



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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SMCG-HRA Series



Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
| | E230531 |

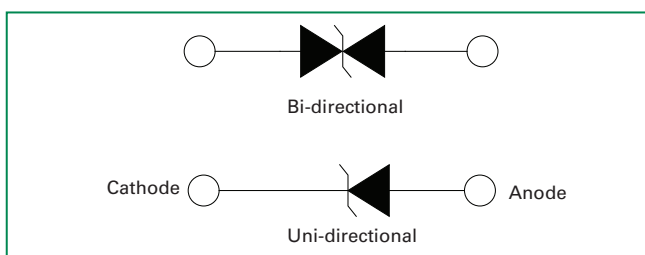
Maximum Ratings and Thermal Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|----------------|------------|--------------------|
| Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000 μs waveform (Fig.2)(Note 1), (Note 2) | P_{PPM} | 1500 | W |
| Power Dissipation on infinite heat sink at $T_A=50^\circ\text{C}$ | $P_{M(AV)}$ | 6.5 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I_{FSM} | 200 | A |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional only | V_F | 3.5 | V |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -65 to 150 | $^\circ\text{C}$ |
| Typical Thermal Resistance Junction to Lead | R_{wJL} | 15 | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient | R_{wJA} | 75 | $^\circ\text{C/W}$ |

Notes:

1. Non-repetitive current pulse, per Fig. 4 and derated above $T_A = 25^\circ\text{C}$ 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 device 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_R less than $1\mu\text{A}$ above 12V
- For surface mounted applications to optimize board space
- L bend lead forming gives best solderability for Hi 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 15kV(Air), 8kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to BV min
- 1500W peak pulse power capability at 10/1000 μs waveform, repetition rate (duty cycles):0.01%
- $V_{BR} @T_J = V_{BR} @25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$ (α T:Temperature Coefficient, typical value is 0.1%)
- Glass passivated chip junction
- High temperature soldering guaranteed: 260 $^\circ\text{C}$ /10 seconds at terminals
- Meet MSL level1, per J-STD-020, LF maximum peak of 260 $^\circ\text{C}$
- Matte tin lead-free plated
- Halogen free
- RoHS compliant with exemption 7a and 7c-I
- 2nd level interconnect is Pb-free per IPC/JEDEC J-STD-609A.01

Applications

TVS devices are ideal for the protection of I/O Interfaces, V_{CC} 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 (μ 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 |

Note:

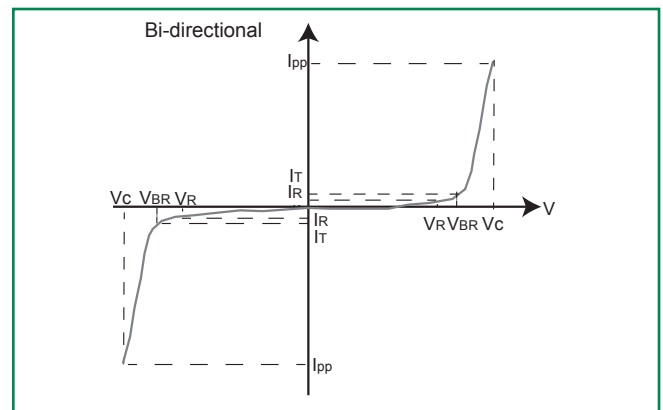
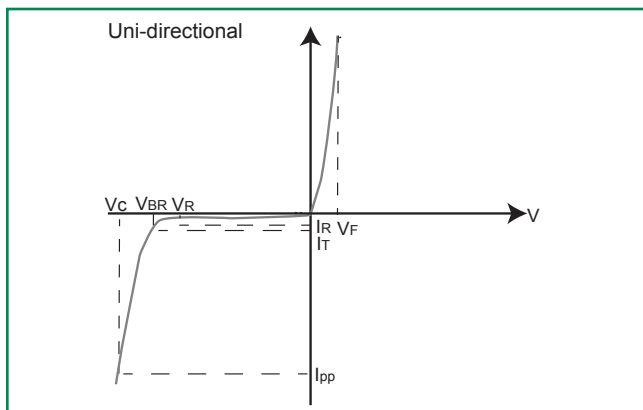
1. For bidirectional type having V_R of 10 volts and less, the I_R limit is double.

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 via contacting Littelfuse service

I-V Curve Characteristics



- P_{PPM} Peak Pulse Power Dissipation** – Max power dissipation
- V_R Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- V_{BR} Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current (I_T)
- V_C Clamping Voltage** – Peak voltage measured across the TVS at a specified I_{ppm} (peak impulse current)
- I_R Reverse Leakage Current** – Current measured at V_R
- V_F Forward Voltage Drop for Uni-directional**

Ratings and Characteristic Curves (T_A=25°C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

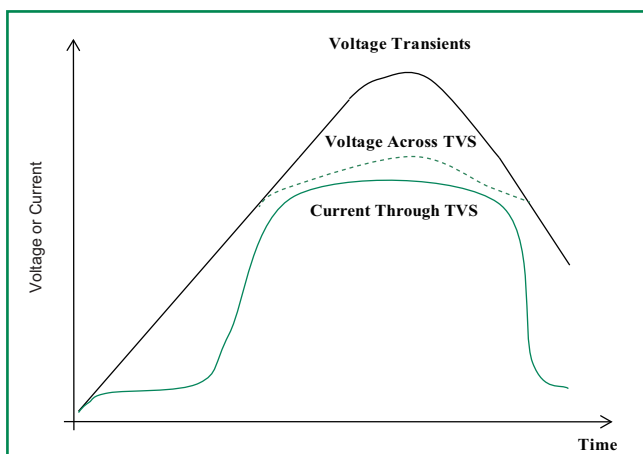
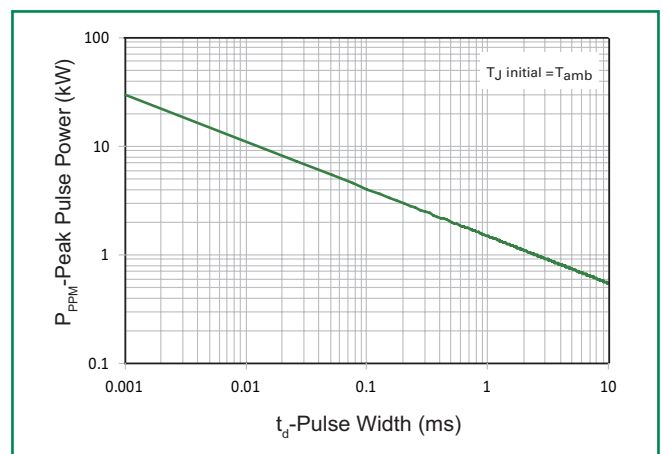


Figure 2 - Peak Pulse Power Rating



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

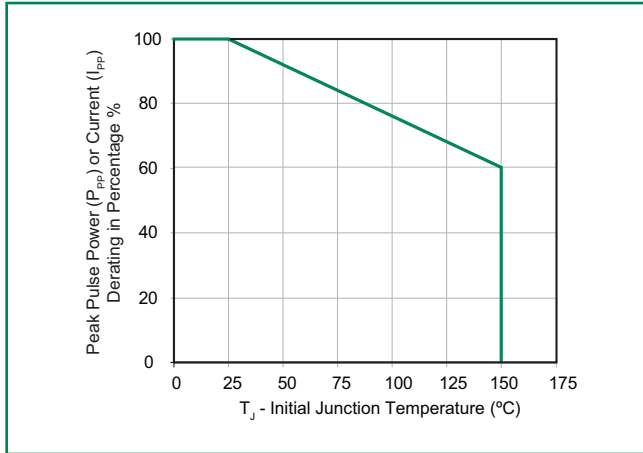


Figure 4 - Pulse Waveform

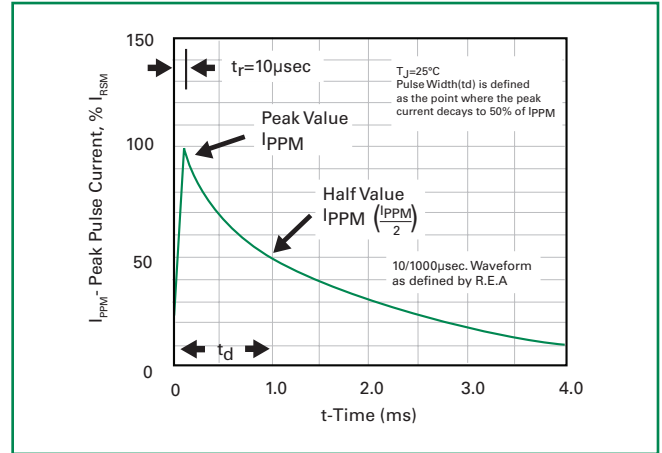


Figure 5 - Typical Junction Capacitance

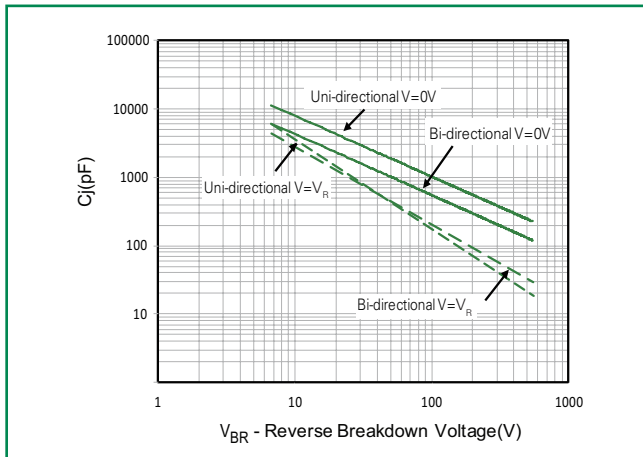


Figure 6 - Typical Transient Thermal Impedance

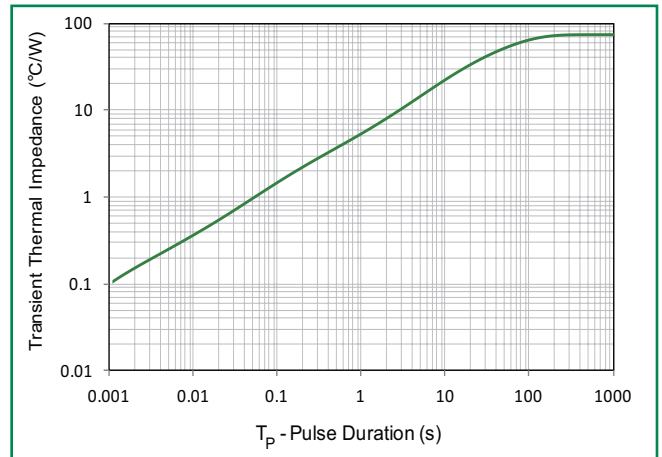
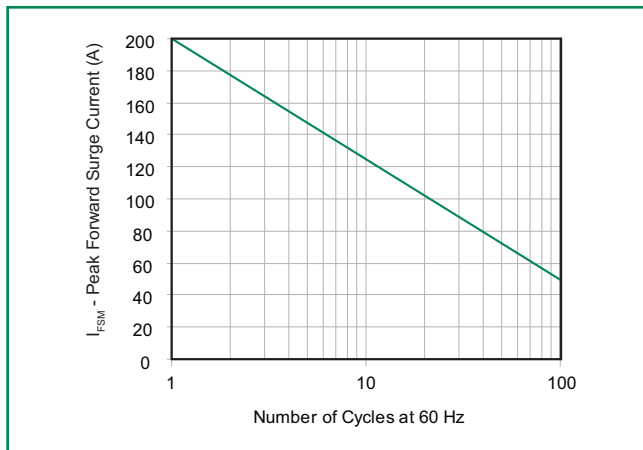
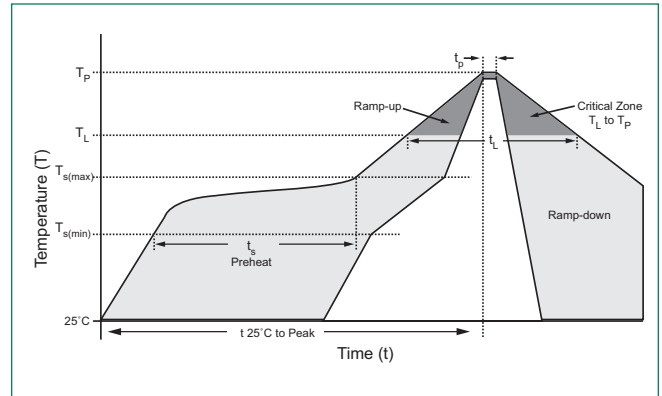


Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



Soldering Parameters

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



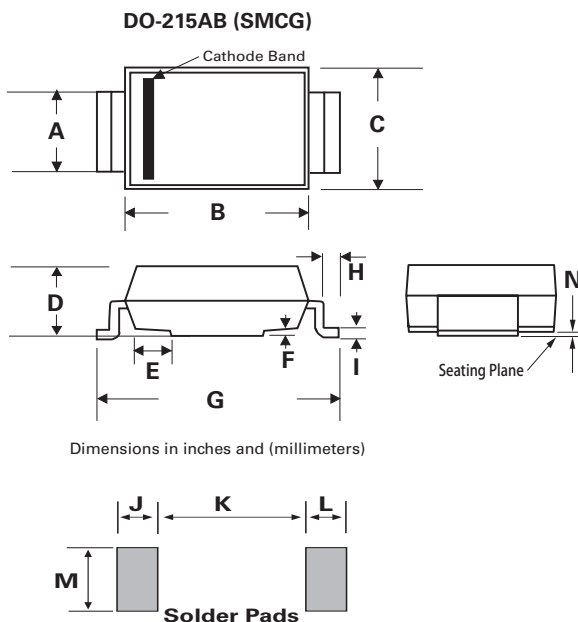
Physical Specifications

| | |
|-----------------|--|
| Weight | 0.007 ounce, 0.21 grams |
| Case | JEDEC DO-215AB. Molded plastic body over glass passivated junction |
| Polarity | Color band denotes positive end (cathode) except Bidirectional. |
| Terminal | Matte Tin-plated leads, Solderable per JESD22-B102 |

Environmental Specifications

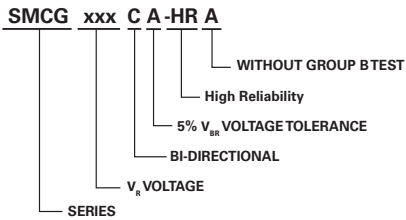
| | |
|---------------------------|--------------------------|
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Thermal Shock | JESD22-A106 |
| MSL | JEDEC-J-STD-020, Level 1 |
| H3TRB | JESD22-A101 |
| RSH | JESD22-A111 |

Dimensions

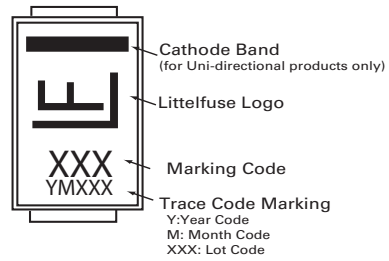


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|--------|
| | Min | Max | Min | Max |
| A | 0.115 | 0.125 | 2.920 | 3.170 |
| B | 0.260 | 0.280 | 6.600 | 7.110 |
| C | 0.220 | 0.245 | 5.590 | 6.220 |
| D | 0.075 | 0.095 | 1.900 | 2.410 |
| E | 0.038 | 0.058 | 0.970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

