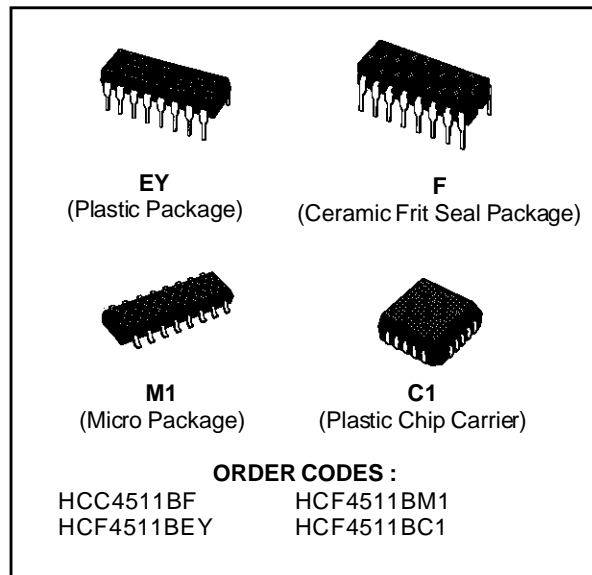


## BCD-TO-SEVEN SEGMENT LATCH/DECODER/DRIVER

- HIGH-OUTPUT-SOURCING CAPABILITY (up to 25 mA)
- INPUT LATCHES FOR BCD CODE STORAGE
- LAMP TEST AND BLANKING CAPABILITY
- 7-SEGMENT OUTPUTS BLANKED FOR BCD INPUT CODES > 1001
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100mA 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"

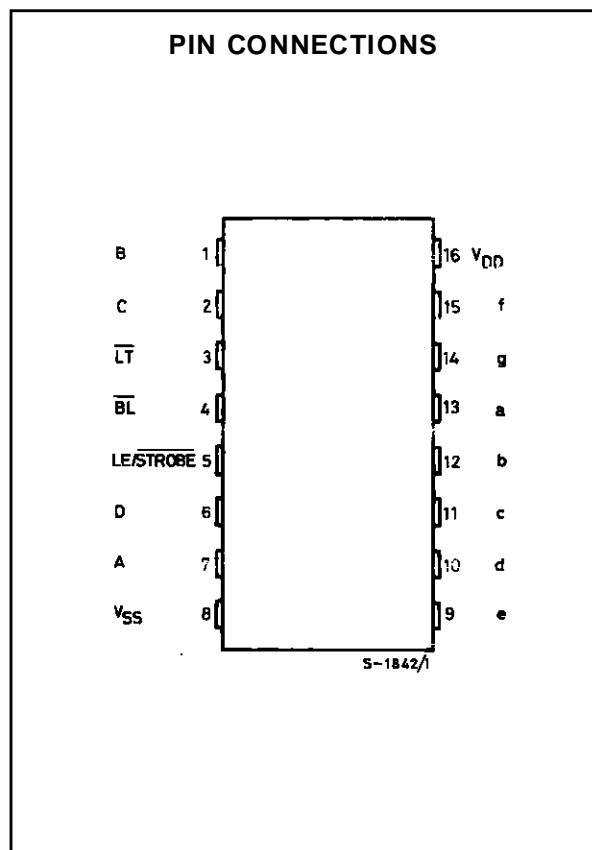


### DESCRIPTION

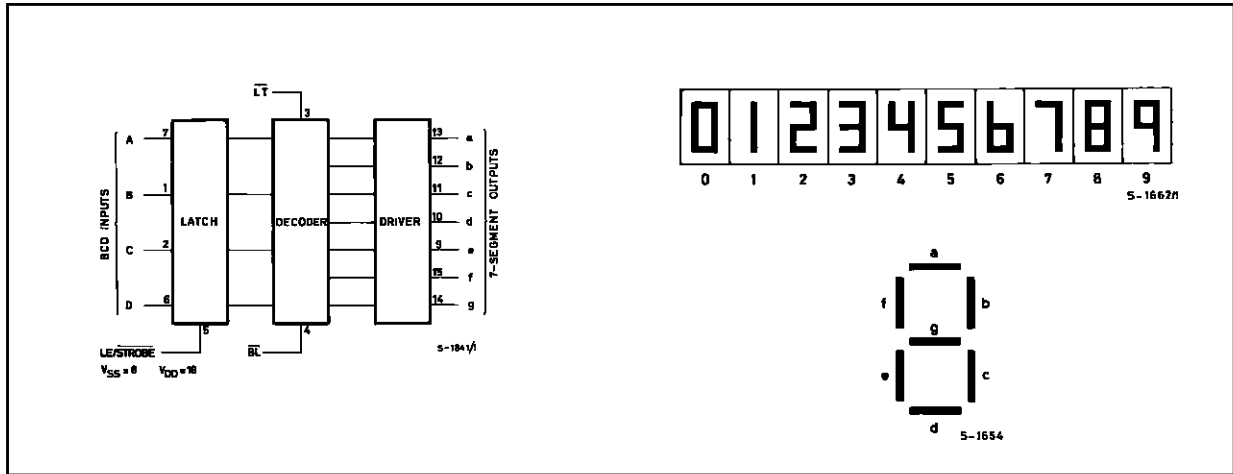
The **HCC 4511B** (extended temperature range) and the **HCF 4511B** (intermediate temperature range) are monolithic integrated circuits available in 16-lead dual in-line plastic or ceramic package and plastic micro package.

The **HCC/HCF 4511B** types are BCD-to-7-segment latch decoder drivers constructed with COS/MOS logic and n-p-n bipolar transistor output devices on a single monolithic structure. These devices combine the low quiescent power dissipation and high noise immunity features of COS/MOS with n-p-n bipolar output transistors capable of sourcing up to 25 mA. This capability allows the **HCC/HCF 4511B** types to drive LED's and other displays directly.

Lamp Test ( $\overline{LT}$ ), Blanking ( $\overline{BL}$ ), and Latch Enable or Strobe inputs are provided to test the display, shut off or intensity-modulate it, and store or strobe a BCD code, respectively. Several different signal may be multiplexed and displayed when external multiplexing circuitry is used.



FUNCTIONAL DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol            | Parameter                                                                              | Value                          | Unit |
|-------------------|----------------------------------------------------------------------------------------|--------------------------------|------|
| V <sub>DD</sub> * | Supply Voltage : <b>HCC</b> Types                                                      | - 0.5 to + 20                  | V    |
|                   | <b>HCF</b> Types                                                                       | - 0.5 to + 18                  | 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 for T <sub>op</sub> = Full Package-temperature Range | 100                            | mW   |
| T <sub>op</sub>   | Operating Temperature : <b>HCC</b> Types                                               | - 55 to + 125                  | °C   |
|                   | <b>HCF</b> Types                                                                       | - 40 to + 85                   | °C   |
| T <sub>stg</sub>  | Storage Temperature                                                                    | - 65 to + 150                  | °C   |

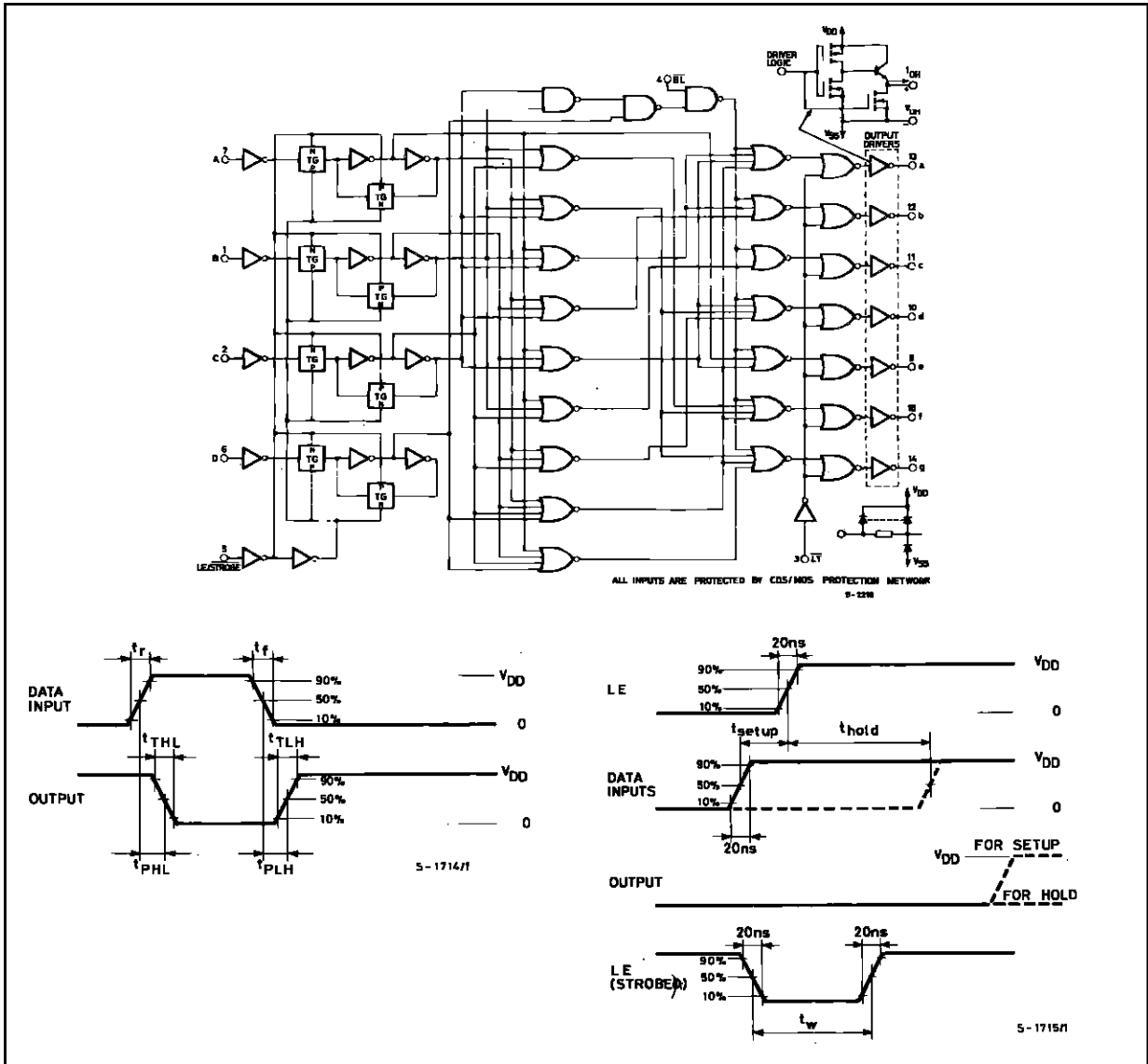
Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure 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        | 3 to 18              | V    |
|                 | <b>HCF</b> Types                         | 3 to 15              | V    |
| V <sub>I</sub>  | Input Voltage                            | 0 to V <sub>DD</sub> | V    |
| T <sub>op</sub> | Operating Temperature : <b>HCC</b> Types | - 55 to + 125        | °C   |
|                 | <b>HCF</b> Types                         | - 40 to + 85         | °C   |

LOGIC DIAGRAMS



# HCC/HFC4511B

## TRUTH TABLE

| LE | $\overline{BI}$ | $\overline{LT}$ | D | C | B | A | a | b | c | d | e | f | g | Display |
|----|-----------------|-----------------|---|---|---|---|---|---|---|---|---|---|---|---------|
| X  | X               | 0               | X | X | X | X | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8       |
| X  | 0               | 1               | X | X | X | X | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0  | 1               | 1               | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0       |
| 0  | 1               | 1               | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1       |
| 0  | 1               | 1               | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 2       |
| 0  | 1               | 1               | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 3       |
| 0  | 1               | 1               | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 4       |
| 0  | 1               | 1               | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 5       |
| 0  | 1               | 1               | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 6       |
| 0  | 1               | 1               | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 7       |
| 0  | 1               | 1               | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8       |
| 0  | 1               | 1               | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 9       |
| 0  | 1               | 1               | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0  | 1               | 1               | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0  | 1               | 1               | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0  | 1               | 1               | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0  | 1               | 1               | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0  | 1               | 1               | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 1  | 1               | 1               | X | X | X | X |   |   |   | * |   |   |   | *       |

## 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      |                       |                       | 5                              | 4                      |                    | 4.1   | 4.55  |      | 4.2   |                     | V    |         |  |
|                 |                      | 0/10      |                       |                       | 10                             | 9                      |                    | 9.1   | 9.55  |      | 9.2   |                     |      |         |  |
|                 |                      | 0/15      |                       |                       | 15                             | 14                     |                    | 14.1  | 14.55 |      | 14.2  |                     |      |         |  |
| V <sub>OL</sub> | Output Low Voltage   | 5/0       |                       |                       | 5                              |                        | 0.05               |       |       | 0.05 |       | 0.05                | V    |         |  |
|                 |                      | 10/0      |                       |                       | 10                             |                        | 0.05               |       |       | 0.05 |       | 0.05                |      |         |  |
|                 |                      | 15/0      |                       |                       | 15                             |                        | 0.05               |       |       | 0.05 |       | 0.05                |      |         |  |
| V <sub>IH</sub> | Input High Voltage   |           | 0.5/3.8               |                       | 5                              | 3.5                    |                    | 3.5   |       |      | 3.5   |                     | V    |         |  |
|                 |                      |           | 1/8.8                 |                       | 10                             | 7                      |                    | 7     |       |      | 7     |                     |      |         |  |
|                 |                      |           | 1.5/13.8              |                       | 15                             | 11                     |                    | 11    |       |      | 11    |                     |      |         |  |
| V <sub>IL</sub> | Input Low Voltage    |           | 3.8/0.5               |                       | 5                              |                        | 1.5                |       |       | 1.5  |       | 1.5                 | V    |         |  |
|                 |                      |           | 8.8/1                 |                       | 10                             |                        | 3                  |       |       | 3    |       | 3                   |      |         |  |
|                 |                      |           | 13.8/1.5              |                       | 15                             |                        | 4                  |       |       | 4    |       | 4                   |      |         |  |
| V <sub>OH</sub> | Output Drive Voltage | HCC Types |                       | 0                     | 5                              |                        | 4.1                |       | 4.10  | 4.55 |       | 4.20                | V    |         |  |
|                 |                      |           |                       | 5                     |                                |                        |                    |       | 4.25  |      |       |                     |      |         |  |
|                 |                      |           |                       | 10                    |                                |                        | 3.80               |       | 3.90  | 4.10 |       | 3.90                |      |         |  |
|                 |                      |           |                       | 15                    |                                |                        |                    |       |       | 3.95 |       |                     |      |         |  |
|                 |                      |           |                       | 20                    |                                |                        | 3.55               |       | 3.40  | 3.75 |       |                     |      |         |  |
|                 |                      |           |                       | 25                    |                                |                        | 3.40               |       | 3.10  | 3.55 |       |                     |      |         |  |
|                 |                      |           |                       | 0                     |                                | 10                     |                    | 9     |       | 9.10 | 9.55  |                     |      | 9.20    |  |
|                 |                      |           |                       | 5                     |                                |                        |                    |       |       |      | 9.25  |                     |      |         |  |
|                 |                      |           |                       | 10                    |                                |                        |                    | 8.85  |       | 9    | 9.15  |                     |      |         |  |
|                 |                      |           | 15                    |                       |                                |                        |                    |       | 9.05  |      |       |                     |      |         |  |
|                 |                      |           | 20                    |                       | 8.70                           |                        |                    | 8.60  | 8.90  |      | 8.40  |                     |      |         |  |
|                 |                      |           | 25                    |                       | 8.60                           |                        |                    | 8.30  | 8.75  |      |       |                     |      |         |  |
|                 |                      |           | 0                     | 15                    |                                | 14                     |                    | 14.10 | 14.55 |      | 14.20 |                     |      |         |  |
|                 |                      |           | 5                     |                       |                                |                        |                    |       | 14.30 |      |       |                     |      |         |  |
|                 |                      |           | 10                    |                       |                                | 13.90                  |                    | 14    | 14.20 |      | 14    |                     |      |         |  |
|                 |                      |           | 15                    |                       |                                |                        |                    |       | 14.10 |      |       |                     |      |         |  |
|                 |                      |           | 20                    |                       |                                | 13.75                  |                    | 13.70 | 13.95 |      | 13.50 |                     |      |         |  |
|                 |                      |           | 25                    |                       |                                | 13.65                  |                    | 13.50 | 13.80 |      | 13.10 |                     |      |         |  |

\* 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 V min. with V<sub>DD</sub> = 15V.

STATIC ELECTRICAL CHARACTERISTICS (continued)

| 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.  |      |       |     |  |
| V <sub>OH</sub>                   | Output Drive Voltage  | HCF Types             |                       |                          | 5                      |                    |       |      | 4.1               |       | 4.1                 | 4.57  |       | 4.1  |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     | 4.24  |       |      |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       | 3.6                 |       | 3.6   | 4.12 |       | 3.3 |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     |       |       | 3.94 |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       | 2.8                 |       | 2.8   | 3.75 |       | 2.5 |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     |       |       | 3.54 |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    | 10    |      |                   | 9.1   |                     | 9.1   | 9.58  |      | 9.1   |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     |       | 9.26  |      |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   | 8.75  |                     | 8.75  | 9.17  |      | 8.45  |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     |       | 9.04  |      |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   | 8.1   |                     | 8.1   | 8.90  |      | 7.8   |     |  |
|                                   |                       |                       |                       |                          |                        |                    | 15    |      |                   | 14.1  |                     | 14.1  | 14.59 |      | 14.1  |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     |       | 14.27 |      |       |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   | 13.75 |                     | 13.75 | 14.18 |      | 13.45 |     |  |
|                                   |                       |                       |                       |                          |                        |                    |       |      |                   |       |                     |       | 14.07 |      |       |     |  |
|                                   |                       | 13.1                  |                       | 13.1                     | 13.95                  |                    |       |      |                   | 12.8  |                     |       |       |      |       |     |  |
|                                   |                       |                       |                       |                          | 13.80                  |                    |       |      |                   |       |                     |       |       |      |       |     |  |
| I <sub>OL</sub>                   | Output Sink Current   | HCC Types             | 0/ 5                  | 0.4                      |                        | 5                  | 0.64  |      | 0.51              | 1     |                     | 0.36  |       |      |       |     |  |
|                                   |                       |                       | 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                 | 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    |       |      |       |     |  |
|                                   |                       | HCF Types             | 0/15                  |                          | 15                     |                    | ±0.3  |      | ±10 <sup>-5</sup> | ± 0.3 |                     | ± 1   |       |      |       |     |  |
| 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.

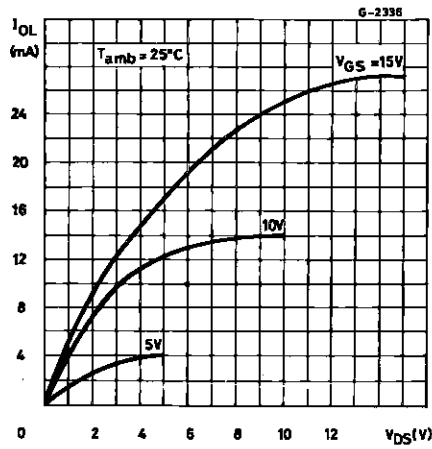
\* T<sub>High</sub> = +125°C for HCC device : +85°C for HCF device.

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 V min. with V<sub>DD</sub> = 15V.

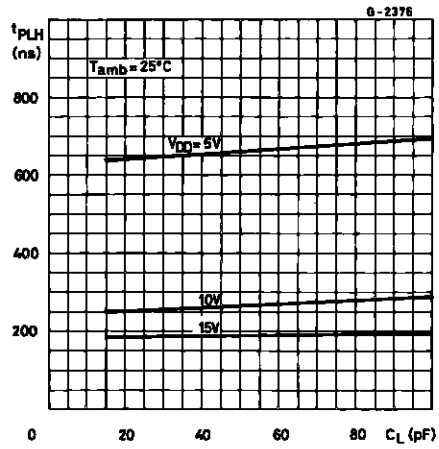
**DYNAMIC ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ K}\Omega$ , typical temperature coefficient for all  $V_{DD}$  values is  $03\text{ }^{\circ}\text{C}$ , all input rise and fall times =  $20\text{ ns}$ )

| Symbol      | Parameter                                  | Test Conditions |              | Value |      |      | Unit |
|-------------|--------------------------------------------|-----------------|--------------|-------|------|------|------|
|             |                                            |                 | $V_{DD}$ (V) | Min.  | Typ. | Max. |      |
| $t_{PHL}$   | Propagation Delay Time (data)              |                 | 5            |       | 520  | 1040 | ns   |
|             |                                            |                 | 10           |       | 210  | 420  |      |
|             |                                            |                 | 15           |       | 150  | 300  |      |
| $t_{PLH}$   | Propagation Delay Time (data)              |                 | 5            |       | 660  | 1320 | ns   |
|             |                                            |                 | 10           |       | 260  | 520  |      |
|             |                                            |                 | 15           |       | 180  | 360  |      |
| $t_{PHL}$   | Propagation Delay Time ( $\overline{BL}$ ) |                 | 5            |       | 350  | 700  | ns   |
|             |                                            |                 | 10           |       | 175  | 350  |      |
|             |                                            |                 | 15           |       | 125  | 250  |      |
| $t_{PLH}$   | Propagation Delay Time ( $\overline{BL}$ ) |                 | 5            |       | 400  | 800  | ns   |
|             |                                            |                 | 10           |       | 175  | 350  |      |
|             |                                            |                 | 15           |       | 150  | 300  |      |
| $t_{PHL}$   | Propagation Delay Time ( $\overline{LT}$ ) |                 | 5            |       | 250  | 500  | ns   |
|             |                                            |                 | 10           |       | 125  | 250  |      |
|             |                                            |                 | 15           |       | 85   | 170  |      |
| $t_{PLH}$   | Propagation Delay Time ( $\overline{LT}$ ) |                 | 5            |       | 150  | 300  | ns   |
|             |                                            |                 | 10           |       | 75   | 150  |      |
|             |                                            |                 | 15           |       | 50   | 100  |      |
| $t_{TLH}$   | Transition Time                            |                 | 5            |       | 40   | 80   | ns   |
|             |                                            |                 | 10           |       | 30   | 60   |      |
|             |                                            |                 | 15           |       | 20   | 40   |      |
| $t_{THL}$   | Transition Time                            |                 | 5            |       | 125  | 310  | ns   |
|             |                                            |                 | 10           |       | 75   | 185  |      |
|             |                                            |                 | 15           |       | 65   | 160  |      |
| $t_{setup}$ | Setup Time                                 |                 | 5            | 150   | 75   |      | ns   |
|             |                                            |                 | 10           | 70    | 35   |      |      |
|             |                                            |                 | 15           | 40    | 20   |      |      |
| $t_{hold}$  | Hold Time                                  |                 | 5            | 0     | -75  |      | ns   |
|             |                                            |                 | 10           | 0     | -35  |      |      |
|             |                                            |                 | 15           | 0     | -20  |      |      |
| $t_w$       | Strobe Pulse Width                         |                 | 5            | 400   | 200  |      | ms   |
|             |                                            |                 | 10           | 160   | 80   |      |      |
|             |                                            |                 | 15           | 100   | 50   |      |      |

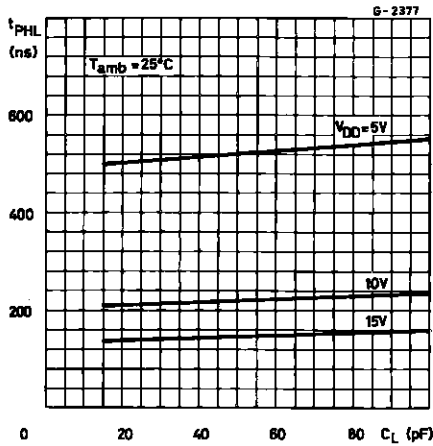
Typical Output Low (sink) Current Characteristics.



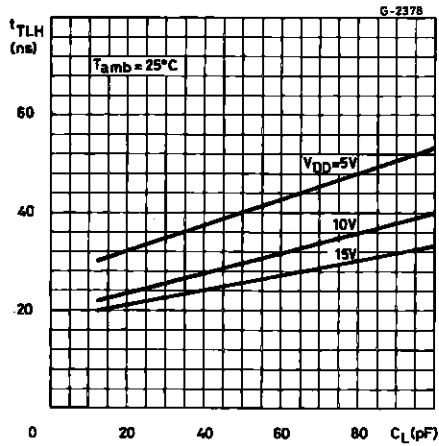
Typical data-to-output, low-to-high-level propagation delay time as a function of load capacitance.



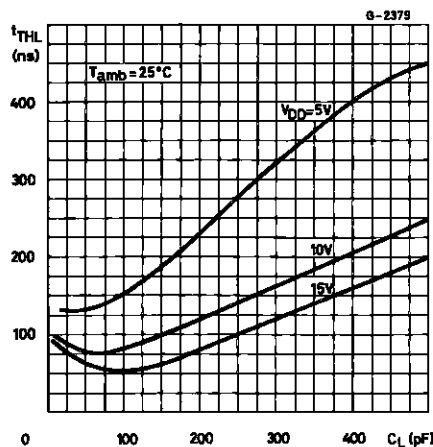
Typical data-to-output, high-to-low-level propagation delay time as a function of load capacitance.



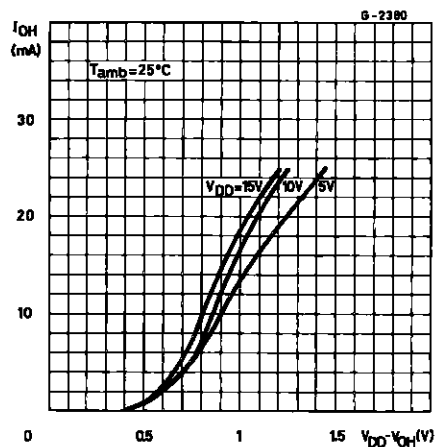
Typical low-to-high level transition time as a function of load capacitance.



Typical high-to-low level transition time as a function of load capacitance.

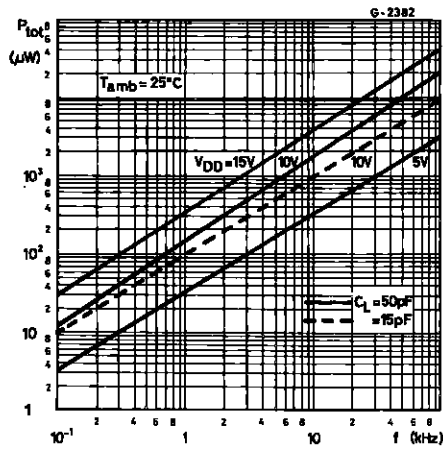


Typical Voltage drop (V\_DD to output) vs. Output source Current as a Function of Supply.

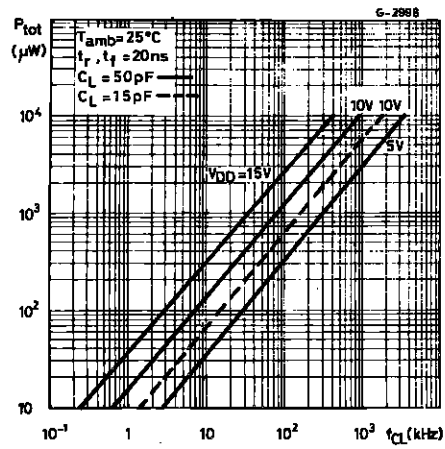




Typical Dynamic Power Dissipation Characteristics.



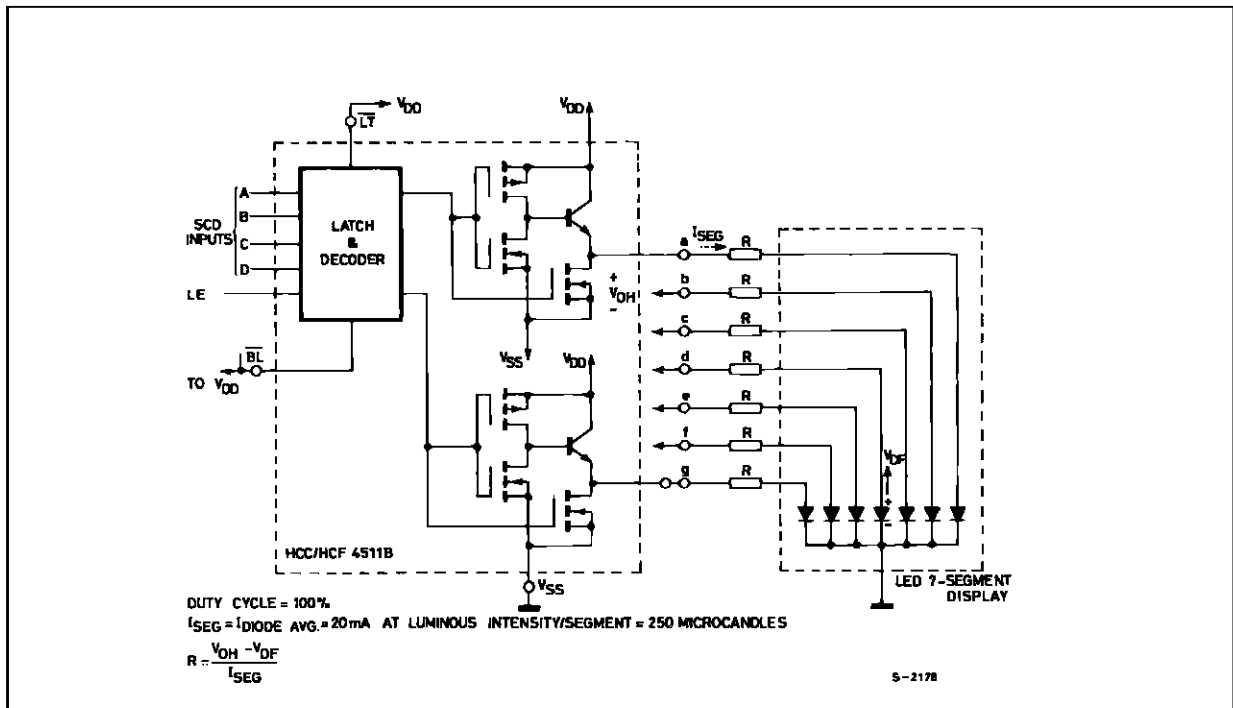
Derated Static Output Current Per Output.



Maximum continuous derated output current  $I_{OH}$  applies to a single output with all other outputs sourcing an equal amount of current at the supply voltages shown. Operation above the derating curve is not recommended.

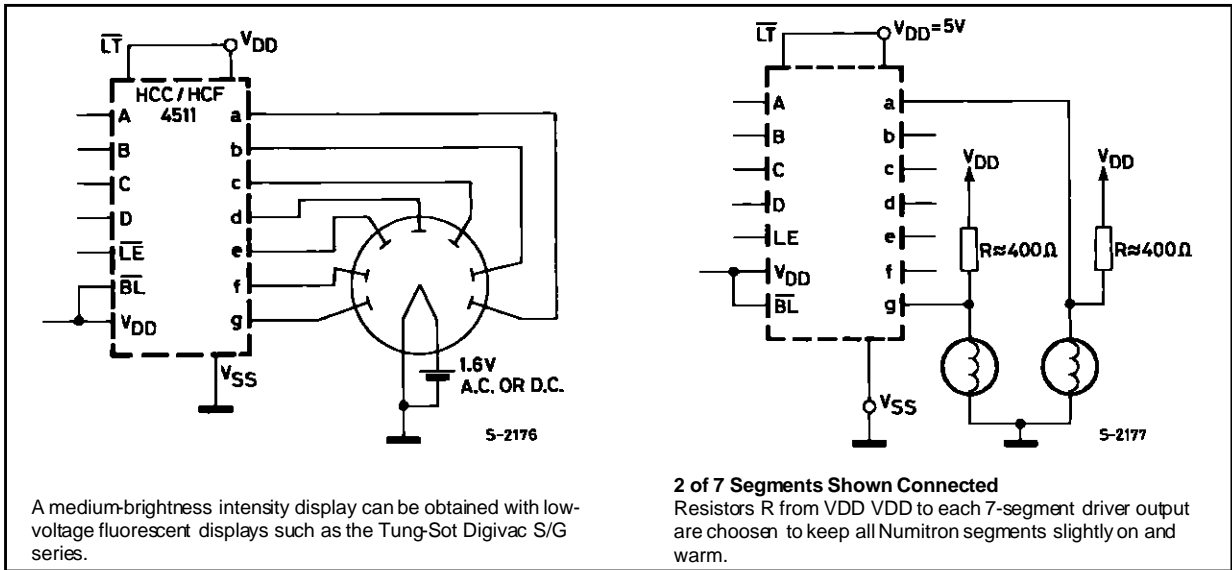
**TYPICAL APPLICATIONS** (interfacing with various displays)

**DRIVING COMMON-CATHODE 7-SEGMENT LED DISPLAYS**



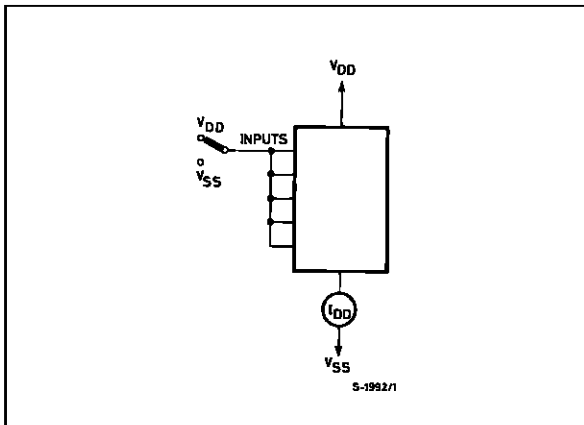
TYPICAL APPLICATIONS (continued)

Driving Low-voltage Fluorescent Displays. Driving Incandescent Displays.

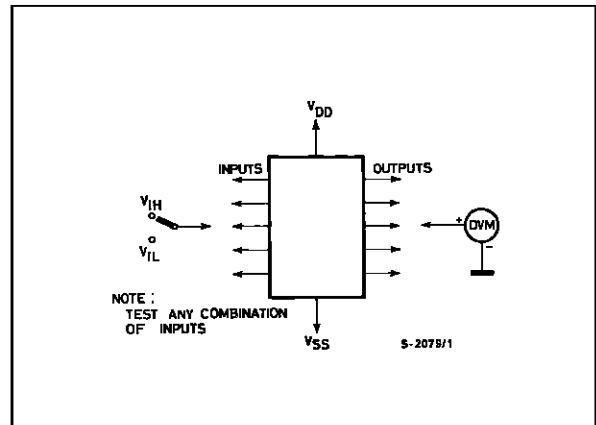


TEST CIRCUITS

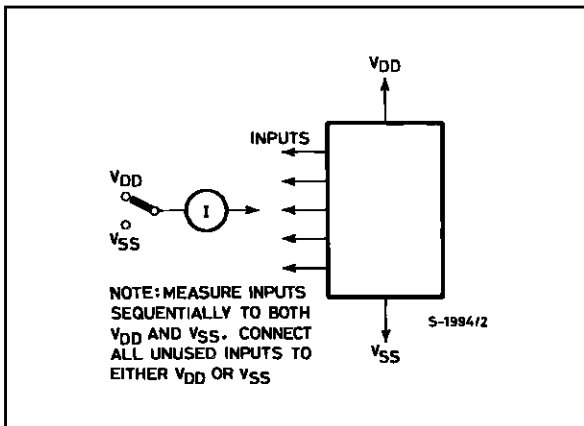
Quiescent Device Current.



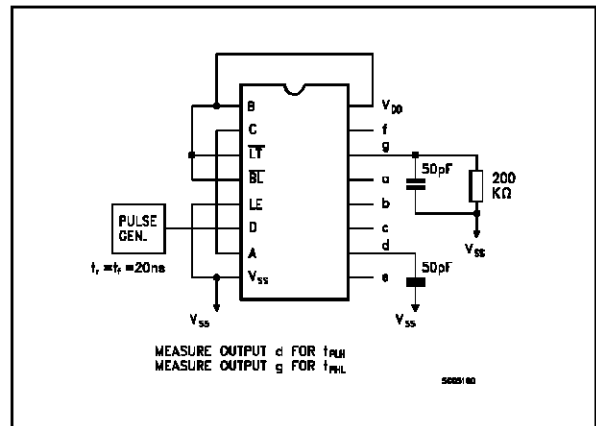
Noise Immunity.



Input Leakage Current.

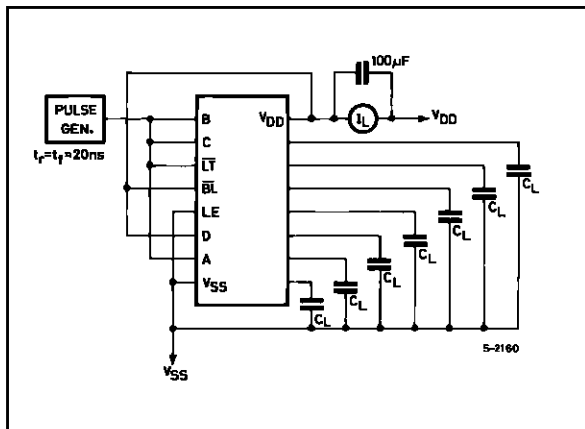


Data Propagation Delay.



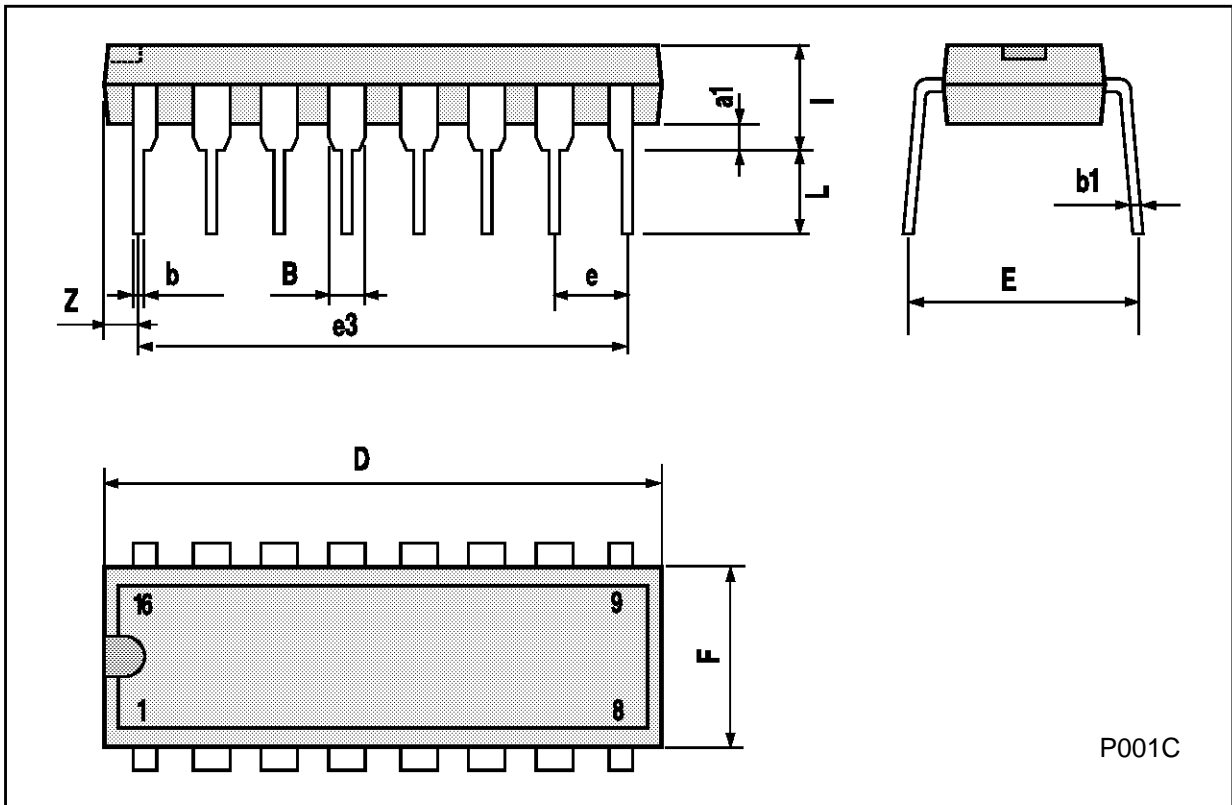
## TEST CIRCUITS (continued)

Dynamic Power dissipation.



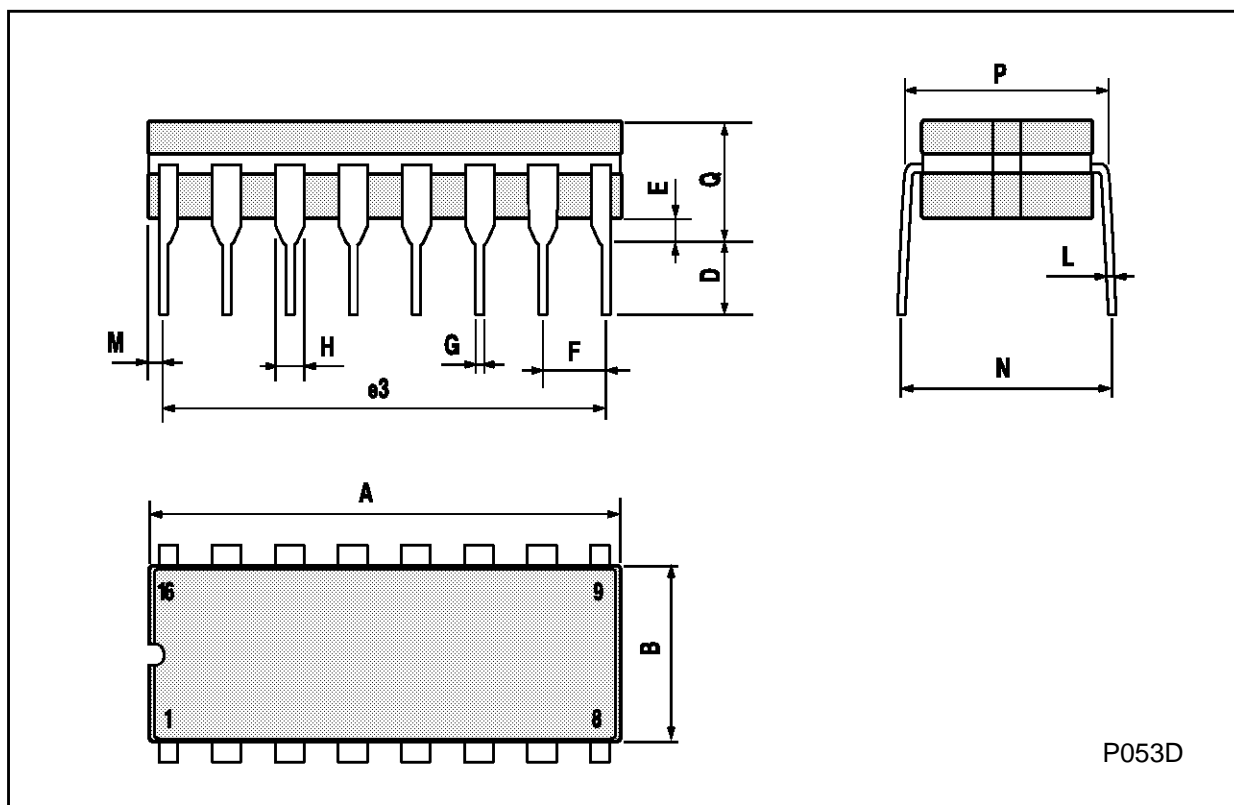
**Plastic DIP16 (0.25) MECHANICAL DATA**

| 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 |



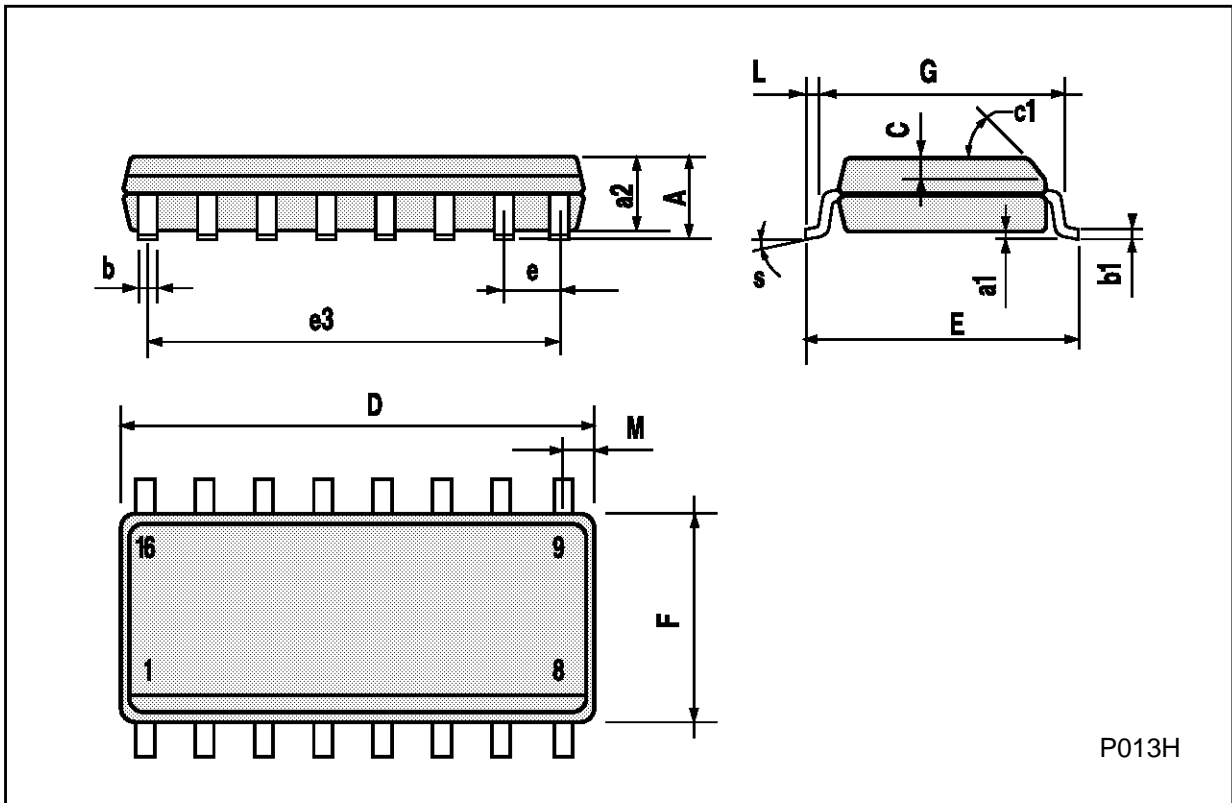
## Ceramic DIP16/1 MECHANICAL DATA

| 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 |



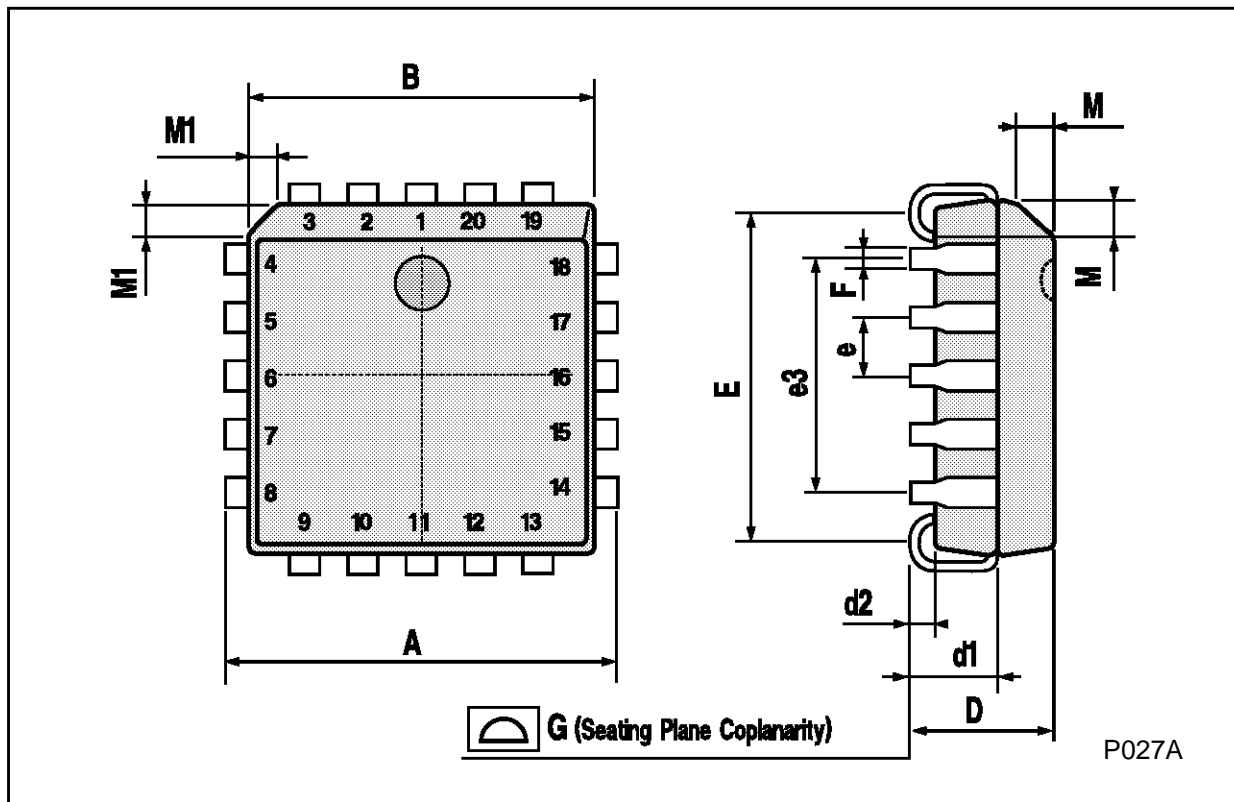
**SO16 (Narrow) MECHANICAL DATA**

| 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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