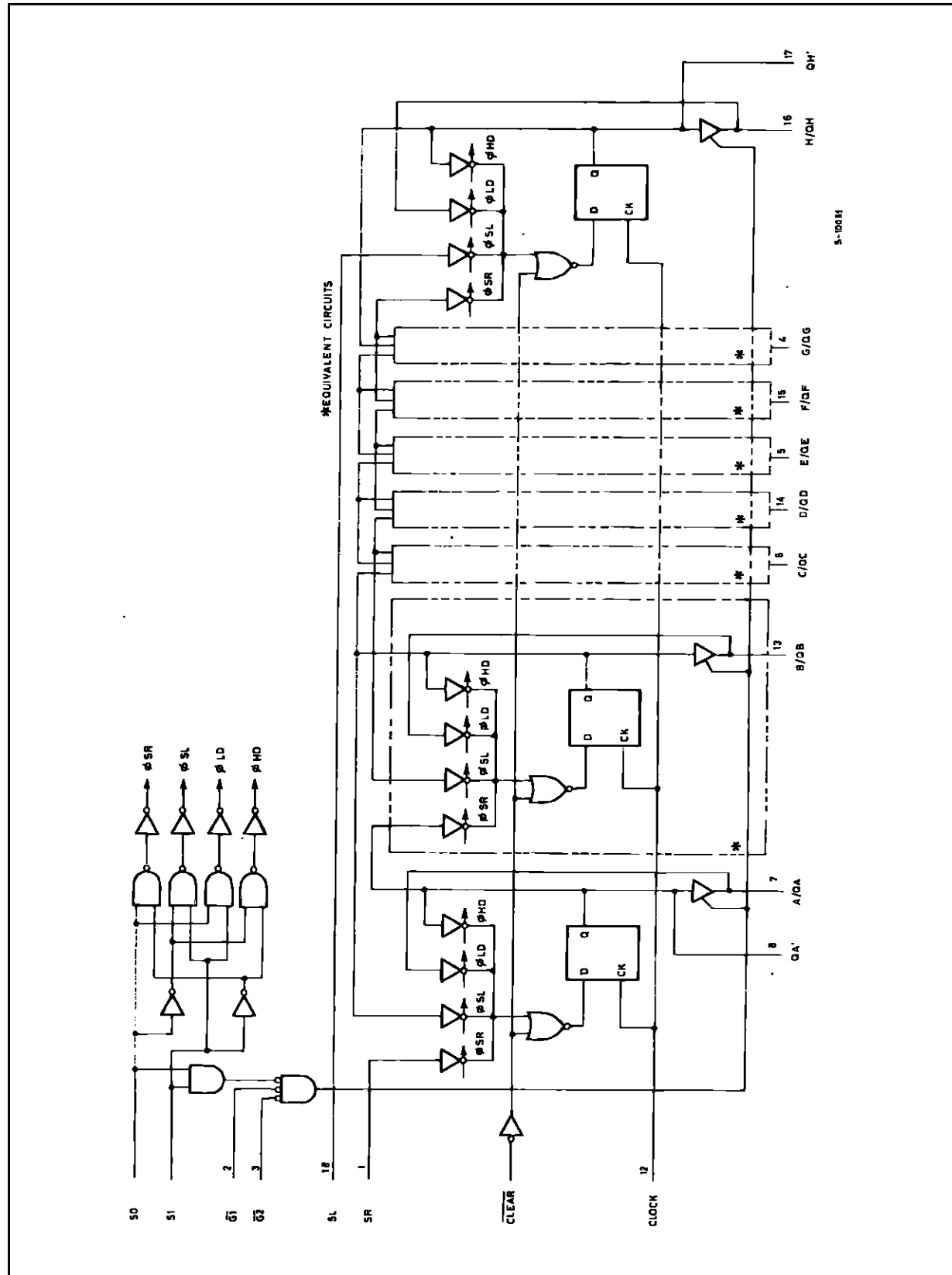
Qnn : THE LEVEL ON Qn BEFORE THE MOST RECENT ACTIVE TRANSITION INDICATED BY OR

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

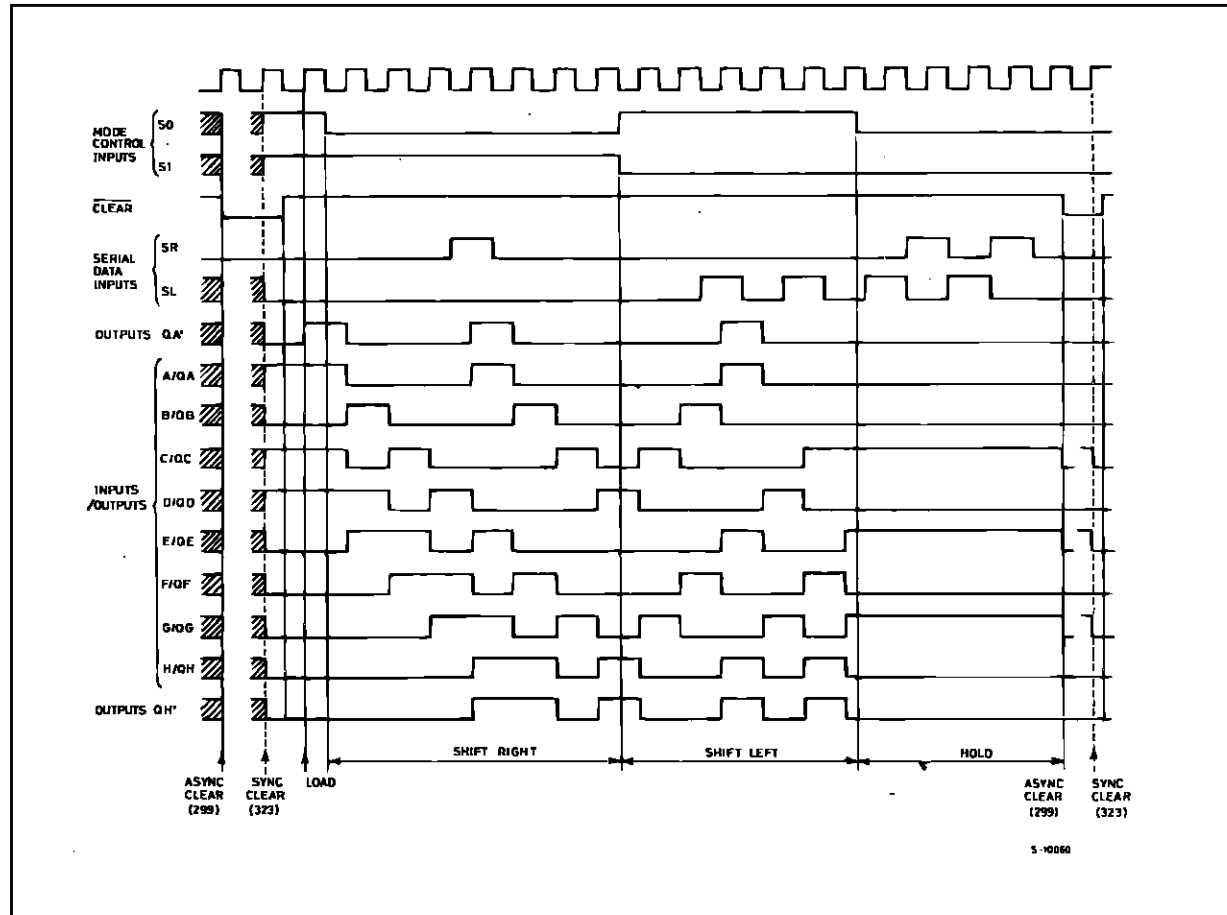
X : DON'T CARE



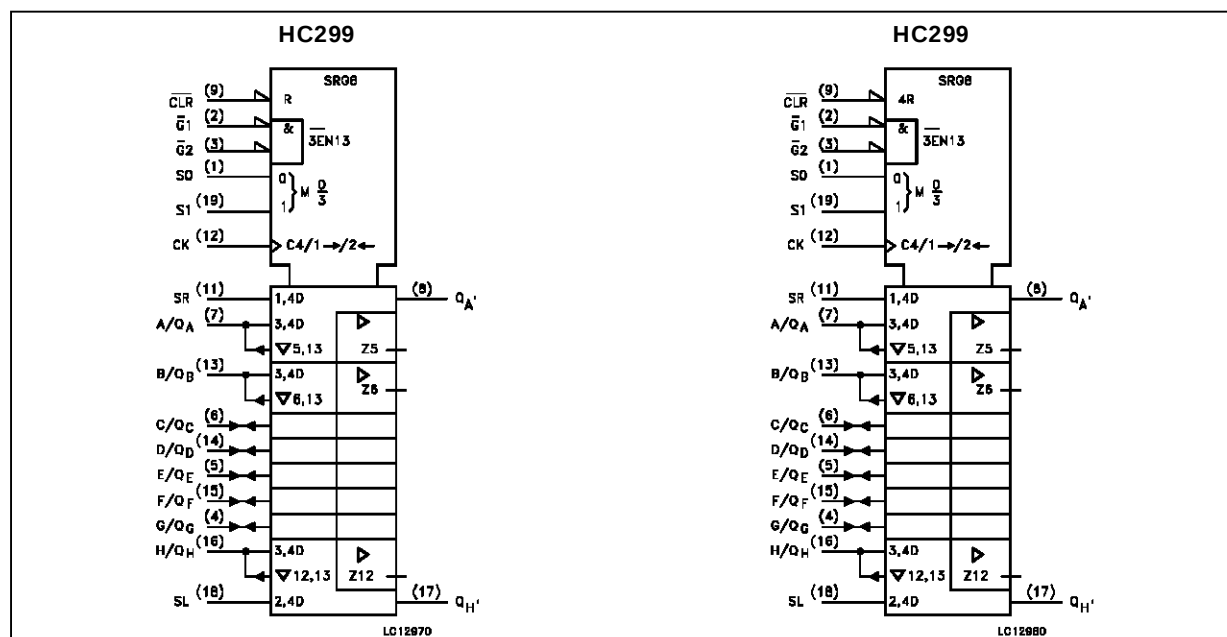
## LOGIC DIAGRAM (HC323)



## 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 <sub>CC</sub>                   | Positive Supply Voltage                                       |

**ABSOLUTE MAXIMUM RATINGS**

| Symbol                              | Parameter                                               | Value                         | Unit |
|-------------------------------------|---------------------------------------------------------|-------------------------------|------|
| V <sub>CC</sub>                     | Supply Voltage                                          | -0.5 to +7                    | V    |
| V <sub>I</sub>                      | DC Input Voltage                                        | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| V <sub>O</sub>                      | DC Output Voltage                                       | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>                     | DC Input Diode Current                                  | ± 20                          | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current                                 | ± 20                          | mA   |
| I <sub>O</sub>                      | DC Output Source Sink Current Per Output Pin (QA -QH)   | ± 35                          | mA   |
| I <sub>O</sub>                      | DC Output Source Sink Current Per Output Pin (QA' -QH') | ±235                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current                    | ± 70                          | mA   |
| P <sub>D</sub>                      | Power Dissipation                                       | 500 (*)                       | mW   |
| T <sub>stg</sub>                    | Storage Temperature                                     | -65 to +150                   | °C   |
| T <sub>L</sub>                      | 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 <sub>CC</sub>                 | Supply Voltage                                                    | 2 to 6                                                                    | V                                 |
| V <sub>I</sub>                  | Input Voltage                                                     | 0 to V <sub>CC</sub>                                                      | V                                 |
| V <sub>O</sub>                  | Output Voltage                                                    | 0 to V <sub>CC</sub>                                                      | V                                 |
| T <sub>op</sub>                 | Operating Temperature: <b>M54HC Series</b><br><b>M74HC Series</b> | -55 to +125<br>-40 to +85                                                 | °C<br>°C                          |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time                                          | V <sub>CC</sub> = 2 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6 V | 0 to 1000<br>0 to 500<br>0 to 400 |
|                                 |                                                                   |                                                                           | ns                                |

## DC SPECIFICATIONS

| Symbol          | Parameter                        | Test Conditions        |                                                                                                |                         | Value                                   |      |      |                      |      |                       | Unit |      |  |
|-----------------|----------------------------------|------------------------|------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------|------|------|----------------------|------|-----------------------|------|------|--|
|                 |                                  | V <sub>CC</sub><br>(V) |                                                                                                |                         | T <sub>A</sub> = 25 °C<br>54HC and 74HC |      |      | -40 to 85 °C<br>74HC |      | -55 to 125 °C<br>54HC |      |      |  |
|                 |                                  |                        |                                                                                                |                         | Min.                                    | Typ. | Max. | Min.                 | Max. | Min.                  |      | Max. |  |
| V <sub>IH</sub> | 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 <sub>IL</sub> | 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 <sub>OH</sub> | High Level Output Voltage        | 2.0                    | V <sub>I</sub> =<br>V <sub>IH</sub><br>or<br>V <sub>IL</sub>                                   | I <sub>O</sub> =-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 <sub>O</sub> =-6.0 mA | 4.18                                    | 4.31 |      | 4.13                 |      | 4.10                  |      |      |  |
|                 |                                  | 6.0                    |                                                                                                | I <sub>O</sub> =-7.8 mA | 5.68                                    | 5.8  |      | 5.63                 |      | 5.60                  |      |      |  |
|                 | QA' TO QH'                       | 4.5                    |                                                                                                | I <sub>O</sub> =-4.0 mA | 4.18                                    | 4.31 |      | 4.13                 |      | 4.10                  |      |      |  |
|                 |                                  | 6.0                    |                                                                                                | I <sub>O</sub> =-5.2 mA | 5.68                                    | 5.8  |      | 5.63                 |      | 5.60                  |      |      |  |
| V <sub>OL</sub> | Low Level Output Voltage         | 2.0                    | V <sub>I</sub> =<br>V <sub>IH</sub><br>or<br>V <sub>IL</sub>                                   | I <sub>O</sub> = 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 <sub>O</sub> = 6.0 mA |                                         | 0.17 | 0.26 |                      | 0.33 |                       | 0.40 |      |  |
|                 |                                  | 6.0                    |                                                                                                | I <sub>O</sub> = 7.8 mA |                                         | 0.18 | 0.26 |                      | 0.33 |                       | 0.40 |      |  |
|                 | QA' TO QH'                       | 4.5                    |                                                                                                | I <sub>O</sub> = 4.0 mA |                                         | 0.17 | 0.26 |                      | 0.33 |                       | 0.40 |      |  |
|                 |                                  | 6.0                    |                                                                                                | I <sub>O</sub> = 5.2 mA |                                         | 0.18 | 0.26 |                      | 0.33 |                       | 0.40 |      |  |
| I <sub>I</sub>  | Input Leakage Current            | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                         |                                         |      | ±0.1 |                      | ±1   |                       | ±1   | µA   |  |
| I <sub>OZ</sub> | 3 State Output Off-state Current | 6.0                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND |                         |                                         |      | ±0.5 |                      | ±5   |                       | ±10  | µA   |  |
| I <sub>CC</sub> | Quiescent Supply Current         | 6.0                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                        |                         |                                         |      | 4    |                      | 40   |                       | 80   | µA   |  |

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

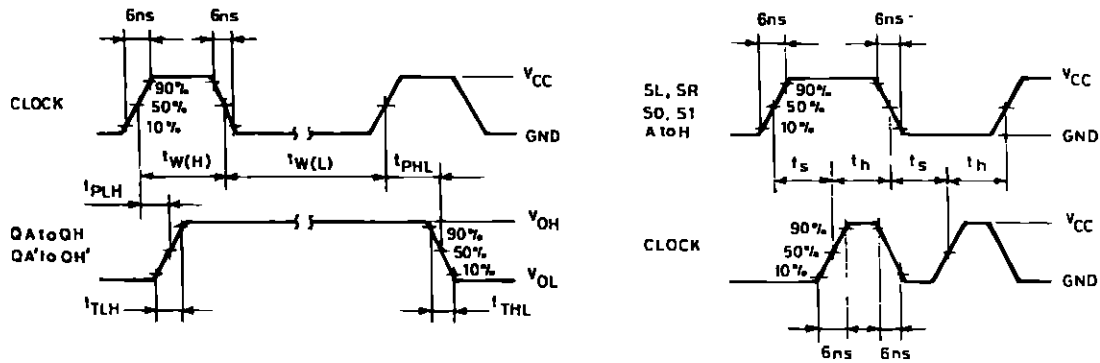
| Symbol                               | Parameter                                  | Test Conditions        |                        |           | Value                                   |      |      |                      |      |                       | Unit |      |
|--------------------------------------|--------------------------------------------|------------------------|------------------------|-----------|-----------------------------------------|------|------|----------------------|------|-----------------------|------|------|
|                                      |                                            | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |           | T <sub>A</sub> = 25 °C<br>54HC and 74HC |      |      | -40 to 85 °C<br>74HC |      | -55 to 125 °C<br>54HC |      |      |
|                                      |                                            |                        |                        |           | Min.                                    | Typ. | Max. | Min.                 | Max. | Min.                  |      | Max. |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time<br>(QA, QH)         | 2.0                    | 50                     |           |                                         | 25   | 60   |                      | 75   |                       | 90   | ns   |
|                                      |                                            | 4.5                    |                        |           |                                         | 7    | 12   |                      | 15   |                       | 18   |      |
|                                      |                                            | 6.0                    |                        |           |                                         | 6    | 10   |                      | 13   |                       | 15   |      |
| t <sub>TLH</sub><br>t <sub>THL</sub> | Output Transition Time<br>(QA', QH')       | 2.0                    | 50                     |           |                                         | 30   | 75   |                      | 95   |                       | 110  | ns   |
|                                      |                                            | 4.5                    |                        |           |                                         | 8    | 15   |                      | 19   |                       | 22   |      |
|                                      |                                            | 6.0                    |                        |           |                                         | 7    | 13   |                      | 16   |                       | 19   |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay Time<br>(CK - QA', QH')  | 2.0                    | 50                     |           |                                         | 85   | 170  |                      | 215  |                       | 255  | ns   |
|                                      |                                            | 4.5                    |                        |           |                                         | 23   | 34   |                      | 43   |                       | 51   |      |
|                                      |                                            | 6.0                    |                        |           |                                         | 18   | 29   |                      | 37   |                       | 43   |      |
| t <sub>PHL</sub>                     | Propagation Delay Time<br>(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** ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ )

| Symbol                                 | Parameter                                                        | Test Conditions        |                        |                       | Value                                   |      |      |                      |      |                       | Unit |      |
|----------------------------------------|------------------------------------------------------------------|------------------------|------------------------|-----------------------|-----------------------------------------|------|------|----------------------|------|-----------------------|------|------|
|                                        |                                                                  | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |                       | T <sub>A</sub> = 25 °C<br>54HC and 74HC |      |      | -40 to 85 °C<br>74HC |      | -55 to 125 °C<br>54HC |      |      |
|                                        |                                                                  |                        |                        |                       | Min.                                    | Typ. | Max. | Min.                 | Max. | Min.                  |      | Max. |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay Time<br>(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 <sub>PHL</sub>                       | Propagation Delay Time<br>(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 <sub>PZL</sub><br>t <sub>PZH</sub>   | 3 State Output Enable Time                                       | 2.0                    | 50                     | R <sub>L</sub> = 1 KΩ |                                         | 60   | 130  |                      | 165  |                       | 195  | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         | 17   | 26   |                      | 33   |                       | 39   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         | 13   | 22   |                      | 28   |                       | 33   |      |
|                                        |                                                                  | 2.0                    | 150                    | R <sub>L</sub> = 1 KΩ |                                         | 78   | 170  |                      | 15   |                       | 255  | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         | 23   | 34   |                      | 43   |                       | 51   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         | 17   | 29   |                      | 37   |                       | 43   |      |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub>   | 3 State Output Disable Time                                      | 2.0                    | 50                     | R <sub>L</sub> = 1 KΩ |                                         | 54   | 150  |                      | 190  |                       | 225  | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         | 19   | 30   |                      | 38   |                       | 45   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         | 16   | 26   |                      | 32   |                       | 38   |      |
| f <sub>MAX</sub>                       | 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 <sub>W(L)</sub><br>t <sub>W(H)</sub> | Minimum Pulse Width<br>(CLOCK)                                   | 2.0                    | 50                     |                       |                                         |      | 75   |                      | 95   |                       | 110  | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         |      | 15   |                      | 19   |                       | 22   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         |      | 13   |                      | 16   |                       | 19   |      |
| t <sub>W(L)</sub>                      | Minimum Pulse Width<br>(CLEAR)                                   | 2.0                    | 50                     | for HC299             |                                         |      | 75   |                      | 95   |                       | 110  | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         |      | 15   |                      | 19   |                       | 22   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         |      | 13   |                      | 16   |                       | 19   |      |
| t <sub>S</sub>                         | Minimum Set-up Time (S0, S1)<br>(SL, SR, A H)<br>(CLEAR for 323) | 2.0                    | 50                     |                       |                                         |      | 100  |                      | 125  |                       | 150  | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         |      | 20   |                      | 25   |                       | 30   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         |      | 17   |                      | 21   |                       | 26   |      |
| t <sub>H</sub>                         | Minimum Hold Time (S0, S1)<br>(SL, SR, A H)<br>(CLEAR for 323)   | 2.0                    | 50                     |                       |                                         |      | 0    |                      | 0    |                       | 0    | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         |      | 0    |                      | 0    |                       | 0    |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         |      | 0    |                      | 0    |                       | 0    |      |
| t <sub>REM</sub>                       | Minimum Removal Time<br>(CLEAR)                                  | 2.0                    | 50                     | for HC299             |                                         |      | 50   |                      | 65   |                       | 75   | ns   |
|                                        |                                                                  | 4.5                    |                        |                       |                                         |      | 10   |                      | 13   |                       | 15   |      |
|                                        |                                                                  | 6.0                    |                        |                       |                                         |      | 9    |                      | 11   |                       | 13   |      |
| C <sub>IN</sub>                        | Input Capacitance                                                |                        |                        |                       |                                         | 5    | 10   |                      | 10   |                       | 10   | pF   |
| C <sub>PD</sub> (*)                    | Power Dissipation Capacitance                                    |                        |                        |                       |                                         | 170  |      |                      |      |                       |      | pF   |

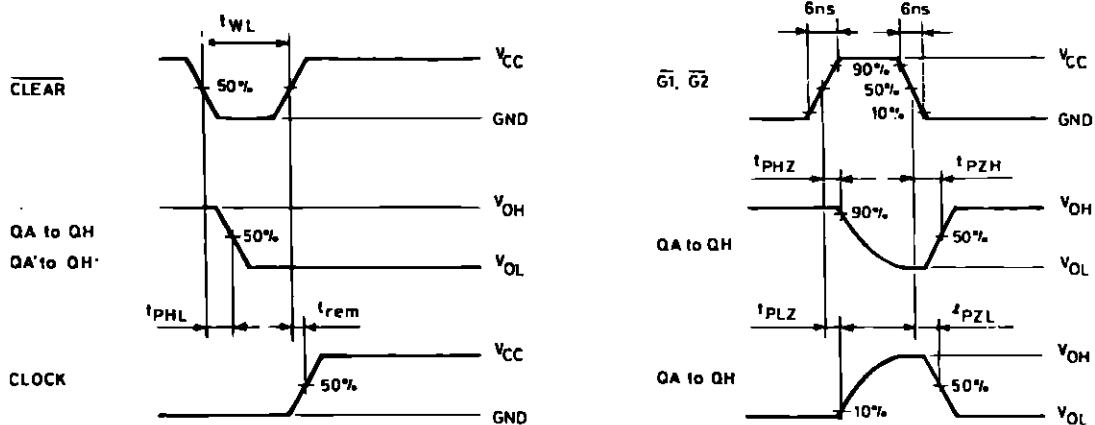
(\*)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$

## SWITCHING CHARACTERISTICS TEST WAVEFORM

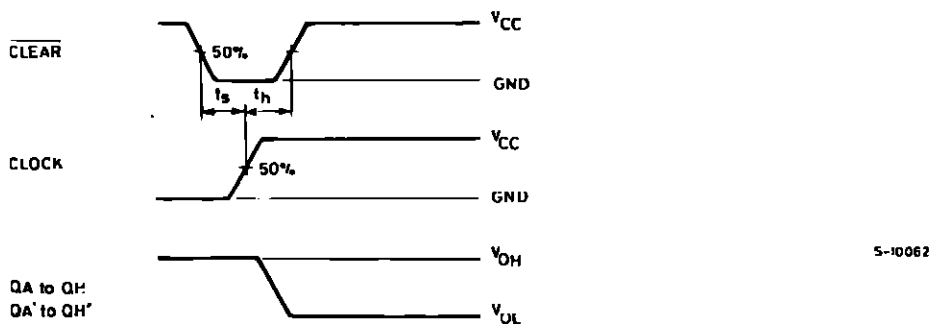


S-10062

## HC299

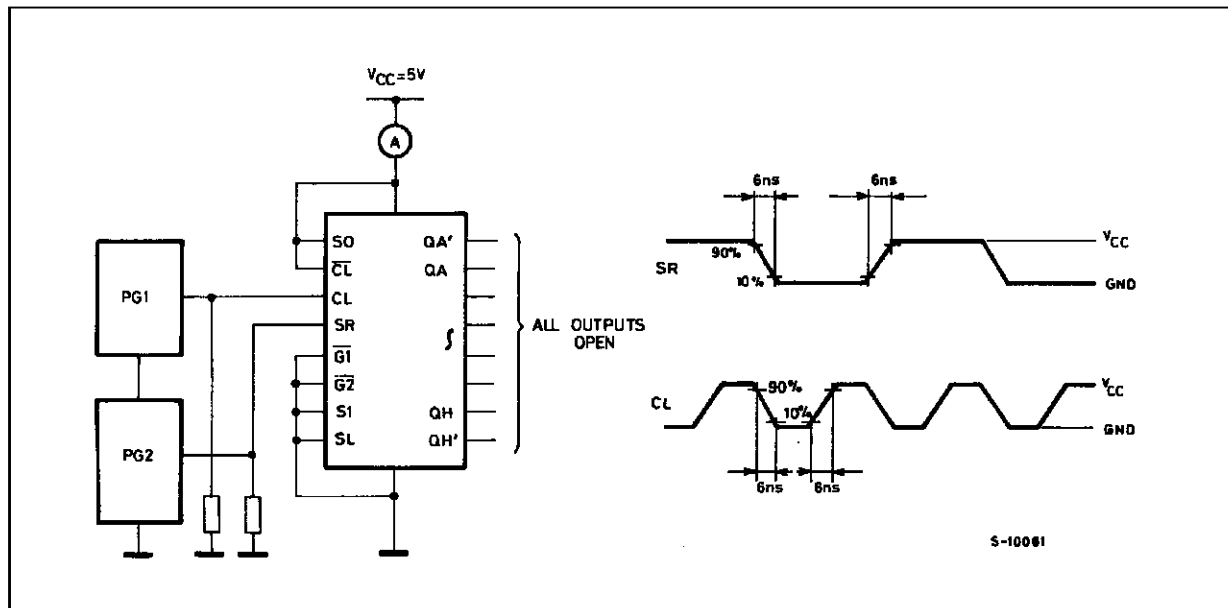


## HC323



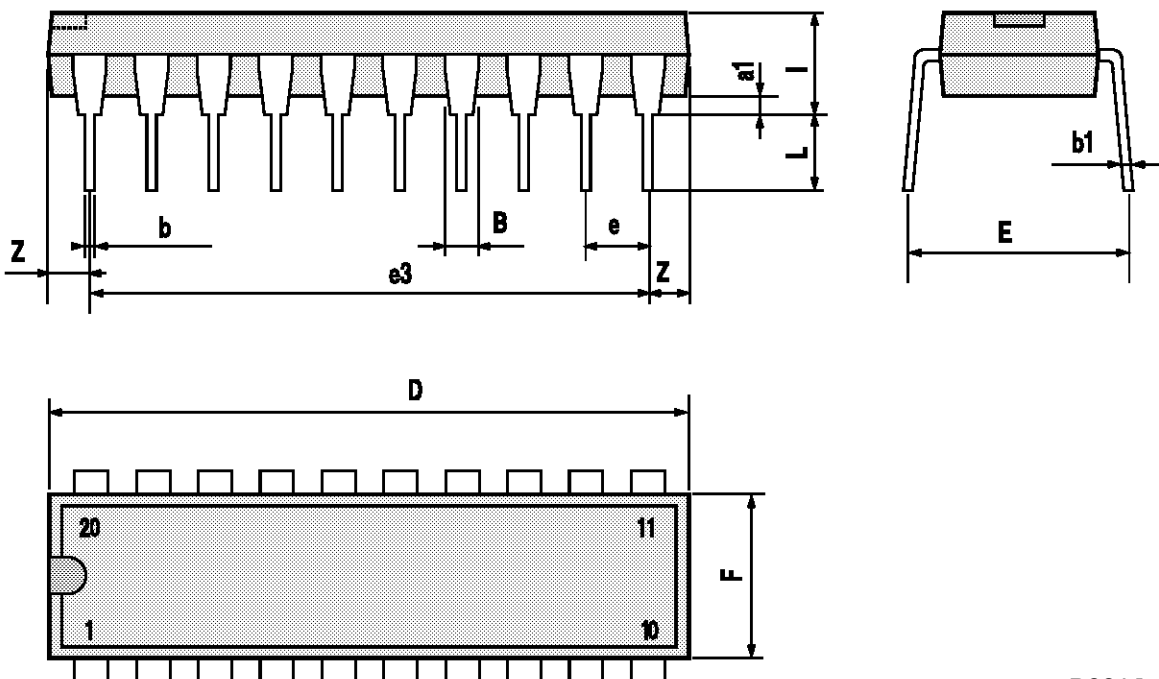
S-10062

TEST CIRCUIT  $I_{CC}$  (Opr.)



## Plastic DIP20 (0.25) MECHANICAL DATA

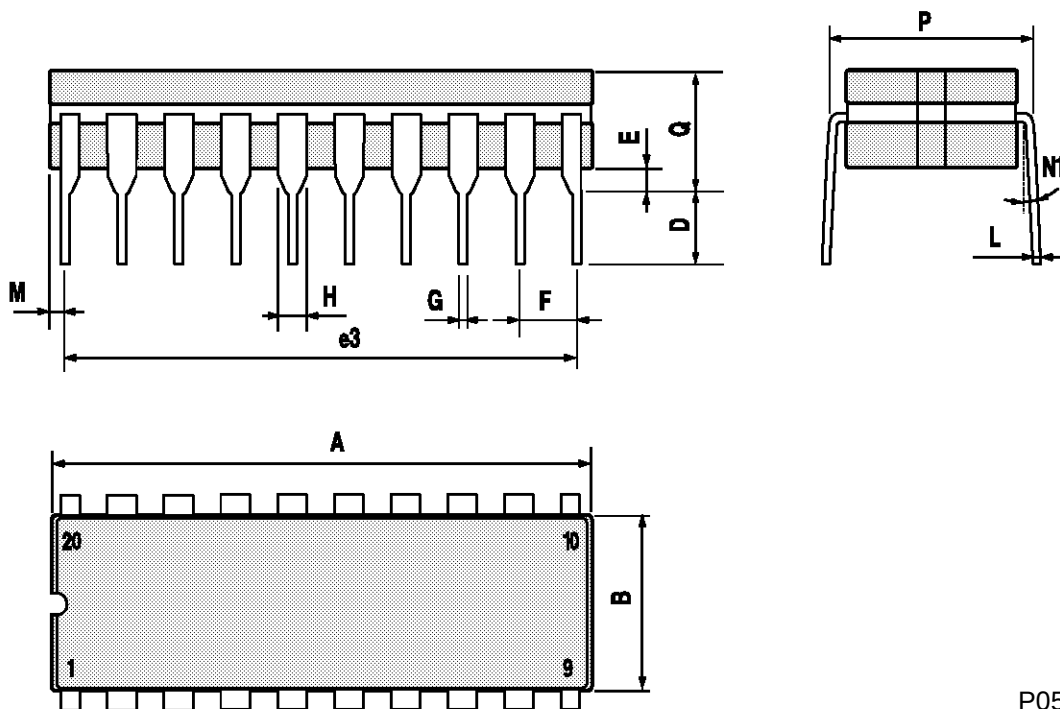
| DIM. | mm    |       |      | inch  |       |       |
|------|-------|-------|------|-------|-------|-------|
|      | MIN.  | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.254 |       |      | 0.010 |       |       |
| B    | 1.39  |       | 1.65 | 0.055 |       | 0.065 |
| b    |       | 0.45  |      |       | 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

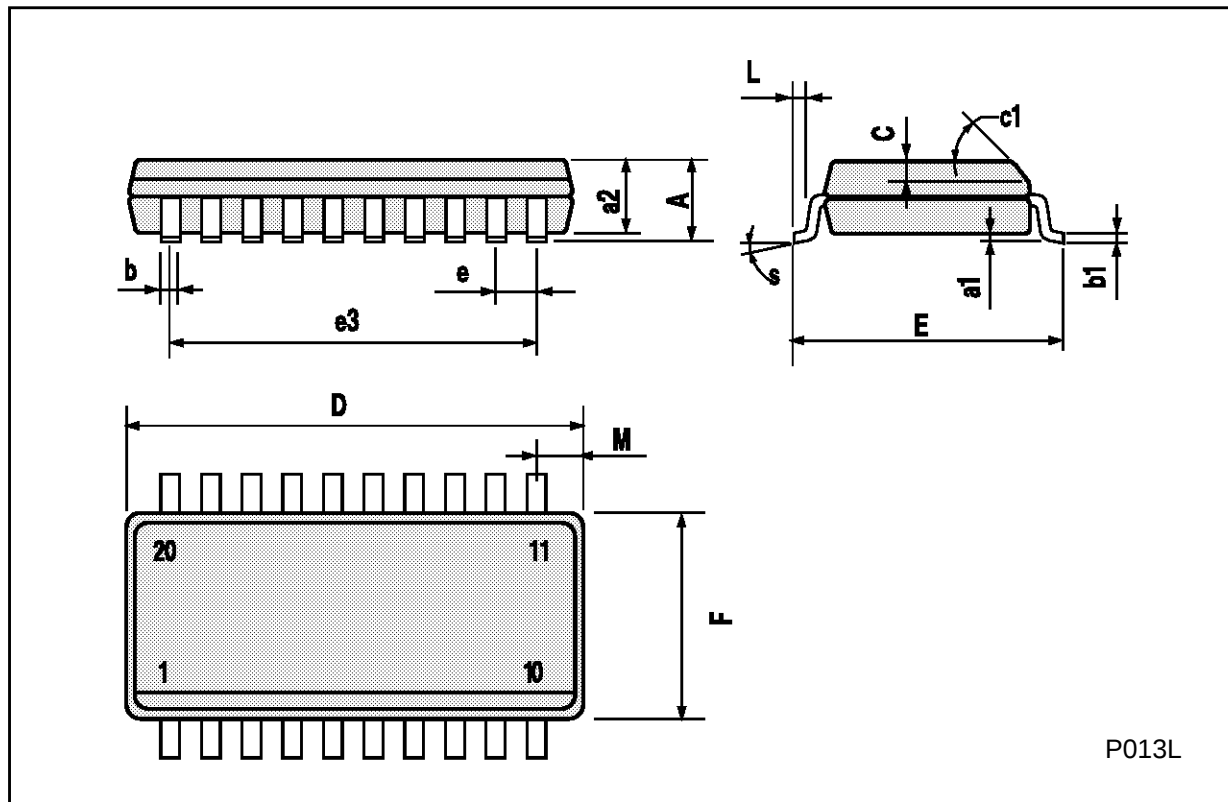
| DIM. | mm                    |       |      | inch  |       |       |
|------|-----------------------|-------|------|-------|-------|-------|
|      | MIN.                  | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |                       |       | 25   |       |       | 0.984 |
| B    |                       |       | 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

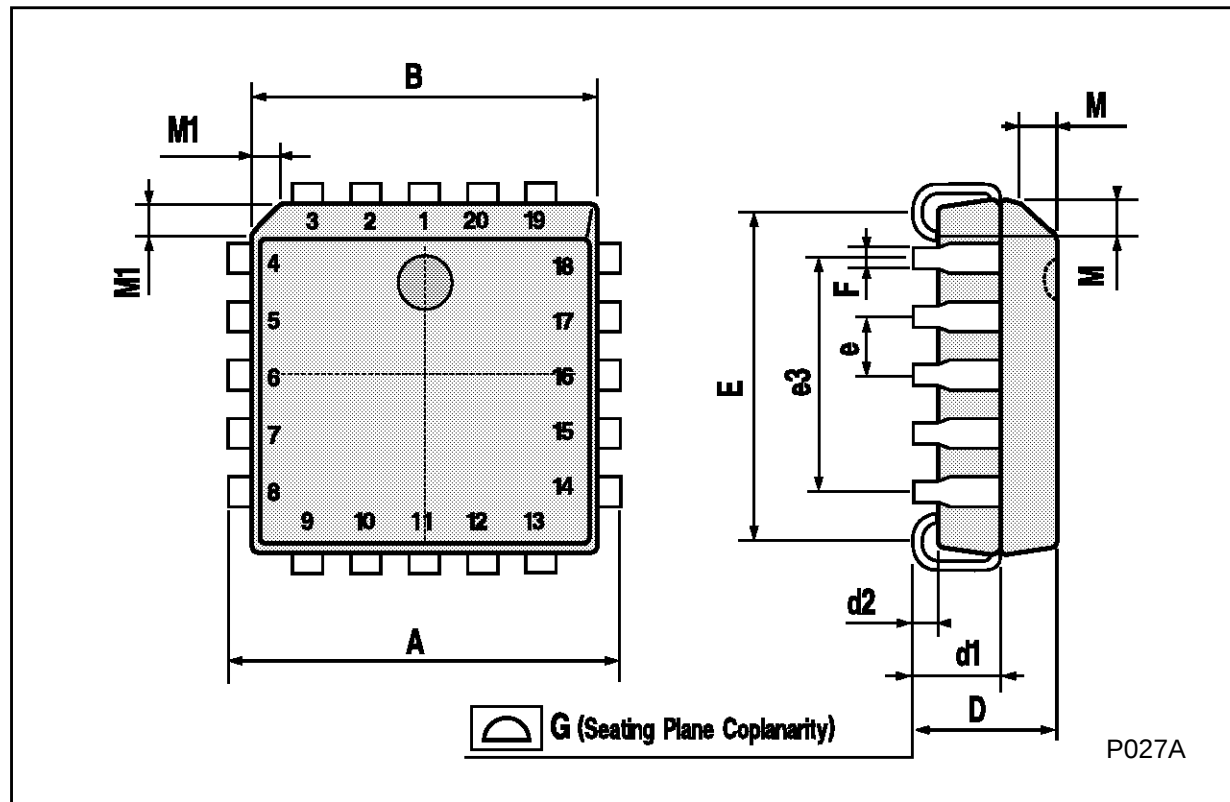
## SO20 MECHANICAL DATA

| 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.)  |       |       |       |       |       |



## 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 |       |



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