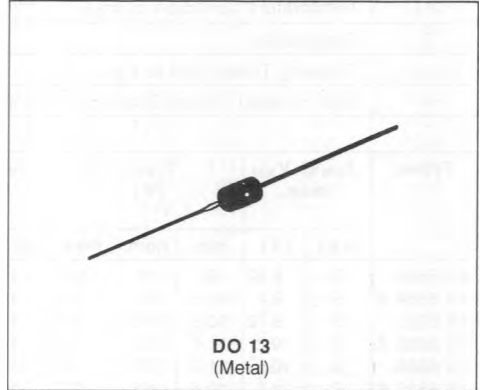


UNIDIRECTIONAL TRANSIENT VOLTAGE SUPPRESSORS

- 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.

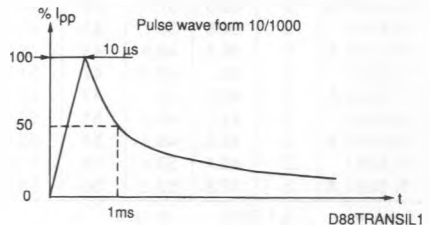
ABSOLUTE RATINGS (limiting values)

| Symbol | Parameter | Value | Unit |
|--------------------|--|--------------------|----------|
| P_p | Peak Pulse Power for 1 ms Exponential Pulse T_j Initial = 25 °C See note 1 | 1500 | W |
| P | Power Dissipation on Infinite Heatsink $T_{amb} = 75$ °C | 5 | W |
| I_{FSM} | Non Repetitive Surge Peak Forward Current T_j Initial = 25 °C $t = 10$ ms | 250 | A |
| T_{stg} T_j | Storage and Junction Temperature Range | - 65 to 175 175 | °C °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 | |
| α_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 | $I_{RM} @ V_{RM}$ max. | | $V_{(BR)}^* @$ (V) | | | I_R | $V_{(CL)} @ I_{PP}$ max. 1 ms expo. | | $V_{CL} @ I_{PP}$ max. 8-20 μs expo. | | α_T max. | C typ. $V_R = 0$ f = 1 MHz |
|-----------|---------------------------|------|-----------------------|------|------|-------|---|------|---|-----|------------------------------|----------------------------------|
| | (μA) | (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} max. | | $V_{(BR)}^*$ @ (V) | | | I_R | $V_{(CL)}$ @ I_{PP} max. 1 ms expo. | | V_{CL} @ I_{PP} max. 8-20 μ s expo. | | α_T max. | C typ. $V_R = 0$ $f = 1$ MHz |
|-----------|-----------------------------|------|-----------------------|------|------|-------|---|------|---|------|-------------------------|------------------------------------|
| | (μ 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.

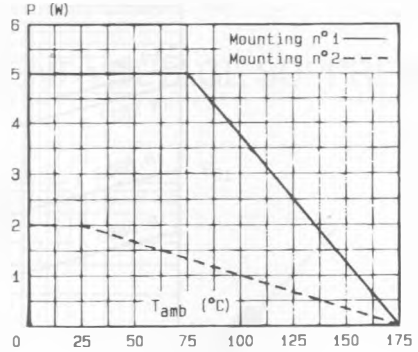


Fig. 4 - Power dissipation versus ambient temperature.

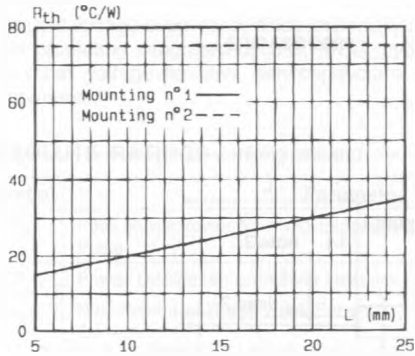


Fig. 5 - Thermal resistance versus lead length.

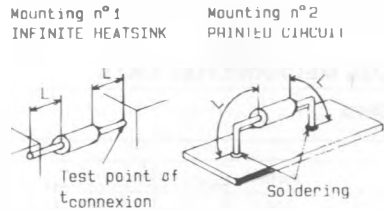


Fig. 6 - Transient thermal impedance junction-ambient for mounting n°2 versus pulse duration ($L = 10 \text{ mm}$).

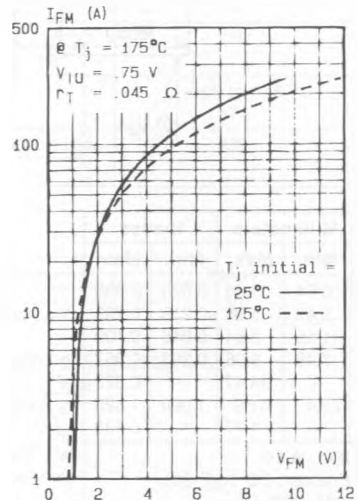


Fig. 7 - Peak forward current versus peak forward voltage drop (typical values for unidirectional types).

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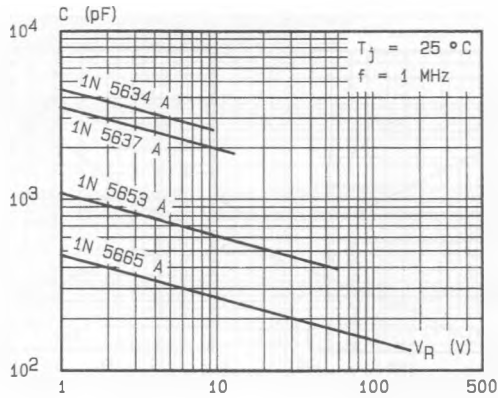


Fig.8 - Capacitance versus reverse applied voltage (typical values).

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PACKAGE MECHANICAL DATA

DO 13 Metal



| Ref. | Millimeters | | Inches | | Notes |
|---|-------------|-------|--------|-------|--|
| | Min. | Max. | Min. | Max. | |
| $\varnothing b_2$ | 0.64 | 0.88 | 0.025 | 0.035 | 1 - $\varnothing D$ is substantially constant along the length G. 2 - This dimension limits any pinch or seal deformation along the tubulation. 3 - The lead diameter $\varnothing b_2$ is not controlled over zone L ₁ . 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). |
| $\varnothing D$ | 5.47 | 5.96 | 0.215 | 0.235 | |
| $\varnothing D_1$ | 1.15 | 2.54 | 0.045 | 0.100 | |
| G | 7.45 | 9.06 | 0.293 | 0.357 | |
| G ₁ | — | 14.47 | — | 0.570 | |
| L | 25.4 | 41.2 | 1.000 | 1.625 | |
| L ₁ | — | 4.77 | — | 0.188 | |
| Code IEC : A 19 Code France : DO 13/F 61 Code USA : DO 13 | | | | | |

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