

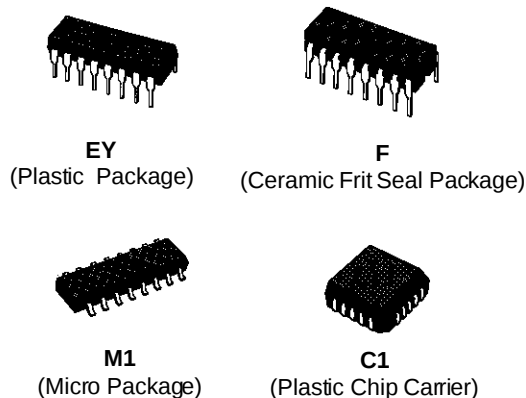
## 8-STAGE SHIFT-AND-STORE BUS REGISTER

- 3-STATE PARALLEL OUTPUTS FOR CONNECTION TO COMMON BUS
- SEPARATE SERIAL OUTPUTS SYNCHRONOUS TO BOTH POSITIVE AND NEGATIVE CLOCK EDGES FOR CASCADING
- MEDIUM SPEED OPERATION 5MHz AT 10V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N°. 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

### DESCRIPTION

The **HCC4094B** (extended temperature range) and **HCF4094B** (intermediate temperature range) are monolithic integrated circuits available in 16-lead dual in-line plastic or ceramic package and plastic micropackage.

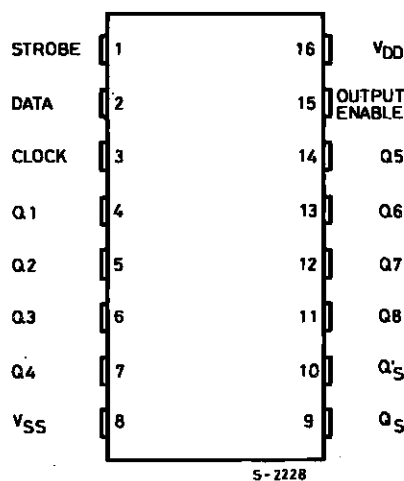
The **HCC/HCF4094B** is an 8-stage serial shift register having a storage latch associated with each stage for strobing data from the serial input to parallel buffered 3-state outputs. The parallel outputs may be connected directly to common bus lines. Data is shifted on positive clock transitions. The data in each shift register stage is transferred to the storage register when the STROBE input is high. Data in the storage register appears at the outputs whenever the OUTPUT-ENABLE signal is high. Two serial outputs are available for cascading a number of **HCC/HCF4094B** devices. Data is available at the  $Q_S$  serial output terminal on positive clock edges to allow for high-speed operation in cascaded systems in which the clock rise time is fast. The same serial information, available at the  $Q'_S$  terminal on the next negative clock edge, provides a means for cascading **HCC/HCF4094B** devices when the clock rise time is slow.



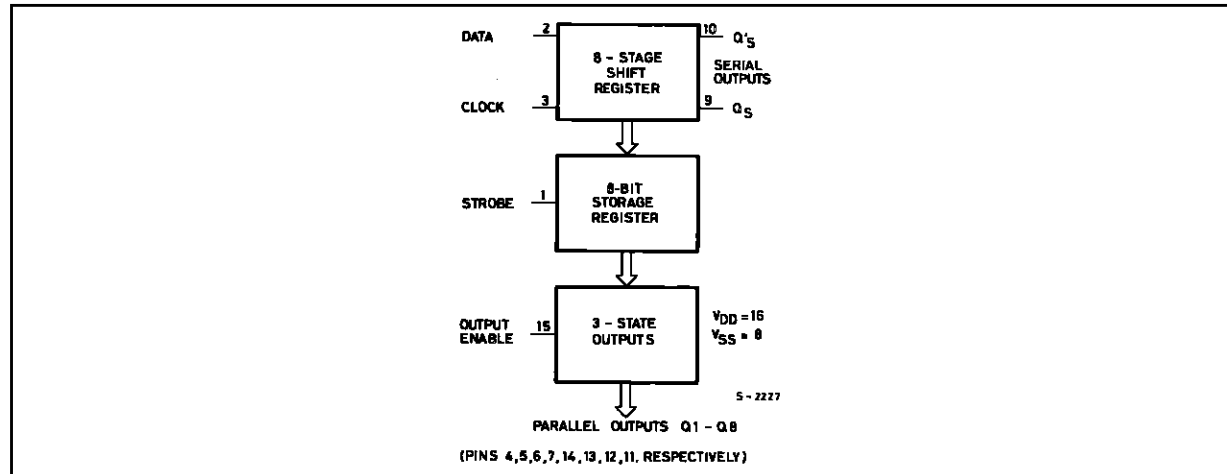
#### ORDER CODES :

|            |            |
|------------|------------|
| HCC4094BF  | HCF4094BM1 |
| HCF4094BEY | HCF4094BC1 |

### PIN CONNECTIONS



# FUNCTIONAL DIAGRAM



# ABSOLUTE MAXIMUM RATINGS

| Symbol            | Parameter                                                                                 | Value                          | Unit     |
|-------------------|-------------------------------------------------------------------------------------------|--------------------------------|----------|
| V <sub>DD</sub> * | Supply Voltage : <b>HCC</b> Types<br><b>HCF</b> Types                                     | – 0.5 to + 20<br>– 0.5 to + 18 | V<br>V   |
| V <sub>i</sub>    | Input Voltage                                                                             | – 0.5 to V <sub>DD</sub> + 0.5 | V        |
| I <sub>I</sub>    | DC Input Current (any one input)                                                          | ± 10                           | mA       |
| P <sub>tot</sub>  | Total Power Dissipation (per package)                                                     | 200                            | mW       |
|                   | Dissipation per Output Transistor<br>for T <sub>op</sub> = Full Package-temperature Range | 100                            | mW       |
| T <sub>op</sub>   | Operating Temperature : <b>HCC</b> Types<br><b>HCF</b> Types                              | – 55 to + 125<br>– 40 to + 85  | °C<br>°C |
| T <sub>stg</sub>  | Storage Temperature                                                                       | – 65 to + 150                  | °C       |

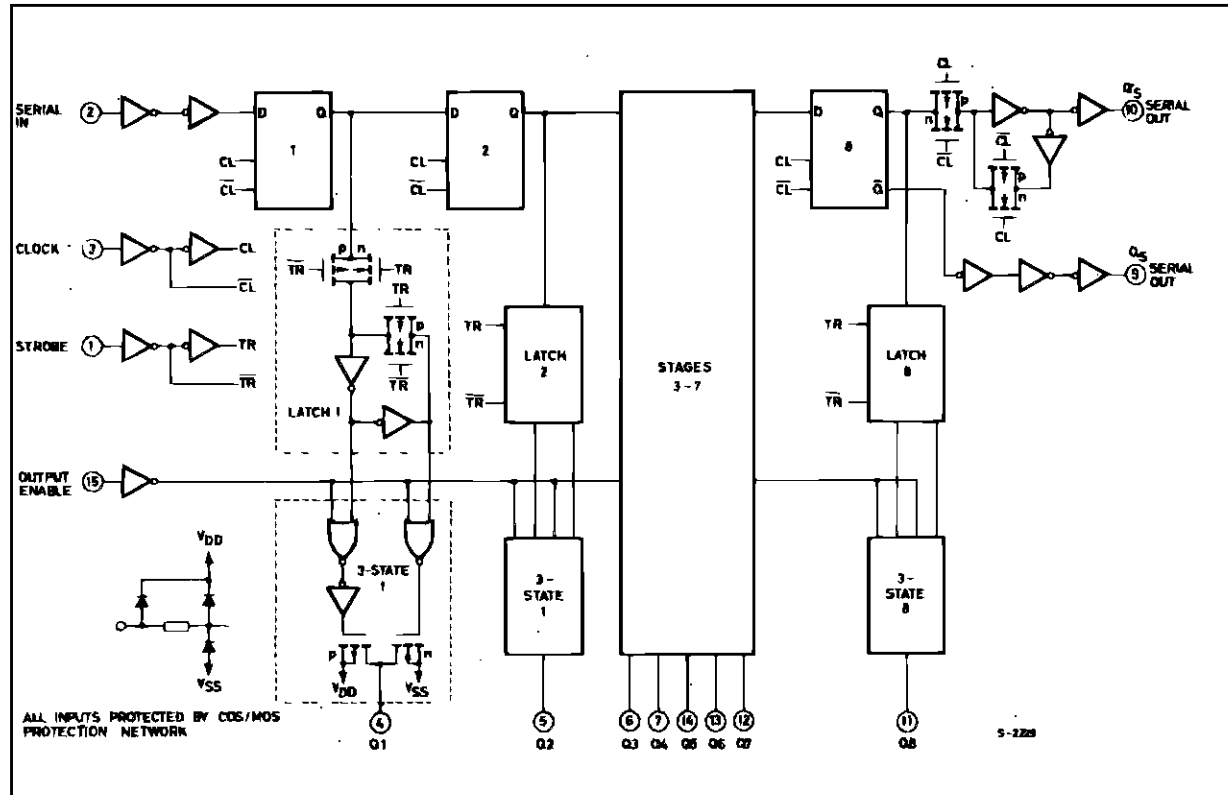
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

\* All voltage values are referred to V<sub>SS</sub> pin voltage.

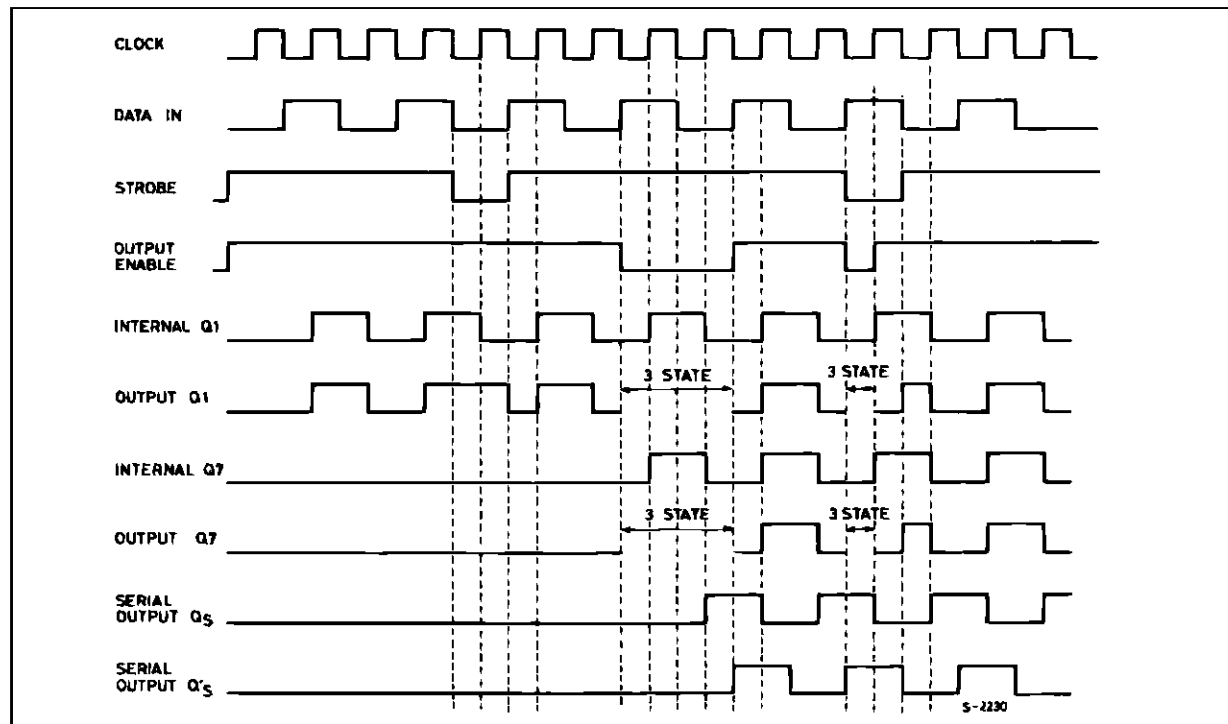
# RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter                                                    | Value                         | Unit     |
|-----------------|--------------------------------------------------------------|-------------------------------|----------|
| V <sub>DD</sub> | Supply Voltage : <b>HCC</b> Types<br><b>HCF</b> Types        | 3 to 18<br>3 to 15            | V<br>V   |
| V <sub>I</sub>  | Input Voltage                                                | 0 to V <sub>DD</sub>          | V        |
| T <sub>op</sub> | Operating Temperature : <b>HCC</b> Types<br><b>HCF</b> Types | – 55 to + 125<br>– 40 to + 85 | °C<br>°C |

## LOGIC DIAGRAMS



## TIMING DIAGRAM



TRUTH TABLE

TRUTH TABLE

| CL <sup>Δ</sup>                                                                   | Outputs Enable | Strobe | Data | Parallel Outputs |                  | Serial Outputs |     |
|-----------------------------------------------------------------------------------|----------------|--------|------|------------------|------------------|----------------|-----|
|                                                                                   |                |        |      | Q1               | QN               | QS*            | Q'S |
|  | 0              | X      | X    | OC               | OC               | Q7             | NC  |
|  | 0              | X      | X    | OC               | OC               | NC             | Q7  |
|  | 1              | 0      | X    | NC               | NC               | Q7             | NC  |
|  | 1              | 1      | 0    | 0                | Q <sub>N-1</sub> | Q7             | NC  |
|  | 1              | 1      | 1    | 1                | Q <sub>N-1</sub> | Q7             | NC  |
|  | 1              | 1      | 1    | NC               | NC               | NC             | Q7  |

▲ = Level Change

X = Don't Care

NC = No Change

OC = Open Circuit

Logic 1 ≡ High

Logic 0 ≡ Low

\* At the positive clock edge information in the 7th shift register stage is transferred to the 8th register stage and the Q<sub>S</sub> output.

## STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

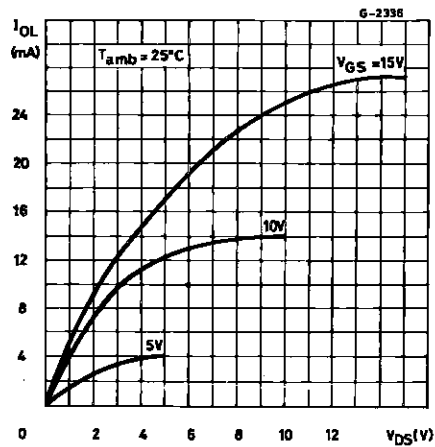
| Symbol                            | Parameter                      |           | Test Conditions       |                       |                          |                        | Value              |       |        |                    |       |                     | Unit  |      |
|-----------------------------------|--------------------------------|-----------|-----------------------|-----------------------|--------------------------|------------------------|--------------------|-------|--------|--------------------|-------|---------------------|-------|------|
|                                   |                                |           | V <sub>I</sub><br>(V) | V <sub>O</sub><br>(V) | I <sub>O</sub>  <br>(μA) | V <sub>DD</sub><br>(V) | T <sub>Low</sub> * |       | 25°C   |                    |       | T <sub>High</sub> * |       |      |
|                                   |                                |           |                       |                       |                          |                        | Min.               | Max.  | Min.   | Typ.               | Max.  | Min.                |       | Max. |
| I <sub>L</sub>                    | Quiescent Current              | HCC Types | 0/ 5                  |                       |                          | 5                      |                    | 5     |        | 0.04               | 5     |                     | 150   | μA   |
|                                   |                                |           | 0/10                  |                       |                          | 10                     |                    | 10    |        | 0.04               | 10    |                     | 300   |      |
|                                   |                                |           | 0/15                  |                       |                          | 15                     |                    | 20    |        | 0.04               | 20    |                     | 600   |      |
|                                   |                                |           | 0/20                  |                       |                          | 20                     |                    | 100   |        | 0.08               | 100   |                     | 3000  |      |
|                                   |                                | HCF Types | 0/ 5                  |                       |                          | 5                      |                    | 20    |        | 0.04               | 20    |                     | 150   |      |
|                                   |                                |           | 0/10                  |                       |                          | 10                     |                    | 40    |        | 0.04               | 40    |                     | 300   |      |
|                                   |                                |           | 0/15                  |                       |                          | 15                     |                    | 80    |        | 0.04               | 80    |                     | 600   |      |
| V <sub>OH</sub>                   | Output High Voltage            | 0/ 5      |                       | < 1                   | 5                        | 4.95                   |                    | 4.95  |        |                    | 4.95  |                     | V     |      |
|                                   |                                | 0/10      |                       | < 1                   | 10                       | 9.95                   |                    | 9.95  |        |                    | 9.95  |                     |       |      |
|                                   |                                | 0/15      |                       | < 1                   | 15                       | 14.95                  |                    | 14.95 |        |                    | 14.95 |                     |       |      |
| V <sub>OL</sub>                   | Output Low Voltage             | 5/0       |                       | < 1                   | 5                        |                        | 0.05               |       |        | 0.05               |       | 0.05                | V     |      |
|                                   |                                | 10/0      |                       | < 1                   | 10                       |                        | 0.05               |       |        | 0.05               |       | 0.05                |       |      |
|                                   |                                | 15/0      |                       | < 1                   | 15                       |                        | 0.05               |       |        | 0.05               |       | 0.05                |       |      |
| V <sub>IH</sub>                   | Input High Voltage             |           | 0.5/4.5               | < 1                   | 5                        | 3.5                    |                    | 3.5   |        |                    | 3.5   |                     | V     |      |
|                                   |                                |           | 1/9                   | < 1                   | 10                       | 7                      |                    | 7     |        |                    | 7     |                     |       |      |
|                                   |                                |           | 1.5/13.5              | < 1                   | 15                       | 11                     |                    | 11    |        |                    | 11    |                     |       |      |
| V <sub>IL</sub>                   | Input Low Voltage              |           | 4.5/0.5               | < 1                   | 5                        |                        | 1.5                |       |        | 1.5                |       | 1.5                 | V     |      |
|                                   |                                |           | 9/1                   | < 1                   | 10                       |                        | 3                  |       |        | 3                  |       | 3                   |       |      |
|                                   |                                |           | 13.5/1.5              | < 1                   | 15                       |                        | 4                  |       |        | 4                  |       | 4                   |       |      |
| I <sub>OH</sub>                   | Output Drive Current           | HCC Types | 0/ 5                  | 2.5                   |                          | 5                      | – 2                |       | – 1.6  | – 3.2              |       | – 1.15              |       | mA   |
|                                   |                                |           | 0/ 5                  | 4.6                   |                          | 5                      | – 0.64             |       | – 0.51 | – 1                |       | – 0.36              |       |      |
|                                   |                                |           | 0/10                  | 9.5                   |                          | 10                     | – 1.6              |       | – 1.3  | – 2.6              |       | – 0.9               |       |      |
|                                   |                                |           | 0/15                  | 13.5                  |                          | 15                     | – 4.2              |       | – 3.4  | – 6.8              |       | – 2.4               |       |      |
|                                   |                                | HCF Types | 0/ 5                  | 2.5                   |                          | 5                      | – 1.53             |       | – 1.36 | – 3.2              |       | – 1.1               |       |      |
|                                   |                                |           | 0/ 5                  | 4.6                   |                          | 5                      | – 0.52             |       | – 0.44 | – 1                |       | – 0.36              |       |      |
|                                   |                                |           | 0/10                  | 9.5                   |                          | 10                     | – 1.3              |       | – 1.1  | – 2.6              |       | – 0.9               |       |      |
| I <sub>OL</sub>                   | Output Sink Current            | HCC Types | 0/ 5                  | 0.4                   |                          | 5                      | 0.64               |       | 0.51   | 1                  |       | 0.36                |       | mA   |
|                                   |                                |           | 0/10                  | 0.5                   |                          | 10                     | 1.6                |       | 1.3    | 2.6                |       | 0.9                 |       |      |
|                                   |                                |           | 0/15                  | 1.5                   |                          | 15                     | 4.2                |       | 3.4    | 6.8                |       | 2.4                 |       |      |
|                                   |                                | HCF Types | 0/ 5                  | 0.4                   |                          | 5                      | 0.52               |       | 0.44   | 1                  |       | 0.36                |       |      |
|                                   |                                |           | 0/10                  | 0.5                   |                          | 10                     | 1.3                |       | 1.1    | 2.6                |       | 0.9                 |       |      |
|                                   |                                |           | 0/15                  | 1.5                   |                          | 15                     | 3.6                |       | 3.0    | 6.8                |       | 2.4                 |       |      |
| I <sub>IH</sub> , I <sub>IL</sub> | Input Leakage Current          | HCC Types | 0/18                  | Any Input             |                          | 18                     |                    | ± 0.1 |        | ±10 <sup>–5</sup>  | ± 0.1 |                     | ± 1   | μA   |
|                                   |                                | HCF Types | 0/15                  |                       |                          | 15                     |                    | ± 0.3 |        | ±10 <sup>–5</sup>  | ± 0.3 |                     | ± 1   |      |
| I <sub>OH</sub> , I <sub>OL</sub> | 3-state Output Leakage Current | HCC Types | 0/18                  | 0/18                  |                          | 18                     |                    | ± 0.4 |        | ± 10 <sup>–4</sup> | ± 0.4 |                     | ± 12  | μA   |
|                                   |                                | HCF Types | 0/15                  | 0/15                  |                          | 15                     |                    | ± 1.0 |        | ± 10 <sup>–4</sup> | ± 1.0 |                     | ± 7.5 |      |
| C <sub>I</sub>                    | Input Capacitance              |           |                       | Any Input             |                          |                        |                    |       |        | 5                  | 7.5   |                     |       | pF   |

\* T<sub>Low</sub> = -55°C for HCC device : -40°C for HCF device.\* T<sub>High</sub> = +125°C for HCC device : +85°C for HCF device.The Noise Margin for both "1" and "0" level is : 1V min. with V<sub>DD</sub> = 5V, 2V min. with V<sub>DD</sub> = 10V, 2.5V min. with V<sub>DD</sub> = 15V.

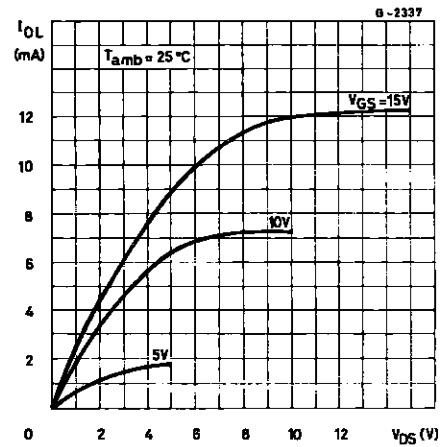
**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$ ,  $C_L = 50\text{pF}$ ,  $R_L = 200\text{k}\Omega$ , typical temperature coefficient for all  $V_{DD} = 0.3\%/^{\circ}\text{C}$  values, all input rise and fall time = 20ns)

| Symbol             | Parameter                                                                               | Test Conditions |              | Value |      |      | Unit          |
|--------------------|-----------------------------------------------------------------------------------------|-----------------|--------------|-------|------|------|---------------|
|                    |                                                                                         |                 | $V_{DD}$ (V) | Min.  | Typ. | Max. |               |
| $t_{PLH}, t_{PHL}$ | Propagation Delay Time Clock to Serial Output $Q_S$                                     |                 | 5            |       | 300  | 600  | ns            |
|                    |                                                                                         |                 | 10           |       | 125  | 250  |               |
|                    |                                                                                         |                 | 15           |       | 95   | 190  |               |
| $t_{PLH}, t_{PHL}$ | Propagation Delay Time Clock to Serial Output $Q'_S$                                    |                 | 5            |       | 230  | 460  | ns            |
|                    |                                                                                         |                 | 10           |       | 110  | 220  |               |
|                    |                                                                                         |                 | 15           |       | 75   | 150  |               |
| $t_{PLH}, t_{PHL}$ | Propagation Delay Time Clock to Parallel Output                                         |                 | 5            |       | 420  | 840  | ns            |
|                    |                                                                                         |                 | 10           |       | 195  | 390  |               |
|                    |                                                                                         |                 | 15           |       | 135  | 270  |               |
| $t_{PLH}, t_{PHL}$ | Propagation Delay Time Strobe to Parallel Output                                        |                 | 5            |       | 290  | 580  | ns            |
|                    |                                                                                         |                 | 10           |       | 145  | 290  |               |
|                    |                                                                                         |                 | 15           |       | 100  | 200  |               |
| $t_{PHZ}$          | Propagation Delay Time Output Enable to Parallel Output : Output High to High Impedance |                 | 5            |       | 140  | 280  | ns            |
|                    |                                                                                         |                 | 10           |       | 75   | 150  |               |
|                    |                                                                                         |                 | 15           |       | 55   | 110  |               |
| $t_{PLZ}$          | Out Low to High Impedance                                                               |                 | 5            |       | 225  | 450  | ns            |
|                    |                                                                                         |                 | 10           |       | 95   | 190  |               |
|                    |                                                                                         |                 | 15           |       | 70   | 140  |               |
| $t_W$              | Strobe Pulse Width                                                                      |                 | 5            | 200   | 100  |      | ns            |
|                    |                                                                                         |                 | 10           | 80    | 40   |      |               |
|                    |                                                                                         |                 | 15           | 70    | 35   |      |               |
| $t_W$              | Clock Pulse Width                                                                       |                 | 5            | 200   | 100  |      | ns            |
|                    |                                                                                         |                 | 10           | 100   | 50   |      |               |
|                    |                                                                                         |                 | 15           | 83    | 40   |      |               |
| $t_{setup}$        | Data Setup Time                                                                         |                 | 5            | 125   | 60   |      | ns            |
|                    |                                                                                         |                 | 10           | 55    | 30   |      |               |
|                    |                                                                                         |                 | 15           | 35    | 20   |      |               |
| $t_{TLH}, t_{THL}$ | Transition Time                                                                         |                 | 5            |       | 100  | 200  | ns            |
|                    |                                                                                         |                 | 10           |       | 50   | 100  |               |
|                    |                                                                                         |                 | 15           |       | 40   | 80   |               |
| $t_r, t_f$         | Clock Input Rise or Fall Time                                                           |                 | 5            | 15    |      |      | $\mu\text{s}$ |
|                    |                                                                                         |                 | 10           | 5     |      |      |               |
|                    |                                                                                         |                 | 15           | 5     |      |      |               |
| $f_{max}$          | Maximum Clock Input Frequency                                                           |                 | 5            | 1.25  | 2.5  |      | MHz           |
|                    |                                                                                         |                 | 10           | 2.5   | 5    |      |               |
|                    |                                                                                         |                 | 15           | 3     | 6    |      |               |

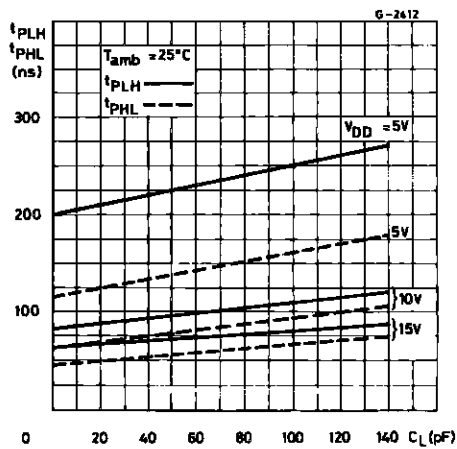
Typical Output Low (sink) Current Characteristics.



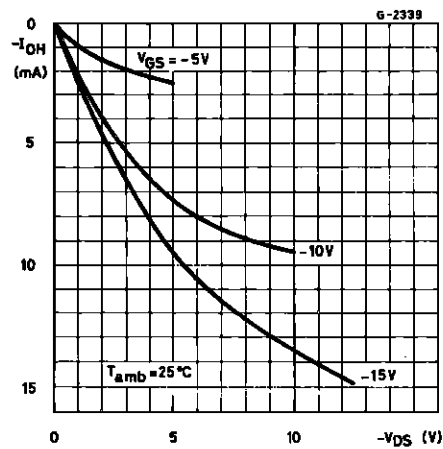
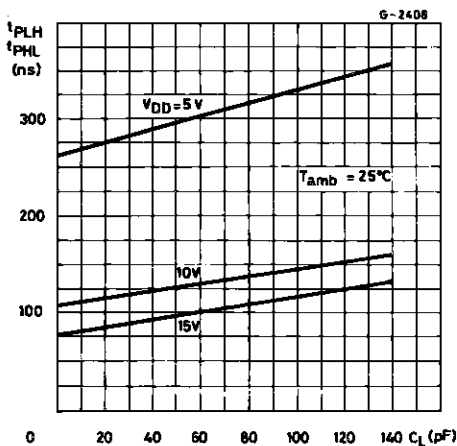
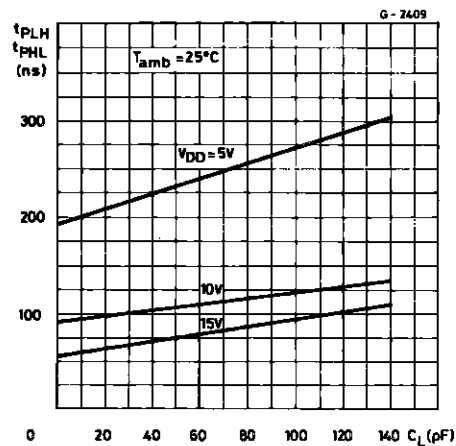
Minimum Output Low (sink) Current Characteristics.



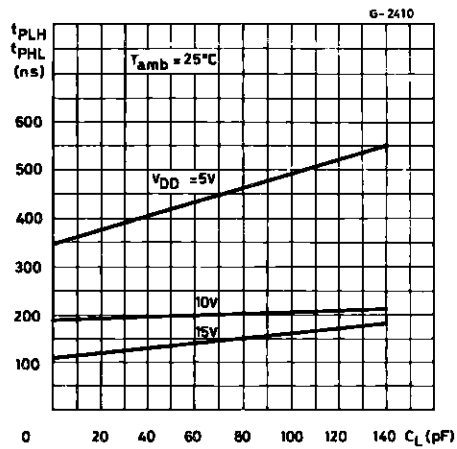
Typical Output High (source) Current Characteristics.



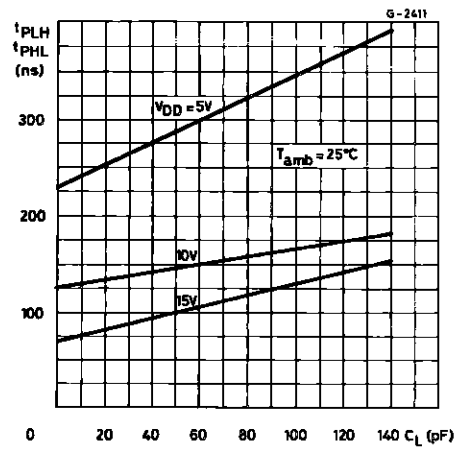
Minimum Output High (source) Current Characteristics.

Clock-to-serial Output  $Q_S$  Propagation Delay vs.  $C_L$ .Clock-to-serial Output  $Q_S$  Propagation Delay vs.  $C_L$ .

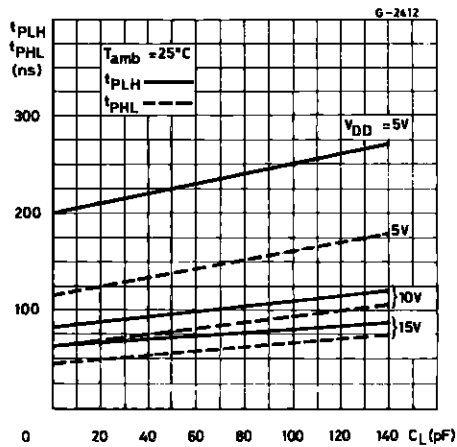
Clock-to-parallel Output Propagation Delay vs.  $C_L$ .



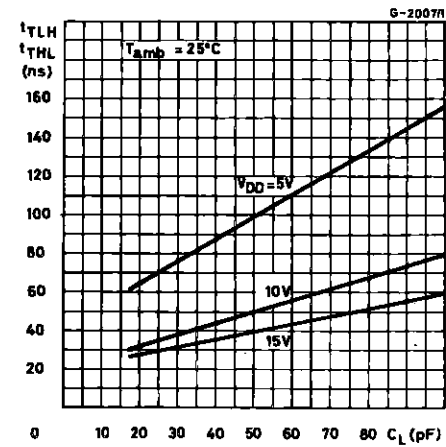
Strobe-to-parallel Output Propagation Delay vs.  $C_L$ .



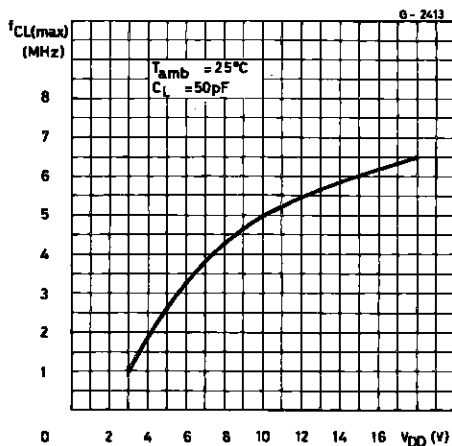
Output Enable-to-parallel Output Propagation Delay vs.



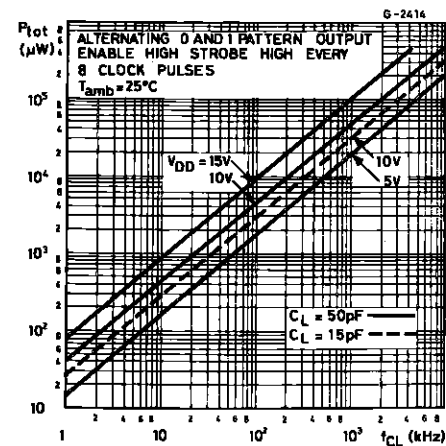
Typical Transition Time vs. Load Capacitance.



Typical Maximum-clock Frequency vs. Supply Voltage.

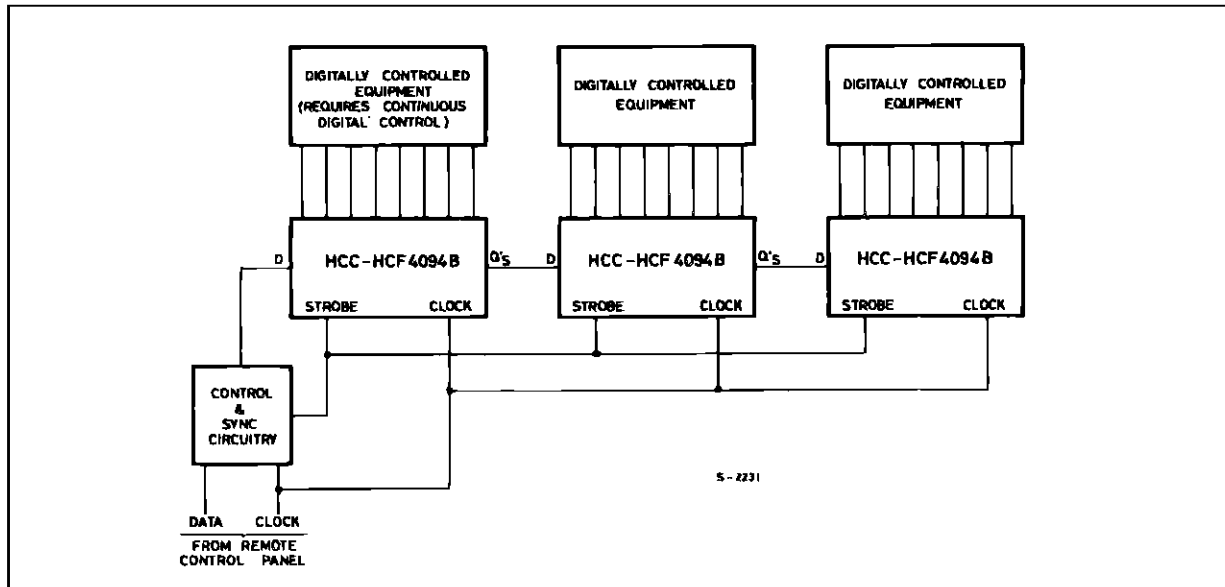


Dynamic Power Dissipation vs. Input Clock Frequency.



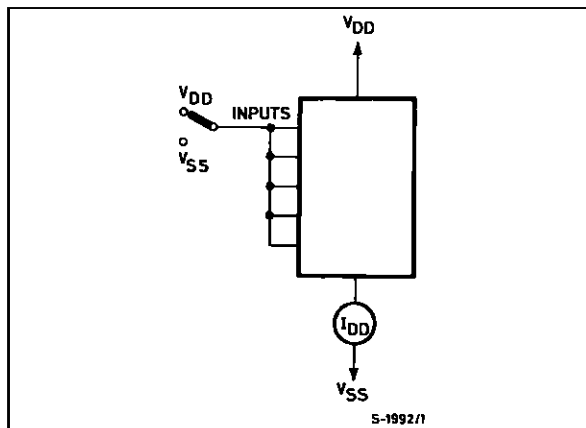
## TYPICAL APPLICATION

## REMOTE CONTROL HOLDING REGISTER

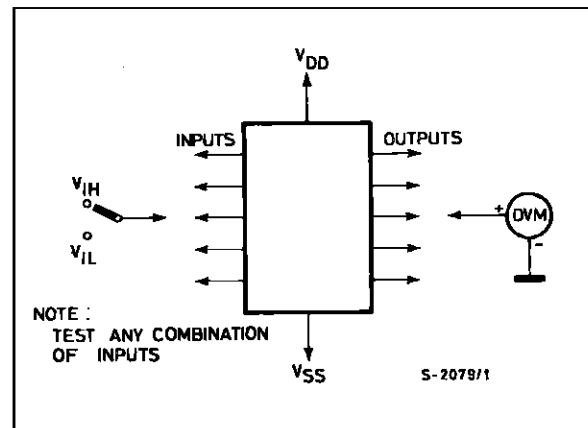


## TEST CIRCUITS

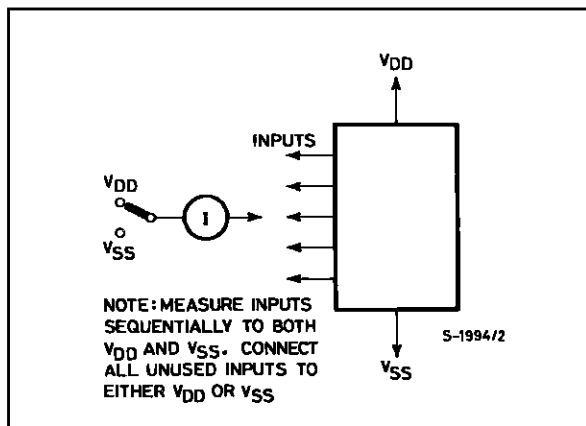
## Quiescent Device Current



## Noise Immunity.

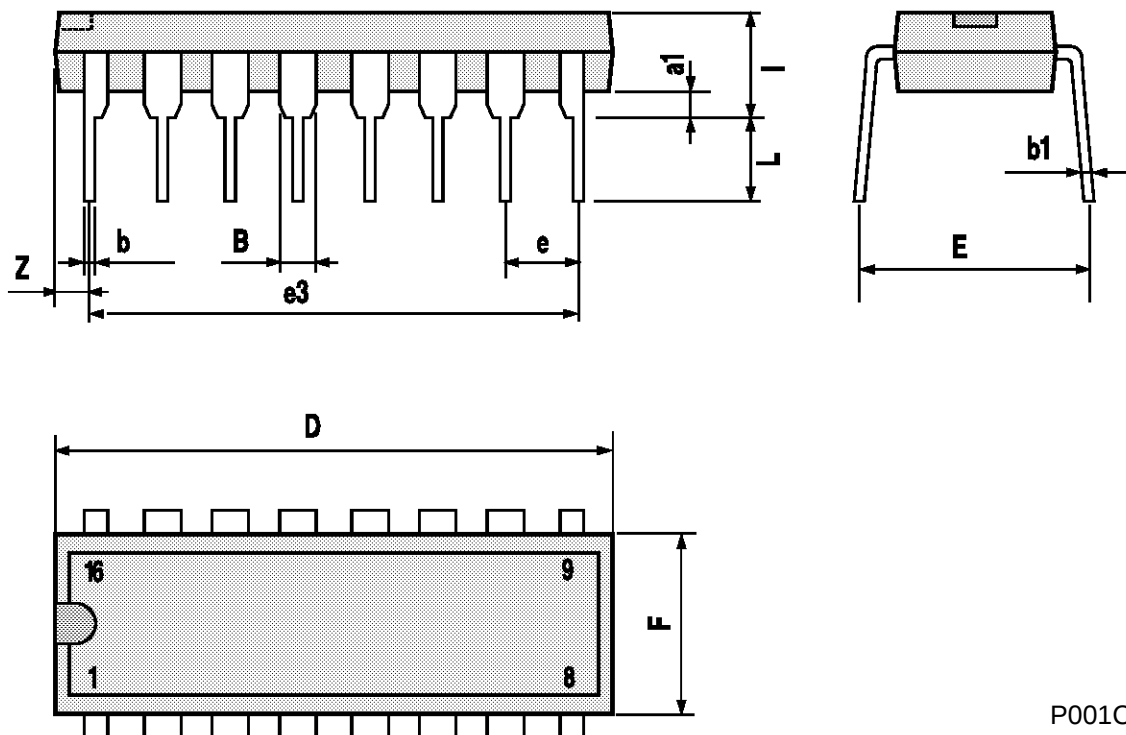


## Input Leakage Current.



## Plastic DIP16 (0.25) MECHANICAL DATA

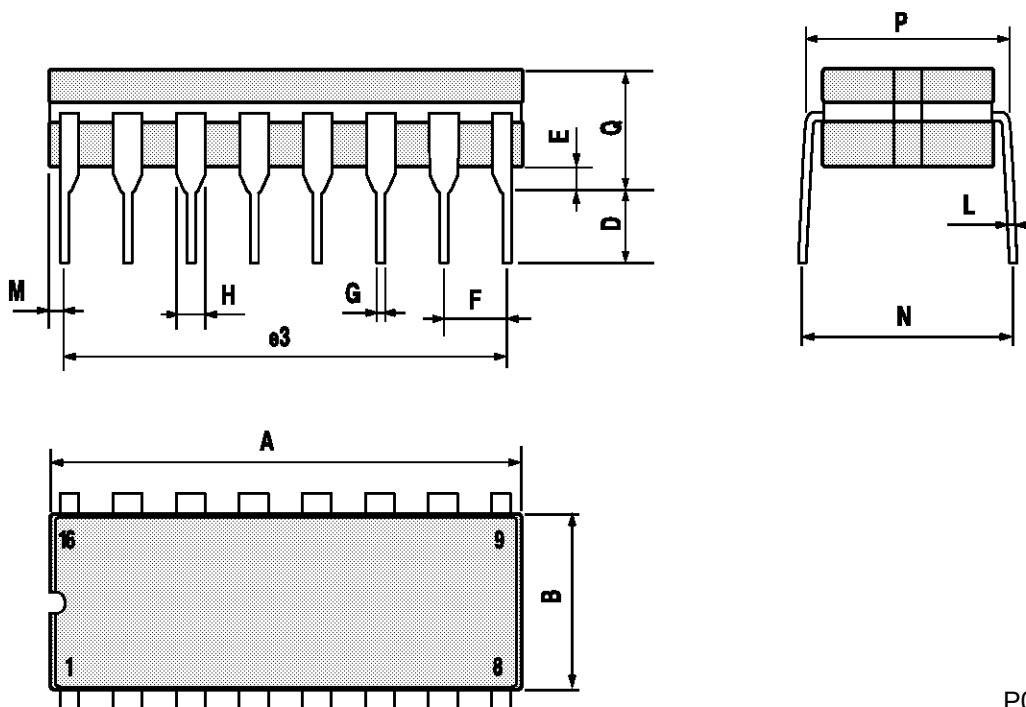
| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 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

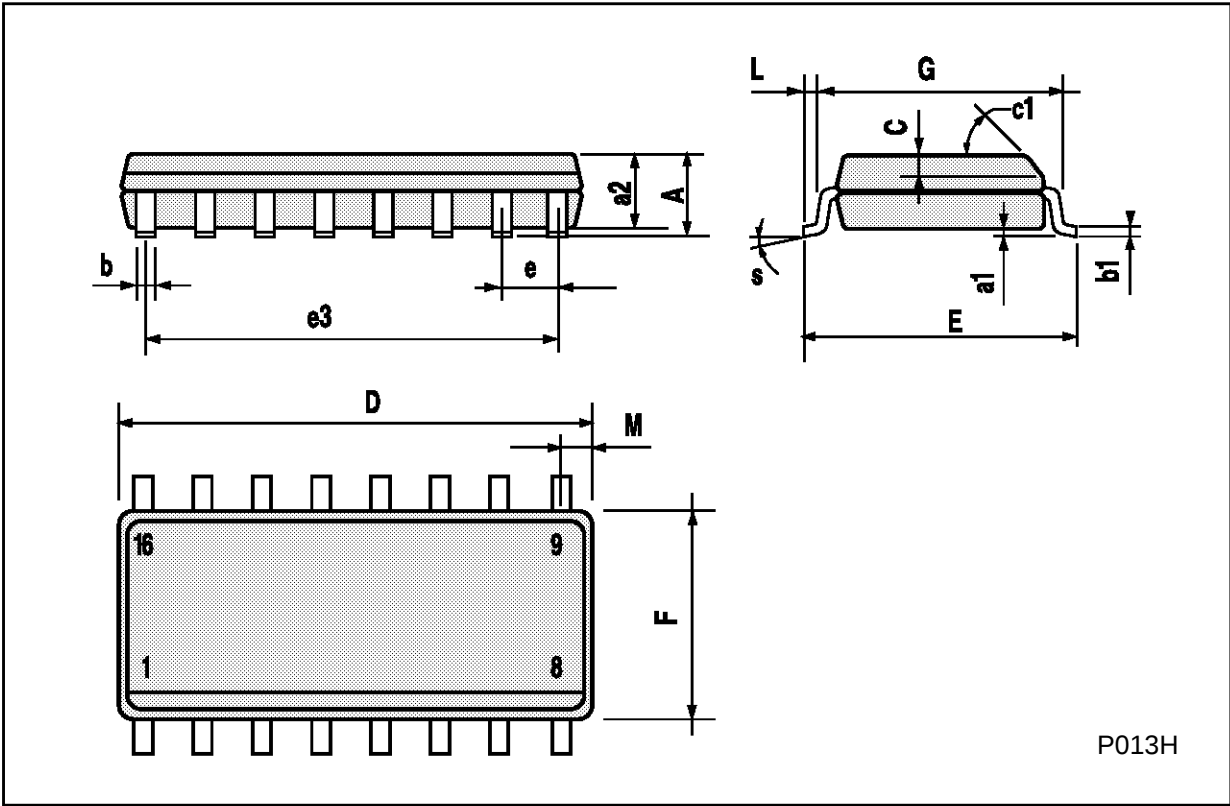
## Ceramic DIP16/1 MECHANICAL DATA

| 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 |



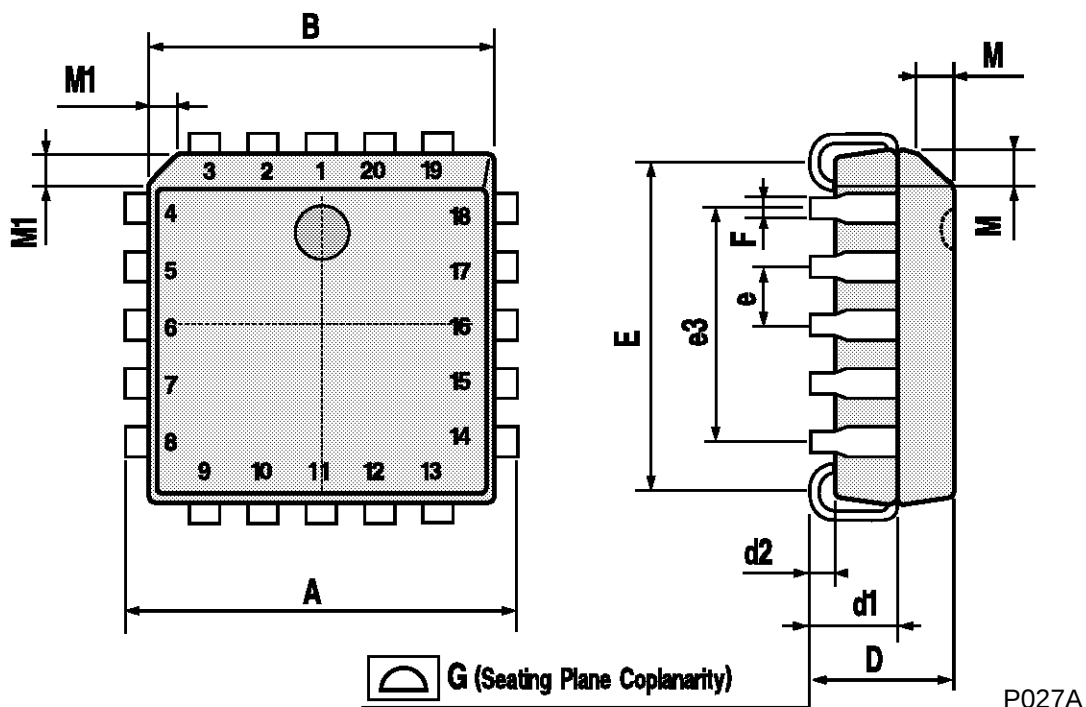
SO16 (Narrow) MECHANICAL DATA

| 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.)  |      |      |       |       |       |



## 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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