



## Axial-Leaded 1.5 Watt Plastic Zener Diodes

### DESCRIPTION

The 1N5913BP<sub>e</sub>3 – 5956BP<sub>e</sub>3 series of 1.5 watt Zeners provides voltage regulation in a selection from 3.3 to 200 volts with different tolerances available. These plastic encapsulated Zeners have moisture classification of Level 1 with no dry pack required. They are also available in various military equivalent screening levels for high reliability. The plastic molded Zeners with a P suffix provide a lower thermal resistance (junction to lead) compared to the optional glass body (G suffix) for these same JEDEC part numbers. Both package options are available by Microsemi.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

### FEATURES

- JEDEC registered 1N5913B – 1N5956B number series.
- Zener voltage available 3.3 V to 200 V.
- Tolerances of 10%, 5%, and 2% are available.
- RoHS compliant.
- Optional glass body axial-leaded Zeners available as [1N5913BG – 1N5956BG](#) (see separate data sheet).

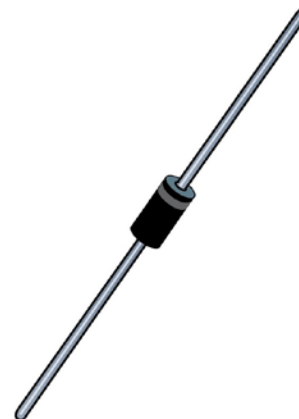
### APPLICATIONS / BENEFITS

- Regulates voltage over a broad operating current and temperature range.
- Flexible axial-lead mounting terminals.
- Non-sensitive to ESD per MIL-STD-750 method 1020.
- Moisture classification is Level 1 per IPC/JEDEC J-STD-020B with no dry pack required.

### MAXIMUM RATINGS @ T<sub>A</sub> = 25 °C unless otherwise specified

| Parameters/Test Conditions                                                                                          | Symbol                            | Value       | Unit |
|---------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------|------|
| Junction and Storage Temperature                                                                                    | T <sub>J</sub> & T <sub>STG</sub> | -65 to +150 | °C   |
| Thermal Resistance Junction-to-Lead<br>@ 3/8 inch (10 mm) lead length from body                                     | R <sub>θJL</sub>                  | 45          | °C/W |
| Thermal Resistance Junction-to-Ambient <sup>(1)</sup>                                                               | R <sub>θJA</sub>                  | 105         | °C/W |
| Steady State Power Dissipation @ T <sub>L</sub> ≤ 82.5 °C <sup>(2)</sup><br>@ T <sub>A</sub> = 25 °C <sup>(1)</sup> | P <sub>D</sub>                    | 1.5<br>1.19 | W    |
| Rated Average Power Dissipation (also see <a href="#">Figure 1</a> )                                                | P <sub>M(AV)</sub>                | 1.5         | W    |
| Forward Voltage @ 200 mA                                                                                            | V <sub>F</sub>                    | 1.2         | V    |
| Solder Temperature @ 10 s                                                                                           |                                   | 260         | °C   |

**Notes:** 1. When mounted on FR4 PC board (1 oz Cu) with 4 mm<sup>2</sup> copper pads and track width 1 mm, length 25 mm.  
2. At 3/8 inch (10 mm) lead length from body.



**DO-41 (DO-204AL)  
Plastic Package**

Also available in:

#### SMB package

(tabbed surface mount)

 [SMBG\(J\)5913B –](#)  
[SMBG\(J\)5956B](#)

#### SMAJ package

(tabbed surface mount)

 [SMAJ5913B –](#)  
[SMAJ5956B](#)

#### Powermite package

(tabbed surface mount)

 [1PMT5913B –](#)  
[1PMT5956B](#)

#### MSC – Lawrence

6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
Fax: (978) 689-0803

#### MSC – Ireland

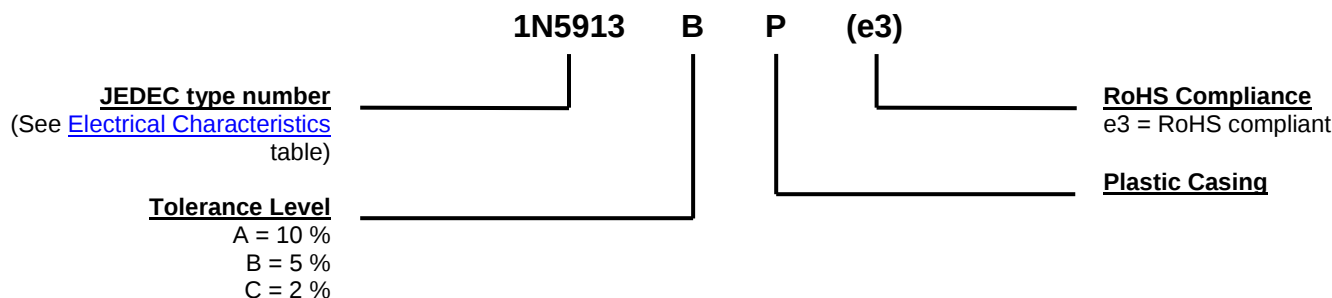
Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

#### Website:

[www.microsemi.com](http://www.microsemi.com)

**MECHANICAL and PACKAGING**

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0.
- TERMINALS: RoHS compliant matte/tin over copper. Solderable per MIL-STD-750, method 2026.
- MARKING: Part number.
- POLARITY: Cathode indicated by band. Diode to be operated with the banded end positive with respect to the opposite end for Zener regulation.
- TAPE & REEL option: Standard per EIA-296 (add TR suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 0.7 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

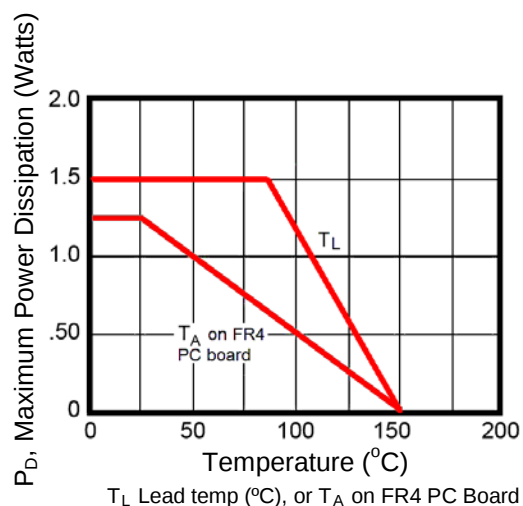
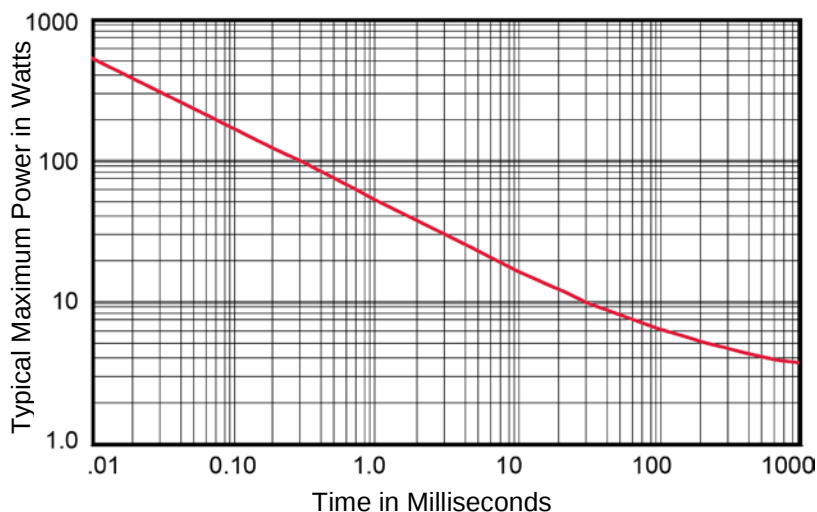
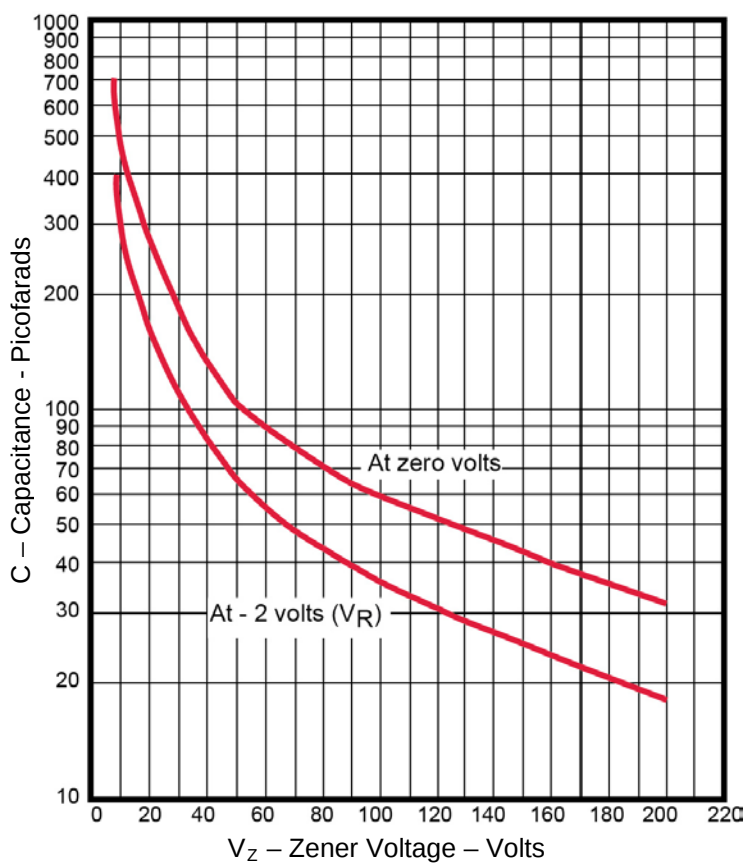
| Symbol                | Definition                                                                                                                                                                                                                                      |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $V_Z$                 | Zener Voltage: The Zener voltage the device will exhibit at a specified current ( $I_Z$ ) in its breakdown region.                                                                                                                              |
| $I_Z, I_{ZT}, I_{ZK}$ | Regulator Current: The dc regulator current ( $I_Z$ ), at a specified test point ( $I_{ZT}$ ), near breakdown knee ( $I_{ZK}$ ).                                                                                                                |
| $Z_{ZT}$ or $Z_{ZK}$  | Dynamic Impedance: The small signal impedance of the diode when biased to operate in its breakdown region at a specified rms current modulation (typically 10% of $I_{ZT}$ or $I_{ZK}$ ) and superimposed on $I_{ZT}$ or $I_{ZK}$ respectively. |
| $V_F$                 | Maximum Forward Voltage: The maximum forward voltage the device will exhibit at a specified current.                                                                                                                                            |
| $I_R$                 | Maximum Reverse Current: The maximum reverse (leakage) current that will flow at the specified voltage and temperature.                                                                                                                         |
| $I_{ZM}$              | Maximum Regulator (Zener) Current: The maximum rated dc current for the specified power rating.                                                                                                                                                 |

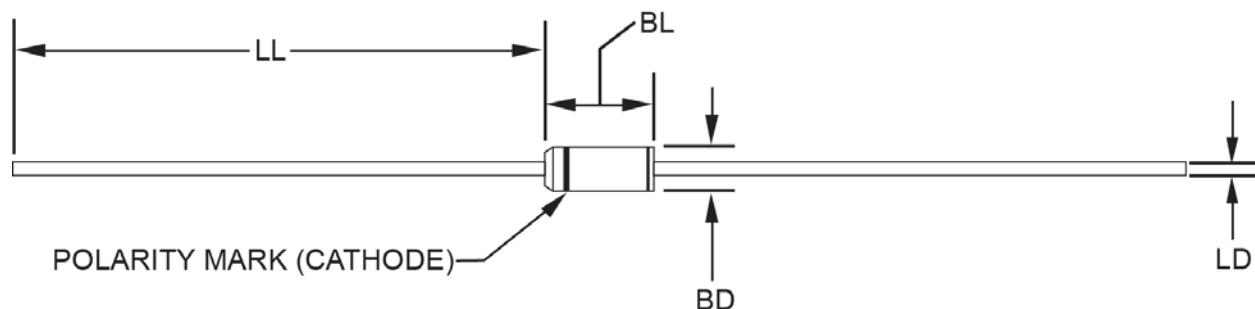
**ELECTRICAL CHARACTERISTICS @  $T_L = 30\text{ }^{\circ}\text{C}$** 

| JEDEC<br>TYPE<br>NUMBER<br>(Note 1) | ZENER<br>VOLTAGE<br>$V_Z$ | TEST<br>CURRENT<br>$I_{ZT}$ | MAXIMUM<br>DYNAMIC<br>IMPEDANCE<br>$Z_{ZT}$ | KNEE<br>CURRENT<br>$I_{ZK}$ | MAXIMUM<br>KNEE<br>IMPEDANCE<br>$Z_{ZK}$ | MAXIMUM<br>REVERSE<br>CURRENT<br>$I_R @ V_R$ | REVERSE<br>VOLTAGE<br>$V_R$ | MAX. DC<br>CURRENT<br>$I_{ZM}$ |
|-------------------------------------|---------------------------|-----------------------------|---------------------------------------------|-----------------------------|------------------------------------------|----------------------------------------------|-----------------------------|--------------------------------|
|                                     | Volts                     | mA                          | Ohms                                        | mA                          | Ohms                                     | $\mu\text{A}$                                | Volts                       | mA                             |
| 1N5913B                             | 3.3                       | 113.6                       | 10                                          | 1.0                         | 500                                      | 100                                          | 1.0                         | 454                            |
| 1N5914B                             | 3.6                       | 104.2                       | 9.0                                         | 1.0                         | 500                                      | 75                                           | 1.0                         | 416                            |
| 1N5915B                             | 3.9                       | 96.1                        | 7.5                                         | 1.0                         | 500                                      | 25                                           | 1.0                         | 384                            |
| 1N5916B                             | 4.3                       | 87.2                        | 6.0                                         | 1.0                         | 500                                      | 5.0                                          | 1.0                         | 348                            |
| 1N5917B                             | 4.7                       | 79.8                        | 5.0                                         | 1.0                         | 500                                      | 5.0                                          | 1.5                         | 319                            |
| 1N5918B                             | 5.1                       | 73.5                        | 4.0                                         | 1.0                         | 350                                      | 5.0                                          | 2.0                         | 294                            |
| 1N5919B                             | 5.6                       | 66.9                        | 2.0                                         | 1.0                         | 250                                      | 5.0                                          | 3.0                         | 267                            |
| 1N5920B                             | 6.2                       | 60.5                        | 2.0                                         | 1.0                         | 200                                      | 5.0                                          | 4.0                         | 241                            |
| 1N5921B                             | 6.8                       | 55.1                        | 2.5                                         | 1.0                         | 200                                      | 5.0                                          | 5.2                         | 220                            |
| 1N5922B                             | 7.5                       | 50                          | 3.0                                         | 0.5                         | 400                                      | 5.0                                          | 6.0                         | 200                            |
| 1N5923B                             | 8.2                       | 45.7                        | 3.5                                         | 0.5                         | 400                                      | 5.0                                          | 6.5                         | 182                            |
| 1N5924B                             | 9.1                       | 41.2                        | 4.0                                         | 0.5                         | 500                                      | 5.0                                          | 7.0                         | 164                            |
| 1N5925B                             | 10                        | 37.5                        | 4.5                                         | 0.25                        | 500                                      | 5.0                                          | 8.0                         | 150                            |
| 1N5926B                             | 11                        | 34.1                        | 5.5                                         | 0.25                        | 550                                      | 1.0                                          | 8.4                         | 136                            |
| 1N5927B                             | 12                        | 31.2                        | 6.5                                         | 0.25                        | 550                                      | 1.0                                          | 9.1                         | 125                            |
| 1N5928B                             | 13                        | 28.8                        | 7.0                                         | 0.25                        | 550                                      | 1.0                                          | 9.9                         | 115                            |
| 1N5929B                             | 15                        | 25                          | 9.0                                         | 0.25                        | 600                                      | 1.0                                          | 11.4                        | 100                            |
| 1N5930B                             | 16                        | 23.4                        | 10                                          | 0.25                        | 600                                      | 1.0                                          | 12.2                        | 93                             |
| 1N5931B                             | 18                        | 20.8                        | 12                                          | 0.25                        | 650                                      | 1.0                                          | 13.7                        | 83                             |
| 1N5932B                             | 20                        | 18.7                        | 14                                          | 0.25                        | 650                                      | 1.0                                          | 15.2                        | 75                             |
| 1N5933B                             | 22                        | 17                          | 17.5                                        | 0.25                        | 650                                      | 1.0                                          | 16.7                        | 68                             |
| 1N5934B                             | 24                        | 15.6                        | 19                                          | 0.25                        | 700                                      | 1.0                                          | 18.2                        | 62                             |
| 1N5935B                             | 27                        | 13.9                        | 23                                          | 0.25                        | 700                                      | 1.0                                          | 20.6                        | 55                             |
| 1N5936B                             | 30                        | 12.5                        | 28                                          | 0.25                        | 750                                      | 1.0                                          | 22.8                        | 50                             |
| 1N5937B                             | 33                        | 11.4                        | 33                                          | 0.25                        | 800                                      | 1.0                                          | 25.1                        | 45                             |
| 1N5938B                             | 36                        | 10.4                        | 38                                          | 0.25                        | 850                                      | 1.0                                          | 27.4                        | 41                             |
| 1N5939B                             | 39                        | 9.6                         | 45                                          | 0.25                        | 900                                      | 1.0                                          | 29.7                        | 38                             |
| 1N5940B                             | 43                        | 8.7                         | 53                                          | 0.25                        | 950                                      | 1.0                                          | 32.7                        | 34                             |
| 1N5941B                             | 47                        | 8.0                         | 67                                          | 0.25                        | 1000                                     | 1.0                                          | 35.8                        | 31                             |
| 1N5942B                             | 51                        | 7.3                         | 70                                          | 0.25                        | 1100                                     | 1.0                                          | 38.8                        | 29                             |
| 1N5943B                             | 56                        | 6.7                         | 86                                          | 0.25                        | 1300                                     | 1.0                                          | 42.6                        | 26                             |
| 1N5944B                             | 62                        | 6.0                         | 100                                         | 0.25                        | 1500                                     | 1.0                                          | 47.1                        | 24                             |
| 1N5945B                             | 68                        | 5.5                         | 120                                         | 0.25                        | 1700                                     | 1.0                                          | 51.2                        | 22                             |
| 1N5946B                             | 75                        | 5.0                         | 140                                         | 0.25                        | 2000                                     | 1.0                                          | 56                          | 20                             |
| 1N5947B                             | 82                        | 4.6                         | 160                                         | 0.25                        | 2500                                     | 1.0                                          | 62.2                        | 18                             |
| 1N5948B                             | 91                        | 4.1                         | 200                                         | 0.25                        | 3000                                     | 1.0                                          | 69.2                        | 16                             |
| 1N5949B                             | 100                       | 3.7                         | 250                                         | 0.25                        | 3100                                     | 1.0                                          | 76                          | 15                             |
| 1N5950B                             | 110                       | 3.4                         | 300                                         | 0.25                        | 4000                                     | 1.0                                          | 83.6                        | 13                             |
| 1N5951B                             | 120                       | 3.1                         | 380                                         | 0.25                        | 4500                                     | 1.0                                          | 91.2                        | 12                             |
| 1N5952B                             | 130                       | 2.9                         | 450                                         | 0.25                        | 5000                                     | 1.0                                          | 98.8                        | 11                             |
| 1N5953B                             | 150                       | 2.5                         | 600                                         | 0.25                        | 6000                                     | 1.0                                          | 114                         | 10                             |
| 1N5954B                             | 160                       | 2.3                         | 700                                         | 0.25                        | 6500                                     | 1.0                                          | 121.6                       | 9.0                            |
| 1N5955B                             | 180                       | 2.1                         | 900                                         | 0.25                        | 7000                                     | 1.0                                          | 136.8                       | 8.0                            |
| 1N5956B                             | 200                       | 1.9                         | 1200                                        | 0.25                        | 8000                                     | 1.0                                          | 152                         | 7.0                            |

**NOTES:**

1. Zener voltage ( $V_Z$ ) is measured at  $T_L = 30\text{ }^{\circ}\text{C}$  and 90 seconds after application of dc current.
2. The Zener impedance is derived from the 60 Hz ac voltage, which results when an ac current having an rms value equal to 10% of the dc Zener current ( $I_{ZT}$  or  $I_{ZK}$ ) is superimposed on  $I_{ZT}$  or  $I_{ZK}$ . See [MicroNote 202](#) for Zener impedance variation with different operating currents.

**GRAPHS**

**FIGURE 1 – Power Derating Curve**

**FIGURE 2 – Transient Surge Capability**  
Square-Wave Pulse Width  
(non-Repetitive) in Milliseconds

**FIGURE 3 – Capacitance vs Zener Voltage**

**PACKAGE DIMENSIONS**

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.

| Ltr       | DIMENSIONS |       |             |       |
|-----------|------------|-------|-------------|-------|
|           | INCH       |       | MILLIMETERS |       |
|           | Min        | Max   | Min         | Max   |
| <b>BD</b> | -          | 0.107 | -           | 2.718 |
| <b>BL</b> | -          | 0.205 | -           | 5.207 |
| <b>LD</b> | 0.030      | 0.034 | 0.762       | 0.864 |
| <b>LL</b> | 1.10       | -     | 27.940      | -     |
|           |            |       |             |       |