



**THE DATASHEET OF  
SMCG14CA-HR**



**SMCG-HR 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 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 device only, duty cycle=4 per minute maximum.

**Functional Diagram**



**Description**

The SMCG-HR 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 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 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- 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, high temperature soldering guaranteed.
- 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-HR	SMCG5.0CA-HR	GDE	BDE	5.0	6.40	7.00	10	9.2	163.0	800	X
SMCG6.0A-HR	SMCG6.0CA-HR	GDG	BDG	6.0	6.67	7.37	10	10.3	145.7	800	X
SMCG6.5A-HR	SMCG6.5CA-HR	GDK	BDK	6.5	7.22	7.98	10	11.2	134.0	500	X
SMCG7.0A-HR	SMCG7.0CA-HR	GDM	BDM	7.0	7.78	8.60	10	12.0	125.0	200	X
SMCG7.5A-HR	SMCG7.5CA-HR	GDP	BDP	7.5	8.33	9.21	1	12.9	116.3	100	X
SMCG8.0A-HR	SMCG8.0CA-HR	GDR	BDR	8.0	8.89	9.83	1	13.6	110.3	50	X
SMCG8.5A-HR	SMCG8.5CA-HR	GDT	BDT	8.5	9.44	10.40	1	14.4	104.2	20	X
SMCG9.0A-HR	SMCG9.0CA-HR	GDV	BDV	9.0	10.00	11.10	1	15.4	97.4	10	X
SMCG10A-HR	SMCG10CA-HR	GDX	BDX	10.0	11.10	12.30	1	17.0	88.3	5	X
SMCG11A-HR	SMCG11CA-HR	GDZ	BDZ	11.0	12.20	13.50	1	18.2	82.5	1	X
SMCG12A-HR	SMCG12CA-HR	GEE	BEE	12.0	13.30	14.70	1	19.9	75.4	1	X
SMCG13A-HR	SMCG13CA-HR	GEG	BEG	13.0	14.40	15.90	1	21.5	69.8	1	X
SMCG14A-HR	SMCG14CA-HR	GEK	BEK	14.0	15.60	17.20	1	23.2	64.7	1	X
SMCG15A-HR	SMCG15CA-HR	GEM	BEM	15.0	16.70	18.50	1	24.4	61.5	1	X
SMCG16A-HR	SMCG16CA-HR	GEP	BEP	16.0	17.80	19.70	1	26.0	57.7	1	X
SMCG17A-HR	SMCG17CA-HR	GER	BER	17.0	18.90	20.90	1	27.6	54.4	1	X
SMCG18A-HR	SMCG18CA-HR	GET	BET	18.0	20.00	22.10	1	29.2	51.4	1	X
SMCG20A-HR	SMCG20CA-HR	GEV	BEV	20.0	22.20	24.50	1	32.4	46.3	1	X
SMCG22A-HR	SMCG22CA-HR	GEX	BEX	22.0	24.40	26.90	1	35.5	42.3	1	X
SMCG24A-HR	SMCG24CA-HR	GEZ	BEZ	24.0	26.70	29.50	1	38.9	38.6	1	X
SMCG26A-HR	SMCG26CA-HR	GFE	BEF	26.0	28.90	31.90	1	42.1	35.7	1	X
SMCG28A-HR	SMCG28CA-HR	GFG	BFG	28.0	31.10	34.40	1	45.4	33.1	1	X
SMCG30A-HR	SMCG30CA-HR	GFK	BFK	30.0	33.30	36.80	1	48.4	31.0	1	X
SMCG33A-HR	SMCG33CA-HR	GFM	BFM	33.0	36.70	40.60	1	53.3	28.2	1	X
SMCG36A-HR	SMCG36CA-HR	GFP	BFP	36.0	40.00	44.20	1	58.1	25.9	1	X
SMCG40A-HR	SMCG40CA-HR	GFR	BFR	40.0	44.40	49.10	1	64.5	23.3	1	X
SMCG43A-HR	SMCG43CA-HR	GFT	BFT	43.0	47.80	52.80	1	69.4	21.7	1	X
SMCG45A-HR	SMCG45CA-HR	GFV	BFV	45.0	50.00	55.30	1	72.7	20.6	1	X
SMCG48A-HR	SMCG48CA-HR	GFX	BFX	48.0	53.30	58.90	1	77.4	19.4	1	X
SMCG51A-HR	SMCG51CA-HR	GFZ	BFZ	51.0	56.70	62.70	1	82.4	18.2	1	X
SMCG54A-HR	SMCG54CA-HR	GGE	BGE	54.0	60.00	66.30	1	87.1	17.3	1	X
SMCG58A-HR	SMCG58CA-HR	GGG	BGG	58.0	64.40	71.20	1	93.6	16.1	1	X
SMCG60A-HR	SMCG60CA-HR	GGK	BGK	60.0	66.70	73.70	1	96.8	15.5	1	X
SMCG64A-HR	SMCG64CA-HR	GGM	BGM	64.0	71.10	78.60	1	103.0	14.6	1	X
SMCG70A-HR	SMCG70CA-HR	GGP	BGP	70.0	77.80	86.00	1	113.0	13.3	1	X
SMCG75A-HR	SMCG75CA-HR	GGR	BGR	75.0	83.30	92.10	1	121.0	12.4	1	X
SMCG78A-HR	SMCG78CA-HR	GGT	BGT	78.0	86.70	95.80	1	126.0	11.9	1	X
SMCG85A-HR	SMCG85CA-HR	GGV	BGV	85.0	94.40	104.00	1	137.0	11.0	1	X
SMCG90A-HR	SMCG90CA-HR	GGX	BGX	90.0	100.00	111.00	1	146.0	10.3	1	X
SMCG100A-HR	SMCG100CA-HR	GGZ	BGZ	100.0	111.00	123.00	1	162.0	9.3	1	X
SMCG110A-HR	SMCG110CA-HR	GHE	BHE	110.0	122.00	135.00	1	177.0	8.5	1	X
SMCG120A-HR	SMCG120CA-HR	GHG	BHG	120.0	133.00	147.00	1	193.0	7.8	1	X

### Screen Process

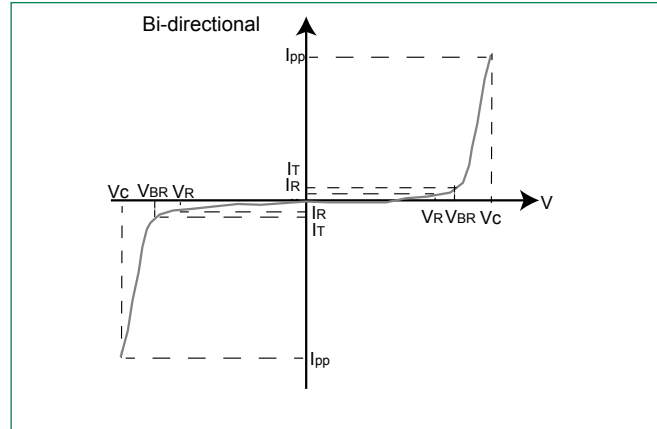
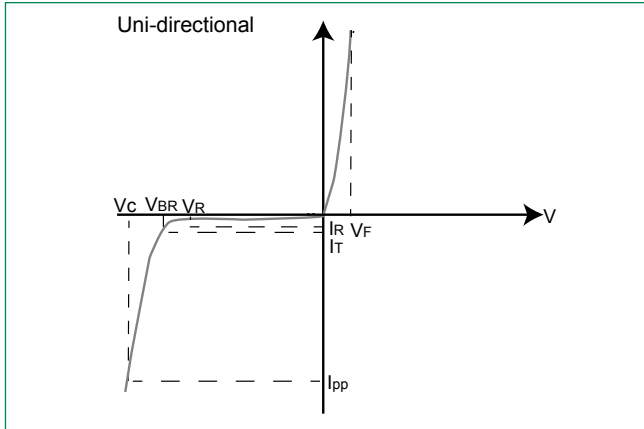
100% vision inspection	MIL-STD-750 method 2074
100% High Temperature Storage Life (168hrs, 175C°)	MIL-STD-750 method 1031
100% X-RAY inspection	MIL-STD-750 method 2076
100% Temperature cycle test (-55-150C°, 20 cycles, dwell time 15 min)	MIL-STD-750 method 1051
100% Reflow (2x)	JEDEC J-STD-020
100% surge test (2x)	MIL-STD-750 method 4066
100% HTRB(150C°, Bias= $V_R$ (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

### Group B Test Requirement

Screen	Method	Condition	Requirement
Surge Test	10/1000 $\mu$ S Peak Pulse Waveform	Maximum Clamping Voltage ( $V_C$ ) @ Peak Pulse Current ( $I_{pp}$ )	Sample Size 45 Perform 10x Accept 0 Failures
Burn - In (HTRB)	MIL - STD - 750, Method 1038.5	Applied Voltage 100% $V_R$ @ 150°C	Sample Size 45 For Unidirectional, 150C°/ $V_R$ /340hours, for Bidirectional, 150C°/ $V_R$ /680hrs(340hours for each direction) Accept 0 Failures
Electrical Tests	–	$I_R$ @ $V_R$ , $V_{BR}$ @ $I_T$	Sample Size 45 Accept 0 Failures

### 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** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**



**Figure 2 - Peak Pulse Power Rating**



**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 <sup>+0/-5</sup> °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 positive end (cathode) except Bidirectional.
<b>Terminal</b>	Matte Tin-plated leads, Solderable per JESD22-B102

**Environmental Specifications**

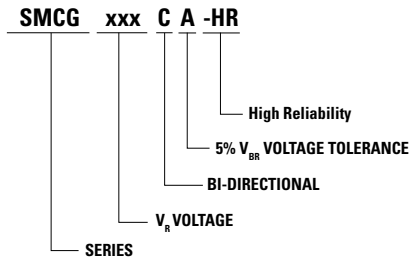
<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Thermal Shock</b>	JESD22-A106
<b>MSL</b>	JEDEC-J-STD-020, Level 1
<b>H3TRB</b>	JESD22-A101
<b>RSH</b>	JESD22-A111

**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**



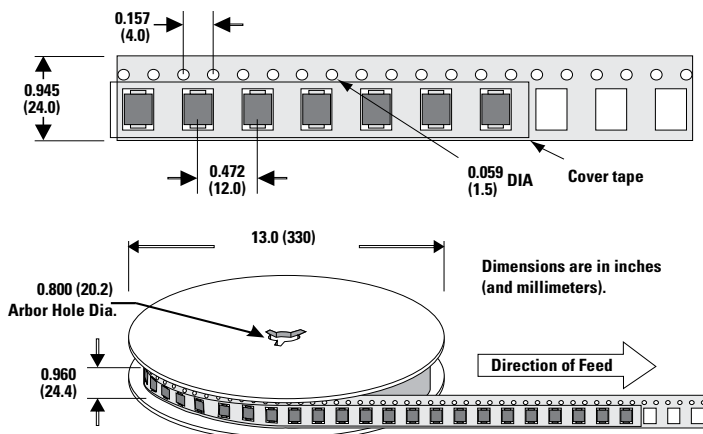
**Part Marking System**



**Packaging**

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

**Tape and Reel Specification**



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