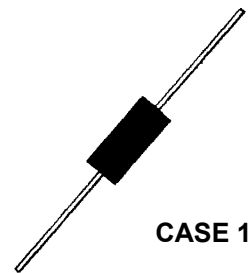


## DESCRIPTION

The Transient Voltage Suppressor (TVS) series for 1N5908 & 1N6267-1N6303A are JEDEC registered selections for unidirectional devices. The popular series of 1.5KE6.8-1.5KE400A offers similar voltages with an extended voltage range and also provides bidirectional options with a C or CA suffix. All have the same high Peak Pulse Power rating of 1500 W and extremely fast response time. They can protect from secondary lightning effects per IEC61000-4-5 and class levels described herein as well as inductive switching environments and induced RF protection. Since their response time is virtually instantaneous, they can also protect from ESD and EFT per IEC61000-4-2 and IEC61000-4-4.

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

## APPEARANCE



## FEATURES

- Economical TVS series for thru-hole mounting
- Available in both Unidirectional and Bidirectional (add C or CA suffix for bi-directional)
- Voltages from 6.8 to 400 V Breakdown ( $V_{BR}$ )
- Suppresses transients up to 1500 watts @ 10/1000  $\mu$ s (see Figure 1)
- Fast response
- Options for screening in accordance with MIL-PRF-19500 for JAN, JANTX, JANTXV, and JANS are available by adding MQ, MX, MV, or MSP prefixes respectively to part numbers.
- Surface mount equivalent packages are available as SMCJ5.0 - SMCJ170CA or SMCJ5.0 - SMCJ170CA (consult factory for other surface mount options)
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B

## APPLICATIONS / BENEFITS

- Protection from switching transients and induced RF
  - Protection from ESD and EFT per IEC 61000-4-2 and IEC 61000-4-4
  - Secondary lightning protection per IEC61000-4-5 with 42 Ohms source impedance:
    - Class 1: 1.5KE6.8A to 1.5KE200A or CA \*
    - Class 2: 1.5KE5.0A to 1.5KE180A or CA \*
    - Class 3: 1.5KE5.0A to 1.5KE91A or CA \*
    - Class 4: 1.5KE5.0A to 1.5KE43A or CA \*
  - Secondary lightning protection per IEC61000-4-5 with 12 Ohms source impedance:
    - Class 1: 1.5KE5.0A to 1.5KE110A or CA \*
    - Class 2: 1.5KE5.0A to 1.5KE56A or CA \*
    - Class 3: 1.5KE5.0A to 1.5KE27A or CA \*
    - Class 4: 1.5KE5.0A to 1.5KE13A or CA \*
  - Secondary lightning protection per IEC61000-4-5 with 2 Ohms source impedance:
    - Class 2: 1.5KE5.0A to 1.5KE24A or CA \*
    - Class 3: 1.5KE5.0 to 1.5KE12A or CA \*
- \* Also applies to 1N5908 and 1Nxxxx of same voltage

## MAXIMUM RATINGS

- Peak Pulse Power dissipation at 25°C: 1500 watts at 10/1000  $\mu$ s (also see Fig 1,2, and 3)
- Impulse repetition rate (duty factor): 0.01%
- $t_{clamping}$  (0 volts to  $V_{BR}$  min.): < 100 ps theoretical for unidirectional and < 5 ns for bidirectional
- Operating and Storage temperature: -65°C to +150°C
- Thermal Resistance: 22°C/W junction to lead at 3/8 inch (10 mm) from body, or 82°C/W junction to ambient when mounted on FR4 PC board with 4 mm<sup>2</sup> copper pads (1oz) and track width 1 mm, length 25 mm
- Steady-State Power dissipation: 5 watts at  $T_L = 40^\circ\text{C}$ , or 1.52 watts at  $T_A = 25^\circ\text{C}$  when mounted on FR4 PC board described for thermal resistance
- Forward Surge: 200 Amps peak impulse of 8.3 ms half-sine wave at 25°C (unidirectional only)
- Solder temperatures: 260°C for 10 s (maximum)

## MECHANICAL AND PACKAGING

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- TERMINATIONS: Tin-lead plated solderable per MIL-STD-750, method 2026
- POLARITY: Cathode indicated by band. No marking on bidirectional devices
- MARKING: Part number
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number)
- WEIGHT: 1.5 grams (approximate)
- See package dimensions on last page

**ELECTRICAL CHARACTERISTICS**

| Industry Type Number | JEDEC Type Number | Rated Standoff Voltage $V_{WM}$ (NOTE 1) | Breakdown Voltage |            | Maximum Clamping Voltage $V_C @ I_{PP}$ | Maximum Standby Current $I_D @ V_{WM}$ | Maximum Peak Pulse Current $I_{PP}$ (Fig. 2) | Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha V_{(BR)}$ |
|----------------------|-------------------|------------------------------------------|-------------------|------------|-----------------------------------------|----------------------------------------|----------------------------------------------|-----------------------------------------------------------------|
|                      |                   |                                          | $V_{(BR)}$ @      | $I_{(BR)}$ |                                         |                                        |                                              |                                                                 |
|                      |                   | Volts                                    | Volts Min. Max.   | mA         | Volts                                   | $\mu A$                                | A                                            | %/°C                                                            |
| -                    | 1N5908            | 5.0                                      | 6.0 - -           | 1          | 7.6                                     | 300                                    | 30                                           | .057                                                            |
| 1.5KE6.8             | 1N6267            | 5.50                                     | 6.12 - 7.48       | 10         | 10.8                                    | 1000                                   | 139.0                                        | .057                                                            |
| 1.5KE6.8A            | 1N6267A           | 5.80                                     | 6.45 - 7.14       | 10         | 10.5                                    | 1000                                   | 143.0                                        | .057                                                            |
| 1.5KE7.5             | 1N6268            | 6.05                                     | 6.75 - 8.25       | 10         | 11.7                                    | 500                                    | 128.0                                        | .061                                                            |
| 1.5KE7.5A            | 1N6268A           | 6.40                                     | 7.13 - 7.88       | 10         | 11.3                                    | 500                                    | 132.0                                        | .061                                                            |
| 1.5KE8.2             | 1N6269            | 6.63                                     | 7.38 - 9.02       | 10         | 12.5                                    | 200                                    | 120.0                                        | .065                                                            |
| 1.5KE8.2A            | 1N6269A           | 7.02                                     | 7.79 - 8.61       | 10         | 12.1                                    | 200                                    | 124.0                                        | .065                                                            |
| 1.5KE9.1             | 1N6270            | 7.37                                     | 8.19 - 10.00      | 1          | 13.8                                    | 50                                     | 109.0                                        | .068                                                            |
| 1.5KE9.1A            | 1N6270A           | 7.78                                     | 8.65 - 9.55       | 1          | 13.4                                    | 50                                     | 112.0                                        | .068                                                            |
| 1.5KE10              | 1N6271            | 8.10                                     | 9.00 - 11.00      | 1          | 15.0                                    | 10                                     | 100.0                                        | .073                                                            |
| 1.5KE10A             | 1N6271A           | 8.55                                     | 9.50 - 10.50      | 1          | 14.5                                    | 10                                     | 103.0                                        | .073                                                            |
| 1.5KE11              | 1N6272            | 8.92                                     | 9.90 - 12.10      | 1          | 16.2                                    | 5                                      | 93.0                                         | .075                                                            |
| 1.5KE11A             | 1N6272A           | 9.40                                     | 10.50 - 11.60     | 1          | 15.6                                    | 5                                      | 96.0                                         | .075                                                            |
| 1.5KE12              | 1N6273            | 9.72                                     | 10.80 - 13.20     | 1          | 17.3                                    | 5                                      | 87.0                                         | .078                                                            |
| 1.5KE12A             | 1N6273A           | 10.220                                   | 11.40 - 12.60     | 1          | 16.7                                    | 5                                      | 90.0                                         | .078                                                            |
| 1.5KE13              | 1N6274            | 10.50                                    | 11.70 - 14.30     | 1          | 19.0                                    | 5                                      | 79.0                                         | .081                                                            |
| 1.5KE13A             | 1N6274A           | 11.10                                    | 12.40 - 13.70     | 1          | 18.2                                    | 5                                      | 82.0                                         | .081                                                            |
| 1.5KE15              | 1N6275            | 12.10                                    | 13.50 - 16.50     | 1          | 22.0                                    | 5                                      | 68.0                                         | .084                                                            |
| 1.5KE15A             | 1N6275A           | 12.80                                    | 14.30 - 15.80     | 1          | 21.2                                    | 5                                      | 71.0                                         | .084                                                            |
| 1.5KE16              | 1N6276            | 12.90                                    | 14.40 - 17.60     | 1          | 23.5                                    | 5                                      | 64.0                                         | .086                                                            |
| 1.5KE16A             | 1N6276A           | 13.60                                    | 15.20 - 16.80     | 1          | 22.5                                    | 5                                      | 67.0                                         | .086                                                            |
| 1.5KE18              | 1N6277            | 14.50                                    | 16.20 - 19.80     | 1          | 26.5                                    | 5                                      | 56.5                                         | .088                                                            |
| 1.5KE18A             | 1N6277A           | 15.30                                    | 17.10 - 18.90     | 1          | 25.2                                    | 5                                      | 59.5                                         | .088                                                            |
| 1.5KE20              | 1N6278            | 16.20                                    | 18.00 - 22.00     | 1          | 29.1                                    | 5                                      | 51.5                                         | .090                                                            |
| 1.5KE20A             | 1N6278A           | 17.10                                    | 19.00 - 21.00     | 1          | 27.7                                    | 5                                      | 54.0                                         | .090                                                            |
| 1.5KE22              | 1N6279            | 17.80                                    | 19.80 - 24.20     | 1          | 31.9                                    | 5                                      | 47.0                                         | .092                                                            |
| 1.5KE22A             | 1N6279A           | 18.80                                    | 20.90 - 23.10     | 1          | 30.6                                    | 5                                      | 49.0                                         | .092                                                            |
| 1.5KE24              | 1N6280            | 19.40                                    | 21.60 - 26.40     | 1          | 34.7                                    | 5                                      | 43.0                                         | .094                                                            |
| 1.5KE24A             | 1N6280A           | 20.50                                    | 22.80 - 25.20     | 1          | 33.2                                    | 5                                      | 45.0                                         | .094                                                            |
| 1.5KE27              | 1N6281            | 21.80                                    | 24.30 - 29.70     | 1          | 39.1                                    | 5                                      | 38.5                                         | .096                                                            |
| 1.5KE27A             | 1N6281A           | 23.10                                    | 25.70 - 28.40     | 1          | 37.5                                    | 5                                      | 40.0                                         | .096                                                            |
| 1.5KE30              | 1N6282            | 24.30                                    | 27.00 - 33.00     | 1          | 43.5                                    | 5                                      | 34.5                                         | .097                                                            |
| 1.5KE30A             | 1N6282A           | 25.60                                    | 28.50 - 31.50     | 1          | 41.4                                    | 5                                      | 36.0                                         | .097                                                            |
| 1.5KE33              | 1N6283            | 26.80                                    | 29.70 - 36.30     | 1          | 47.7                                    | 5                                      | 31.5                                         | .098                                                            |
| 1.5KE33A             | 1N6283A           | 28.20                                    | 31.40 - 34.70     | 1          | 45.7                                    | 5                                      | 33.0                                         | .098                                                            |
| 1.5KE36              | 1N6284            | 29.10                                    | 32.40 - 39.60     | 1          | 52.0                                    | 5                                      | 29.0                                         | .099                                                            |
| 1.5KE36A             | 1N6284A           | 30.80                                    | 34.20 - 37.80     | 1          | 49.9                                    | 5                                      | 30.0                                         | .099                                                            |
| 1.5KE39              | 1N6285            | 31.60                                    | 35.10 - 42.90     | 1          | 56.4                                    | 5                                      | 26.5                                         | .100                                                            |
| 1.5KE39A             | 1N6285A           | 33.30                                    | 37.10 - 41.00     | 1          | 53.9                                    | 5                                      | 28.0                                         | .100                                                            |
| 1.5KE43              | 1N6286            | 34.80                                    | 38.70 - 47.30     | 1          | 61.9                                    | 5                                      | 24.0                                         | .101                                                            |
| 1.5KE43A             | 1N6286A           | 36.80                                    | 40.90 - 45.20     | 1          | 59.3                                    | 5                                      | 25.3                                         | .101                                                            |
| 1.5KE47              | 1N6287            | 38.10                                    | 42.30 - 51.70     | 1          | 67.8                                    | 5                                      | 22.2                                         | .101                                                            |
| 1.5KE47A             | 1N6287A           | 40.20                                    | 44.70 - 49.40     | 1          | 64.8                                    | 5                                      | 23.2                                         | .101                                                            |
| 1.5KE51              | 1N6288            | 41.30                                    | 45.90 - 56.10     | 1          | 73.5                                    | 5                                      | 20.4                                         | .102                                                            |
| 1.5KE51A             | 1N6288A           | 43.60                                    | 48.50 - 53.60     | 1          | 70.1                                    | 5                                      | 21.4                                         | .102                                                            |
| 1.5KE56              | 1N6289            | 45.40                                    | 50.40 - 61.60     | 1          | 80.5                                    | 5                                      | 18.6                                         | .103                                                            |
| 1.5KE56A             | 1N6289A           | 47.80                                    | 53.20 - 58.80     | 1          | 77.0                                    | 5                                      | 19.5                                         | .103                                                            |
| 1.5KE62              | 1N6290            | 50.20                                    | 55.80 - 68.20     | 1          | 89.0                                    | 5                                      | 16.9                                         | .104                                                            |
| 1.5KE62A             | 1N6290A           | 53.00                                    | 58.90 - 65.10     | 1          | 85.0                                    | 5                                      | 17.7                                         | .104                                                            |
| 1.5KE68              | 1N6291            | 55.10                                    | 61.20 - 74.80     | 1          | 98.0                                    | 5                                      | 15.3                                         | .104                                                            |
| 1.5KE68A             | 1N6291A           | 58.10                                    | 64.60 - 71.40     | 1          | 92.0                                    | 5                                      | 16.3                                         | .104                                                            |
| 1.5KE75              | 1N6292            | 60.70                                    | 67.50 - 82.50     | 1          | 108.0                                   | 5                                      | 13.9                                         | .105                                                            |
| 1.5KE75A             | 1N6292A           | 64.10                                    | 71.30 - 78.80     | 1          | 103.0                                   | 5                                      | 14.6                                         | .105                                                            |

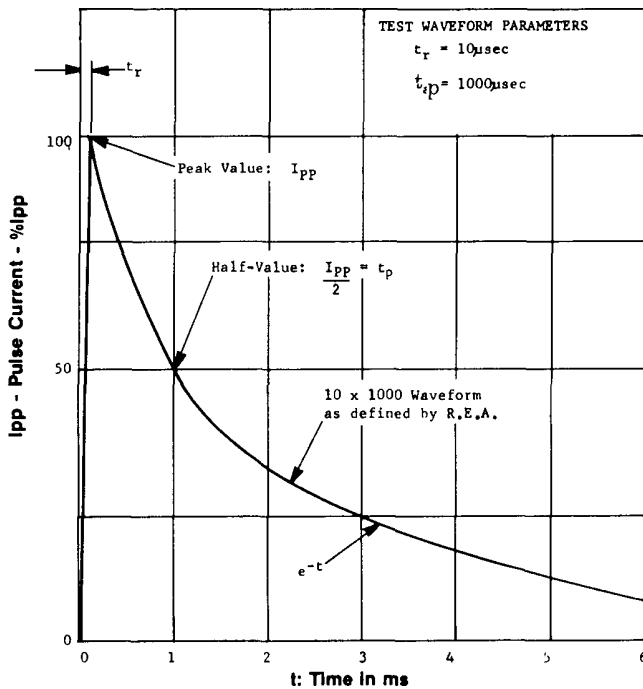
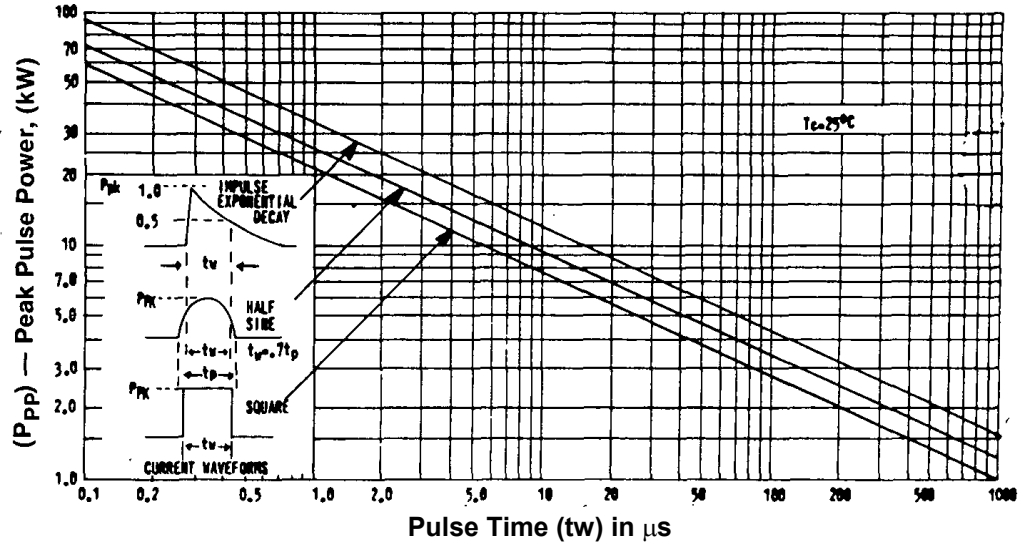
| Industry Type Number | JEDEC Type Number | Rated Standoff Voltage $V_{WM}$ (NOTE 1) | Breakdown Voltage |   |            | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ | Maximum Standby Current $I_D$ @ $V_{WM}$ | Maximum Peak Pulse Current $I_{PP}$ (Fig. 2) | Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha V_{(BR)}$ |
|----------------------|-------------------|------------------------------------------|-------------------|---|------------|-------------------------------------------|------------------------------------------|----------------------------------------------|-----------------------------------------------------------------|
|                      |                   |                                          | $V_{(BR)}$        | @ | $I_{(BR)}$ |                                           |                                          |                                              |                                                                 |
|                      |                   | Volts                                    | Volts Min. Max.   |   | mA         | Volts                                     | $\mu A$                                  | A                                            | %/°C                                                            |
| 1.5KE82              | 1N6293            | 66.40                                    | 73.80 – 90.20     | 1 |            | 118.0                                     | 5                                        | 12.7                                         | .105                                                            |
| 1.5KE82A             | 1N6293A           | 70.10                                    | 77.90 – 86.10     | 1 |            | 113.0                                     | 5                                        | 13.3                                         | .105                                                            |
| 1.5KE91              | 1N6294            | 73.70                                    | 81.90 – 100.00    | 1 |            | 131.0                                     | 5                                        | 11.4                                         | .106                                                            |
| 1.5KE91A             | 1N6294A           | 77.80                                    | 86.50 – 95.50     | 1 |            | 125.0                                     | 5                                        | 12.0                                         | .106                                                            |
| 1.5KE100             | 1N6295            | 81.00                                    | 90.00 – 110.00    | 1 |            | 144.0                                     | 5                                        | 10.4                                         | .106                                                            |
| 1.5KE100A            | 1N6295A           | 85.50                                    | 95.00 – 105.00    | 1 |            | 137.0                                     | 5                                        | 11.0                                         | .106                                                            |
| 1.5KE110             | 1N6296            | 89.20                                    | 99.00 – 121.00    | 1 |            | 158.0                                     | 5                                        | 9.5                                          | .107                                                            |
| 1.5KE110A            | 1N6296A           | 94.00                                    | 105.00 – 116.00   | 1 |            | 152.0                                     | 5                                        | 9.9                                          | .107                                                            |
| 1.5KE120             | 1N6297            | 97.20                                    | 108.00 – 132.00   | 1 |            | 173.0                                     | 5                                        | 8.7                                          | .107                                                            |
| 1.5KE120A            | 1N6297A           | 102.00                                   | 114.00 – 126.00   | 1 |            | 165.0                                     | 5                                        | 9.1                                          | .107                                                            |
| 1.5KE130             | 1N6298            | 105.00                                   | 117.00 – 143.00   | 1 |            | 187.0                                     | 5                                        | 8.0                                          | .107                                                            |
| 1.5KE130A            | 1N6298A           | 111.00                                   | 124.00 – 137.00   | 1 |            | 179.0                                     | 5                                        | 8.4                                          | .107                                                            |
| 1.5KE150             | 1N6299            | 121.00                                   | 135.00 – 165.00   | 1 |            | 215.0                                     | 5                                        | 7.0                                          | .108                                                            |
| 1.5KE150A            | 1N6299A           | 128.00                                   | 143.00 – 158.00   | 1 |            | 207.0                                     | 5                                        | 7.2                                          | .108                                                            |
| 1.5KE160             | 1N6300            | 130.00                                   | 144.00 – 176.00   | 1 |            | 230.0                                     | 5                                        | 6.5                                          | .108                                                            |
| 1.5KE160A            | 1N6300A           | 136.00                                   | 152.00 – 168.00   | 1 |            | 219.0                                     | 5                                        | 6.8                                          | .108                                                            |
| 1.5KE170             | 1N6301            | 138.00                                   | 153.00 – 187.00   | 1 |            | 244.0                                     | 5                                        | 6.2                                          | .108                                                            |
| 1.5KE170A            | 1N6301A           | 145.00                                   | 162.00 – 179.00   | 1 |            | 234.0                                     | 5                                        | 6.4                                          | .108                                                            |
| 1.5KE180             | 1N6303            | 146.00                                   | 162.00 – 198.00   | 1 |            | 258.0                                     | 5                                        | 5.8                                          | .108                                                            |
| 1.5KE180A            | 1N6303A           | 154.00                                   | 171.00 – 189.00   | 1 |            | 246.0                                     | 5                                        | 6.1                                          | .108                                                            |
| 1.5KE200             | -                 | 162.00                                   | 180.00 – 220.00   | 1 |            | 287.0                                     | 5                                        | 5.2                                          | .108                                                            |
| 1.5KE200A            |                   | 171.00                                   | 190.00 – 210.00   | 1 |            | 274.0                                     | 5                                        | 5.5                                          | .108                                                            |
| 1.5KE220             |                   | 175.00                                   | 198.00 – 242.00   | 1 |            | 344.0                                     | 5                                        | 4.3                                          | .110                                                            |
| 1.5KE220A            |                   | 185.00                                   | 209.00 – 231.00   | 1 |            | 328.0                                     | 5                                        | 4.6                                          | .110                                                            |
| 1.5KE250             | -                 | 202.00                                   | 225.00 – 275.00   | 1 |            | 360.0                                     | 5                                        | 5.0                                          | .110                                                            |
| 1.5KE250A            |                   | 214.00                                   | 237.00 – 263.00   | 1 |            | 344.0                                     | 5                                        | 5.0                                          | .110                                                            |
| 1.5KE300             |                   | 243.00                                   | 270.00 – 330.00   | 1 |            | 430.0                                     | 5                                        | 5.0                                          | .111                                                            |
| 1.5KE300A            |                   | 256.00                                   | 285.00 – 315.00   | 1 |            | 414.0                                     | 5                                        | 5.0                                          | .111                                                            |
| 1.5KE350             | -                 | 284.00                                   | 315.00 – 385.00   | 1 |            | 504.0                                     | 5                                        | 4.0                                          | .111                                                            |
| 1.5KE350A            |                   | 300.00                                   | 332.00 – 368.00   | 1 |            | 482.0                                     | 5                                        | 4.0                                          | .111                                                            |
| 1.5KE400             |                   | 324.00                                   | 360.00 – 440.00   | 1 |            | 574.0                                     | 5                                        | 4.0                                          | .111                                                            |
| 1.5KE400A            |                   | 324.00                                   | 380.00 – 420.00   | 1 |            | 548.0                                     | 5                                        | 4.0                                          | .111                                                            |

- NOTES:**
1. Normal selection criteria for TVS devices is by rated stand-off voltage ( $V_{WM}$ ) and should be equal or greater than dc or continuous peak operating voltage.
  2. TVS devices are tested to maximum peak pulse current ( $I_{PP}$ ) with clamping voltage monitored. This surge capability is one of the most significant electrical characteristics of the device and should be considered as part of customer quality inspections.
  3. For Bidirectional part number add C or CA as suffix (e.e., 1.5KE33C or 1.5KE33CA). For Bidirectional types having  $V_{WM}$  of 8 volts and under, the  $I_D$  leakage current is doubled. 1N62XX or 1N5908 not available as Bidirectional. For Bipolar capacitance will be .5 that shown in Fig. 2 for zero bias.
  4. For unidirectional, the forward voltage ( $V_F$ ) is 3.5 volts maximum at 100 Amps peak for 8.3 ms half-sine wave.

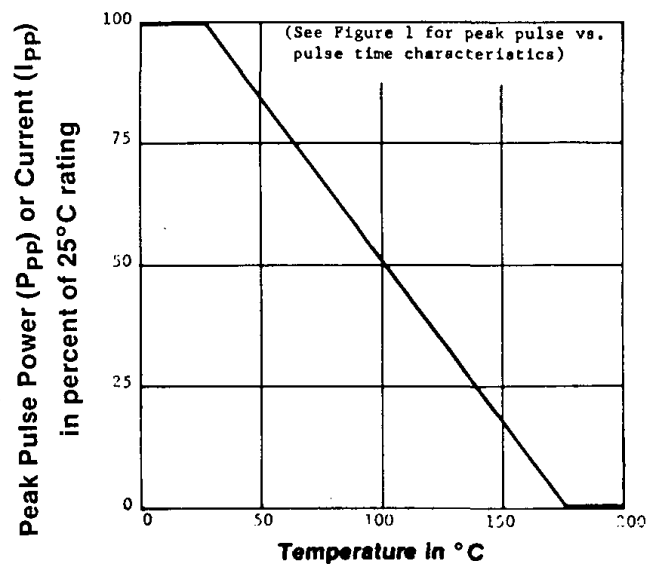
### SYMBOLS & DEFINITIONS

| Symbol     | Definition                      |
|------------|---------------------------------|
| $V_{WM}$   | Working Peak (Standoff) Voltage |
| $I_{PP}$   | Peak Pulse Current              |
| $P_{PP}$   | Peak Pulse Power                |
| $V_C(MAX)$ | Maximum Clamping Voltage        |
| $V_{(BR)}$ | Breakdown Voltage               |
| $I_{(BR)}$ | Test Current                    |
| $I_D$      | Standby Current                 |

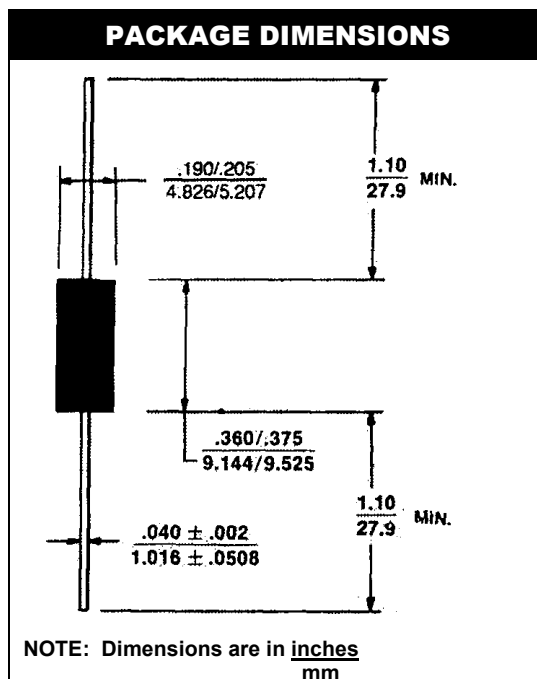
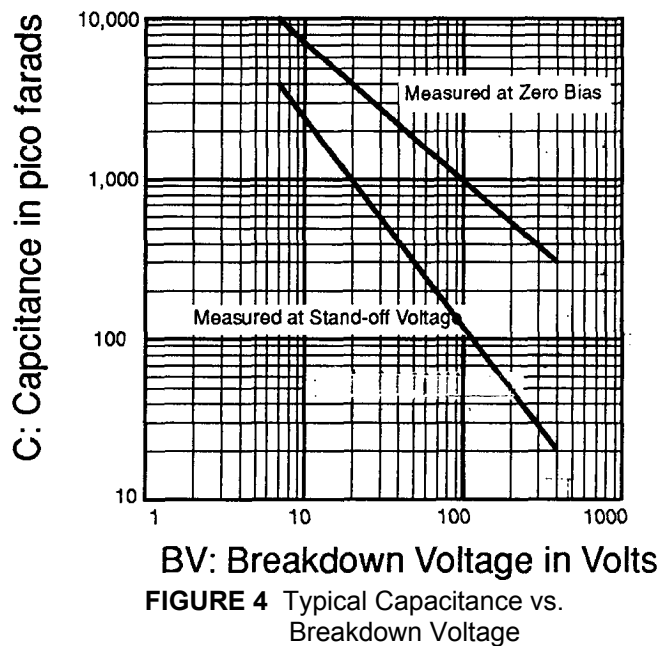
**FIGURE 1**  
Peak Pulse Power vs.  
Pulse Time ( $t_w$ ) in  $\mu s$



**FIGURE 2** Pulse Wave Form



**FIGURE 3** Derating Curve



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