

# 1N5333B Series

Preferred Device

## 5 Watt Surmetic™ 40 Zener Voltage Regulators

This is a complete series of 5 Watt Zener diodes with tight limits and better operating characteristics that reflect the superior capabilities of silicon-oxide passivated junctions. All this in an axial lead, transfer-molded plastic package that offers protection in all common environmental conditions.

### Features

- Zener Voltage Range – 3.3 V to 200 V
- ESD Rating of Class 3 (>16 kV) per Human Body Model
- Surge Rating of up to 180 W @ 8.3 ms
- Maximum Limits Guaranteed on up to Six Electrical Parameters
- Pb-Free Packages are Available

### Mechanical Characteristics

**CASE:** Void free, transfer-molded, thermosetting plastic

**FINISH:** All external surfaces are corrosion resistant and leads are readily solderable

**MAXIMUM LEAD TEMPERATURE FOR SOLDERING PURPOSES:** 230°C, 1/16 in. from the case for 10 seconds

**POLARITY:** Cathode indicated by polarity band

**MOUNTING POSITION:** Any

### MAXIMUM RATINGS

| Rating  | Symbol         | Value       | Unit  |
|---|----------------|-------------|-------|
| Max. Steady State Power Dissipation<br>@ $T_L = 75^\circ\text{C}$ , Lead Length = 3/8 in<br>Derate above 75°C | $P_D$          | 5           | W     |
|   |                | 40          | mW/°C |
| Operating and Storage<br>Temperature Range  | $T_J, T_{stg}$ | -65 to +200 | °C    |

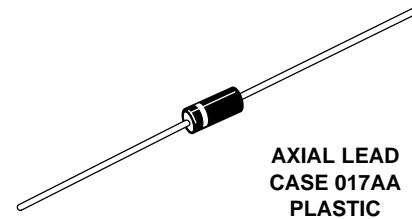
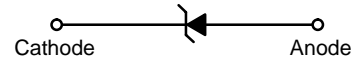
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

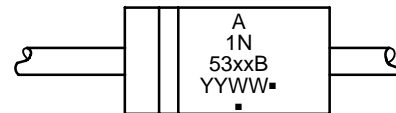


ON Semiconductor®

<http://onsemi.com>



### MARKING DIAGRAM



A = Assembly Location  
1N53xxB = Device Number  
(Refer to Tables on Pages 3 & 4)  
YY = Year  
WW = Work Week  
■ = Pb-Free Package  
(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device       | Package                 | Shipping†        |
|--------------|-------------------------|------------------|
| 1N53xxB, G   | Axial Lead<br>(Pb-Free) | 1000 Units/Box   |
| 1N53xxBRL, G | Axial Lead<br>(Pb-Free) | 4000/Tape & Reel |

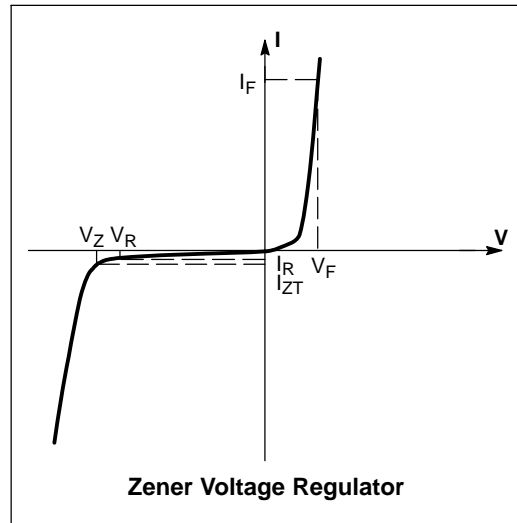
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Preferred devices are recommended choices for future use and best overall value.

## 1N5333B Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 1.2\text{ V Max @ } I_F = 1.0\text{ A}$  for all types)

| Symbol       | Parameter  |
|--------------|--|
| $V_Z$        | Reverse Zener Voltage @ $I_{ZT}$                 |
| $I_{ZT}$     | Reverse Current                                  |
| $Z_{ZT}$     | Maximum Zener Impedance @ $I_{ZT}$               |
| $I_{ZK}$     | Reverse Current                                  |
| $Z_{ZK}$     | Maximum Zener Impedance @ $I_{ZK}$               |
| $I_R$        | Reverse Leakage Current @ $V_R$                  |
| $V_R$        | Breakdown Voltage                                |
| $I_F$        | Forward Current                                  |
| $V_F$        | Forward Voltage @ $I_F$                          |
| $I_R$        | Maximum Surge Current @ $T_A = 25^\circ\text{C}$ |
| $\Delta V_Z$ | Reverse Zener Voltage Change                     |
| $I_{ZM}$     | Maximum DC Zener Current                         |



# 1N5333B Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 1.2\text{ V Max}$  @  $I_F = 1.0\text{ A}$  for all types)

| Device <sup>†</sup><br>(Note 1) | Device<br>Marking | Zener Voltage (Note 2) |            |              |            | Zener Impedance (Note 2) |                     |          | Leakage<br>Current |             | $I_R$<br>(Note 3) | $\Delta V_Z$<br>(Note 4) | $I_{ZM}$<br>(Note 5) |
|---------------------------------|-------------------|------------------------|------------|--------------|------------|--------------------------|---------------------|----------|--------------------|-------------|-------------------|--------------------------|----------------------|
|                                 |                   | $V_Z$ (Volts)          |            |              | @ $I_{ZT}$ | $Z_{ZT}$ @ $I_{ZT}$      | $Z_{ZK}$ @ $I_{ZK}$ | $I_{ZK}$ | $I_R$ @ $V_R$      |             |                   |                          |                      |
|                                 |                   | Min                    | Nom        | Max          | mA         | $\Omega$                 | $\Omega$            | mA       | $\mu\text{A Max}$  | Volts       |                   |                          |                      |
| <b>1N5333B, G</b>               | <b>1N5333B</b>    | <b>3.14</b>            | <b>3.3</b> | <b>3.47</b>  | <b>380</b> | <b>3</b>                 | <b>400</b>          | <b>1</b> | <b>300</b>         | <b>1</b>    | <b>20</b>         | <b>0.85</b>              | <b>1440</b>          |
| 1N5334B, G                      | 1N5334B           | 3.42                   | 3.6        | 3.78         | 350        | 2.5                      | 500                 | 1        | 150                | 1           | 18.7              | 0.8                      | 1320                 |
| 1N5335B, G                      | 1N5335B           | 3.71                   | 3.9        | 4.10         | 320        | 2                        | 500                 | 1        | 50                 | 1           | 17.6              | 0.54                     | 1220                 |
| 1N5336B, G                      | 1N5336B           | 4.09                   | 4.3        | 4.52         | 290        | 2                        | 500                 | 1        | 10                 | 1           | 16.4              | 0.49                     | 1100                 |
| <b>1N5337B, G</b>               | <b>1N5337B</b>    | <b>4.47</b>            | <b>4.7</b> | <b>4.94</b>  | <b>260</b> | <b>2</b>                 | <b>450</b>          | <b>1</b> | <b>5</b>           | <b>1</b>    | <b>15.3</b>       | <b>0.44</b>              | <b>1010</b>          |
| <b>1N5338B, G</b>               | <b>1N5338B</b>    | <b>4.85</b>            | <b>5.1</b> | <b>5.36</b>  | <b>240</b> | <b>1.5</b>               | <b>400</b>          | <b>1</b> | <b>1</b>           | <b>1</b>    | <b>14.4</b>       | <b>0.39</b>              | <b>930</b>           |
| <b>1N5339B, G</b>               | <b>1N5339B</b>    | <b>5.32</b>            | <b>5.6</b> | <b>5.88</b>  | <b>220</b> | <b>1</b>                 | <b>400</b>          | <b>1</b> | <b>1</b>           | <b>2</b>    | <b>13.4</b>       | <b>0.25</b>              | <b>865</b>           |
| 1N5340B, G                      | 1N5340B           | 5.70                   | 6.0        | 6.30         | 200        | 1                        | 300                 | 1        | 1                  | 3           | 12.7              | 0.19                     | 790                  |
| <b>1N5341B, G</b>               | <b>1N5341B</b>    | <b>5.89</b>            | <b>6.2</b> | <b>6.51</b>  | <b>200</b> | <b>1</b>                 | <b>200</b>          | <b>1</b> | <b>1</b>           | <b>3</b>    | <b>12.4</b>       | <b>0.1</b>               | <b>765</b>           |
| <b>1N5342B, G</b>               | <b>1N5342B</b>    | <b>6.46</b>            | <b>6.8</b> | <b>7.14</b>  | <b>175</b> | <b>1</b>                 | <b>200</b>          | <b>1</b> | <b>10</b>          | <b>5.2</b>  | <b>11.5</b>       | <b>0.15</b>              | <b>700</b>           |
| 1N5343B, G                      | 1N5343B           | 7.13                   | 7.5        | 7.88         | 175        | 1.5                      | 200                 | 1        | 10                 | 5.7         | 10.7              | 0.15                     | 630                  |
| 1N5344B, G                      | 1N5344B           | 7.79                   | 8.2        | 8.61         | 150        | 1.5                      | 200                 | 1        | 10                 | 6.2         | 10                | 0.2                      | 580                  |
| 1N5345B, G                      | 1N5345B           | 8.27                   | 8.7        | 9.14         | 150        | 2                        | 200                 | 1        | 10                 | 6.6         | 9.5               | 0.2                      | 545                  |
| 1N5346B, G                      | 1N5346B           | 8.65                   | 9.1        | 9.56         | 150        | 2                        | 150                 | 1        | 7.5                | 6.9         | 9.2               | 0.22                     | 520                  |
| <b>1N5347B, G</b>               | <b>1N5347B</b>    | <b>9.50</b>            | <b>10</b>  | <b>10.5</b>  | <b>125</b> | <b>2</b>                 | <b>125</b>          | <b>1</b> | <b>5</b>           | <b>7.6</b>  | <b>8.6</b>        | <b>0.22</b>              | <b>475</b>           |
| 1N5348B, G                      | 1N5348B           | 10.45                  | 11         | 11.55        | 125        | 2.5                      | 125                 | 1        | 5                  | 8.4         | 8.0               | 0.25                     | 430                  |
| <b>1N5349B, G</b>               | <b>1N5349B</b>    | <b>11.4</b>            | <b>12</b>  | <b>12.6</b>  | <b>100</b> | <b>2.5</b>               | <b>125</b>          | <b>1</b> | <b>2</b>           | <b>9.1</b>  | <b>7.5</b>        | <b>0.25</b>              | <b>395</b>           |
| <b>1N5350B, G</b>               | <b>1N5350B</b>    | <b>12.35</b>           | <b>13</b>  | <b>13.65</b> | <b>100</b> | <b>2.5</b>               | <b>100</b>          | <b>1</b> | <b>1</b>           | <b>9.9</b>  | <b>7.0</b>        | <b>0.25</b>              | <b>365</b>           |
| 1N5351B, G                      | 1N5351B           | 13.3                   | 14         | 14.7         | 100        | 2.5                      | 75                  | 1        | 1                  | 10.6        | 6.7               | 0.25                     | 340                  |
| <b>1N5352B, G</b>               | <b>1N5352B</b>    | <b>14.25</b>           | <b>15</b>  | <b>15.75</b> | <b>75</b>  | <b>2.5</b>               | <b>75</b>           | <b>1</b> | <b>1</b>           | <b>11.5</b> | <b>6.3</b>        | <b>0.25</b>              | <b>315</b>           |
| <b>1N5353B, G</b>               | <b>1N5353B</b>    | <b>15.2</b>            | <b>16</b>  | <b>16.8</b>  | <b>75</b>  | <b>2.5</b>               | <b>75</b>           | <b>1</b> | <b>1</b>           | <b>12.2</b> | <b>6.0</b>        | <b>0.3</b>               | <b>295</b>           |
| 1N5354B, G                      | 1N5354B           | 16.15                  | 17         | 17.85        | 70         | 2.5                      | 75                  | 1        | 0.5                | 12.9        | 5.8               | 0.35                     | 280                  |
| 1N5355B, G                      | 1N5355B           | 17.1                   | 18         | 18.9         | 65         | 2.5                      | 75                  | 1        | 0.5                | 13.7        | 5.5               | 0.4                      | 264                  |
| 1N5356B, G                      | 1N5356B           | 18.05                  | 19         | 19.95        | 65         | 3                        | 75                  | 1        | 0.5                | 14.4        | 5.3               | 0.4                      | 250                  |
| 1N5357B, G                      | 1N5357B           | 19                     | 20         | 21           | 65         | 3                        | 75                  | 1        | 0.5                | 15.2        | 5.1               | 0.4                      | 237                  |
| <b>1N5358B, G</b>               | <b>1N5358B</b>    | <b>20.9</b>            | <b>22</b>  | <b>23.1</b>  | <b>50</b>  | <b>3.5</b>               | <b>75</b>           | <b>1</b> | <b>0.5</b>         | <b>16.7</b> | <b>4.7</b>        | <b>0.45</b>              | <b>216</b>           |
| <b>1N5359B, G</b>               | <b>1N5359B</b>    | <b>22.8</b>            | <b>24</b>  | <b>25.2</b>  | <b>50</b>  | <b>3.5</b>               | <b>100</b>          | <b>1</b> | <b>0.5</b>         | <b>18.2</b> | <b>4.4</b>        | <b>0.55</b>              | <b>198</b>           |
| 1N5360B, G                      | 1N5360B           | 23.75                  | 25         | 26.25        | 50         | 4                        | 110                 | 1        | 0.5                | 19          | 4.3               | 0.55                     | 190                  |
| <b>1N5361B, G</b>               | <b>1N5361B</b>    | <b>25.65</b>           | <b>27</b>  | <b>28.35</b> | <b>50</b>  | <b>5</b>                 | <b>120</b>          | <b>1</b> | <b>0.5</b>         | <b>20.6</b> | <b>4.1</b>        | <b>0.6</b>               | <b>176</b>           |
| 1N5362B, G                      | 1N5362B           | 26.6                   | 28         | 29.4         | 50         | 6                        | 130                 | 1        | 0.5                | 21.2        | 3.9               | 0.6                      | 170                  |

Devices listed in **bold, italic** are ON Semiconductor **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

1. **TOLERANCE AND TYPE NUMBER DESIGNATION**

The JEDEC type numbers shown indicate a tolerance of  $\pm 5\%$ .

2. **ZENER VOLTAGE ( $V_Z$ ) and IMPEDANCE ( $I_{ZT}$  and  $I_{ZK}$ )**

Test conditions for zener voltage and impedance are as follows:  $I_Z$  is applied  $40 \pm 10$  ms prior to reading. Mounting contacts are located  $3/8''$  to  $1/2''$  from the inside edge of mounting clips to the body of the diode ( $T_A = 25^\circ\text{C} + 8^\circ\text{C}, -2^\circ\text{C}$ ).

3. **SURGE CURRENT ( $I_R$ )**

Surge current is specified as the maximum allowable peak, non-recurrent square-wave current with a pulse width, PW, of 8.3 ms. The data given in Figure 5 may be used to find the maximum surge current for a square wave of any pulse width between 1 ms and 1000 ms by plotting the applicable points on logarithmic paper. Examples of this, using the 3.3 V and 200 V zener are shown in Figure 6. Mounting contact located as specified in Note 2 ( $T_A = 25^\circ\text{C} + 8^\circ\text{C}, -2^\circ\text{C}$ ).

4. **VOLTAGE REGULATION ( $\Delta V_Z$ )**

The conditions for voltage regulation are as follows:  $V_Z$  measurements are made at 10% and then at 50% of the  $I_Z$  max value listed in the electrical characteristics table. The test current time duration for each  $V_Z$  measurement is  $40 \pm 10$  ms. Mounting contact located as specified in Note 2 ( $T_A = 25^\circ\text{C} + 8^\circ\text{C}, -2^\circ\text{C}$ ).

5. **MAXIMUM REGULATOR CURRENT ( $I_{ZM}$ )**

The maximum current shown is based on the maximum voltage of a 5% type unit, therefore, it applies only to the B-suffix device. The actual  $I_{ZM}$  for any device may not exceed the value of 5 watts divided by the actual  $V_Z$  of the device.  $T_L = 75^\circ\text{C}$  at  $3/8''$  maximum from the device body.

†The "G" suffix indicates Pb-Free package available.

# 1N5333B Series

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 1.2\text{ V Max}$  @  $I_F = 1.0\text{ A}$  for all types)

| Device <sup>†</sup><br>(Note 6) | Device<br>Marking | Zener Voltage (Note 7) |            |              |            | Zener Impedance (Note 7) |                     |          | Leakage<br>Current |             | $I_R$<br>(Note 8) | $\Delta V_Z$<br>(Note 9) | $I_{ZM}$<br>(Note 10) |
|---------------------------------|-------------------|------------------------|------------|--------------|------------|--------------------------|---------------------|----------|--------------------|-------------|-------------------|--------------------------|-----------------------|
|                                 |                   | $V_Z$ (Volts)          |            |              | @ $I_{ZT}$ | $Z_{ZT}$ @ $I_{ZT}$      | $Z_{ZK}$ @ $I_{ZK}$ | $I_{ZK}$ | $I_R$ @ $V_R$      |             |                   |                          |                       |
|                                 |                   | Min                    | Nom        | Max          | mA         | $\Omega$                 | $\Omega$            | mA       | $\mu\text{A Max}$  | Volts       |                   |                          |                       |
| 1N5363B, G                      | 1N5363B           | 28.5                   | 30         | 31.5         | 40         | 8                        | 140                 | 1        | 0.5                | 22.8        | 3.7               | 0.6                      | 158                   |
| 1N5364B, G                      | 1N5364B           | 31.35                  | 33         | 34.65        | 40         | 10                       | 150                 | 1        | 0.5                | 25.1        | 3.5               | 0.6                      | 144                   |
| <b>1N5365B, G</b>               | <b>1N5365B</b>    | <b>34.2</b>            | <b>36</b>  | <b>37.8</b>  | <b>30</b>  | <b>11</b>                | <b>160</b>          | <b>1</b> | <b>0.5</b>         | <b>27.4</b> | <b>3.5</b>        | <b>0.65</b>              | <b>132</b>            |
| 1N5366B, G                      | 1N5366B           | 37.05                  | 39         | 40.95        | 30         | 14                       | 170                 | 1        | 0.5                | 29.7        | 3.1               | 0.65                     | 122                   |
| 1N5367B, G                      | 1N5367B           | 40.85                  | 43         | 45.15        | 30         | 20                       | 190                 | 1        | 0.5                | 32.7        | 2.8               | 0.7                      | 110                   |
| <b>1N5368B, G</b>               | <b>1N5368B</b>    | <b>44.65</b>           | <b>47</b>  | <b>49.35</b> | <b>25</b>  | <b>25</b>                | <b>210</b>          | <b>1</b> | <b>0.5</b>         | <b>35.8</b> | <b>2.7</b>        | <b>0.8</b>               | <b>100</b>            |
| 1N5369B, G                      | 1N5369B           | 48.45                  | 51         | 53.55        | 25         | 27                       | 230                 | 1        | 0.5                | 38.8        | 2.5               | 0.9                      | 93                    |
| 1N5370B, G                      | 1N5370B           | 53.2                   | 56         | 58.8         | 20         | 35                       | 280                 | 1        | 0.5                | 42.6        | 2.3               | 1.0                      | 86                    |
| 1N5371B, G                      | 1N5371B           | 57                     | 60         | 63           | 20         | 40                       | 350                 | 1        | 0.5                | 45.5        | 2.2               | 1.2                      | 79                    |
| 1N5372B, G                      | 1N5372B           | 58.9                   | 62         | 65.1         | 20         | 42                       | 400                 | 1        | 0.5                | 47.1        | 2.1               | 1.35                     | 76                    |
| 1N5373B, G                      | 1N5373B           | 64.6                   | 68         | 71.4         | 20         | 44                       | 500                 | 1        | 0.5                | 51.7        | 2.0               | 1.52                     | 70                    |
| 1N5374B, G                      | 1N5374B           | 71.25                  | 75         | 78.75        | 20         | 45                       | 620                 | 1        | 0.5                | 56          | 1.9               | 1.6                      | 63                    |
| 1N5375B, G                      | 1N5375B           | 77.9                   | 82         | 86.1         | 15         | 65                       | 720                 | 1        | 0.5                | 62.2        | 1.8               | 1.8                      | 58                    |
| 1N5376B, G                      | 1N5376B           | 82.65                  | 87         | 91.35        | 15         | 75                       | 760                 | 1        | 0.5                | 66          | 1.7               | 2.0                      | 54.5                  |
| 1N5377B, G                      | 1N5377B           | 86.45                  | 91         | 95.55        | 15         | 75                       | 760                 | 1        | 0.5                | 69.2        | 1.6               | 2.2                      | 52.5                  |
| 1N5378B, G                      | 1N5378B           | 95                     | 100        | 105          | 12         | 90                       | 800                 | 1        | 0.5                | 76          | 1.5               | 2.5                      | 47.5                  |
| 1N5379B, G                      | 1N5379B           | 104.5                  | 110        | 115.5        | 12         | 125                      | 1000                | 1        | 0.5                | 83.6        | 1.4               | 2.5                      | 43                    |
| 1N5380B, G                      | 1N5380B           | 114                    | 120        | 126          | 10         | 170                      | 1150                | 1        | 0.5                | 91.2        | 1.3               | 2.5                      | 39.5                  |
| 1N5381B, G                      | 1N5381B           | 123.5                  | 130        | 136.5        | 10         | 190                      | 1250                | 1        | 0.5                | 98.8        | 1.2               | 2.5                      | 36.6                  |
| 1N5382B, G                      | 1N5382B           | 133                    | 140        | 147          | 8          | 230                      | 1500                | 1        | 0.5                | 106         | 1.2               | 2.5                      | 34                    |
| <b>1N5383B, G</b>               | <b>1N5383B</b>    | <b>142.5</b>           | <b>150</b> | <b>157.5</b> | <b>8</b>   | <b>330</b>               | <b>1500</b>         | <b>1</b> | <b>0.5</b>         | <b>114</b>  | <b>1.1</b>        | <b>3.0</b>               | <b>31.6</b>           |
| 1N5384B, G                      | 1N5384B           | 152                    | 160        | 168          | 8          | 350                      | 1650                | 1        | 0.5                | 122         | 1.1               | 3.0                      | 29.4                  |
| 1N5385B, G                      | 1N5385B           | 161.5                  | 170        | 178.5        | 8          | 380                      | 1750                | 1        | 0.5                | 129         | 1.0               | 3.0                      | 28                    |
| 1N5386B, G                      | 1N5386B           | 171                    | 180        | 189          | 5          | 430                      | 1750                | 1        | 0.5                | 137         | 1.0               | 4.0                      | 26.4                  |
| 1N5387B, G                      | 1N5387B           | 180.5                  | 190        | 199.5        | 5          | 450                      | 1850                | 1        | 0.5                | 144         | 0.9               | 5.0                      | 25                    |
| 1N5388B, G                      | 1N5388B           | 190                    | 200        | 210          | 5          | 480                      | 1850                | 1        | 0.5                | 152         | 0.9               | 5.0                      | 23.6                  |

Devices listed in **bold, italic** are ON Semiconductor **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

## 6. TOLERANCE AND TYPE NUMBER DESIGNATION

The JEDEC type numbers shown indicate a tolerance of  $\pm 5\%$ .

## 7. ZENER VOLTAGE ( $V_Z$ ) and IMPEDANCE ( $I_{ZT}$ and $I_{ZK}$ )

Test conditions for zener voltage and impedance are as follows:  $I_Z$  is applied  $40 \pm 10$  ms prior to reading. Mounting contacts are located  $3/8''$  to  $1/2''$  from the inside edge of mounting clips to the body of the diode ( $T_A = 25^\circ\text{C}$ ,  $+8^\circ\text{C}$ ,  $-2^\circ\text{C}$ ).

## 8. SURGE CURRENT ( $I_R$ )

Surge current is specified as the maximum allowable peak, non-recurrent square-wave current with a pulse width, PW, of 8.3 ms. The data given in Figure 5 may be used to find the maximum surge current for a square wave of any pulse width between 1 ms and 1000 ms by plotting the applicable points on logarithmic paper. Examples of this, using the 3.3 V and 200 V zener are shown in Figure 6. Mounting contact located as specified in Note 7 ( $T_A = 25^\circ\text{C}$ ,  $+8^\circ\text{C}$ ,  $-2^\circ\text{C}$ ).

## 9. VOLTAGE REGULATION ( $\Delta V_Z$ )

The conditions for voltage regulation are as follows:  $V_Z$  measurements are made at 10% and then at 50% of the  $I_Z$  max value listed in the electrical characteristics table. The test current time duration for each  $V_Z$  measurement is  $40 \pm 10$  ms. Mounting contact located as specified in Note 7 ( $T_A = 25^\circ\text{C}$ ,  $+8^\circ\text{C}$ ,  $-2^\circ\text{C}$ ).

## 10. MAXIMUM REGULATOR CURRENT ( $I_{ZM}$ )

The maximum current shown is based on the maximum voltage of a 5% type unit, therefore, it applies only to the B-suffix device. The actual  $I_{ZM}$  for any device may not exceed the value of 5 watts divided by the actual  $V_Z$  of the device.  $T_L = 75^\circ\text{C}$  at  $3/8''$  maximum from the device body.

†The "G" suffix indicates Pb-Free package available.

# 1N5333B Series

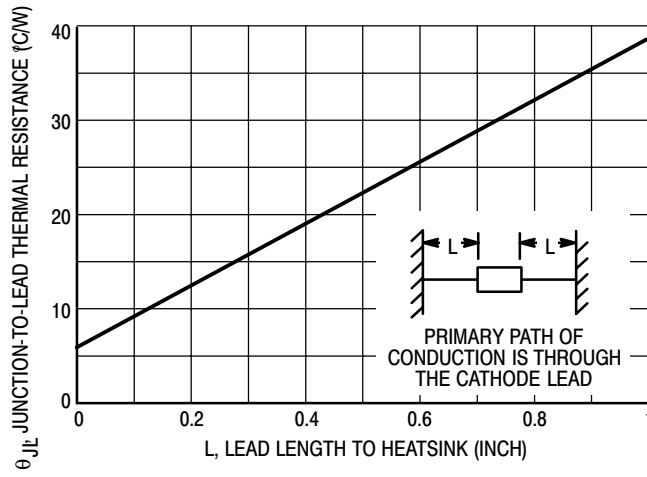


Figure 1. Typical Thermal Resistance

## TEMPERATURE COEFFICIENTS

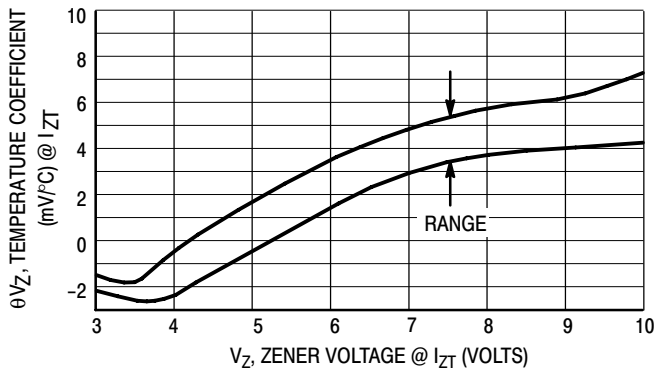


Figure 2. Temperature Coefficient-Range for Units 3 to 10 Volts

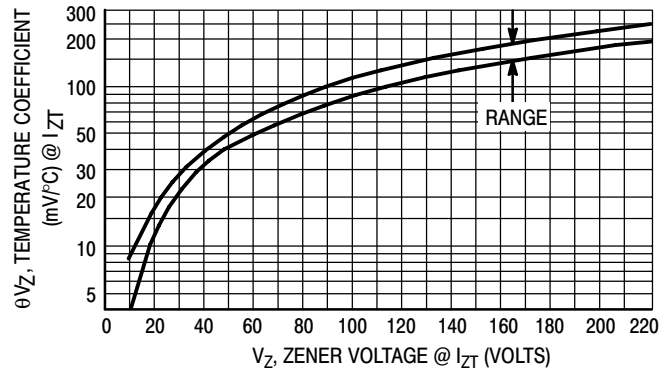
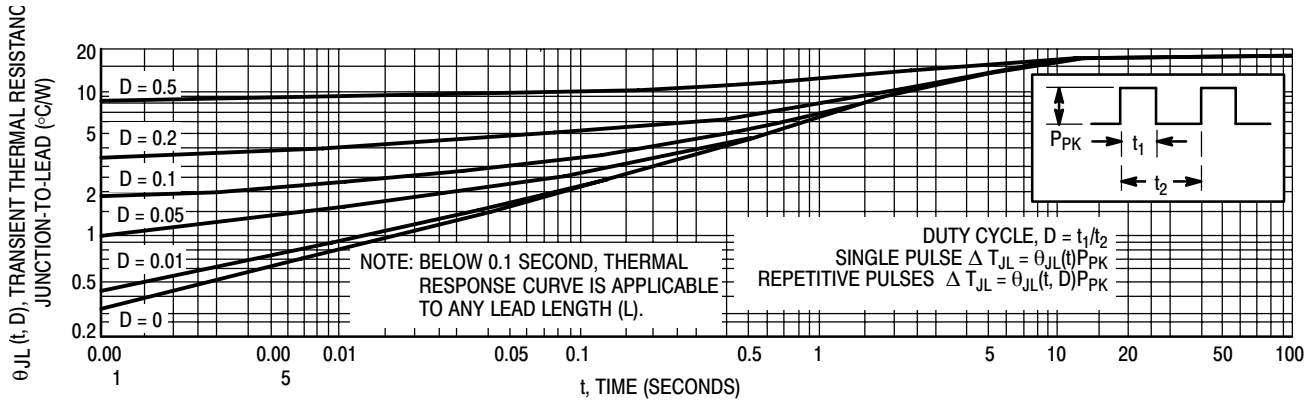
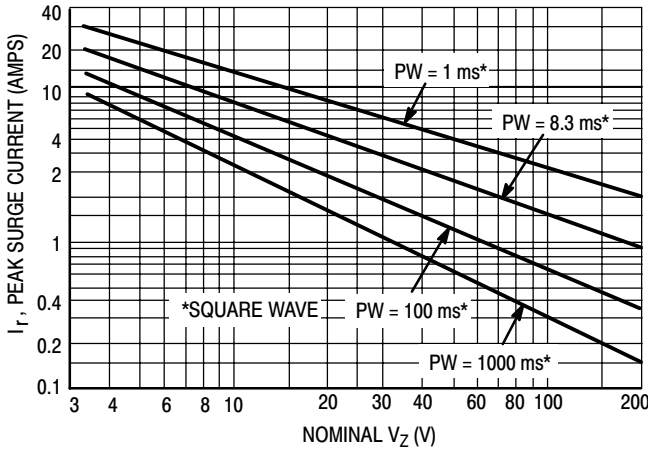


Figure 3. Temperature Coefficient-Range for Units 10 to 220 Volts

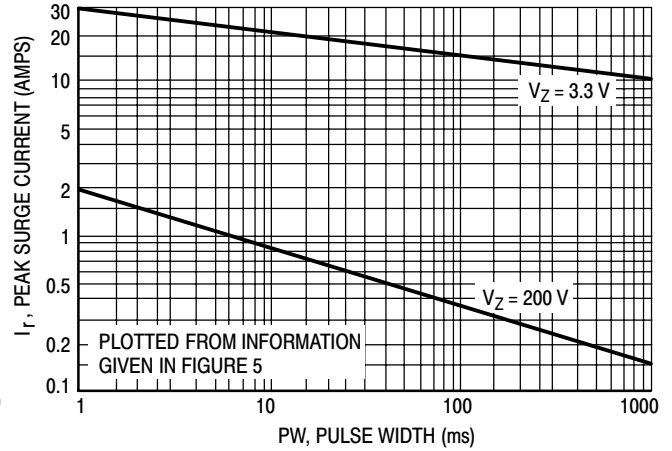
# 1N5333B Series



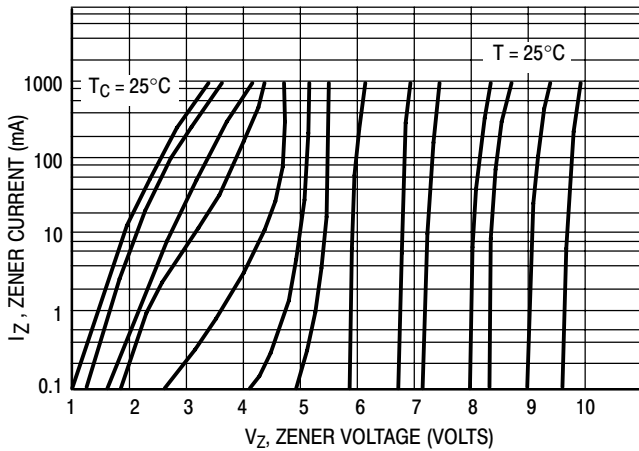
**Figure 4. Typical Thermal Response**  
L, Lead Length = 3/8 Inch



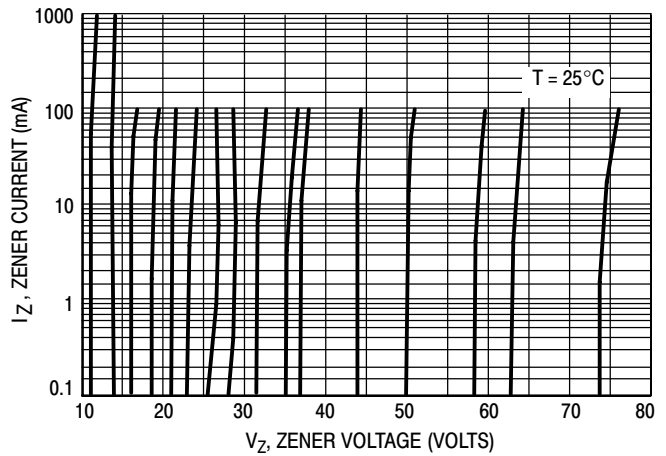
**Figure 5. Maximum Non-Repetitive Surge Current**  
versus Nominal Zener Voltage  
(See Note 3)



**Figure 6. Peak Surge Current versus Pulse Width**  
(See Note 3)

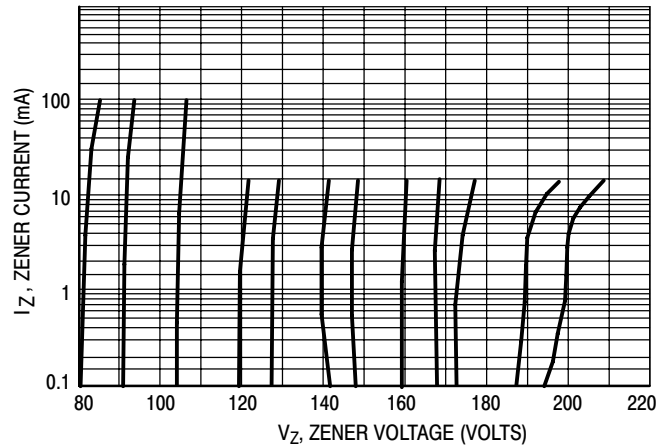


**Figure 7. Zener Voltage versus Zener Current**  
 $V_Z = 3.3$  thru 10 Volts



**Figure 8. Zener Voltage versus Zener Current**  
 $V_Z = 11$  thru 75 Volts

## 1N5333B Series



**Figure 9. Zener Voltage versus Zener Current  
V<sub>Z</sub> = 82 thru 200 Volts**

### APPLICATION NOTE

Since the actual voltage available from a given Zener diode is temperature dependent, it is necessary to determine junction temperature under any set of operating conditions in order to calculate its value. The following procedure is recommended:

Lead Temperature, T<sub>L</sub>, should be determined from:

$$T_L = \theta_{LA} P_D + T_A$$

$\theta_{LA}$  is the lead-to-ambient thermal resistance and P<sub>D</sub> is the power dissipation.

Junction Temperature, T<sub>J</sub>, may be found from:

$$T_J = T_L + \Delta T_{JL}$$

$\Delta T_{JL}$  is the increase in junction temperature above the lead temperature and may be found from Figure 4 for a train of power pulses or from Figure 1 for dc power.

$$\Delta T_{JL} = \theta_{JL} P_D$$

For worst-case design, using expected limits of I<sub>Z</sub>, limits of P<sub>D</sub> and the extremes of T<sub>J</sub> ( $\Delta T_J$ ) may be estimated. Changes in voltage, V<sub>Z</sub>, can then be found from:

$$\Delta V = \theta_{VZ} \Delta T_J$$

$\theta_{VZ}$ , the Zener voltage temperature coefficient, is found from Figures 2 and 3.

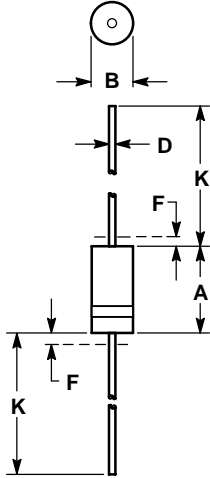
Under high power-pulse operation, the Zener voltage will vary with time and may also be affected significantly by the zener resistance. For best regulation, keep current excursions as low as possible.

Data of Figure 4 should not be used to compute surge capability. Surge limitations are given in Figure 5. They are lower than would be expected by considering only junction temperature, as current crowding effects cause temperatures to be extremely high in small spots resulting in device degradation should the limits of Figure 5 be exceeded.

# 1N5333B Series

## PACKAGE DIMENSIONS

### SURMETIC 40, AXIAL LEAD CASE 017AA-01 ISSUE O



#### NOTES:

1. CONTROLLING DIMENSION: INCH
2. LEAD DIAMETER AND FINISH NOT CONTROLLED WITHIN DIMENSION F.
3. CATHODE BAND INDICATES POLARITY

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.330  | 0.350 | 8.38        | 8.89  |
| B   | 0.130  | 0.145 | 3.30        | 3.68  |
| D   | 0.037  | 0.043 | 0.94        | 1.09  |
| F   | ---    | 0.050 | ---         | 1.27  |
| K   | 1.000  | 1.250 | 25.40       | 31.75 |

SURMETIC is a trademark of Semiconductor Components Industries, LLC (SCILLC).

**ON Semiconductor** and **ON** are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

#### PUBLICATION ORDERING INFORMATION

##### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative