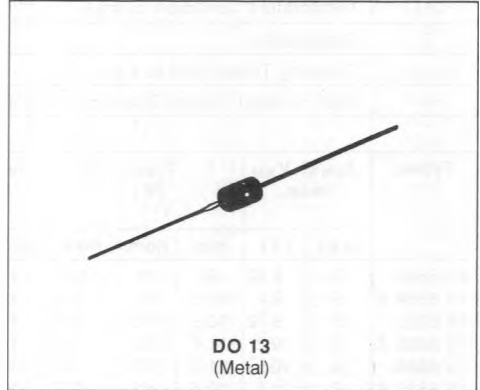


## UNIDIRECTIONAL TRANSIENT VOLTAGE SUPPRESSORS

- HIGH SURGE CAPABILITY :  
1.5 kW/1 ms EXPO
- VERY FAST CLAMPING TIME : 1 ps
- LARGE VOLTAGE RANGE :  
8.9 V → 171 V



### DESCRIPTION

Transient voltage suppressor diodes especially useful in protecting integrated circuits. MOS, hybrids and other voltage-sensitive semiconductors and components.

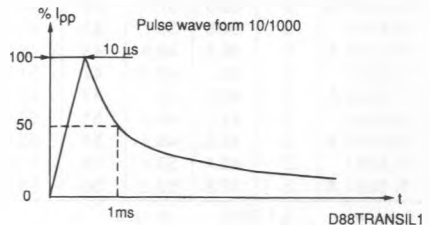
### ABSOLUTE RATINGS (limiting values)

| Symbol             | Parameter  | Value              | Unit     |
|--------------------|--|--------------------|----------|
| $P_p$              | Peak Pulse Power for 1 ms Exponential Pulse<br>$T_j$ Initial = 25 °C<br>See note 1 | 1500               | W        |
| $P$                | Power Dissipation on Infinite Heatsink<br>$T_{amb} = 75$ °C                        | 5                  | W        |
| $I_{FSM}$          | Non Repetitive Surge Peak Forward Current<br>$T_j$ Initial = 25 °C<br>$t = 10$ ms  | 250                | A        |
| $T_{stg}$<br>$T_j$ | Storage and Junction Temperature Range   | - 65 to 175<br>175 | °C<br>°C |
| $T_L$              | Maximum Lead Temperature for Soldering During 10 s at 4 mm from Case               | 230                | °C       |

### THERMAL RESISTANCE

| Symbol        | Parameter  | Value | Unit |
|---------------|--|-------|------|
| $R_{th(j-l)}$ | Junction-leads on Infinite Heatsink for $L_{lead} = 10$ mm | 20    | °C/W |

**Note :** 1. For surges upper than the maximum values, the diode will present a short-circuit anode-cathode.



**ELECTRICAL CHARACTERISTICS** ( $T_j = 25^{\circ}\text{C}$ )

| Symbol         | Parameter   | Value      |
|----------------|---|------------|
| $V_{RM}$       | Stand-off Voltage                                     | See table  |
| $V_{(BR)}$     | Breakdown Voltage                                     |            |
| $V_{(CL)}$     | Clamping Voltage                                      |            |
| $I_{PP}$       | Peak Pulse Current                                    |            |
| $\alpha_T$     | Temperature Coefficient of $V_{(BR)}$                 |            |
| C              | Capacitance   |            |
| $t_{clamping}$ | Clamping Time (0 volt to $V_{(BR)}$ )                 | 1 ps max.  |
| $V_F$          | Peak Forward Voltage Drop ( $I_{FM} = 100\text{ A}$ ) | 3.5 V max. |

| Types     | $I_{RM} @ V_{RM}$<br>max. |      | $V_{(BR)}^* @$<br>(V) |      |      | $I_R$ | $V_{(CL)} @ I_{PP}$<br>max.<br>1 ms expo. |      | $V_{CL} @ I_{PP}$<br>max.<br>8-20 $\mu\text{s}$ expo. |     | $\alpha_T$<br>max.             | C typ.<br>$V_R = 0$<br>f = 1 MHz |
|-----------|---------------------------|------|-----------------------|------|------|-------|---|------|---|-----|--------------------------------|----------------------------------|
|           | ( $\mu\text{A}$ )         | (V)  | min.                  | nom. | max. | (mA)  | (V)                                       | (A)  | (V)   | (A) | ( $10^{-4}/^{\circ}\text{C}$ ) | (pF)                             |
| 1N 5634   | 5                         | 8.92 | 9.9                   | 11   | 12.1 | 1     | 16.2                                      | 93   | 21.2  | 849 | 7.5                            | 6400                             |
| 1N 5634 A | 5                         | 9.4  | 10.5                  | 11   | 11.6 | 1     | 15.6                                      | 96   | 20.3  | 887 | 7.5                            | 6400                             |
| 1N 5635   | 5                         | 9.72 | 10.8                  | 12   | 13.2 | 1     | 17.3                                      | 87   | 22.7  | 793 | 7.8                            | 6000                             |
| 1N 5635 A | 5                         | 10.2 | 11.4                  | 12   | 12.6 | 1     | 16.7                                      | 90   | 21.7  | 829 | 7.8                            | 6000                             |
| 1N 5636   | 5                         | 10.5 | 11.7                  | 13   | 14.3 | 1     | 19  | 79   | 24.6  | 732 | 8.1                            | 5500                             |
| 1N 5636 A | 5                         | 11.1 | 12.4                  | 13   | 13.7 | 1     | 18.2                                      | 82   | 23.6  | 763 | 8.1                            | 5500                             |
| 1N 5637   | 5                         | 12.1 | 13.5                  | 15   | 16.5 | 1     | 22  | 68   | 28.4  | 634 | 8.4                            | 5000                             |
| 1N 5637 A | 5                         | 12.8 | 14.3                  | 15   | 15.8 | 1     | 21.2                                      | 71   | 27.2  | 662 | 8.4                            | 5000                             |
| 1N 5638   | 5                         | 12.9 | 14.4                  | 16   | 17.6 | 1     | 23.5                                      | 64   | 30.3  | 594 | 8.6                            | 4700                             |
| 1N 5638 A | 5                         | 13.6 | 15.2                  | 16   | 16.8 | 1     | 22.5                                      | 67   | 28.9  | 623 | 8.6                            | 4700                             |
| 1N 5639   | 5                         | 14.5 | 16.2                  | 18   | 19.8 | 1     | 26.5                                      | 56.5 | 34  | 529 | 8.8                            | 4300                             |
| 1N 5639 A | 5                         | 15.3 | 17.1                  | 18   | 18.9 | 1     | 25.2                                      | 59.5 | 32.5  | 554 | 8.8                            | 4300                             |
| 1N 5640   | 5                         | 16.2 | 18                    | 20   | 22   | 1     | 29.1                                      | 51.5 | 37.8  | 476 | 9                              | 4000                             |
| 1N 5640 A | 5                         | 17.1 | 19                    | 20   | 21   | 1     | 27.7                                      | 54   | 36.1  | 498 | 9                              | 4000                             |
| 1N 5641   | 5                         | 17.8 | 19.8                  | 22   | 24.2 | 1     | 31.9                                      | 47   | 41.2  | 437 | 9.2                            | 3700                             |
| 1N 5641 A | 5                         | 18.8 | 20.9                  | 22   | 23.1 | 1     | 30.6                                      | 49   | 39.3  | 458 | 9.2                            | 3700                             |
| 1N 5642   | 5                         | 19.4 | 21.6                  | 24   | 26.4 | 1     | 34.7                                      | 43   | 44.9  | 401 | 9.4                            | 3500                             |
| 1N 5642 A | 5                         | 20.5 | 22.8                  | 24   | 25.2 | 1     | 33.2                                      | 45   | 42.8  | 421 | 9.4                            | 3500                             |
| 1N 5643   | 5                         | 21.8 | 24.3                  | 27   | 29.7 | 1     | 39.1                                      | 38.5 | 50.5  | 356 | 9.6                            | 3200                             |
| 1N 5643 A | 5                         | 23.1 | 25.7                  | 27   | 28.4 | 1     | 37.5                                      | 40   | 48.3  | 373 | 9.6                            | 3200                             |
| 1N 5644   | 5                         | 24.3 | 27                    | 30   | 33   | 1     | 43.5                                      | 34.5 | 56.1  | 321 | 9.7                            | 2900                             |
| 1N 5644 A | 5                         | 25.6 | 28.5                  | 30   | 31.5 | 1     | 41.4                                      | 36   | 53.5  | 336 | 9.7                            | 2900                             |
| 1N 5645   | 5                         | 26.8 | 29.7                  | 33   | 36.3 | 1     | 47.7                                      | 31.5 | 61.7  | 292 | 9.8                            | 2700                             |
| 1N 5645 A | 5                         | 28.2 | 31.4                  | 33   | 34.7 | 1     | 45.7                                      | 33   | 59  | 305 | 9.8                            | 2700                             |
| 1N 5646   | 5                         | 29.1 | 32.4                  | 36   | 39.6 | 1     | 52  | 29   | 67.3  | 267 | 9.9                            | 2500                             |
| 1N 5646 A | 5                         | 30.8 | 34.2                  | 36   | 37.8 | 1     | 49.9                                      | 30   | 64.3  | 280 | 9.9                            | 2500                             |
| 1N 5647   | 5                         | 31.6 | 35.1                  | 39   | 42.9 | 1     | 56.4                                      | 26.5 | 73  | 246 | 10                             | 2400                             |
| 1N 5647 A | 5                         | 33.3 | 37.1                  | 39   | 41   | 1     | 53.9                                      | 28   | 69.7  | 258 | 10                             | 2400                             |
| 1N 5648   | 5                         | 34.8 | 38.7                  | 43   | 47.3 | 1     | 61.9                                      | 24   | 80.4  | 224 | 10.1                           | 2200                             |
| 1N 5648 A | 5                         | 36.8 | 40.9                  | 43   | 45.2 | 1     | 59.3                                      | 25.3 | 76.8  | 234 | 10.1                           | 2200                             |
| 1N 5649   | 5                         | 38.1 | 42.3                  | 47   | 51.7 | 1     | 67.8                                      | 22.2 | 88  | 204 | 10.1                           | 2050                             |
| 1N 5649 A | 5                         | 40.2 | 44.7                  | 47   | 49.4 | 1     | 64.8                                      | 23.2 | 84  | 214 | 10.1                           | 2050                             |
| 1N 5650   | 5                         | 41.3 | 45.9                  | 51   | 56.1 | 1     | 73.5                                      | 20.4 | 95.5  | 188 | 10.2                           | 1950                             |
| 1N 5650 A | 5                         | 43.6 | 48.5                  | 51   | 53.6 | 1     | 70.1                                      | 21.4 | 91  | 198 | 10.2                           | 1950                             |
| 1N 5651   | 5                         | 45.4 | 50.4                  | 56   | 61.6 | 1     | 80.5                                      | 18.6 | 105   | 171 | 10.3                           | 1800                             |
| 1N 5651 A | 5                         | 47.8 | 53.2                  | 56   | 58.8 | 1     | 77  | 19.5 | 100   | 180 | 10.3                           | 1800                             |

\* Pulse test  $t_p < 50\text{ms}$   $\delta < 2\%$ .

(continued)

| Types     | $I_{RM}$ @ $V_{RM}$<br>max. |      | $V_{(BR)}^*$ @<br>(V) |      |      | $I_R$ | $V_{(CL)}$ @ $I_{PP}$<br>max.<br>1 ms expo. |      | $V_{CL}$ @ $I_{PP}$<br>max.<br>8-20 $\mu$ s expo. |      | $\alpha_T$<br>max.      | C typ.<br>$V_R = 0$<br>$f = 1$ MHz |
|-----------|-----------------------------|------|-----------------------|------|------|-------|---|------|---|------|-------------------------|------------------------------------|
|           | ( $\mu$ A)                  | (V)  | min.                  | nom. | max. | (mA)  | (V)   | (A)  | (V)   | (A)  | ( $10^{-4}/^{\circ}$ C) | (pF)                               |
| 1N 5652   | 5                           | 50.2 | 55.8                  | 62   | 68.2 | 1     | 89  | 16.9 | 116   | 155  | 10.4                    | 1700                               |
| 1N 5652 A | 5                           | 53   | 58.9                  | 62   | 65.1 | 1     | 85  | 17.7 | 111   | 162  | 10.4                    | 1700                               |
| 1N 5653   | 5                           | 55.1 | 61.2                  | 68   | 74.8 | 1     | 98  | 15.3 | 127   | 142  | 10.4                    | 1550                               |
| 1N 5653 A | 5                           | 58.1 | 64.6                  | 68   | 71.4 | 1     | 92  | 16.3 | 121   | 148  | 10.4                    | 1550                               |
| 1N 5654   | 5                           | 60.7 | 67.5                  | 75   | 82.5 | 1     | 108   | 13.9 | 140   | 128  | 10.5                    | 1450                               |
| 1N 5654 A | 5                           | 64.1 | 71.3                  | 75   | 78.8 | 1     | 103   | 14.6 | 134   | 134  | 10.5                    | 1450                               |
| 1N 5655   | 5                           | 66.4 | 73.8                  | 82   | 90.2 | 1     | 118   | 12.7 | 153   | 117  | 10.5                    | 1350                               |
| 1N 5655 A | 5                           | 70.1 | 77.9                  | 82   | 86.1 | 1     | 113   | 13.3 | 146   | 123  | 10.5                    | 1350                               |
| 1N 5656   | 5                           | 73.7 | 81.9                  | 91   | 100  | 1     | 131   | 11.4 | 170   | 106  | 10.6                    | 1250                               |
| 1N 5656 A | 5                           | 77.8 | 86.5                  | 91   | 95.5 | 1     | 125   | 12   | 162   | 111  | 10.6                    | 1250                               |
| 1N 5657   | 5                           | 81   | 90                    | 100  | 110  | 1     | 144   | 10.4 | 187   | 96   | 10.6                    | 1150                               |
| 1N 5657 A | 5                           | 85.5 | 95                    | 100  | 105  | 1     | 137   | 11   | 178   | 101  | 10.6                    | 1150                               |
| 1N 5658   | 5                           | 89.2 | 99                    | 110  | 121  | 1     | 158   | 9.5  | 203   | 89   | 10.7                    | 1050                               |
| 1N 5658 A | 5                           | 94   | 105                   | 110  | 116  | 1     | 152   | 9.9  | 195   | 92   | 10.7                    | 1050                               |
| 1N 5659   | 5                           | 97.2 | 108                   | 120  | 132  | 1     | 173   | 8.7  | 222   | 81   | 10.7                    | 1000                               |
| 1N 5659 A | 5                           | 102  | 114                   | 120  | 126  | 1     | 165   | 9.1  | 212   | 85   | 10.7                    | 1000                               |
| 1N 5660   | 5                           | 105  | 117                   | 130  | 143  | 1     | 187   | 8    | 240   | 75   | 10.7                    | 950                                |
| 1N 5660 A | 5                           | 111  | 124                   | 130  | 137  | 1     | 179   | 8.4  | 230   | 78   | 10.7                    | 950                                |
| 1N 5661   | 5                           | 121  | 135                   | 150  | 165  | 1     | 215   | 7    | 277   | 65   | 10.8                    | 850                                |
| 1N 5661 A | 5                           | 128  | 143                   | 150  | 158  | 1     | 207   | 7.2  | 265   | 68   | 10.8                    | 850                                |
| 1N 5662   | 5                           | 130  | 144                   | 160  | 176  | 1     | 230   | 6.5  | 296   | 61   | 10.8                    | 800                                |
| 1N 5662 A | 5                           | 136  | 152                   | 160  | 168  | 1     | 219   | 6.8  | 282   | 64   | 10.8                    | 800                                |
| 1N 5663   | 5                           | 138  | 153                   | 170  | 187  | 1     | 244   | 6.2  | 314   | 57.5 | 10.8                    | 750                                |
| 1N 5663 A | 5                           | 145  | 161                   | 170  | 179  | 1     | 234   | 6.4  | 301   | 60   | 10.8                    | 750                                |
| 1N 5664   | 5                           | 146  | 162                   | 180  | 198  | 1     | 258   | 5.8  | 333   | 54   | 10.8                    | 725                                |
| 1N 5664 A | 5                           | 154  | 171                   | 180  | 189  | 1     | 246   | 6.1  | 317   | 57   | 10.8                    | 725                                |
| 1N 5665   | 5                           | 162  | 180                   | 200  | 220  | 1     | 287   | 5.2  | 370   | 48.5 | 10.8                    | 675                                |
| 1N 5665 A | 5                           | 171  | 190                   | 200  | 210  | 1     | 274   | 5.5  | 353   | 51   | 10.8                    | 675                                |

\* Pulse test

 $t_p < 50$ ms $\delta < 2\%$ .

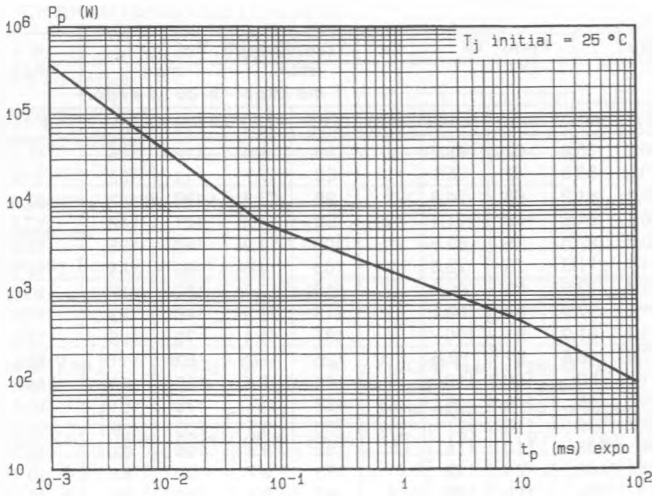


Fig.1 - Peak pulse power versus exponential pulse duration.

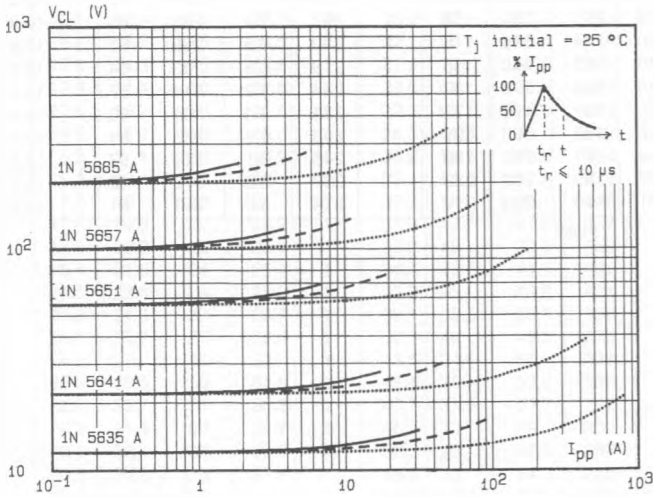


Fig.2 - Clamping voltage versus peak pulse current.  
 exponential waveform  $t = 20 \mu s$  .....  
 $t = 1 ms$  - - - -  
 $t = 10 ms$  ———

Note : The curves of the figure 2 are specified for a junction temperature of 25 °C before surge. The given results may be extrapolated for other junction temperatures by using the following formula :  $\Delta V (BR) = \alpha_T (V (BR)) \times [T_j - 25] \times V (BR)$   
 For intermediate voltages, extrapolate the given results.

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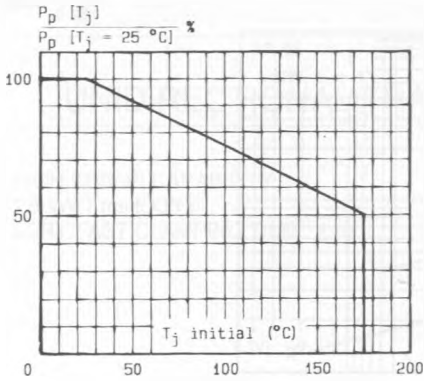


Fig. 3 - Allowable power dissipation versus junction temperature.

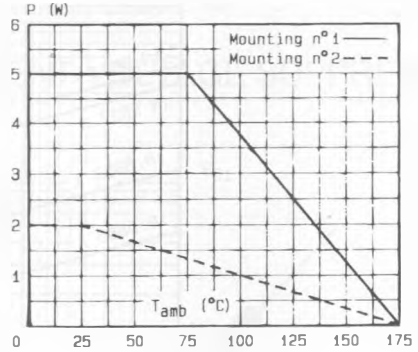


Fig. 4 - Power dissipation versus ambient temperature.

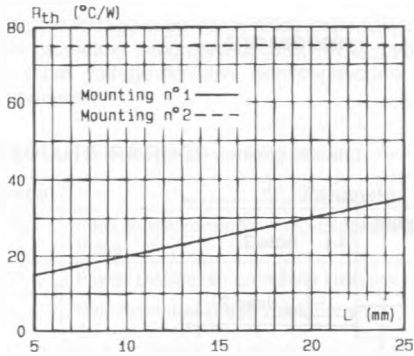


Fig. 5 - Thermal resistance versus lead length.

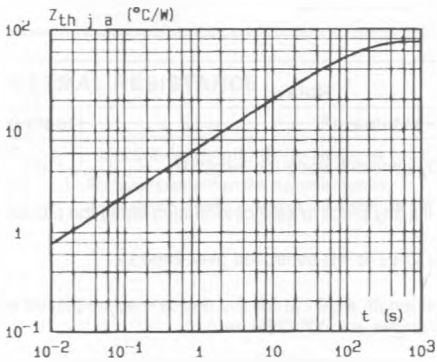
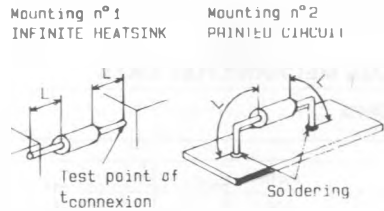


Fig. 6 - Transient thermal impedance junction-ambient for mounting n°2 versus pulse duration ( $L = 10 \text{ mm}$ ).

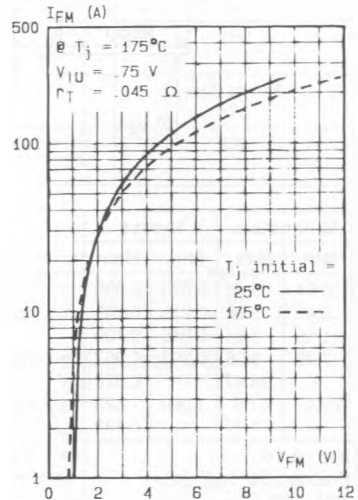


Fig. 7 - Peak forward current versus peak forward voltage drop (typical values for unidirectional types).

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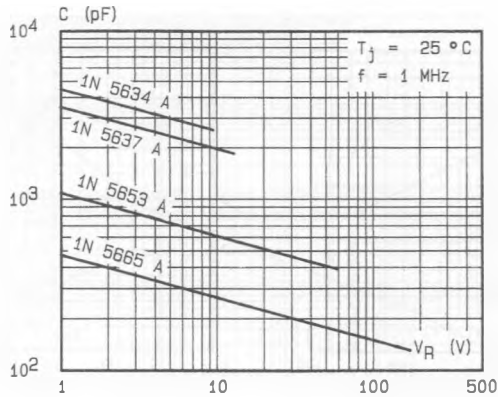
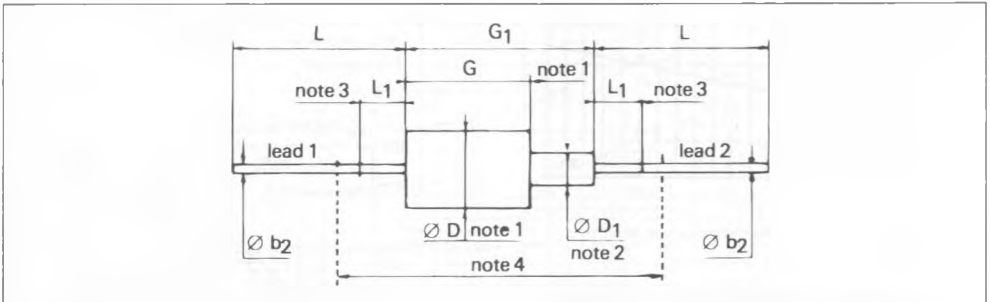


Fig.8 - Capacitance versus reverse applied voltage (typical values).

D891N5634AP6

**PACKAGE MECHANICAL DATA**

DO 13 Metal



| Ref.  | Millimeters |       | Inches |       | Notes   |
|---|-------------|-------|--------|-------|---|
|   | Min.        | Max.  | Min.   | Max.  |   |
| ∅ b <sub>2</sub>  | 0.64        | 0.88  | 0.025  | 0.035 | 1 - ∅ D is substantially constant along the length G.<br>2 - This dimension limits any pinch or seal deformation along the tubulation.<br>3 - The lead diameter ∅ b <sub>2</sub> is not controlled over zone L <sub>1</sub> .<br>4 - The minimum axial length within which the device may be placed with its leads bent at right angles is 1.00" (25.4 mm). |
| ∅ D   | 5.47        | 5.96  | 0.215  | 0.235 |   |
| ∅ D <sub>1</sub>  | 1.15        | 2.54  | 0.045  | 0.100 |   |
| G   | 7.45        | 9.06  | 0.293  | 0.357 |   |
| G <sub>1</sub>  | —           | 14.47 | —      | 0.570 |   |
| L   | 25.4        | 41.2  | 1.000  | 1.625 |   |
| L <sub>1</sub>  | —           | 4.77  | —      | 0.188 |   |
| Code IEC : A 19<br>Code France : DO 13/F 61<br>Code USA : DO 13 |             |       |        |       |   |

Cooling method : by convection (method A).  
 Marking : type number.  
 Weight : 1.5 g.  
 Lead 1 connected electrically to case.