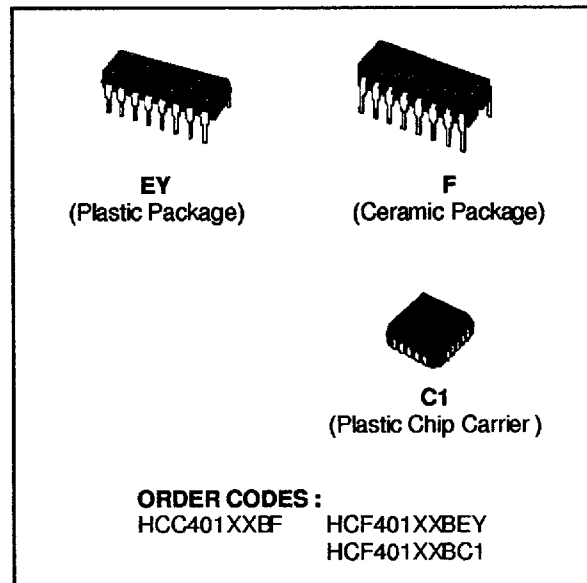


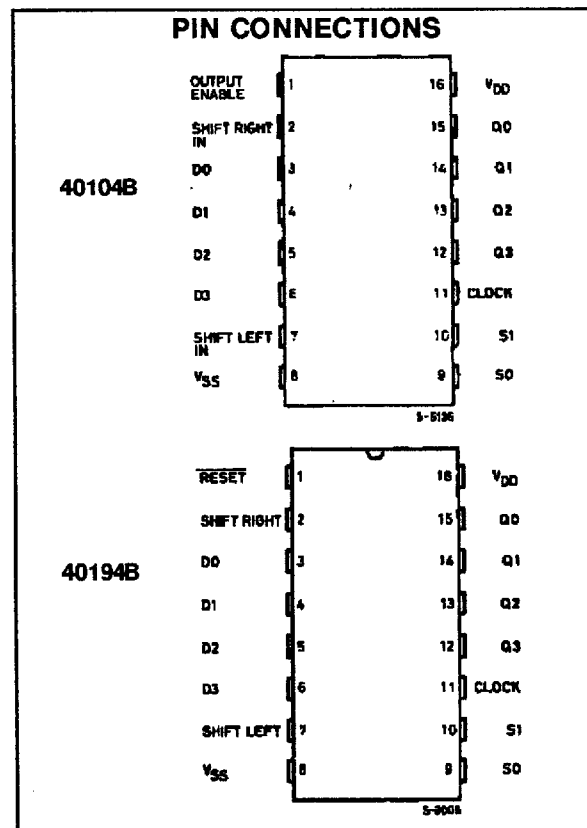
**4-BIT BIDIRECTIONAL UNIVERSAL SHIFT REGISTER**

- MEDIUM-SPEED OPERATION :  $f_{CL} = 9\text{MHz}$  (typ.) @  $V_{DD} = 10\text{V}$
- FULLY STATIC OPERATION
- SYNCHRONOUS PARALLEL OR SERIAL OPERATION
- THREE-STATE OUTPUTS (**HCC/HCF40104B**)
- ASYNCHRONOUS MASTER RESET (**HCC/HCF40194B**)
- STANDARDIZED, SYMMETRICAL OUTPUT CHARACTERISTICS
- QUIESCENT CURRENT AT 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 **HCC40104B**, **HCC40194B**, (extended temperature range) and the **HCC40104B**, **HCF40194B** (intermediate temperature range) are monolithic integrated circuits, available in 16-lead dual in-line plastic or ceramic package and plastic micro package. The **HCC/HCF 40104B** is a universal shift register featuring parallel inputs, parallel outputs, SHIFT RIGHT and SHIFT LEFT serial inputs, and a high-impedance third output state allowing the device to be used in bus-organized systems. In the parallel-load mode (S0 and S1 are high), data is loaded into the associated flip-flop and appears at the output after the positive transition of the CLOCK input. During loading, serial data flow is inhibited. Shift-right and shift-left are accomplished synchronously on the positive clock edge with serial data entered at the SHIFT RIGHT and SHIFT LEFT serial inputs, respectively. Clearing the register is accomplished by setting both mode controls low and clocking the register. When the output enable input is low, all outputs assume the high impedance state. The **HCC/HCF40194B** is a universal shift register featuring parallel inputs, parallel outputs SHIFT RIGHT and SHIFT LEFT serial inputs, and a direct overriding clear input. In the parallel-load mode (S0 and S1 are high), data is loaded into the associated flip-flop and

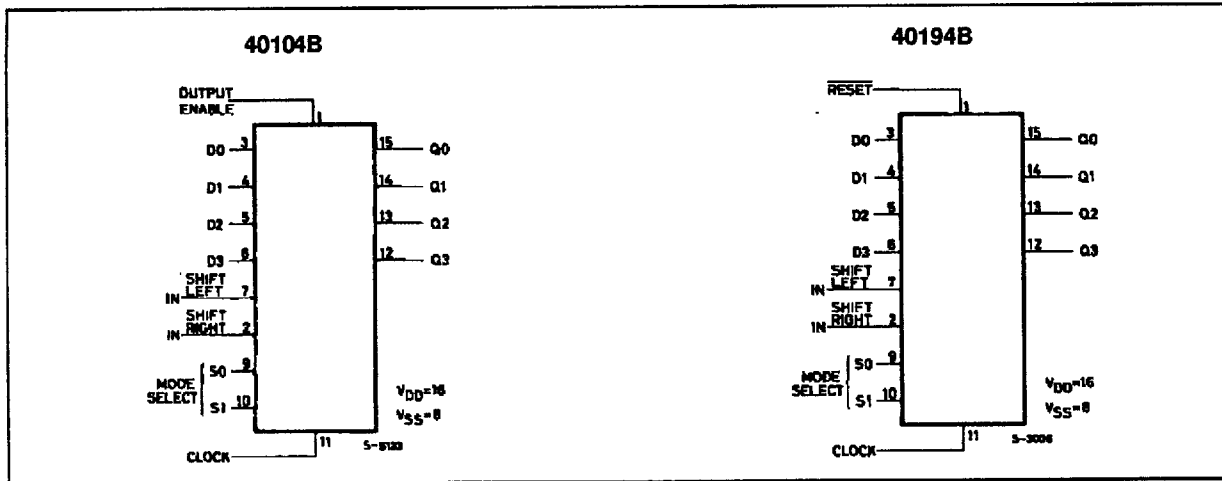


# HCC/HCF40104B/40194B

appears at the output after the positive transition of the CLOCK input. During loading, serial data flow is inhibited. Shift right and shift left are accomplished synchronously on the positive clock edge with data entered at the SHIFT RIGHT and SHIFT LEFT serial

inputs, respectively. Clocking of the register is inhibited when both mode control inputs are low. When low, the RESET input resets all stages and forces all outputs low. The HCC/HCF40194B is similar to industry types 340194 and MC40194.

## FUNCTIONAL DIAGRAMS



## ABSOLUTE MAXIMUM RATINGS

| Symbol     | Parameter   | Value                          | Unit        |
|------------|---|--------------------------------|-------------|
| $V_{DD}^*$ | Supply Voltage : HCC Types<br>HCF Types   | - 0.5 to + 20<br>- 0.5 to + 18 | V           |
| $V_i$      | Input Voltage   | - 0.5 to $V_{DD} + 0.5$        | V           |
| $I_i$      | DC Input Current (any one input)  | $\pm 10$                       | mA          |
| $P_{tot}$  | Total Power Dissipation (per package)<br>Dissipation per Output Transistor<br>for $T_{op}$ = Full Package-temperature Range | 200<br>100                     | mW          |
| $T_{op}$   | Operating Temperature : HCC Types<br>HCF Types  | - 55 to + 125<br>- 40 to + 85  | $^{\circ}C$ |
| $T_{stg}$  | Storage Temperature   | - 65 to + 150                  | $^{\circ}C$ |

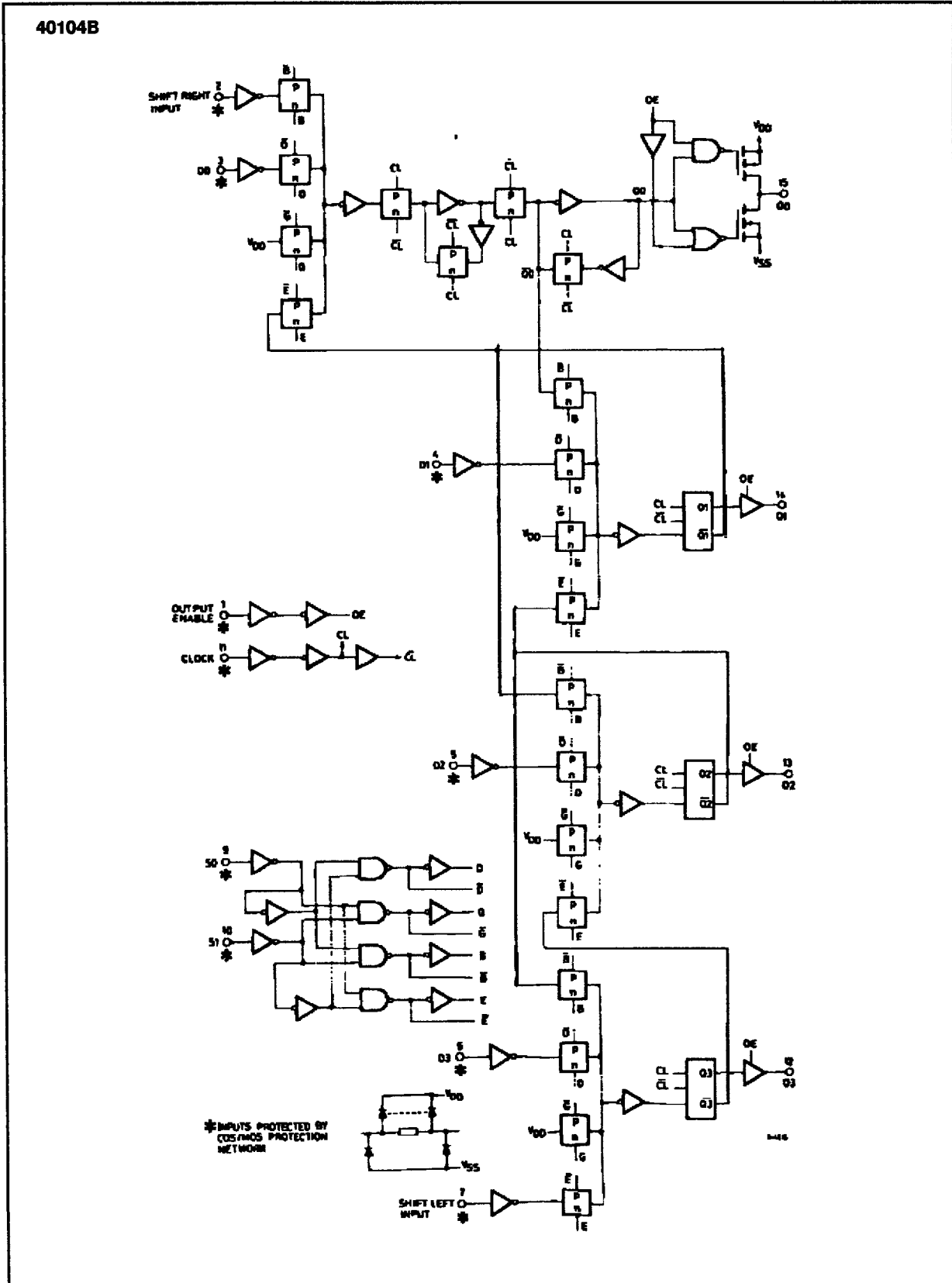
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure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

\* All voltages values are referred to  $V_{SS}$  pin voltage.

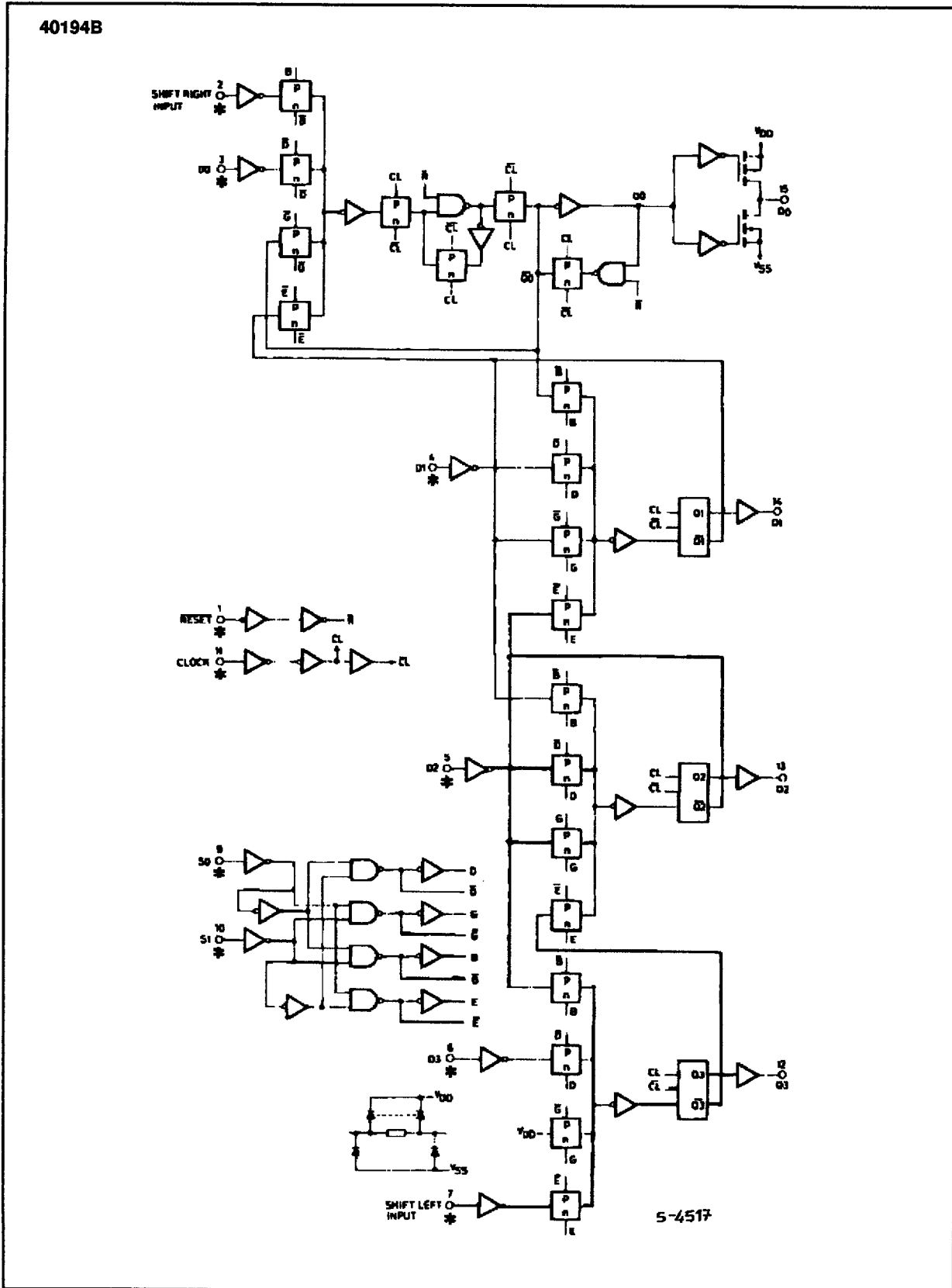
## RECOMMENDED OPERATING CONDITIONS

| Symbol   | Parameter                                      | Value                         | Unit        |
|----------|--|-------------------------------|-------------|
| $V_{DD}$ | Supply Voltage : HCC Types<br>HCF Types        | 3 to 18<br>3 to 15            | V           |
| $V_i$    | Input Voltage                                  | 0 to $V_{DD}$                 | V           |
| $T_{op}$ | Operating Temperature : HCC Types<br>HCF Types | - 55 to + 125<br>- 40 to + 85 | $^{\circ}C$ |

LOGIC DIAGRAMS



LOGIC DIAGRAMS



## 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>( $\mu$ A) | 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     | $\mu$ A |
|                                   |                       |                       | 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    |         |         |
|                                   |                       |                       | 0/15                  | 13.5                           |                        | 15                 | -3.6      |       | -3.0          | -6.8      |                     | -2.4    |         |         |
| 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                     |                    | $\pm 0.1$ |       | $\pm 10^{-5}$ | $\pm 0.1$ |                     | $\pm 1$ | $\mu$ A |         |
|                                   |                       | HCF Types             | 0/15                  |                                |                        |                    |           |       |               |           |                     |         |         | 15      |
| 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, 2.5 min. with V<sub>DD</sub> = 15V

# HCC/HCF40104B/40194B

**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  $V_{DD}$  values is  $0.3\%/^{\circ}\text{C}$ , 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<br>Clock to Q |                 | 5            |       | 220   | 440  | ns            |
|                             |                                      |                 | 10           |       | 100   | 200  |               |
|                             |                                      |                 | 15           |       | 70    | 140  |               |
| $t_{PZH}, t_{PZL}, t_{PLZ}$ | 3-state Outputs ■<br>High Impedance  |                 | 5            |       | 80    | 160  | ns            |
|                             |                                      |                 | 10           |       | 35    | 70   |               |
|                             |                                      |                 | 15           |       | 25    | 50   |               |
| $t_{PHZ}$                   |                                      |                 | 5            |       | 45    | 90   | ns            |
|                             |                                      |                 | 10           |       | 25    | 50   |               |
|                             |                                      |                 | 15           |       | 20    | 40   |               |
| $t_{THL}, t_{TLH}$          | Transition Time                      |                 | 5            |       | 100   | 200  | ns            |
|                             |                                      |                 | 10           |       | 50    | 100  |               |
|                             |                                      |                 | 15           |       | 40    | 80   |               |
| $t_{setup}$                 | Setup Time D0,D3,SR, SL<br>to Clock  |                 | 5            |       | 80    | 100  | ns            |
|                             |                                      |                 | 10           |       | 35    | 70   |               |
|                             |                                      |                 | 15           |       | 20    | 50   |               |
|                             | S0, S1 to Clock                      |                 | 5            |       | 200   | 400  | ns            |
|                             |                                      |                 | 10           |       | 110   | 220  |               |
|                             |                                      |                 | 15           |       | 65    | 130  |               |
| $t_{hold}$                  | Hold Time D0,D3,SR, SL<br>to Clock   |                 | 5            |       | - 65  | 0    | ns            |
|                             |                                      |                 | 10           |       | - 25  | 0    |               |
|                             |                                      |                 | 15           |       | - 15  | 0    |               |
|                             | S0, S1 to Clock                      |                 | 5            |       | - 170 | 0    | ns            |
|                             |                                      |                 | 10           |       | - 95  | 0    |               |
|                             |                                      |                 | 15           |       | - 55  | 0    |               |
| $t_w$                       | Clock Pulse Width                    |                 | 5            |       | 90    | 180  | ns            |
|                             |                                      |                 | 10           |       | 40    | 180  |               |
|                             |                                      |                 | 15           |       | 25    | 50   |               |
| $f_{CL}$                    | Clock Input Frequency                |                 | 5            | 3     | 6     |      | MHz           |
|                             |                                      |                 | 10           | 6     | 12    |      |               |
|                             |                                      |                 | 15           | 8     | 15    |      |               |
| $t_r, t_f$                  | Clock Input Rise or Fall Time        |                 | 5            |       |       | 1000 | $\mu\text{s}$ |
|                             |                                      |                 | 10           |       |       | 100  |               |
|                             |                                      |                 | 15           |       |       | 100  |               |
| $t_w$                       | Reset Pulse Width*                   |                 | 5            |       | 150   | 300  | ns            |
|                             |                                      |                 | 10           |       | 100   | 200  |               |
|                             |                                      |                 | 15           |       | 70    | 140  |               |
| $t_{PRHL}$                  | Propagation Delay Reset*             |                 | 5            |       | 230   | 460  | ns            |
|                             |                                      |                 | 10           |       | 90    | 180  |               |
|                             |                                      |                 | 15           |       | 65    | 130  |               |

■ For 40104B series only \* For 40194B series only.

TRUTH TABLES

40104B

| Clock $\Delta$ | Mode Select |    | Output Enable | Action   |
|----------------|-------------|----|---------------|--|
|                | S0          | S1 |               |  |
| $\_ / \_$      | 0           | 0  | 1             | Reset  |
| $\_ / \_$      | 1           | 0  | 1             | Shift Right (Q0 toward Q3)   |
| $\_ / \_$      | 0           | 1  | 1             | Shift Left (Q3 toward Q0)  |
| $\_ / \_$      | 1           | 1  | 1             | Parallel Load  |
| X              | X           | X  | 0             | Operations occur as shown above, but outputs assume high impedance |

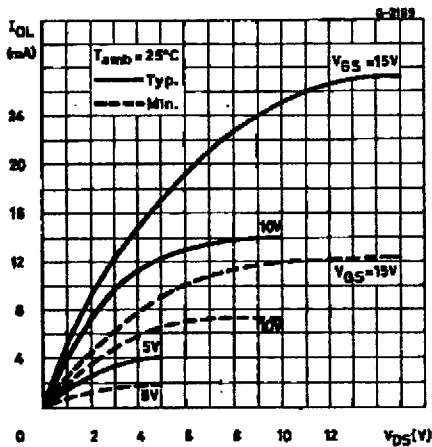
40194B

| Clock     | Mode Select |    | Reset | Action                     |
|-----------|-------------|----|-------|----------------------------|
|           | S0          | S1 |       |                            |
| X         | 0           | 0  | 1     | No Change                  |
| $\_ / \_$ | 1           | 0  | 1     | Shift Right (Q0 toward Q3) |
| $\_ / \_$ | 0           | 1  | 1     | Shift Left (Q3 toward Q0)  |
| $\_ / \_$ | 1           | 1  | 1     | Parallel Load              |
| X         | X           | X  | 0     | Reset                      |

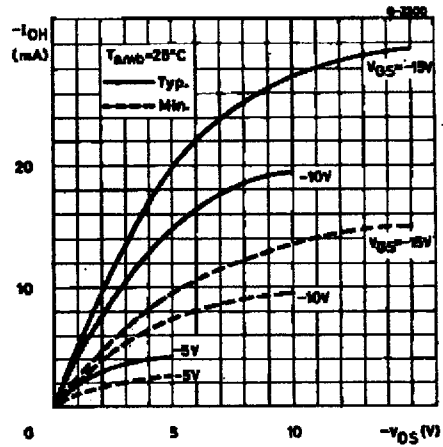
1=High level  
0=Low level

X= Don't care  
 $\Delta$  = Level change

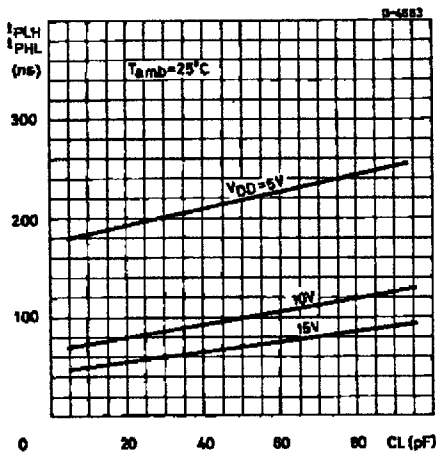
Output Low (sink) Current Characteristics.



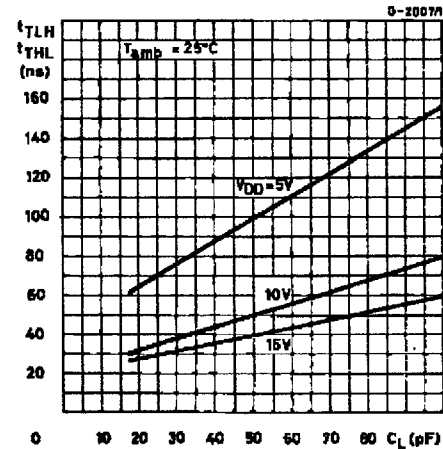
Output High (source) Current Characteristics.



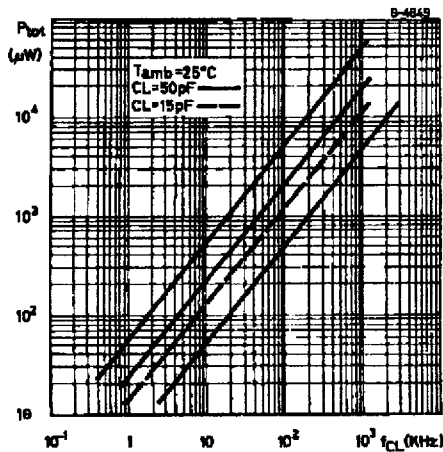
Typical Propagation Delay Time vs. Load Capacitance.



Typical Transition Time vs. Load Capacitance.

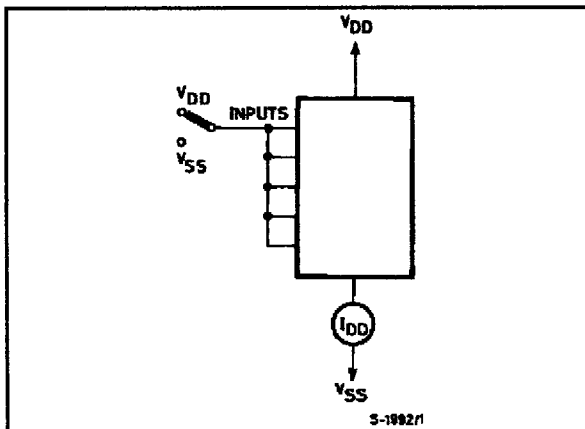


Typical Dynamic Power Dissipation vs. Frequency.

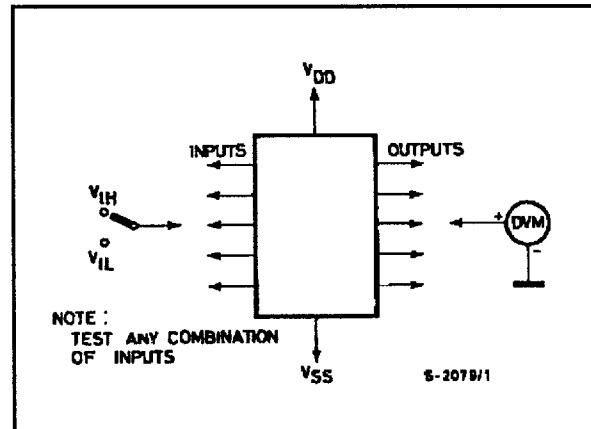


TEST CIRCUITS

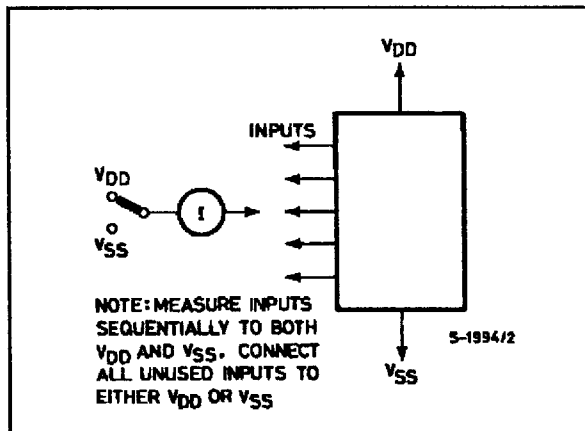
Quiescent Device Current



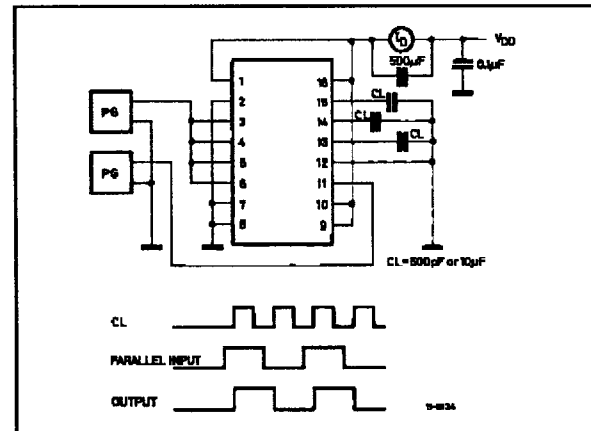
Input Voltage



Input Leakage Current



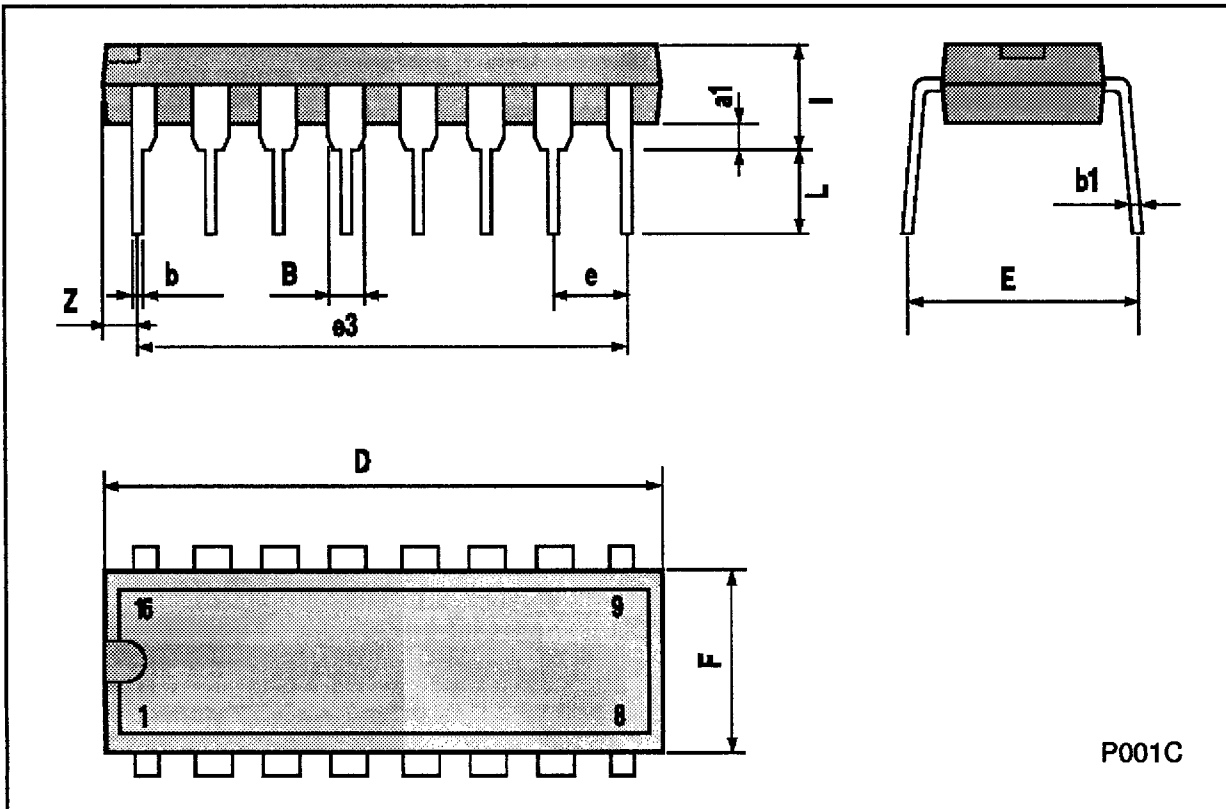
Dynamic Power Dissipation





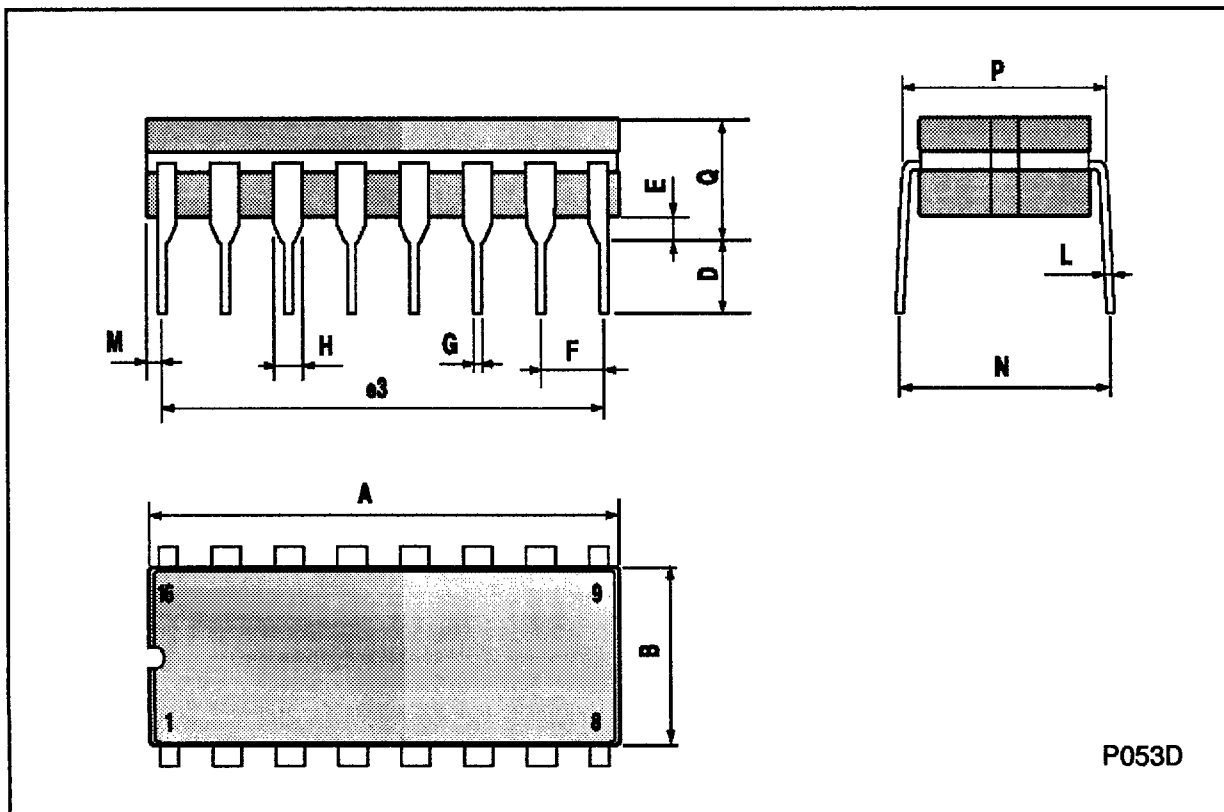
**Plastic DIP16 (0.25) MECHANICAL DATA**

| 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 |



**Ceramic DIP16/1 MECHANICAL DATA**

| DIM. | mm   |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP.  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      |       | 20   |       |       | 0.787 |
| B    |      |       | 7    |       |       | 0.276 |
| D    |      | 3.3   |      |       | 0.130 |       |
| E    | 0.38 |       |      | 0.015 |       |       |
| e3   |      | 17.78 |      |       | 0.700 |       |
| F    | 2.29 |       | 2.79 | 0.090 |       | 0.110 |
| G    | 0.4  |       | 0.55 | 0.016 |       | 0.022 |
| H    | 1.17 |       | 1.52 | 0.046 |       | 0.060 |
| L    | 0.22 |       | 0.31 | 0.009 |       | 0.012 |
| M    | 0.51 |       | 1.27 | 0.020 |       | 0.050 |
| N    |      |       | 10.3 |       |       | 0.406 |
| P    | 7.8  |       | 8.05 | 0.307 |       | 0.317 |
| Q    |      |       | 5.08 |       |       | 0.200 |



P053D

**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 |       |

