


## SMCG-HRA Series



### Agency Approvals

| Agency  | Agency File Number |
|---|--------------------|
|  | E230531            |

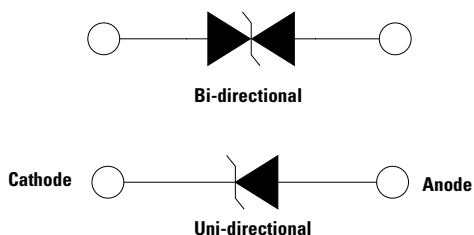
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter   | Symbol                            | Value      | Unit |
|---|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation (IPP x VC) by 10/1000µs waveform (Fig.2)(Note 1), (Note 2) | P <sub>PPM</sub>                  | 1500       | W    |
| Power Dissipation on infinite heat sink at T <sub>A</sub> =50°C                         | P <sub>M(AV)</sub>                | 6.5        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                        | I <sub>FSM</sub>                  | 200        | A    |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional only                   | V <sub>F</sub>                    | 3.5        | V    |
| Operating Junction and Storage Temperature Range  | T <sub>J</sub> , T <sub>STG</sub> | -65 to 150 | °C   |
| Typical Thermal Resistance Junction to Lead   | R <sub>θJL</sub>                  | 15         | °C/W |
| Typical Thermal Resistance Junction to Ambient  | R <sub>θJA</sub>                  | 75         | °C/W |

#### Notes:

1. Non-repetitive current pulse per Fig. 4 and derated above T<sub>A</sub> = 25°C per Fig. 3.
2. Mounted on copper pad area of 0.31x0.31" (8.0 x 8.0mm) to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional component only, duty cycle=4 per minute maximum.

### Functional Diagram



### Description

The SMCG-HRA series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.


### Features

- High-Reliability up-screened for critical applications require higher reliability performance and low infant mortality failures.
- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA when V<sub>BR</sub> min>12V
- Surface mount component to optimize board space
- L bend lead forming gives best solderability for High reliability application
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to V<sub>BR</sub> min
- 1500W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- V<sub>BR</sub> @T<sub>J</sub> = V<sub>BR</sub> @25°C x (1 + α T x (T<sub>J</sub> - 25)) (α T: Temperature Coefficient, typical value is 0.1 %)
- Glass passivated chip junction
- High temperature soldering guaranteed: 260°C/10 seconds at terminals
- Meet MSL level1, per J-STD-020
- Matte tin lead-free plated
- Halogen free
- RoHS compliant with exemption 7a and 7c-I
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)

### Applications

TVS components are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

### Electrical Characteristics

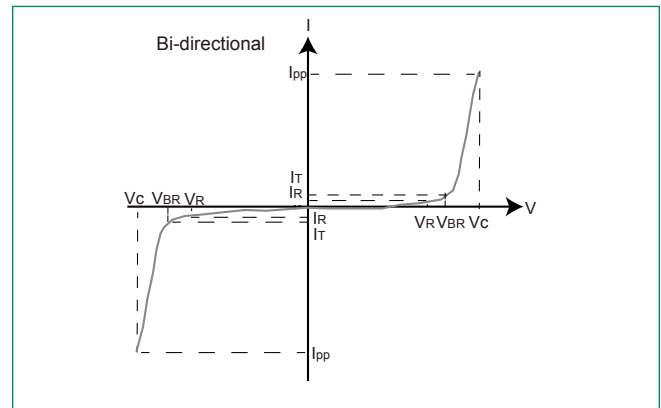
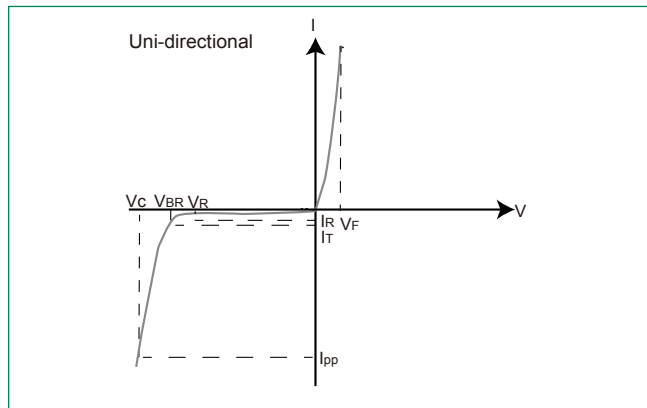
| Part Number (Uni) | Part Number (Bi) | Marking |      | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |        | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Maximum Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu A$ ) | Agency Approval  |
|-------------------|------------------|---------|------|---|--|--------|-------------------------|---|---|---|---|
|                   |                  | UNI     | BI   |   | MIN  | MAX    |                         |   |   |   |   |
| SMCG5.0A-HRA      | SMCG5.0CA-HRA    | GDEH    | BDEH | 5.0                                     | 6.40                                       | 7.00   | 10                      | 9.2   | 163.0                                   | 800   | X   |
| SMCG6.0A-HRA      | SMCG6.0CA-HRA    | GDGH    | BDGH | 6.0                                     | 6.67                                       | 7.37   | 10                      | 10.3  | 145.7                                   | 800   | X   |
| SMCG6.5A-HRA      | SMCG6.5CA-HRA    | GDKH    | BDKH | 6.5                                     | 7.22                                       | 7.98   | 10                      | 11.2  | 134.0                                   | 500   | X   |
| SMCG7.0A-HRA      | SMCG7.0CA-HRA    | GDMH    | BDMH | 7.0                                     | 7.78                                       | 8.60   | 10                      | 12.0  | 125.0                                   | 200   | X   |
| SMCG7.5A-HRA      | SMCG7.5CA-HRA    | GDPH    | BDPH | 7.5                                     | 8.33                                       | 9.21   | 1                       | 12.9  | 116.3                                   | 100   | X   |
| SMCG8.0A-HRA      | SMCG8.0CA-HRA    | GDRH    | BDRH | 8.0                                     | 8.89                                       | 9.83   | 1                       | 13.6  | 110.3                                   | 50  | X   |
| SMCG8.5A-HRA      | SMCG8.5CA-HRA    | GDTH    | BDTH | 8.5                                     | 9.44                                       | 10.40  | 1                       | 14.4  | 104.2                                   | 20  | X   |
| SMCG9.0A-HRA      | SMCG9.0CA-HRA    | GDVH    | BDVH | 9.0                                     | 10.00                                      | 11.10  | 1                       | 15.4  | 97.4                                    | 10  | X   |
| SMCG10A-HRA       | SMCG10CA-HRA     | GDXH    | BDXH | 10.0                                    | 11.10                                      | 12.30  | 1                       | 17.0  | 88.3                                    | 5   | X   |
| SMCG11A-HRA       | SMCG11CA-HRA     | GDZH    | BDZH | 11.0                                    | 12.20                                      | 13.50  | 1                       | 18.2  | 82.5                                    | 1   | X   |
| SMCG12A-HRA       | SMCG12CA-HRA     | GEEH    | BEEH | 12.0                                    | 13.30                                      | 14.70  | 1                       | 19.9  | 75.4                                    | 1   | X   |
| SMCG13A-HRA       | SMCG13CA-HRA     | GEGH    | BEGH | 13.0                                    | 14.40                                      | 15.90  | 1                       | 21.5  | 69.8                                    | 1   | X   |
| SMCG14A-HRA       | SMCG14CA-HRA     | GEKH    | BEKH | 14.0                                    | 15.60                                      | 17.20  | 1                       | 23.2  | 64.7                                    | 1   | X   |
| SMCG15A-HRA       | SMCG15CA-HRA     | GEMH    | BEMH | 15.0                                    | 16.70                                      | 18.50  | 1                       | 24.4  | 61.5                                    | 1   | X   |
| SMCG16A-HRA       | SMCG16CA-HRA     | GEPH    | BEPH | 16.0                                    | 17.80                                      | 19.70  | 1                       | 26.0  | 57.7                                    | 1   | X   |
| SMCG17A-HRA       | SMCG17CA-HRA     | GERH    | BERH | 17.0                                    | 18.90                                      | 20.90  | 1                       | 27.6  | 54.4                                    | 1   | X   |
| SMCG18A-HRA       | SMCG18CA-HRA     | GETH    | BETH | 18.0                                    | 20.00                                      | 22.10  | 1                       | 29.2  | 51.4                                    | 1   | X   |
| SMCG20A-HRA       | SMCG20CA-HRA     | GEVH    | BEVH | 20.0                                    | 22.20                                      | 24.50  | 1                       | 32.4  | 46.3                                    | 1   | X   |
| SMCG22A-HRA       | SMCG22CA-HRA     | GEXH    | BEXH | 22.0                                    | 24.40                                      | 26.90  | 1                       | 35.5  | 42.3                                    | 1   | X   |
| SMCG24A-HRA       | SMCG24CA-HRA     | GEZH    | BEZH | 24.0                                    | 26.70                                      | 29.50  | 1                       | 38.9  | 38.6                                    | 1   | X   |
| SMCG26A-HRA       | SMCG26CA-HRA     | GFEH    | BFEH | 26.0                                    | 28.90                                      | 31.90  | 1                       | 42.1  | 35.7                                    | 1   | X   |
| SMCG28A-HRA       | SMCG28CA-HRA     | GFGH    | BFGH | 28.0                                    | 31.10                                      | 34.40  | 1                       | 45.4  | 33.1                                    | 1   | X   |
| SMCG30A-HRA       | SMCG30CA-HRA     | GFKH    | BFKH | 30.0                                    | 33.30                                      | 36.80  | 1                       | 48.4  | 31.0                                    | 1   | X   |
| SMCG33A-HRA       | SMCG33CA-HRA     | GFMH    | BFMH | 33.0                                    | 36.70                                      | 40.60  | 1                       | 53.3  | 28.2                                    | 1   | X   |
| SMCG36A-HRA       | SMCG36CA-HRA     | GFPH    | BFPH | 36.0                                    | 40.00                                      | 44.20  | 1                       | 58.1  | 25.9                                    | 1   | X   |
| SMCG40A-HRA       | SMCG40CA-HRA     | GFRH    | BFRH | 40.0                                    | 44.40                                      | 49.10  | 1                       | 64.5  | 23.3                                    | 1   | X   |
| SMCG43A-HRA       | SMCG43CA-HRA     | GFTH    | BFTH | 43.0                                    | 47.80                                      | 52.80  | 1                       | 69.4  | 21.7                                    | 1   | X   |
| SMCG45A-HRA       | SMCG45CA-HRA     | GFVH    | BFVH | 45.0                                    | 50.00                                      | 55.30  | 1                       | 72.7  | 20.6                                    | 1   | X   |
| SMCG48A-HRA       | SMCG48CA-HRA     | GFXH    | BFXH | 48.0                                    | 53.30                                      | 58.90  | 1                       | 77.4  | 19.4                                    | 1   | X   |
| SMCG51A-HRA       | SMCG51CA-HRA     | GFZH    | BFZH | 51.0                                    | 56.70                                      | 62.70  | 1                       | 82.4  | 18.2                                    | 1   | X   |
| SMCG54A-HRA       | SMCG54CA-HRA     | GGEH    | BGEH | 54.0                                    | 60.00                                      | 66.30  | 1                       | 87.1  | 17.3                                    | 1   | X   |
| SMCG58A-HRA       | SMCG58CA-HRA     | GGGH    | BGGH | 58.0                                    | 64.40                                      | 71.20  | 1                       | 93.6  | 16.1                                    | 1   | X   |
| SMCG60A-HRA       | SMCG60CA-HRA     | GGKH    | BGKH | 60.0                                    | 66.70                                      | 73.70  | 1                       | 96.8  | 15.5                                    | 1   | X   |
| SMCG64A-HRA       | SMCG64CA-HRA     | GGMH    | BGMH | 64.0                                    | 71.10                                      | 78.60  | 1                       | 103.0   | 14.6                                    | 1   | X   |
| SMCG70A-HRA       | SMCG70CA-HRA     | GGPH    | BGPH | 70.0                                    | 77.80                                      | 86.00  | 1                       | 113.0   | 13.3                                    | 1   | X   |
| SMCG75A-HRA       | SMCG75CA-HRA     | GGRH    | BGRH | 75.0                                    | 83.30                                      | 92.10  | 1                       | 121.0   | 12.4                                    | 1   | X   |
| SMCG78A-HRA       | SMCG78CA-HRA     | GGTH    | BGTH | 78.0                                    | 86.70                                      | 95.80  | 1                       | 126.0   | 11.9                                    | 1   | X   |
| SMCG85A-HRA       | SMCG85CA-HRA     | GGVH    | BGVH | 85.0                                    | 94.40                                      | 104.00 | 1                       | 137.0   | 11.0                                    | 1   | X   |
| SMCG90A-HRA       | SMCG90CA-HRA     | GGXH    | BGXH | 90.0                                    | 100.00                                     | 111.00 | 1                       | 146.0   | 10.3                                    | 1   | X   |
| SMCG100A-HRA      | SMCG100CA-HRA    | GGZH    | BGZH | 100.0                                   | 111.00                                     | 123.00 | 1                       | 162.0   | 9.3                                     | 1   | X   |
| SMCG110A-HRA      | SMCG110CA-HRA    | GHEH    | BHEH | 110.0                                   | 122.00                                     | 135.00 | 1                       | 177.0   | 8.5                                     | 1   | X   |
| SMCG120A-HRA      | SMCG120CA-HRA    | GHGH    | BHGH | 120.0                                   | 133.00                                     | 147.00 | 1                       | 193.0   | 7.8                                     | 1   | X   |
| SMCG130A-HRA      | SMCG130CA-HRA    | GHHH    | BHHH | 130.0                                   | 144.00                                     | 159.00 | 1                       | 209.0   | 7.2                                     | 1   | X   |

### Screen Process

|  |                                   |
|--|-----------------------------------|
| 100% vision inspection   | MIL-STD-750 method 2074           |
| 100%High Temperature Storage Life (168hrs,175C)  | MIL-STD-750 method 1031           |
| 100% X-RAY inspection  | MIL-STD-750 method 2076           |
| 100% Temperature cycle test (-55-150C, 20 cycles, dwell time 15 min)                                       | MIL-STD-750 method 1051           |
| 100% Reflow (2x)   | JEDEC J-STD-020                   |
| 100% surge test (2x)   | MIL-STD-750 method 4066           |
| 100% HTRB(150C, Bias=VR(80% breakdown voltage), 96hrs),for Bi-direction products, 96hrs for each direction | MIL-STD-750 method 1038           |
| Final electrical test( 100% 3 sigma limit, 100% dynamic test and PAT limit)                                | MIL-STD-750 method 4016.4021.4011 |

**Note:** Up-screen program can be specified by customer's request by contacting Littelfuse customer service

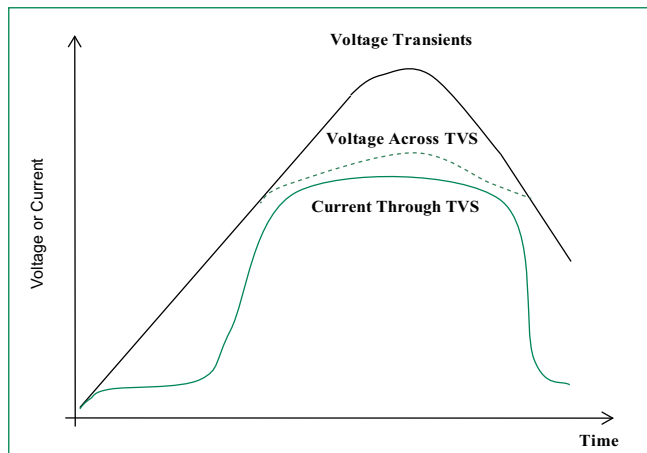
### I-V Curve Characteristics



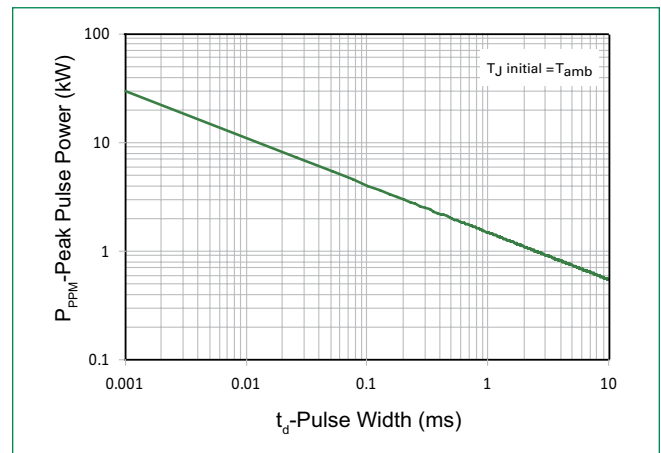
**P<sub>PPM</sub>** Peak Pulse Power Dissipation (IPP x VC)-- Max power dissipation  
**V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation  
**V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)  
**V<sub>C</sub>** Clamping Voltage – Peak voltage measured across the TVS at a specified I<sub>ppm</sub> (peak impulse current)  
**I<sub>R</sub>** Reverse Leakage Current – Current measured at V<sub>R</sub>  
**V<sub>F</sub>** Forward Voltage Drop for Uni-directional

### Ratings and Characteristic Curves (T<sub>A</sub>=25°C unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**



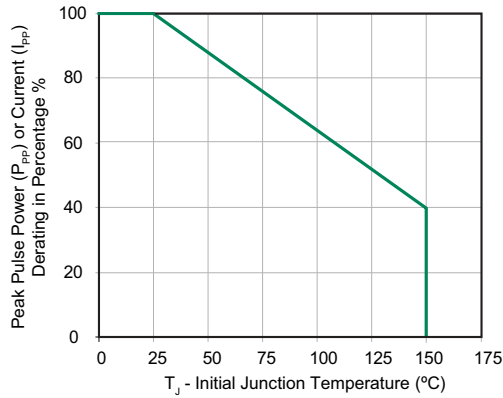
**Figure 2 - Peak Pulse Power Rating**



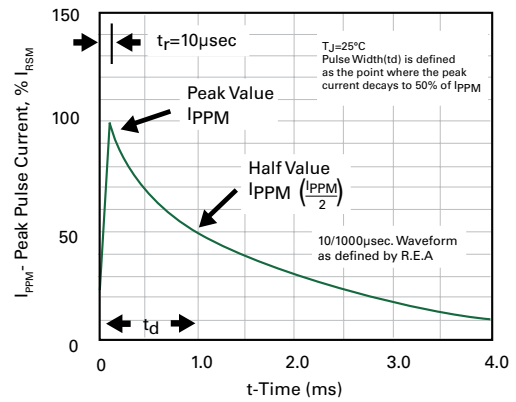
continues on next page.

### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted) (Continued)

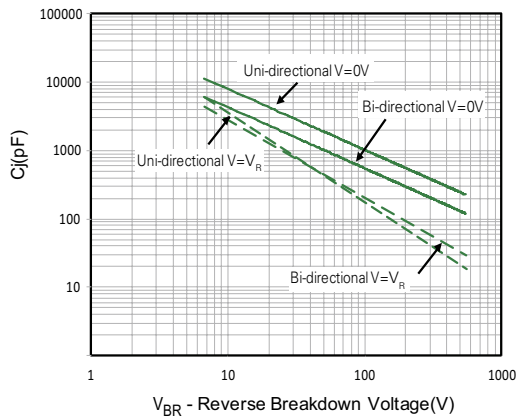
**Figure 3 - Peak Pulse Power Derating Curve**



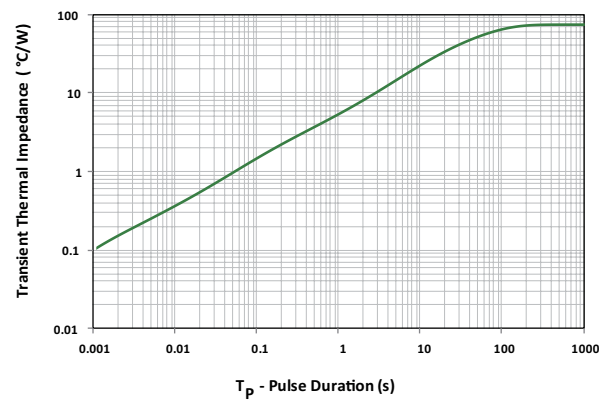
**Figure 4 - Pulse Waveform**



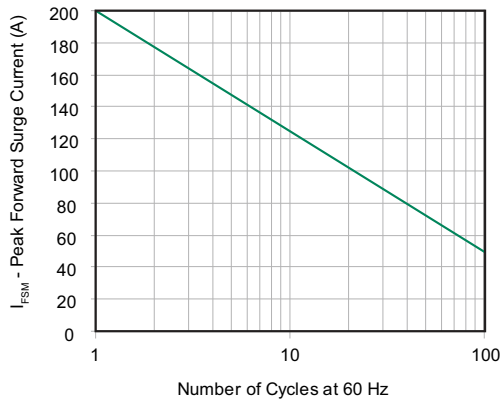
**Figure 5 - Typical Junction Capacitance**



**Figure 6 - Typical Transient Thermal Impedance**

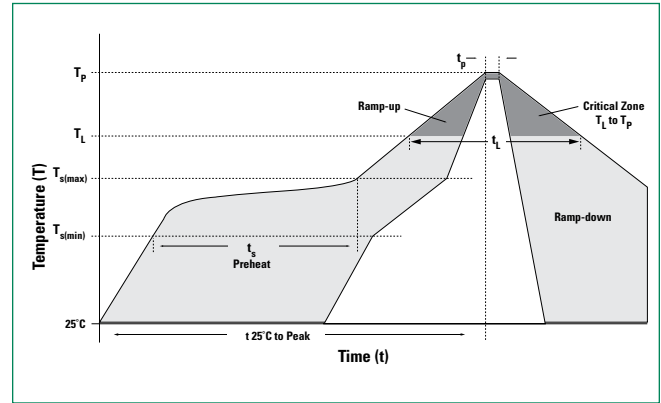


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



### Soldering Parameters

|   |                                    |                    |
|---|------------------------------------|--------------------|
| <b>Reflow Condition</b>   |                                    | Lead-free assembly |
| <b>Pre Heat</b>   | - Temperature Min ( $T_{s(min)}$ ) | 150°C              |
|   | - Temperature Max ( $T_{s(max)}$ ) | 200°C              |
|   | - Time (min to max) ( $t_s$ )      | 60 – 120 secs      |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak</b> |                                    | 3°C/second max     |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>     |                                    | 3°C/second max     |
| <b>Reflow</b>   | - Temperature ( $T_L$ ) (Liquidus) | 217°C              |
|   | - Time (min to max) ( $t_s$ )      | 60 – 150 seconds   |
| <b>Peak Temperature (<math>T_p</math>)</b>                            |                                    | 260 $\pm$ 0/5 °C   |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>  |                                    | 30 seconds         |
| <b>Ramp-down Rate</b>   |                                    | 6°C/second max     |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>               |                                    | 8 minutes Max.     |
| <b>Do not exceed</b>  |                                    | 260°C              |



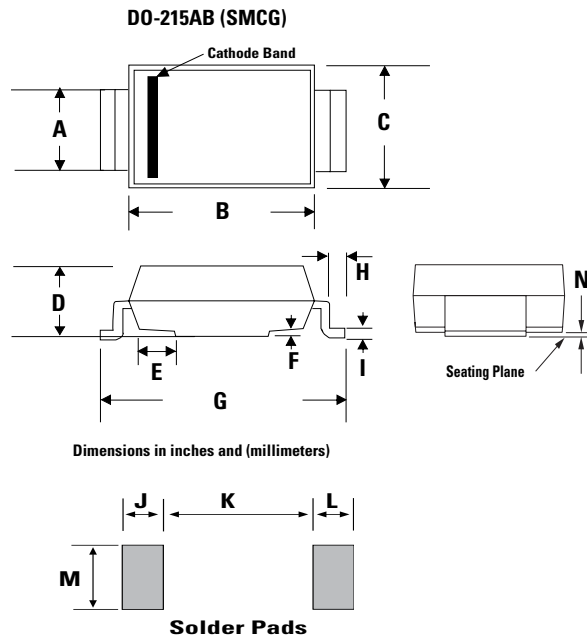
### Physical Specifications

|                 |  |
|-----------------|--|
| <b>Weight</b>   | 0.007 ounce, 0.21 grams  |
| <b>Case</b>     | JEDEC DO-215AB. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode for unidirectional components           |

### Environmental Specifications

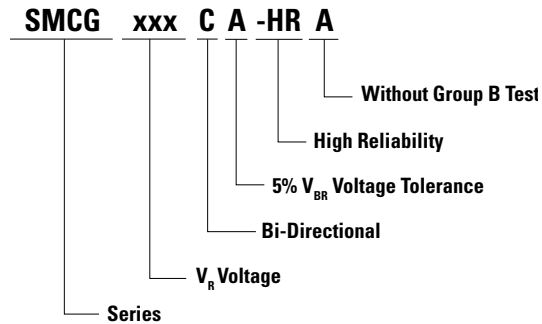
|                           |                          |
|---------------------------|--------------------------|
| <b>High Temp. Storage</b> | JESD22-A103              |
| <b>HTRB</b>               | JESD22-A108              |
| <b>Thermal Shock</b>      | JESD22-A106              |
| <b>MSL</b>                | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>              | JESD22-A101              |

### Dimensions

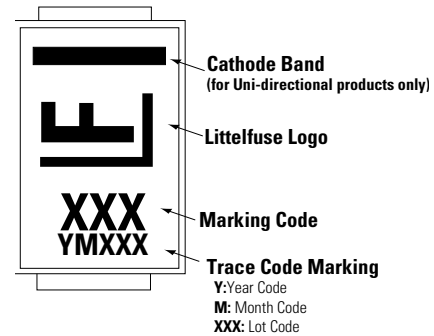


| Dimensions | Inches |       | Millimeters |        |
|------------|--------|-------|-------------|--------|
|            | Min    | Max   | Min         | Max    |
| <b>A</b>   | 0.115  | 0.125 | 2.920       | 3.170  |
| <b>B</b>   | 0.260  | 0.280 | 6.600       | 7.110  |
| <b>C</b>   | 0.220  | 0.245 | 5.590       | 6.220  |
| <b>D</b>   | 0.075  | 0.095 | 1.900       | 2.410  |
| <b>E</b>   | 0.038  | 0.058 | 0.970       | 1.470  |
| <b>F</b>   | -      | 0.020 | -           | 0.510  |
| <b>G</b>   | 0.380  | 0.400 | 9.640       | 10.160 |
| <b>H</b>   | 0.024  | 0.040 | 0.610       | 1.020  |
| <b>I</b>   | 0.006  | 0.016 | 0.150       | 0.410  |
| <b>J</b>   | -      | 0.050 | -           | 1.270  |
| <b>K</b>   | -      | 0.310 | -           | 7.870  |
| <b>L</b>   | -      | 0.050 | -           | 1.270  |
| <b>M</b>   | -      | 0.125 | -           | 3.170  |
| <b>N</b>   | 0.002  | 0.008 | 0.050       | 0.200  |

### Part Numbering System



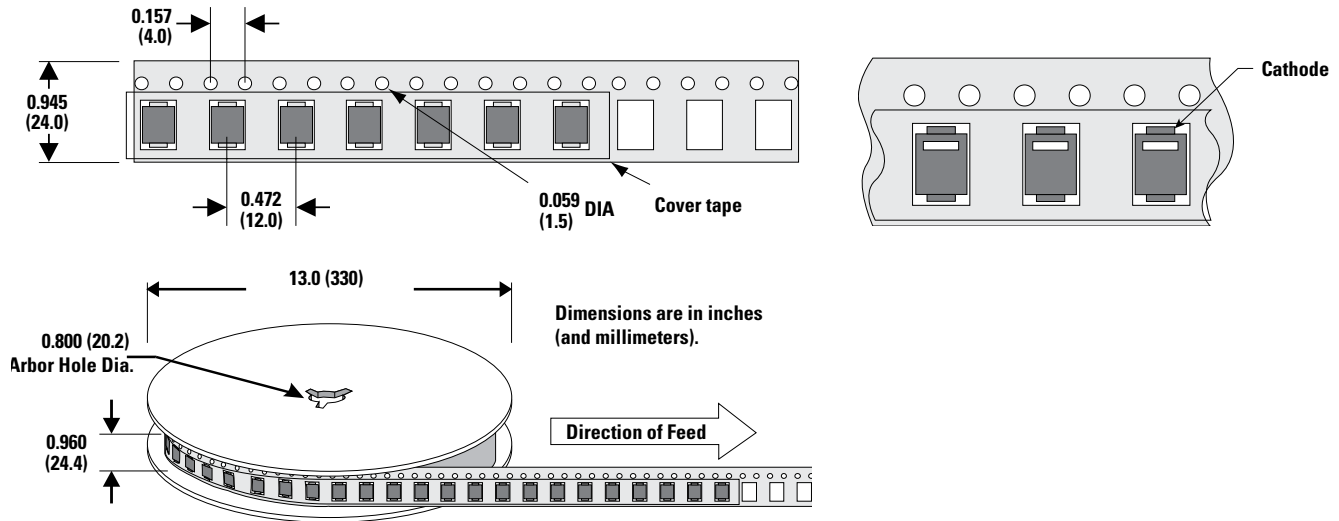
### Part Marking System



### Packaging

| Part number   | Component Package | Quantity | Packaging Option                  | Packaging Specification |
|---------------|-------------------|----------|-----------------------------------|-------------------------|
| SMCGxxxXX-HRA | DO-215AB          | 1500     | Tape & Reel – 24mm tape /13" reel | EIA STD RS-481          |

### Tape and Reel Specification



# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

## Littelfuse:

|                                     |                                      |                                     |                                      |                                     |                                      |
|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|
| <a href="#"><u>SMCG5.0A-HRA</u></a> | <a href="#"><u>SMCG5.0CA-HRA</u></a> | <a href="#"><u>SMCG6.5A-HRA</u></a> | <a href="#"><u>SMCG6.5CA-HRA</u></a> | <a href="#"><u>SMCG8.0A-HRA</u></a> | <a href="#"><u>SMCG8.0CA-HRA</u></a> |
| <a href="#"><u>SMCG10A-HRA</u></a>  | <a href="#"><u>SMCG10CA-HRA</u></a>  | <a href="#"><u>SMCG11A-HRA</u></a>  | <a href="#"><u>SMCG11CA-HRA</u></a>  | <a href="#"><u>SMCG12A-HRA</u></a>  | <a href="#"><u>SMCG12CA-HRA</u></a>  |
| <a href="#"><u>SMCG13A-HRA</u></a>  | <a href="#"><u>SMCG13CA-HRA</u></a>  | <a href="#"><u>SMCG14A-HRA</u></a>  | <a href="#"><u>SMCG14CA-HRA</u></a>  | <a href="#"><u>SMCG15A-HRA</u></a>  | <a href="#"><u>SMCG15CA-HRA</u></a>  |
| <a href="#"><u>SMCG16A-HRA</u></a>  | <a href="#"><u>SMCG16CA-HRA</u></a>  | <a href="#"><u>SMCG17A-HRA</u></a>  | <a href="#"><u>SMCG17CA-HRA</u></a>  | <a href="#"><u>SMCG18A-HRA</u></a>  | <a href="#"><u>SMCG18CA-HRA</u></a>  |
| <a href="#"><u>SMCG20A-HRA</u></a>  | <a href="#"><u>SMCG20CA-HRA</u></a>  | <a href="#"><u>SMCG22A-HRA</u></a>  | <a href="#"><u>SMCG22CA-HRA</u></a>  | <a href="#"><u>SMCG24A-HRA</u></a>  | <a href="#"><u>SMCG24CA-HRA</u></a>  |
| <a href="#"><u>SMCG26A-HRA</u></a>  | <a href="#"><u>SMCG26CA-HRA</u></a>  | <a href="#"><u>SMCG28A-HRA</u></a>  | <a href="#"><u>SMCG28CA-HRA</u></a>  | <a href="#"><u>SMCG30A-HRA</u></a>  | <a href="#"><u>SMCG30CA-HRA</u></a>  |
| <a href="#"><u>SMCG33A-HRA</u></a>  | <a href="#"><u>SMCG33CA-HRA</u></a>  | <a href="#"><u>SMCG36A-HRA</u></a>  | <a href="#"><u>SMCG36CA-HRA</u></a>  | <a href="#"><u>SMCG40A-HRA</u></a>  | <a href="#"><u>SMCG40CA-HRA</u></a>  |
| <a href="#"><u>SMCG43A-HRA</u></a>  | <a href="#"><u>SMCG43CA-HRA</u></a>  | <a href="#"><u>SMCG45A-HRA</u></a>  | <a href="#"><u>SMCG45CA-HRA</u></a>  | <a href="#"><u>SMCG48A-HRA</u></a>  | <a href="#"><u>SMCG48CA-HRA</u></a>  |
| <a href="#"><u>SMCG51A-HRA</u></a>  | <a href="#"><u>SMCG51CA-HRA</u></a>  | <a href="#"><u>SMCG54A-HRA</u></a>  | <a href="#"><u>SMCG54CA-HRA</u></a>  | <a href="#"><u>SMCG58A-HRA</u></a>  | <a href="#"><u>SMCG58CA-HRA</u></a>  |
| <a href="#"><u>SMCG64A-HRA</u></a>  | <a href="#"><u>SMCG64CA-HRA</u></a>  | <a href="#"><u>SMCG78A-HRA</u></a>  | <a href="#"><u>SMCG78CA-HRA</u></a>  | <a href="#"><u>SMCG100A-HRA</u></a> | <a href="#"><u>SMCG100CA-HRA</u></a> |
| <a href="#"><u>SMCG110A-HRA</u></a> | <a href="#"><u>SMCG110CA-HRA</u></a> | <a href="#"><u>SMCG120A-HRA</u></a> | <a href="#"><u>SMCG120CA-HRA</u></a> |                                     |                                      |