

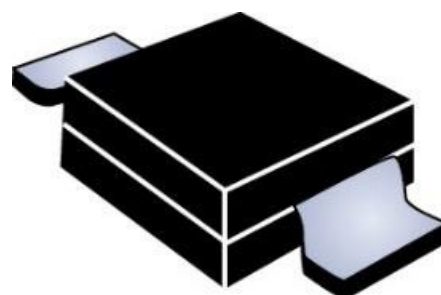
## Product Overview

The MSMCG(J)5.0A through MXLSMCG(J)170A series of 1500 watt high-reliability Transient Voltage Suppressors (TVSS) protects a variety of voltage-sensitive components. The SMCG gull-wing design in the DO-215AB package allows for visible solder connections. The SMCJ J-bend design in the DO-214AB package allows for greater PC board mounting density. Selections include unidirectional and bidirectional as well as RoHS compliant versions. These are available with a variety of upstreaming options for enhanced reliability. They can protect against the secondary effects of lightning per IEC61000-4-5 and against voltage pulses from inductive switching environments and induced by RF radiation. Since their response time is virtually instantaneous, they can also be used in protection from ESD and EFT per IEC61000-4-2 and IEC61000-4-4.

### Features

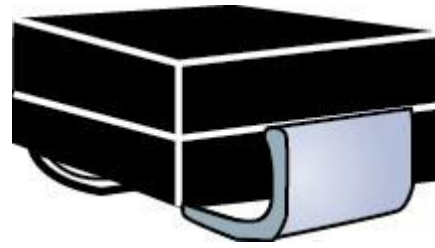
- High reliability devices with fabrication and assembly lot traceability for all M prefix devices
- All devices are 100% surge tested.
- 3 $\sigma$  lot norm screening performed on standby current ( $I_D$ ) for all M prefix devices
- Available in both unidirectional and bidirectional versions
- Suppress transients up to 1,500W at 10/1000  $\mu$ s (see [Figure 4-1](#))
- Moisture classification is "Level 1" with no dry pack required per IPC/JEDEC J-STD-020B for all M prefix devices
- Enhanced reliability screening options available in reference to MIL-PRF-19500. Refer to [High Reliability Up-Screened Plastic Products Portfolio](#) for more details on the screening options (See [Part Nomenclature](#) for all available options)
- RoHS compliant versions available
- Axial-lead equivalent packages for thru-hole mounting are available as 1.5KE6.8A to 1.5KE200CA or 1N6267 thru 1N6303A and 1N5908 (contact Microchip for other surface mount options.)

**Figure 1.** DO-215AB (SMCG) Package



**Applications/Benefits**

- High-reliability devices
- Available in working stand-off voltage range of 5.0 to 170V
- 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: MSMC 5.0A to MXLSMC 170CA
  - Class 2: MSMC 5.0A to MXLSMC 150CA
  - Class 3: MSMC 5.0A to MXLSMC 75CA
  - Class 4: MSMC 5.0A to MXLSMC 36CA
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
  - Class 1: MSMC 5.0A to MXLSMC 90CA
  - Class 2: MSMC 5.0A to MXLSMC 45CA
  - Class 3: MSMC 5.0A to MXLSMC 24CA
  - Class 4: MSMC 5.0A to MXLSMC 11CA
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
  - Class 2: MSMC 5.0A to MXLSMC 22CA
  - Class 3: MSMC 5.0A to MXLSMC 10CA

**Figure 2. DO-214AB (SMCJ) Package**

All SMC series are equivalent to prior SMM package identifications.

Also available:

Commercial Grade: [SMCG\(J\)5.0A – SMCG\(J\)170CAe3](#)

Axial-Lead: [M1.5KE6.8A-MXL1.5KE200CA](#)

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# 1. Maximum Ratings

**Table 1-1.** Maximum Ratings

| Parameters/Test Conditions                                                                                                                                |                            | Symbol              | Value                  | Unit   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------|------------------------|--------|
| Junction and storage temperature                                                                                                                          |                            | $T_J$ and $T_{STG}$ | -65 to +150            | °C     |
| Thermal resistance junction-to-lead                                                                                                                       |                            | $R_{\theta JL}$     | 20                     | °C/W   |
| Thermal resistance junction-to-ambient <sup>1</sup>                                                                                                       |                            | $R_{\theta JA}$     | 80                     | °C/W   |
| Peak pulse power dissipation at 25 °C (at 10/1000 $\mu$ s, see <a href="#">Figure 4-1</a> , <a href="#">Figure 4-2</a> , and <a href="#">Figure 4-3</a> ) |                            | $P_{PP}$            | 1500                   | W      |
| Impulse repetition rate (duty factor)                                                                                                                     |                            | df                  | 0.01                   | %      |
| $t_{clamping}$ (0 volts to V(BR) min.)                                                                                                                    | Unidirectional             | $t_{clamping}$      | < 100                  | ps     |
|                                                                                                                                                           | Bidirectional              |                     | < 5                    | ns     |
| Average power dissipation                                                                                                                                 | TL = +30 °C<br>TA = +25 °C | $P_{M(AV)}$         | 6<br>1.56 <sup>1</sup> | W      |
| Maximum forward surge current <sup>2</sup>                                                                                                                |                            | $I_{FSM}$           | 200                    | A (pk) |
| Solder temperature at 10 s                                                                                                                                |                            | $T_{SP}$            | 260                    | °C     |

**Notes:**

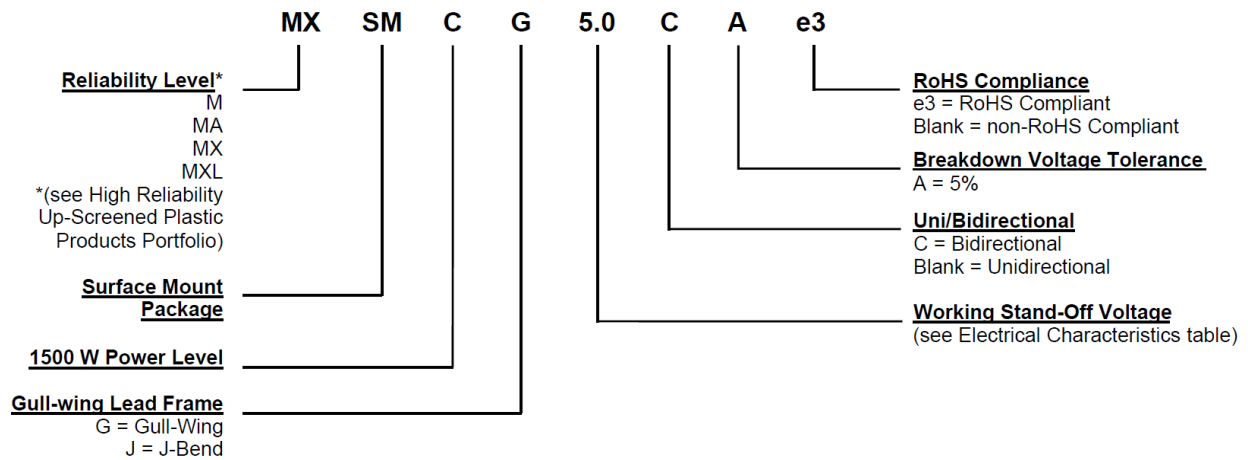
1. When mounted on FR4 PC board (1 oz Cu) with recommended footprint
2. Peak impulse of 8.3 ms half-sine wave at 25 °C (unidirectional only)

## 1.1 Mechanical and Packaging

- Case: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- Terminals: Tin-lead or RoHS compliant annealed matte-tin plating. Solderable to MIL-STD-750, method 2026
- Marking: Reliability level, part number, and date code
- Polarity: Cathode indicated by band. No cathode band on bi-directional devices
- Tape and reel option: Standard per EIA-481-2 with 16 mm tape (add "TR" suffix to part number). Consult factory for quantities.
- Weight: Approximately 0.25 grams
- See [Package Dimensions](#)

## 2. Part Nomenclature

Figure 2-1. Part Nomenclature



### 2.1 Symbols and Definitions

Table 2-1. Symbols and Definitions

| Symbol     | Definition                                                                                                                                                                              |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_{(BR)}$ | Breakdown current: The current used for measuring breakdown voltage $V_{(BR)}$ .                                                                                                        |
| $I_D$      | Standby current: The current at the rated stand-off voltage ( $V_{WM}$ ).                                                                                                               |
| $I_F$      | Forward current: The forward current DC value, no alternating component.                                                                                                                |
| $I_{PP}$   | Peak impulse current: The peak current during the impulse.                                                                                                                              |
| $P_{PP}$   | Peak pulse power: The peak power that can be applied for a specific pulse width and waveform. The product of $V_C$ and $I_{PP}$ .                                                       |
| $V_{(BR)}$ | Breakdown voltage: The voltage across the device at a specified current $I_{(BR)}$ in the breakdown region.                                                                             |
| $V_C$      | Clamping voltage: The voltage across the device in a region of low differential resistance during the application of an impulse current ( $I_{PP}$ ) for a specified waveform.          |
| $V_{WM}$   | Working stand-off voltage: The maximum-rated value of DC or repetitive peak positive cathode to anode voltage that may be continuously applied over the standard operating temperature. |

### 3. Electrical Characteristics

**Table 3-1.** Electrical Characteristics at 25 °C Unless Otherwise Stated

| Microchip Part Number |              | Working Stand-Off Voltage $V_{WM}$<br>Volts | Breakdown Voltage $V_{(BR)}$ at $I_{(BR)}$<br>Volts |                  | Maximum Clamping Voltage at $I_{PP}$<br>Volts | Peak Impulse Current at 10/1000 $\mu s$<br>(See Figure 4-2)<br>$I_{PP}$<br>Amps | Maximum Standby Current at $V_{WM}$<br>$I_D$<br>$\mu A$ |
|-----------------------|--------------|---------------------------------------------|-----------------------------------------------------|------------------|-----------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------|
| Gull-Wing             | J-Bend       |                                             | Min. Max.                                           | $I_{(BR)}$<br>mA |                                               |                                                                                 |                                                         |
| MSMCG5.0(C)A          | MSMCJ5.0(C)A | 5.0                                         | 6.40–7.00                                           | 10               | 9.2                                           | 163.0                                                                           | 1000                                                    |
| MSMCG6.0(C)A          | MSMCJ6.0(C)A | 6.0                                         | 6.67–7.37                                           | 10               | 10.3                                          | 145.6                                                                           | 1000                                                    |
| MSMCG6.5(C)A          | MSMCJ6.5(C)A | 6.5                                         | 7.22–7.98                                           | 10               | 11.2                                          | 133.9                                                                           | 500                                                     |
| MSMCG7.0(C)A          | MSMCJ7.0(C)A | 7.0                                         | 7.78–8.60                                           | 10               | 12.0                                          | 125.0                                                                           | 200                                                     |
| MSMCG7.5(C)A          | MSMCJ7.5(C)A | 7.5                                         | 8.33–9.21                                           | 1                | 12.9                                          | 116.3                                                                           | 100                                                     |
| MSMCG8.0(C)A          | MSMCJ8.0(C)A | 8.0                                         | 8.89–9.83                                           | 1                | 13.6                                          | 110.3                                                                           | 50                                                      |
| MSMCG8.5(C)A          | MSMCJ8.5(C)A | 8.5                                         | 9.44–10.4                                           | 1                | 14.4                                          | 104.2                                                                           | 20                                                      |
| MSMCG9.0(C)A          | MSMCJ9.0(C)A | 9.0                                         | 10.0–11.1                                           | 1                | 15.4                                          | 97.4                                                                            | 10                                                      |
| MSMCG10(C)A           | MSMCJ10(C)A  | 10                                          | 11.1–12.3                                           | 1                | 17.0                                          | 88.2                                                                            | 5                                                       |
| MSMCG11(C)A           | MSMCJ11(C)A  | 11                                          | 12.2–13.5                                           | 1                | 18.2                                          | 82.4                                                                            | 5                                                       |
| MSMCG12(C)A           | MSMCJ12(C)A  | 12                                          | 13.3–14.7                                           | 1                | 19.9                                          | 75.3                                                                            | 5                                                       |
| MSMCG13(C)A           | MSMCJ13(C)A  | 13                                          | 14.4–15.9                                           | 1                | 21.5                                          | 69.7                                                                            | 1                                                       |
| MSMCG14(C)A           | MSMCJ14(C)A  | 14                                          | 15.6–17.2                                           | 1                | 23.2                                          | 64.7                                                                            | 1                                                       |
| MSMCG15(C)A           | MSMCJ15(C)A  | 15                                          | 16.7–18.5                                           | 1                | 24.4                                          | 61.5                                                                            | 1                                                       |
| MSMCG16(C)A           | MSMCJ16(C)A  | 16                                          | 17.8–19.7                                           | 1                | 26.0                                          | 57.7                                                                            | 1                                                       |
| MSMCG17(C)A           | MSMCJ17(C)A  | 17                                          | 18.9–20.9                                           | 1                | 27.6                                          | 53.3                                                                            | 1                                                       |
| MSMCG18(C)A           | MSMCJ18(C)A  | 18                                          | 20.0–22.1                                           | 1                | 29.2                                          | 51.4                                                                            | 1                                                       |
| MSMCG20(C)A           | MSMCJ20(C)A  | 20                                          | 22.2–24.5                                           | 1                | 32.4                                          | 46.3                                                                            | 1                                                       |
| MSMCG22(C)A           | MSMCJ22(C)A  | 22                                          | 24.4–26.9                                           | 1                | 35.5                                          | 42.2                                                                            | 1                                                       |
| MSMCG24(C)A           | MSMCJ24(C)A  | 24                                          | 26.7–29.5                                           | 1                | 38.9                                          | 38.6                                                                            | 1                                                       |
| MSMCG26(C)A           | MSMCJ26(C)A  | 26                                          | 28.9–31.9                                           | 1                | 42.1                                          | 35.6                                                                            | 1                                                       |
| MSMCG28(C)A           | MSMCJ28(C)A  | 28                                          | 31.1–34.4                                           | 1                | 45.4                                          | 33.0                                                                            | 1                                                       |
| MSMCG30(C)A           | MSMCJ30(C)A  | 30                                          | 33.3–36.8                                           | 1                | 48.4                                          | 31.0                                                                            | 1                                                       |
| MSMCG33(C)A           | MSMCJ33(C)A  | 33                                          | 36.7–40.6                                           | 1                | 53.3                                          | 28.1                                                                            | 1                                                       |
| MSMCG36(C)A           | MSMCJ36(C)A  | 36                                          | 40.0–44.2                                           | 1                | 58.1                                          | 25.8                                                                            | 1                                                       |
| MSMCG40(C)A           | MSMCJ40(C)A  | 40                                          | 44.4–49.1                                           | 1                | 64.5                                          | 23.2                                                                            | 1                                                       |
| MSMCG43(C)A           | MSMCJ43(C)A  | 43                                          | 47.8–52.8                                           | 1                | 69.4                                          | 21.6                                                                            | 1                                                       |
| MSMCG45(C)A           | MSMCJ45(C)A  | 45                                          | 50.0–55.3                                           | 1                | 72.7                                          | 20.6                                                                            | 1                                                       |
| MSMCG48(C)A           | MSMCJ48(C)A  | 48                                          | 53.3–58.9                                           | 1                | 77.4                                          | 19.4                                                                            | 1                                                       |
| MSMCG51(C)A           | MSMCJ51(C)A  | 51                                          | 56.7–62.7                                           | 1                | 82.4                                          | 18.2                                                                            | 1                                                       |
| MSMCG54(C)A           | MSMCJ54(C)A  | 54                                          | 60.0–66.3                                           | 1                | 87.1                                          | 17.2                                                                            | 1                                                       |
| MSMCG58(C)A           | MSMCJ58(C)A  | 58                                          | 64.4–71.2                                           | 1                | 93.6                                          | 16.0                                                                            | 1                                                       |

.....continued

| Microchip Part Number |              | Working<br>Stand-Off<br>Voltage $V_{WM}$<br><br>Volts | Breakdown<br>Voltage $V_{(BR)}$ at<br>$I_{(BR)}$<br>Volts |                  | Maximum<br>Clamping<br>Voltage at $I_{PP}$<br><br>Volts | Peak Impulse<br>Current at<br>10/1000 $\mu s$<br>(See Figure 4-2)<br>$I_{PP}$<br>Amps | Maximum<br>Standby<br>Current at $V_{WM}$<br><br>$I_D$<br>$\mu A$ |
|-----------------------|--------------|-------------------------------------------------------|-----------------------------------------------------------|------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Gull-Wing             | J-Bend       |                                                       | Min. Max.                                                 | $I_{(BR)}$<br>mA |                                                         |                                                                                       |                                                                   |
| MSMCG60(C)A           | MSMCJ60(C)A  | 60                                                    | 66.7–73.7                                                 | 1                | 96.8                                                    | 15.5                                                                                  | 1                                                                 |
| MSMCG64(C)A           | MSMCJ64(C)A  | 64                                                    | 71.1–78.6                                                 | 1                | 103.0                                                   | 14.6                                                                                  | 1                                                                 |
| MSMCG70(C)A           | MSMCJ70(C)A  | 70                                                    | 77.8–86.0                                                 | 1                | 113                                                     | 13.3                                                                                  | 1                                                                 |
| MSMCG75(C)A           | MSMCJ75(C)A  | 75                                                    | 83.3–92.1                                                 | 1                | 121                                                     | 12.4                                                                                  | 1                                                                 |
| MSMCG78(C)A           | MSMCJ78(C)A  | 78                                                    | 86.7–95.8                                                 | 1                | 126                                                     | 11.4                                                                                  | 1                                                                 |
| MSMCG85(C)A           | MSMCJ85(C)A  | 85                                                    | 94.4–104.0                                                | 1                | 137                                                     | 10.4                                                                                  | 1                                                                 |
| MSMCG90(C)A           | MSMCJ90(C)A  | 90                                                    | 100–111                                                   | 1                | 146                                                     | 10.3                                                                                  | 1                                                                 |
| MSMCG100(C)A          | MSMCJ100(C)A | 100                                                   | 111–123                                                   | 1                | 162                                                     | 9.3                                                                                   | 1                                                                 |
| MSMCG110(C)A          | MSMCJ110(C)A | 110                                                   | 122–135                                                   | 1                | 177                                                     | 8.4                                                                                   | 1                                                                 |
| MSMCG120(C)A          | MSMCJ120(C)A | 120                                                   | 133–147                                                   | 1                | 193                                                     | 7.8                                                                                   | 1                                                                 |
| MSMCG130(C)A          | MSMCJ130(C)A | 130                                                   | 144–159                                                   | 1                | 209                                                     | 7.2                                                                                   | 1                                                                 |
| MSMCG150(C)A          | MSMCJ150(C)A | 150                                                   | 167–185                                                   | 1                | 243                                                     | 6.2                                                                                   | 1                                                                 |
| MSMCG160(C)A          | MSMCJ160(C)A | 160                                                   | 178–197                                                   | 1                | 259                                                     | 5.8                                                                                   | 1                                                                 |
| MSMCG170(C)A          | MSMCJ170(C)A | 170                                                   | 189–209                                                   | 1                | 275                                                     | 5.5                                                                                   | 1                                                                 |

## 4. Graphs

Figure 4-1. Peak Pulse Power Vs. Pulse Time

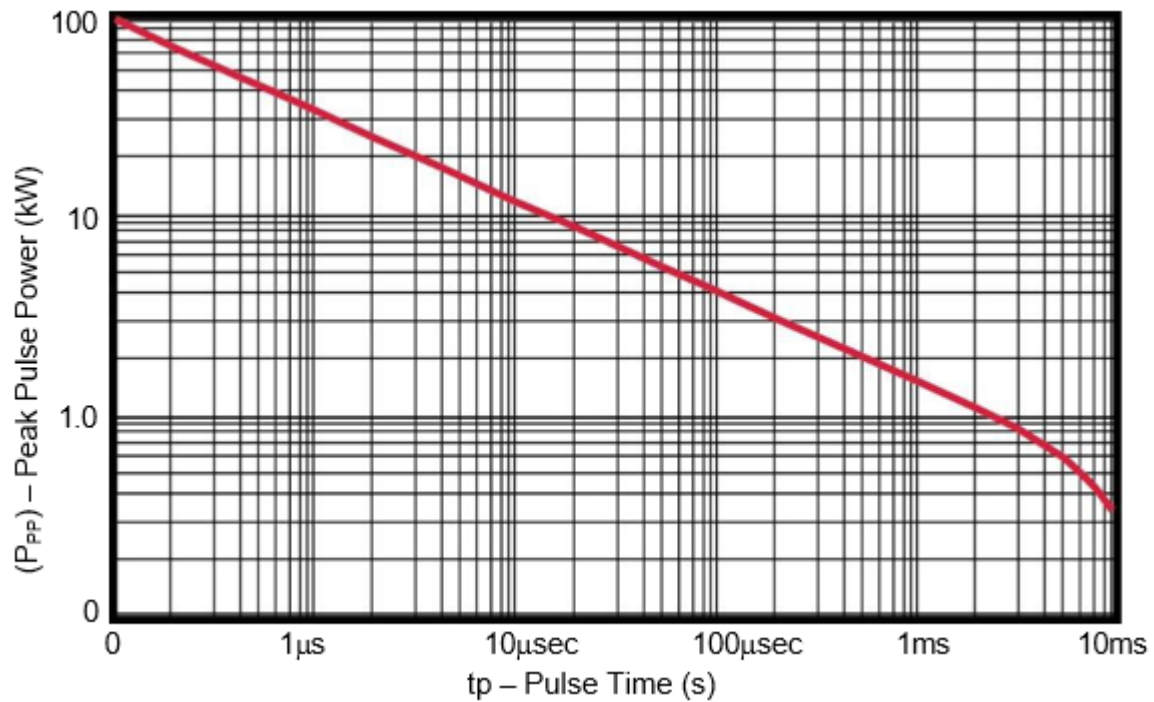


Figure 4-2. Pulse Waveform

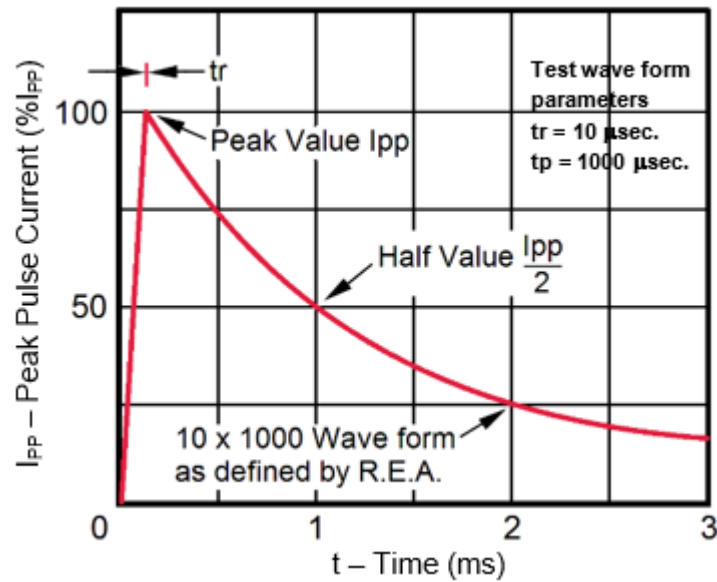


**Figure 4-3. Derating Curve**

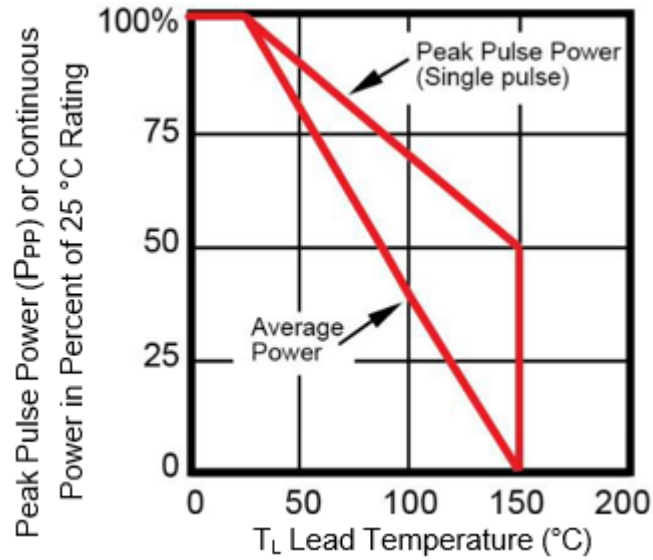
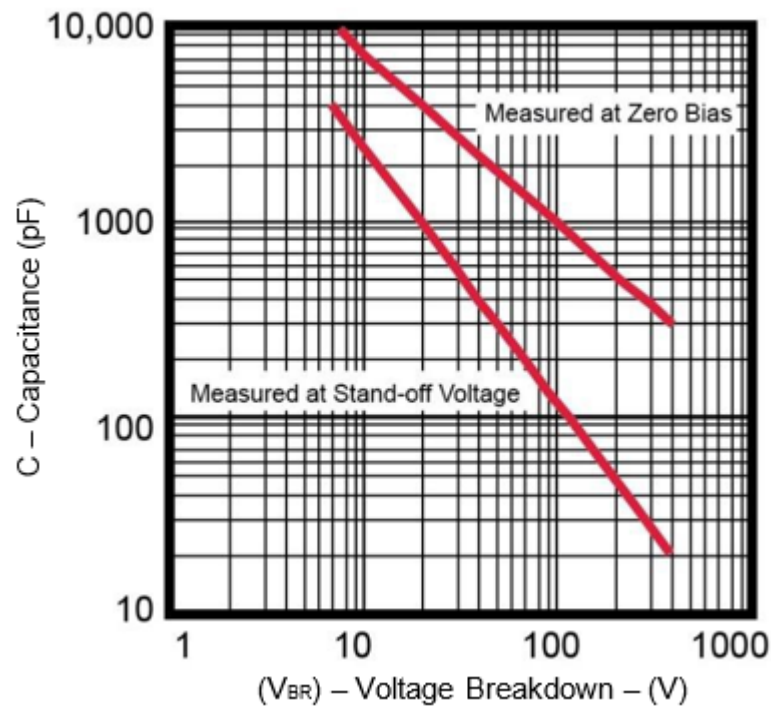


**Figure 4-4. Typical Capacitance Vs. Breakdown Voltage (Unidirectional Configuration)<sup>1</sup>**

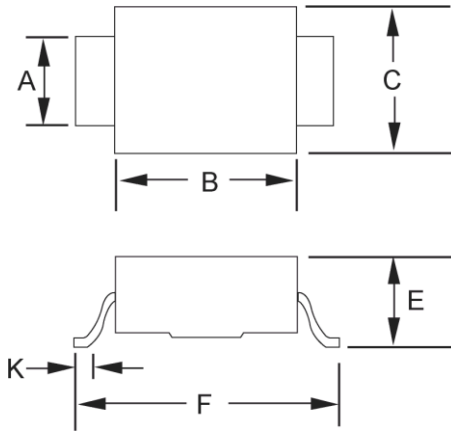


**Note:**

1. Bidirectional capacitance is half that shown at zero volts.

## 5. Package Dimensions

Figure 5-1. SMCG (DO-215AB)

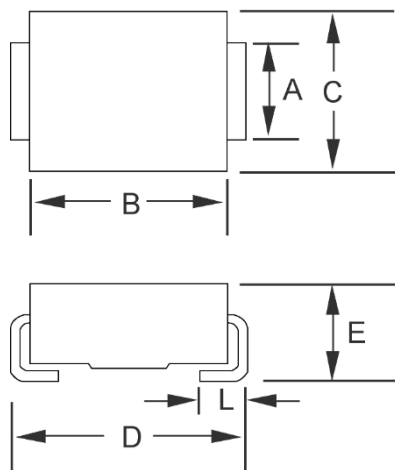


| Ltr            | Dimensions |       |             |       |
|----------------|------------|-------|-------------|-------|
|                | Inch       |       | Millimeters |       |
|                | Min.       | Max.  | Min.        | Max.  |
| A              | 0.115      | 0.121 | 2.92        | 3.07  |
| B              | 0.260      | 0.280 | 6.60        | 7.11  |
| C              | 0.220      | 0.245 | 5.59        | 6.22  |
| E <sup>1</sup> | 0.077      | 0.110 | 1.95        | 2.80  |
| F              | 0.380      | 0.400 | 9.65        | 10.16 |
| K              | 0.025      | 0.040 | 0.635       | 1.016 |

**Note:**

1. Dimension "E" exceeds the JEDEC outline as shown. Typical stand-off height: 0.004"–0.008" (0.1 mm – 0.2 mm).

Figure 5-2. SMCJ (DO-214AB)



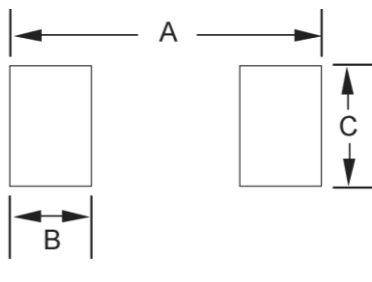
| Ltr            | Dimensions |       |             |      |
|----------------|------------|-------|-------------|------|
|                | Inch       |       | Millimeters |      |
|                | Min.       | Max.  | Min.        | Max. |
| A              | 0.115      | 0.121 | 2.92        | 3.07 |
| B              | 0.260      | 0.280 | 6.60        | 7.11 |
| C              | 0.220      | 0.245 | 5.59        | 6.22 |
| D              | 0.305      | 0.320 | 7.75        | 8.13 |
| E <sup>1</sup> | 0.077      | 0.110 | 1.95        | 2.80 |
| L              | 0.030      | 0.060 | 0.760       | 1.52 |

**Note:**

1. Dimension "E" exceeds the JEDEC outline in height as shown. Typical stand-off height: 0.004"–0.008" (0.1 mm – 0.2 mm).

## 6. Pad Layout

Figure 6-1. Pad Layout



| SMCG (DO-215AB) |       |             |
|-----------------|-------|-------------|
| Ltr             | Inch  | Millimeters |
| A               | 0.510 | 12.95       |
| B               | 0.110 | 2.79        |
| C               | 0.150 | 3.81        |

| SMCJ (DO-214AB) |       |             |
|-----------------|-------|-------------|
| Ltr             | Inch  | Millimeters |
| A               | 0.390 | 9.90        |
| B               | 0.110 | 2.79        |
| C               | 0.150 | 3.81        |

## 7. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

| Revision | Date    | Description       |
|----------|---------|-------------------|
| A        | 10/2023 | Initial revision. |

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ISBN: 978-1-6683-3329-7

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