

**1500 WATT UNIDIRECTIONAL  
 TRANSIENT VOLTAGE SUPPRESSOR**  
*Qualified per MIL-PRF-19500/500*

**DEVICES**

**\* 1N5629 thru 1N5665  
 1N5629A thru 1N5665A**

**\* Commercial only**

**LEVELS**

**JAN  
 JANTX  
 JANTXV**

**DESCRIPTION**

This popular Transient Voltage Suppressor (TVS) series for 1N5629 thru 1N5665A are JEDEC registered selections for unidirectional devices. All have the same high Peak Pulse Power rating of 1500 W with extremely fast response times. They are also available in military qualified selections as described in the Features section herein. They are most often used for protecting against transients from inductive switching environments, induced RF effects, or induced secondary lightning effects as found in lower surge levels of IEC61000-4-5. They are also very successful in protecting airborne avionics and electrical systems. 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>



**DO-13 (DO-202AA)**

**FEATURES**

- Unidirectional TVS series for thru-hole mounting
- Suppresses transients up to 1500 watts @ 10/1000  $\mu$ s (see Figure 1)
- Clamps transient in less than 100 pico seconds
- Working voltage ( $V_{WM}$ ) range 5 V to 171 V
- Hermetic sealed DO-13 metal package
- JAN/TX/TXV military qualifications also available for the tighter tolerance "A" suffix devices per MIL-PRF-19500/500 by adding the JAN, JANTX, or JANTXV prefix, e.g. JANTXV1N5629A, etc.
- For bidirectional TVS in the same DO-13 package, see separate data sheet for the 1N6036 – 1N6072A series (also military qualified)
- Surface mount equivalent packages also available as SMCJ5.0 - SMCJ170CA or SMCG5.0 – SMCG170CA in separate data sheet (consult factory for other surface mount options)
- Plastic axial-leaded equivalents available in the 1N6267 – 1N6303A series in separate data sheet

## APPLICATIONS / BENEFITS

- Protection from switching transients and induced RF
- ESD & EFT protection per IEC 61000-4-2 and -4-4
- Secondary lightning protection per IEC61000-4-5 with 42 Ohms source impedance:
  - Class 1: 1N5629 to 1N5665A
  - Class 2: 1N5629 to 1N5663A
  - Class 3: 1N5629 to 1N5655A
  - Class 4: 1N5629 to 1N5648A
- Secondary lightning protection per IEC61000-4-5 with 12 Ohms source impedance:
  - Class 1: 1N5629 to 1N5658A
  - Class 2: 1N5629 to 1N5651A
  - Class 3: 1N5629 to 1N5643A
  - Class 4: 1N5629 to 1N5636A
- Secondary lightning protection per IEC61000-4-5 with 2 Ohms source impedance:
  - Class 2: 1N5629 to 1N5642A
  - Class 3: 1N5629 to 1N5635A
- Inherently radiation hard per Microsemi MicroNote 050

## MAXIMUM RATINGS

- 1500 Watts for 10/1000  $\mu$ s with repetition rate of 0.01% or less\* at lead temperature ( $T_L$ ) 25°C (see Figs 1, 2, & 4)
- Operating & Storage Temperatures: -65° to +175°C
- THERMAL RESISTANCE: 50°C/W junction to lead at 0.375 inches (10 mm) from body or 110°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
- DC Power Dissipation\*: 1 Watt at  $T_L \leq +125^\circ\text{C}$  3/8" (10 mm) from body (see derating in Fig 3 and note below)
- Forward surge current: 200 Amps for 8.3ms half-sine wave at  $T_A = +25^\circ\text{C}$
- Solder Temperatures: 260 ° C for 10 s (maximum)

## MECHANICAL AND PACKAGING

- CASE: DO-13 (DO-202AA), welded, hermetically sealed metal and glass
- FINISH: All external metal surfaces are Tin-Lead plated and solderable per MIL-STD-750 method 2026
- POLARITY: Cathode connected to case and polarity indicated by diode symbol
- MARKING: Part number and polarity diode symbol
- WEIGHT: 1.4 grams. (Approx)
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number)
- See package dimension on last page

\* TVS devices are not typically used for dc power dissipation and are instead operated at or less than their rated standoff voltage ( $V_{WM}$ ) except for transients that briefly drive the device into avalanche breakdown ( $V_{BR}$  to  $V_C$  region).

## ELECTRICAL CHARACTERISTICS @ T<sub>A</sub> = 25°C

| JEDEC<br>Type<br>No.* | Breakdown<br>Voltage<br>V <sub>(BR)</sub> @ I <sub>(BR)</sub> |       | Breakdown<br>Current<br>I <sub>(BR)</sub> | Rated<br>Standoff<br>Voltage<br>V <sub>WM</sub> | Maximum<br>Standby<br>Current<br>I <sub>D</sub> @ V <sub>WM</sub> | Maximum<br>Clamping<br>Voltage<br>V <sub>C</sub> @ I <sub>PP</sub> | Maximum<br>Peak Pulse<br>Current<br>I <sub>PP</sub> | Maximum<br>Temperature<br>Coefficient of<br>V <sub>(BR)</sub> α <sub>V(BR)</sub> |
|-----------------------|---|-------|---|---|---|--|---|--|
|                       | Min.  | Max.  |   |   |   |  |   |  |
|                       | V   | V     | mA  | V   | μA  | V  | A   | %/°C   |
| 1N5629                | 6.12  | 7.48  | 10  | 5.50  | 1000  | 10.8   | 139   | .057   |
| 1N5629A               | 6.45  | 7.14  | 10  | 5.80  | 1000  | 10.5   | 143   | .057   |
| 1N5630                | 6.75  | 8.25  | 10  | 6.05  | 500   | 11.7   | 128   | .061   |
| 1N5630A               | 7.13  | 7.88  | 10  | 6.40  | 500   | 11.3   | 132   | .061   |
| 1N5631                | 7.38  | 9.02  | 10  | 6.63  | 200   | 12.5   | 120   | .065   |
| 1N5631A               | 7.79  | 8.61  | 10  | 7.02  | 200   | 12.1   | 124   | .065   |
| 1N5632                | 8.19  | 10.0  | 1   | 7.37  | 50  | 13.8   | 109   | .068   |
| 1N5632A               | 8.65  | 9.55  | 1   | 7.78  | 50  | 13.4   | 112   | .068   |
| 1N5633                | 9.00  | 11.0  | 1   | 8.10  | 10  | 15.0   | 100   | .073   |
| 1N5633A               | 9.5   | 10.5  | 1   | 8.55  | 10  | 14.5   | 103   | .073   |
| 1N5634                | 9.9   | 12.1  | 1   | 8.92  | 5   | 16.2   | 93  | .075   |
| 1N5634A               | 10.5  | 11.6  | 1   | 9.40  | 5   | 15.6   | 96  | .075   |
| 1N5635                | 10.8  | 13.2  | 1   | 9.72  | 5   | 17.3   | 87  | .078   |
| 1N5635A               | 11.4  | 12.6  | 1   | 10.2  | 5   | 16.7   | 90  | .078   |
| 1N5636                | 11.7  | 14.3  | 1   | 10.5  | 5   | 19.0   | 79  | .081   |
| 1N5636A               | 12.4  | 13.7  | 1   | 11.1  | 5   | 18.2   | 82  | .081   |
| 1N5637                | 13.5  | 16.5  | 1   | 12.1  | 5   | 22.0   | 68  | .084   |
| 1N5637A               | 14.3  | 15.8  | 1   | 12.8  | 5   | 21.2   | 71  | .084   |
| 1N5638                | 14.4  | 17.6  | 1   | 12.9  | 5   | 23.5   | 64  | .086   |
| 1N5638A               | 15.2  | 16.8  | 1   | 13.6  | 5   | 22.5   | 67  | .086   |
| 1N5639                | 16.2  | 19.8  | 1   | 14.5  | 5   | 26.5   | 56.5  | .088   |
| 1N5639A               | 17.1  | 18.9  | 1   | 15.3  | 5   | 25.2   | 59.5  | .088   |
| 1N5640                | 18.0  | 22.0  | 1   | 16.2  | 5   | 29.1   | 51.5  | .090   |
| 1N5640A               | 19.0  | 21.0  | 1   | 17.1  | 5   | 27.7   | 54  | .090   |
| 1N5641                | 19.8  | 24.2  | 1   | 17.8  | 5   | 31.9   | 47  | .092   |
| 1N5641A               | 20.9  | 23.1  | 1   | 18.8  | 5   | 30.6   | 49  | .092   |
| 1N5642                | 21.6  | 26.4  | 1   | 19.4  | 5   | 34.7   | 43  | .094   |
| 1N5642A               | 22.8  | 25.2  | 1   | 20.5  | 5   | 33.2   | 45  | .094   |
| 1N5643                | 24.3  | 29.7  | 1   | 21.8  | 5   | 39.1   | 38.5  | .096   |
| 1N5643A               | 25.7  | 28.4  | 1   | 23.1  | 5   | 37.5   | 40  | .096   |
| 1N5644                | 27.0  | 33.0  | 1   | 24.3  | 5   | 43.5   | 34.5  | .097   |
| 1N5644A               | 28.5  | 31.5  | 1   | 25.6  | 5   | 41.4   | 36  | .097   |
| 1N5645                | 29.7  | 36.3  | 1   | 26.8  | 5   | 47.7   | 31.5  | .098   |
| 1N5645A               | 31.4  | 34.7  | 1   | 28.2  | 5   | 45.7   | 33  | .098   |
| 1N5646                | 32.4  | 39.6  | 1   | 29.1  | 5   | 52.0   | 29  | .099   |
| 1N5646A               | 34.2  | 37.8  | 1   | 30.8  | 5   | 49.9   | 30  | .099   |
| 1N5647                | 35.1  | 42.9  | 1   | 31.6  | 5   | 56.4   | 26.5  | .100   |
| 1N5647A               | 37.1  | 41.0  | 1   | 33.3  | 5   | 53.9   | 28  | .100   |
| 1N5648                | 38.7  | 47.3  | 1   | 34.8  | 5   | 61.9   | 24  | .101   |
| 1N5648A               | 40.9  | 45.2  | 1   | 36.8  | 5   | 59.3   | 25.3  | .101   |
| 1N5649                | 42.3  | 51.7  | 1   | 38.1  | 5   | 67.8   | 22.2  | .101   |
| 1N5649A               | 44.7  | 49.4  | 1   | 40.2  | 5   | 64.8   | 23.2  | .101   |
| 1N5650                | 45.9  | 56.1  | 1   | 41.3  | 5   | 73.5   | 20.4  | .102   |
| 1N5650A               | 48.5  | 53.6  | 1   | 43.6  | 5   | 70.1   | 21.4  | .102   |
| 1N5651                | 50.4  | 61.6  | 1   | 45.4  | 5   | 80.5   | 18.6  | .103   |
| 1N5651A               | 53.2  | 58.8  | 1   | 47.8  | 5   | 77.0   | 19.5  | .103   |
| 1N5652                | 55.8  | 68.2  | 1   | 50.2  | 5   | 89.0   | 16.9  | .104   |
| 1N5652A               | 58.9  | 65.1  | 1   | 53.0  | 5   | 85.0   | 17.7  | .104   |
| 1N5653                | 61.2  | 74.8  | 1   | 55.1  | 5   | 98.0   | 15.3  | .104   |
| 1N5653A               | 64.6  | 71.4  | 1   | 58.1  | 5   | 92.0   | 16.3  | .104   |
| 1N5654                | 67.5  | 82.5  | 1   | 60.7  | 5   | 108  | 13.9  | .105   |
| 1N5654A               | 71.3  | 78.8  | 1   | 64.1  | 5   | 103  | 14.6  | .105   |
| 1N5655                | 73.8  | 90.2  | 1   | 66.4  | 5   | 118  | 12.7  | .105   |
| 1N5655A               | 77.9  | 86.1  | 1   | 70.1  | 5   | 113  | 13.3  | .105   |
| 1N5656                | 81.9  | 100.0 | 1   | 73.7  | 5   | 131  | 11.4  | .106   |
| 1N5656A               | 86.5  | 95.5  | 1   | 77.8  | 5   | 125  | 12.0  | .106   |
| 1N5657                | 90  | 110   | 1   | 81.0  | 5   | 144  | 10.4  | .106   |
| 1N5657A               | 95  | 105   | 1   | 85.5  | 5   | 137  | 11.0  | .106   |
| 1N5658                | 99  | 121   | 1   | 89.2  | 5   | 158  | 9.5   | .107   |
| 1N5658A               | 105   | 116   | 1   | 94.0  | 5   | 152  | 9.9   | .107   |
| 1N5659                | 108   | 132   | 1   | 97.2  | 5   | 173  | 8.7   | .107   |
| 1N5659A               | 114   | 126   | 1   | 102   | 5   | 165  | 9.1   | .107   |
| 1N5660                | 117   | 143   | 1   | 105   | 5   | 187  | 8.0   | .107   |
| 1N5660A               | 124   | 137   | 1   | 111   | 5   | 179  | 8.4   | .107   |

## ELECTRICAL CHARACTERISTICS @ $T_A = 25^\circ\text{C}$

| JEDEC Type No.* | Breakdown Voltage $V_{(BR)}$ @ $I_{(BR)}$ |      | Breakdown Current $I_{(BR)}$ | Rated Standoff Voltage $V_{WM}$ | Maximum Standby Current $I_D$ @ $V_{WM}$ | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ | Maximum Peak Pulse Current $I_{PP}$ | Maximum Temperature Coefficient of $V_{(BR)}$ $\alpha_{V(BR)}$ |
|-----------------|---|------|------------------------------|---------------------------------|--|---|-------------------------------------|--|
|                 | Min.                                      | Max. |                              |                                 |  |   |                                     |  |
|                 | V   | V    | mA                           | V                               | $\mu\text{A}$                            | V   | A                                   | %/ $^\circ\text{C}$  |
| 1N5661          | 135                                       | 165  | 1                            | 121                             | 5  | 215                                       | 7.0                                 | .108   |
| 1N5661A         | 143                                       | 158  | 1                            | 128                             | 5  | 207                                       | 7.2                                 | .108   |
| 1N5662          | 144                                       | 176  | 1                            | 130                             | 5  | 230                                       | 6.5                                 | .108   |
| 1N5662A         | 152                                       | 168  | 1                            | 136                             | 5  | 219                                       | 6.8                                 | .108   |
| 1N5663          | 153                                       | 187  | 1                            | 138                             | 5  | 244                                       | 6.2                                 | .108   |
| 1N5663A         | 162                                       | 179  | 1                            | 145                             | 5  | 234                                       | 6.4                                 | .108   |
| 1N5664          | 162                                       | 198  | 1                            | 146                             | 5  | 258                                       | 5.8                                 | .108   |
| 1N5664A         | 171                                       | 189  | 1                            | 154                             | 5  | 246                                       | 6.1                                 | .108   |
| 1N5665          | 180                                       | 220  | 1                            | 162                             | 5  | 287                                       | 5.2                                 | .108   |
| 1N5665A         | 190                                       | 210  | 1                            | 171                             | 5  | 274                                       | 5.5                                 | .108   |

**NOTE 1:** A TVS is normally selected according to the rated "Standoff Voltage"  $V_{WM}$  that should be equal to or greater than the dc or continuous peak operating voltage level.

**NOTE 2:** Also available in military qualified types with a JAN, JANTX, or JANTXV prefix.

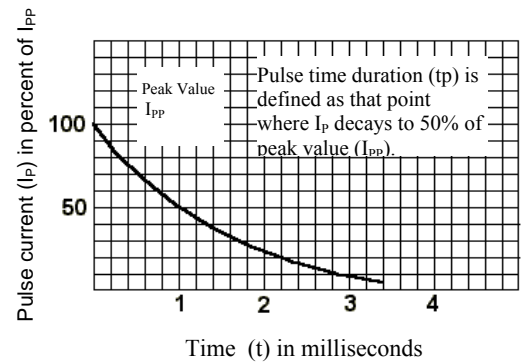
## SYMBOLS & DEFINITIONS

| Symbol     | Definition  |
|------------|---|
| $V_{WM}$   | Standoff Voltage: Applied Reverse Voltage to assure a nonconductive condition. (See Note 1 above.)  |
| $V_{(BR)}$ | Breakdown Voltage: This is the Breakdown Voltage the device will exhibit at $25^\circ\text{C}$  |
| $V_C$      | Maximum Clamping Voltage: The maximum peak voltage appearing across the TVS when subjected to the peak pulse current in a one millisecond time interval. The peak pulse voltage is the combination of voltage rise due to both the series resistance and thermal rise and positive temperature coefficient ( $\alpha_{V(BR)}$ ) |
| $I_{PP}$   | Peak Pulse Current: The peak current during the impulse (See Figure 2)  |
| $P_{PP}$   | Peak Pulse Power: The pulse power as determined by the product of $V_C$ and $I_{PP}$  |
| $I_D$      | Standby Current: The current at the standoff voltage ( $V_{WM}$ )   |
| $I_{(BR)}$ | Breakdown Current: The current used for measuring Breakdown Voltage ( $V_{(BR)}$ )  |

## GRAPHS



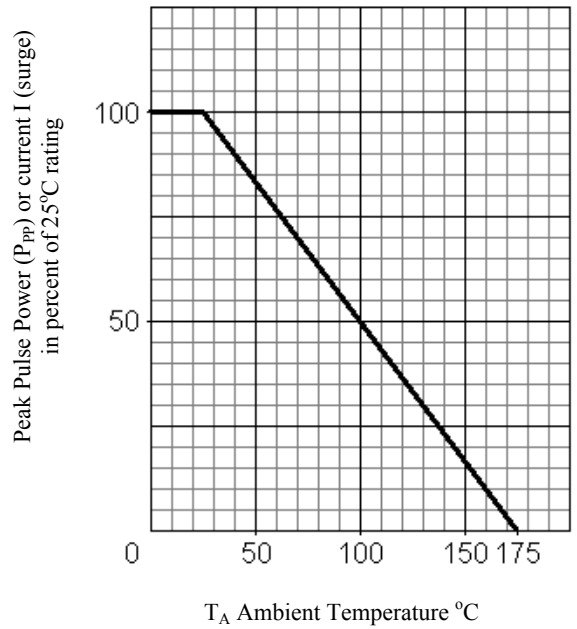
**FIG. 1** – Non-repetitive peak pulse power rating curve  
 NOTE: Peak power defined as peak voltage times peak current



**FIG. 2** Pulse wave form for exponential surge



**FIG. 3** Steady-state power derating curve



$T_A$  Ambient Temperature °C

**FIG. 4** Derating Curve