# **Transient Voltage Suppression Diodes**

# Surface Mount - 1500W > SMCG-HR series

# SMCG-HR Series





#### **Agency Approvals**

AGENCY	AGENCY FILE NUMBER
<b>27</b> .	E230531

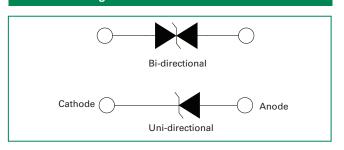
# **Maximum Ratings and Thermal Characteristics** (T<sub>a</sub>=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at $T_A$ =25°C by 10/1000 $\mu$ s waveform (Fig.2)(Note 1), (Note 2)	P <sub>PPM</sub>	1500	W
Power Dissipation on infinite heat sink at $T_A = 50^{\circ}$ 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	А
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>wL</sub>	15	°C/W
Typical Thermal Resistance Junction to Ambient	R <sub>uJA</sub>	75	°C/W

#### Notes:

- 1. Non-repetitive current pulse , per Fig. 4 and derated above  $T_{\rm A} = 25^{\circ}{\rm C}$  per Fig. 3.
- 2. Mounted on copper pad area of  $0.31 \times 0.31$ " (8.0  $\times$  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 upscreened for critical applications require higher reliability performance and low infant mortality failures.
- · Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>B</sub> less than 1µA above 12V
- · For surface mounted applications to optimize board space
- L bend lead forming gives best solderbility 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 10/1000µs waveform, repetition rate (duty cycles):0.01%
- V<sub>BR</sub> @T<sub>J</sub>= V<sub>BR</sub>@25°C x (1+αT  $\times$  (T<sub>1</sub>- 25)) ( $\alpha$  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, LF maximun peak of 260°C
- Matte tin lead–free plated
- Halogen free
- RoHS compliant with exemption 7a and 7c-l
- 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<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.



# Transient Voltage Suppression Diodes Surface Mount – 1500W > SMCG-HR series

### **Electrical Characteristics**

SMCG6.0A-HR   SMCG6.0CA-HR   GDE   BDE   5.0   6.40   700   10   9.2   163.0   800   X	Part Number (Uni)	Part Number (Bi)	Mar	king	Reverse Stand off Voltage V <sub>R</sub>	Volta	kdown geV <sub>BR</sub> s) @ I <sub>T</sub>	Test Current I <sub>T</sub>	Maximum Clamping Voltage V <sub>c</sub> @	Maximum Peak Pulse Current I <sub>pp</sub>	Maximum Reverse Leakage I <sub>R</sub> @ V_	Agency Approval
SMCG6 0.A-HR   SMCG6 0.C-A-HR   GDC   BDC   6.0   6.67   7.37   10   10.3   145.7   800   X	, ,	` ´	UNI	BI	(Volts)	MIN	MAX	(mA)	(V) <sup>pp</sup>	(A) pp	(μA) <sup>β</sup>	
SMCG6 6A-HR   SMCG6 5CA-HR   GDV   BDK   6.5   7.22   7.88   10   11.2   134.0   500   X				BDE				_			800	
SMCG70A-HR   SMCG70CA-HR   GDM   BDM   70   7.78   8.80   10   12.0   125.0   200   X							_	_				
SMCG675A-HR   SMCG80CA-HR   GDP   BDP   7.5   B.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   SMCG9.0CA-HR   GDV   BDV   9.0   10.00   11.10   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   SMCG13A-HR   SMCG12CA-HR   GEE   BEE   12.0   13.30   14.70   1   19.9   75.4   1   X   SMCG13A-HR   SMCG12CA-HR   GEG   BEG   13.0   14.40   15.90   1   21.5   69.8   1   X   SMCG13A-HR   SMCG14CA-HR   GEG   BEG   BEG   13.0   14.40   15.90   1   21.5   69.8   1   X   SMCG15A-HR   SMCG14CA-HR   GEF   BEF   BEK   14.0   15.60   17.20   1   23.2   64.7   1   X   SMCG15A-HR   SMCG14CA-HR   GEF   BEF   16.0   17.80   19.70   1   24.4   61.5   1   X   SMCG16A-HR   SMCG16CA-HR   GEF   BEF   16.0   17.80   19.70   1   26.0   57.7   1   X   SMCG1BA-HR   SMCG16CA-HR   GEF   BEF   18.0   20.00   22.10   1   29.2   51.4   1   X   SMCG20A-HR   SMCG2CA-HR   GEV   BEV   20.0   22.20   24.50   1   32.4   46.3   1   X   SMCG2A-HR   SMCG2CA-HR   GEX   BEX   22.0   24.50   1   32.4   46.3   1   X   SMCG2A-HR   SMCG2CA-HR   GEX   BEX   22.0   24.50   1   35.5   42.3   1   X   SMCG2A-HR   SMCG2CA-HR   GEX   BEX   22.0   24.50   1   35.5   42.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFF   BFF   26.0   28.90   31.90   1   42.1   35.7   1   X   SMCG3A-HR   SMCG3CA-HR   GFF   BFF   40.0   44.40   49.10   1   45.4   33.1   1   X   SMCG3A-HR   SMCG3CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFR   BFR   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFR   BFR   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFR   BFR   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFR   BFR   40.0   40.00   40.00   40.00   40.00   40.00   40.00   40.00   40.00   40.00   40.00   40.00   4								_				
SMCGB.5AHR   SMCGB.5CAHR   GDT   BDT   B.5   9.44   10.40   1   14.4   104.2   20   X   SMCGB.0AHR   SMCGB.0CAHR   GDV   BDV   9.0   10.00   11.10   1   15.4   97.4   10   X   SMCGB.AHR   SMCGB.CAHR   GDV   BDX   BDX   10.0   11.10   1   15.4   97.4   10   X   SMCGB.AHR   SMCGB.CAHR   GDZ   BDZ   11.0   12.30   1   17.0   88.3   5   X   SMCGB.AHR   SMCGB.CAHR   GDZ   BDZ   11.0   12.20   13.50   1   18.2   82.5   1   X   SMCGB.AHR   SMCGB.CAHR   GEB   BEE   12.0   13.30   14.70   1   19.9   75.4   1   X   SMCGB.AHR   SMCGB.CAHR   GEB   BEG   BEG   BEG   13.0   14.40   15.90   1   21.5   69.8   1   X   SMCGB.AHR   SMCGB.CAHR   GEB   BEG   BEG   13.0   14.40   15.90   1   21.5   69.8   1   X   SMCGB.AHR   SMCGB.CAHR   GEM   BEM   15.0   16.70   18.50   1   23.2   64.7   1   X   SMCGB.AHR   SMCGB.CAHR   GEM   BEM   15.0   16.70   18.50   1   24.4   61.5   1   X   SMCGB.AHR   SMCGB.CAHR   GEP   BEP   16.0   17.80   19.70   1   26.0   57.7   1   X   SMCGB.AHR   SMCGB.CAHR   GEP   BEP   16.0   17.80   19.70   1   26.0   57.7   1   X   SMCGB.AHR   SMCGB.CAHR   GET   BET   18.0   20.90   1   27.6   69.4   1   X   SMCGB.AHR   SMCGB.CAHR   GET   BET   18.0   20.90   21.0   1   29.2   51.4   1   X   SMCGB.AHR   SMCGB.CAHR   GEV   BEV   20.0   22.20   24.50   1   32.4   46.3   1   X   SMCG22A.HR   SMCG22C.AHR   GEV   BEV   20.0   22.20   24.50   1   32.4   46.3   1   X   SMCG22A.HR   SMCG22C.AHR   GEV   BEV   20.0   22.50   1   38.9   38.6   1   X   SMCG2BA.HR   SMCG3CA.HR   GEF   BFE   26.0   28.90   31.90   1   42.1   35.7   1   X   SMCG3A.HR   SMCG3CA.HR   GFE   BFE   26.0   28.90   31.90   1   42.1   35.7   1   X   SMCG3A.HR   SMCG3CA.HR   GFE   BFF   26.0   28.90   31.90   1   42.1   35.7   1   X   SMCG3A.HR   SMCG3CA.HR   GFF   BFF   36.0   40.00   44.20   1   58.1   25.9   1   X   SMCG3A.HR   SMCG3CA.HR   GFF   BFF   36.0   40.00   44.20   1   58.1   25.9   1   X   SMCG3A.HR   SMCG3CA.HR   GFF   BFF   43.0   47.80   52.80   1   69.4   21.7   1   X   SMCGBA.HR   SMCGBCA.HR   GFF   BFF   43.0   47.80   52.80   1   6							-					
SMCG9.0AHR   SMCG9.0CAHR   GDV   BDV   9.0   10.00   11.10   1   15.4   97.4   10   X   SMCG10AHR   SMCG10CAHR   GDX   BDX   10.0   11.10   12.09   1   17.0   88.3   5   X   SMCG11CAHR   SMCG11CAHR   GDX   BDX   10.0   11.0   12.09   1   17.0   18.2   82.5   1   X   SMCG12AHR   SMCG12CAHR   GEE   BEE   12.0   13.30   14.70   1   19.9   75.4   1   X   SMCG13CAHR   SMCG14CAHR   GEE   BEE   12.0   13.30   14.70   1   19.9   75.4   1   X   SMCG13CAHR   SMCG14CAHR   GEG   BEG   13.0   14.40   15.90   1   21.5   69.8   1   X   SMCG14CAHR   GEK   BEK   14.0   15.60   17.20   1   23.2   64.7   1   X   SMCG15CAHR   SMCG15CAHR   GEK   BEK   14.0   15.60   17.20   1   23.2   64.7   1   X   SMCG16CAHR   SMCG15CAHR   GEM   BEM   15.0   16.70   18.50   1   24.4   61.5   1   X   SMCG16CAHR   SMCG16CAHR   GEP   BEP   16.0   17.80   19.70   1   26.0   57.7   1   X   SMCG18CAHR   SMCG16CAHR   GER   BER   17.0   18.90   20.90   1   27.6   54.4   1   X   SMCG18CAHR   SMCG16CAHR   GER   BER   17.0   18.90   20.90   1   27.6   54.4   1   X   SMCG18CAHR   SMCG2CAHR   GER   BET   18.0   20.00   22.210   1   29.2   51.4   1   X   SMCG22AHR   SMCG2CAHR   GEE   BEV   20.0   22.0   24.50   1   32.4   46.3   1   X   SMCG22AHR   SMCG2CACAHR   GEZ   BEZ   24.0   26.70   29.50   1   38.9   38.6   1   X   SMCG2ACAHR   SMCG2CACAHR   GEZ   BEZ   24.0   26.70   29.50   1   38.9   38.6   1   X   SMCG2ACAHR   SMCG2CACAHR   GFE   BFE   60.0   28.90   31.90   1   42.1   35.7   1   X   SMCG3ACAHR   SMCG3CACAHR   GFM   BFM   33.0   36.70   40.60   1   53.3   28.2   1   X   SMCG3ACAHR   SMCG3CACAHR   GFM   BFM   33.0   36.70   40.60   1   53.3   28.2   1   X   SMCG3CACAHR   GFM   GFM   BFM   33.0   36.70   40.60   1   58.1   25.9   1   X   SMCG4ACAHR   SMCG4CACAHR   GFR   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG4CACAHR   SMCG4CCAHR   GFR   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG4CACAHR   SMCG4CCAHR   GFR   BFF   43.0   47.80   52.80   1   69.4   21.7   1   X   SMCG6ACAHR   SMCG6GACAHR   GFR   BFR   40.0   44.40			_									
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   GEB   BEE   12.0   13.30   14.70   1   19.9   75.4   1   X   SMCG13A-HR   SMCG13CA-HR   GEG   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   SMCG15CA-HR   GEK   BEK   14.0   15.60   17.20   1   23.2   64.7   1   X   SMCG16A-HR   SMCG15CA-HR   GEM   BEM   15.0   16.70   18.50   1   24.4   61.5   1   X   SMCG16A-HR   SMCG15CA-HR   GEM   BEM   15.0   16.70   18.50   1   24.4   61.5   1   X   SMCG16A-HR   SMCG16CA-HR   GER   BEP   16.0   17.80   19.70   1   26.0   57.7   1   X   SMCG16A-HR   SMCG18CA-HR   GER   BER   170   18.90   20.90   1   27.6   54.4   1   X   SMCG20A-HR   SMCG18CA-HR   GET   BET   18.0   20.00   22.10   1   29.2   51.4   1   X   SMCG20A-HR   SMCG20A-HR   GEV   BEV   20.0   22.20   24.40   26.90   1   32.4   46.3   1   X   SMCG22A-HR   SMCG2CA-HR   GEZ   BEZ   24.0   26.70   29.50   1   33.5   42.3   1   X   SMCG28A-HR   SMCG2CA-HR   GEZ   BEZ   24.0   26.70   29.50   1   38.9   38.6   1   X   SMCG28A-HR   SMCG20CA-HR   GFK   BFK   30.0   33.30   36.80   1   48.4   31.0   1   X   SMCG3A-HR   SMCG30CA-HR   GFK   BFK   30.0   33.30   36.80   1   48.4   31.0   1   X   SMCG3A-HR   SMCG30CA-HR   GFK   BFK   30.0   33.30   36.80   1   48.4   31.0   1   X   SMCG3A-HR   SMCG30CA-HR   GFK   BFK   30.0   33.30   36.80   1   48.4   31.0   1   X   SMCG3A-HR   SMCG30CA-HR   GFR   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG30CA-HR   GFR   BFR   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG30CA-HR   GFR   BFR   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG30CA-HR   GFR   BFR   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG30CA-HR   GFR   BFR   40.0   66.00   55.30   1   77.7   20.6   1   X   SMCG3A-HR   SMCG30CA-HR			_			_				-		
SMCG11AHR         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         GEK         BEK         13.0         14.40         15.90         1         21.5         69.8         1         X           SMCG15A-HR         SMCG16CA-HR         GEK         BEM         15.0         16.70         18.50         1         24.4         61.5         1         X           SMCG16A-HR         SMCG16CA-HR         GER         BER         15.0         16.70         18.50         1         24.4         61.5         1         X           SMCG17A-HR         SMCG16CA-HR         GER         BER         17.0         18.90         20.90         1         27.6         54.4         1         X           SMCG20A-HR         SMCG20CA-HR         GER         BET         18.0         20.00         22.10         1         29.2         51.4         1         X           SMCG22A-HR												
SMCG12A-HR   SMCG12CA-HR   GEE   BEE   12.0   13.30   14.70   1   19.9   75.4   1   X   SMCG13A-HR   SMCG14CA-HR   GEG   BEG   13.0   14.40   15.90   1   21.5   66.8   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   GEM   BEM   15.0   16.70   18.50   1   24.4   61.5   1   X   SMCG16A-HR   SMCG17CA-HR   GEP   BEP   16.0   17.80   19.70   1   26.0   57.7   1   X   SMCG16A-HR   SMCG17CA-HR   GET   BET   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   SMCG20A-HR   SMCG2CA-HR   GEV   BEV   20.0   22.20   24.50   1   35.5   42.3   1   X   SMCG26A-HR   SMCG2CA-HR   GEZ   BEZ   24.0   26.70   29.50   1   38.9   38.6   1   X   SMCG26A-HR   SMCG2CA-HR   GEZ   BEZ   24.0   26.70   29.50   1   38.9   38.6   1   X   SMCG26A-HR   SMCG2CA-HR   GEF   BEE   26.0   28.90   31.90   1   42.1   35.7   1   X   SMCG30A-HR   SMCG3CA-HR   GFK   BFK   30.0   33.30   36.80   1   48.4   31.0   1   X   SMCG33A-HR   SMCG3CA-HR   GFK   BFK   30.0   33.30   36.80   1   48.4   31.0   1   X   SMCG33A-HR   SMCG3CA-HR   GFK   BFM   33.0   36.70   40.60   1   53.3   28.2   1   X   SMCG33A-HR   SMCG3CA-HR   GFF   BFF   36.0   40.00   44.20   1   58.1   25.9   1   X   SMCG3A-HR   SMCG3CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG3CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG4CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG4CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG4CA-HR   GFF   BFF   40.0   44.40   49.10   1   64.5   23.3   1   X   SMCG3A-HR   SMCG4CA-HR   GFF   BFF   40.												
SMCG13A+R         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           SMCG16A-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           SMCG18A-HR         SMCG18CA-HR         GER         BER         17.0         18.90         20.90         1         27.6         54.4         1         X           SMCG20A-HR         SMCG20CA-HR         GEV         BEV         20.00         22.10         1         29.2         51.4         1         X           SMCG22A-HR         SMCG22CA-HR         GEV         BEZ         24.0         26.70         29.50         1         35.5         42.3         1         X           SMCG22A-HR         SMCG26CA-HR         GFE												
SMCG14A-HR         SMCG16CA-HR         GEK         BEK         14.0         15.60         17.20         1         23.2         64.7         1         X           SMCG15CA-HR         GEM         BEM         15.0         16.70         18.50         1         24.4         61.5         1         X           SMCG16A-HR         SMCG17CA-HR         GEP         BEP         16.0         11.780         19.70         1         26.0         57.7         1         X           SMCG17CA-HR         GEM         BER         17.0         18.90         20.90         1         27.6         54.4         1         X           SMCG18CA-HR         GET         BET         18.0         20.00         22.10         1         29.2         51.4         1         X           SMCG20A-HR         SMCG22CA-HR         GEX         BEX         22.0         22.20         24.50         1         35.5         42.3         1         X           SMCG22A-HR         SMCG22CA-HR         GEZ         BEZ         24.0         26.70         29.50         1         38.9         38.6         1         X           SMCG28A-HR         SMCG30CA-HR         GFE         BFE <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><u> </u></td><td></td></t<>											<u> </u>	
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         1780         19.70         1         26.0         57.7         1         X           SMCG17A-HR         SMCG18CA-HR         GER         BER         17.0         18.90         20.90         1         27.6         54.4         1         X           SMCG2A-HR         SMCG20CA-HR         GEV         BEV         20.00         22.10         1         29.2         51.4         1         X           SMCG22A-HR         SMCG22CA-HR         GEV         BEV         20.0         22.20         24.50         1         32.4         46.3         1         X           SMCG2A-HR         SMCG24CA-HR         GEZ         BEZ         24.0         26.70         29.50         1         38.9         38.6         1         X           SMCG2BA-HR         SMCG3CA-HR         GFE         BFE         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG3BA-HR         SMCG3GCA-HR<												
SMCG16A-HR         SMCG16CA-HR         GEP         BEP         16.0         17.80         19.70         1         26.0         57.7         1         X           SMCG17A-HR         GER         BER         BER         17.0         18.90         20.90         1         27.6         54.4         1         X           SMCG18A-HR         SMCG10CA-HR         GEV         BEV         20.00         22.20         24.50         1         32.4         46.3         1         X           SMCG22A-HR         GEV         BEV         20.0         22.20         24.50         1         32.4         46.3         1         X           SMCG22A-HR         GEX         BEX         22.0         24.40         26.90         1         35.5         42.3         1         X           SMCG2BA-HR         SMCG29CA-HR         GFE         BEF         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG3BA-HR         SMCG3CA-HR         GFE         BFE         28.0         31.10         34.40         1         45.4         33.1         1         X           SMCG3BA-HR         SMCG3GCA-HR         GFK         BF												
SMCG17A-HR         SMCG17CA-HR         GER         BER         17.0         18.90         20.90         1         27.6         54.4         1         X           SMCG18CA-HR         GET         BET         18.0         20.00         22.10         1         29.2         51.4         1         X           SMCG20A-HR         SMCG2CA-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         GEZ         BEZ         24.0         26.70         29.50         1         38.9         38.6         1         X           SMCG2BA-HR         SMCG26CA-HR         GFE         BFE         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG2BA-HR         SMCG30CA-HR         GFK         BFK         30.0         31.10         34.40         1         45.4         33.1         1         X           SMCG33CA-HR         GFK         BFK         3												
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           SMCG26A-HR         GEZ         BEZ         24.0         26.70         29.50         1         38.9         38.6         1         X           SMCG26A-HR         GFG         BFE         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG30A-HR         SMCG30CA-HR         GFK         BFK         30.0         33.30         36.80         1         48.4         31.0         1         X           SMCG36A-HR         SMCG30CA-HR         GFM         BFM         33.0         36.70         40.60         1         53.3         28.2         1         X           SMCG36A-HR         SMCG36CA-HR         GFP												
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           SMCG24CA-HR         GEZ         BEZ         24.0         26.70         29.50         1         38.9         38.6         1         X           SMCG26A-HR         SMCG26CA-HR         GFE         BFE         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG30A-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           SMCG30A-HR         SMCG30CA-HR         GFK         BFM         33.0         36.70         40.60         1         53.3         28.2         1         X           SMCG3CA-HR         GFP         BFM         3												
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         BFE         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG30A-HR         SMCG30CA-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           SMCG30A-HR         SMCG30CA-HR         GFP         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           SMCG36A-HR <td></td>												
SMCG24A-HR         SMCG24CA-HR         GEZ         BEZ         24.0         26.70         29.50         1         38.9         38.6         1         X           SMCG26A-HR         GFE         BFE         26.0         28.90         31.90         1         42.1         35.7         1         X           SMCG28A-HR         SMCG30CA-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           SMCG30A-HR         SMCG30CA-HR         GFM         BFM         33.0         36.70         40.60         1         53.3         28.2         1         X           SMCG36A-HR         GFP         BFP         36.0         40.00         44.20         1         58.1         25.9         1         X           SMCG43CA-HR         GFF         BFR         40.0         44.40         49.10         1         64.5         23.3         1         X           SMCG43CA-HR         GFT         BFT         43.0         47.80 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						_						
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         SMCG36CA-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           SMCG43CA-HR         GFR         BFT         43.0         47.80         52.80         1         69.4         21.7         1         X           SMCG45CA-HR         GFV         BFV         45.0         50.00         55.30         1         72.7         20.6         1         X           SMCG48CA-HR         GFX         BFX <td< td=""><td></td><td></td><td>GEZ</td><td>BEZ</td><td></td><td></td><td>29.50</td><td>1</td><td>38.9</td><td>38.6</td><td>1</td><td>X</td></td<>			GEZ	BEZ			29.50	1	38.9	38.6	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         SMCG45CA-HR         GFT         BFT         43.0         47.80         52.80         1         69.4         21.7         1         X           SMCG45CA-HR         SMCG45CA-HR         GFV         BFV         45.0         50.00         55.30         1         72.7         20.6         1         X           SMCG48CA-HR         SMCG48CA-HR         GFX         BFX         48.0         53.30         58.90         1         77.4         19.4         1         X           SMCG54CA-HR<	SMCG26A-HR	SMCG26CA-HR	GFE	BFE	26.0	28.90	31.90	1	42.1	35.7	1	Х
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         SMCG45CA-HR         GFT         BFT         43.0         47.80         52.80         1         69.4         21.7         1         X           SMCG45A-HR         SMCG48CA-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           SMCG58A-HR <td>SMCG28A-HR</td> <td>SMCG28CA-HR</td> <td>GFG</td> <td>BFG</td> <td>28.0</td> <td>31.10</td> <td>34.40</td> <td>1</td> <td>45.4</td> <td>33.1</td> <td>1</td> <td>Х</td>	SMCG28A-HR	SMCG28CA-HR	GFG	BFG	28.0	31.10	34.40	1	45.4	33.1	1	Х
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           SMCG60A-HR <td>SMCG30A-HR</td> <td>SMCG30CA-HR</td> <td>GFK</td> <td>BFK</td> <td>30.0</td> <td>33.30</td> <td>36.80</td> <td>1</td> <td>48.4</td> <td>31.0</td> <td>1</td> <td>Х</td>	SMCG30A-HR	SMCG30CA-HR	GFK	BFK	30.0	33.30	36.80	1	48.4	31.0	1	Х
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           SMCG45CA-HR         GFV         BFV         45.0         50.00         55.30         1         72.7         20.6         1         X           SMCG48CA-HR         GFV         BFV         45.0         50.00         55.30         1         72.7         20.6         1         X           SMCG48CA-HR         GFX         BFX         48.0         53.30         58.90         1         77.4         19.4         1         X           SMCG51CA-HR         GFZ         BFZ         51.0         56.70         62.70         1         82.4         18.2         1         X           SMCG54CA-HR         GGE         BGE         54.0         60.00         66.30         1         87.1         17.3         1         X           SMCG60CA-HR         GGG         BGG         58.0         64.40         71.20         1	SMCG33A-HR	SMCG33CA-HR	GFM	BFM	33.0	36.70	40.60	1	53.3	28.2	1	Х
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           SMCG70A-HR <td>SMCG36A-HR</td> <td>SMCG36CA-HR</td> <td>GFP</td> <td>BFP</td> <td>36.0</td> <td>40.00</td> <td>44.20</td> <td>1</td> <td>58.1</td> <td>25.9</td> <td>1</td> <td>X</td>	SMCG36A-HR	SMCG36CA-HR	GFP	BFP	36.0	40.00	44.20	1	58.1	25.9	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           SMCG60A-HR         SMCG60CA-HR         GGM         BGM         64.0         71.10         78.60         1         103.0         14.6         1         X           SMCG70A-HR <td>SMCG40A-HR</td> <td>SMCG40CA-HR</td> <td>GFR</td> <td>BFR</td> <td>40.0</td> <td>44.40</td> <td>49.10</td> <td>1</td> <td>64.5</td> <td>23.3</td> <td>1</td> <td>X</td>	SMCG40A-HR	SMCG40CA-HR	GFR	BFR	40.0	44.40	49.10	1	64.5	23.3	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           SMCG60A-HR         SMCG60CA-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 </td <td>SMCG43A-HR</td> <td>SMCG43CA-HR</td> <td>GFT</td> <td>BFT</td> <td>43.0</td> <td>47.80</td> <td>52.80</td> <td>1</td> <td>69.4</td> <td>21.7</td> <td>1</td> <td>X</td>	SMCG43A-HR	SMCG43CA-HR	GFT	BFT	43.0	47.80	52.80	1	69.4	21.7	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<			_		45.0	50.00		1		20.6		
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					48.0	53.30		1				
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-			_						_		<u> </u>	
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           SMCG1											·	
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		<del></del>										
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											-	
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												
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							_				· ·	
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		-										
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											· ·	
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												
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												

Note

1. For bidirectional type having  $V_{_{\rm B}}$  of 10 volts and less, the I $_{_{\rm B}}$  limit is double.

# **Transient Voltage Suppression Diodes**Surface Mount – 1500W > SMCG-HR series

#### **Screen Process**

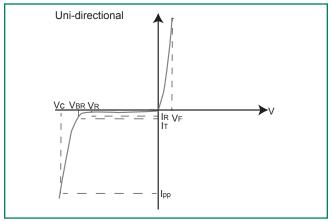
100% vision inspection	MIL-STD-750 method 2074
100%High Temperature Storage Life (168hrs,175C)	MIL-STD-750 method 1031
100% X-RAY inspection	MIL-STD-750 method 2076
100% Temperature cycle test (-55-150C, 20 cycles, dwell time 15 min)	MIL-STD-750 method 1051
100% Reflow (2x)	JEDEC J-STD-020
100% surge test (2x)	MIL-STD-750 method 4066
100% HTRB(150C, Bias=VR(80% breakdown voltage), 96hrs),for Bidirection 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

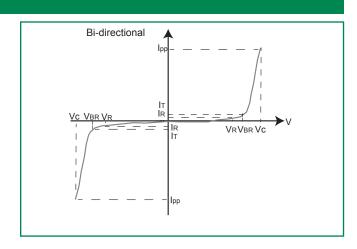
Note: Up-screen program can be specified by customer's request via contacting Littelfuse service

## **Group B Test Requirement**

Screen	Method	Condition	Requirement
Surge Test	10/1000 µS Peak Pluse Waveform	Maximum Clamping Voltage (V <sub>C</sub> ) @ Peak Plus Current (I <sub>PP</sub> )	Sample Size 45 Perform 10x Accept 0 Failures
Burn - In (HTRB)	MIL - STD - 750, Method 1038.5	Applied Voltage 100% V <sub>R</sub> @150°C	Sample Size 45 For Unidirectional, 150C/V <sub>R</sub> /340hours, for Bidirectional, 150C/V <sub>R</sub> /680hrs(340hours for each direction) Accept 0 Failures
Electrical Tests	-	I <sub>R</sub> @V <sub>R</sub> , V( <sub>BR</sub> )@I <sub>T</sub>	Sample Size 45 Accept 0 Failures

#### **I-V Curve Characteristics**





- P<sub>PPM</sub> Peak Pulse Power Dissipation Max power dissipation
- V<sub>s</sub> Stand-off Voltage -- Maximum voltage that can be applied to the TVS without operation
- $V_{_{BR}}$  **Breakdown Voltage** Maximum voltagethat flows though the TVS at a specified test current (I,)
- V<sub>c</sub> Clamping Voltage Peak voltage measured across the TVS at a specified Ippm (peak impulse current)
- Reverse Leakage Current Current measured at V<sub>R</sub>
- V<sub>,</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

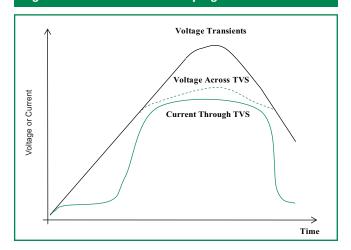


Figure 2 - Peak Pulse Power Rating

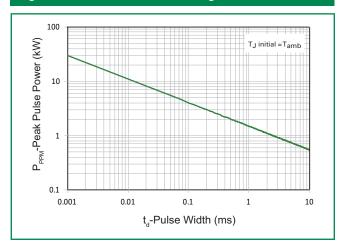


Figure 3 - Peak Pulse Power Derating Curve

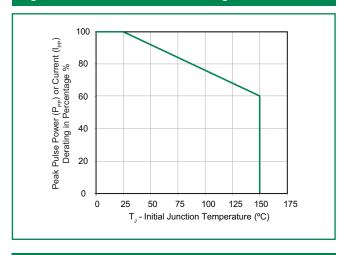


Figure 4 - Pulse Waveform

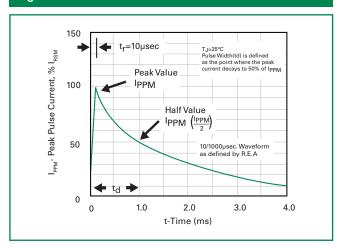


Figure 5 - Typical Junction Capacitance

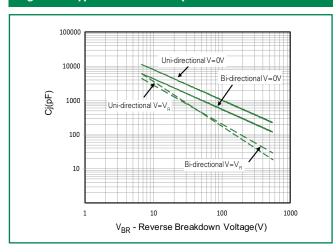


Figure 6 - Typical Transient Thermal Impedance

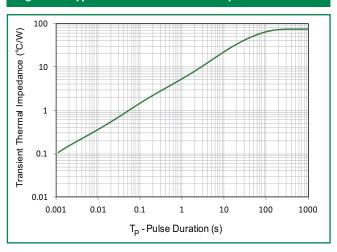
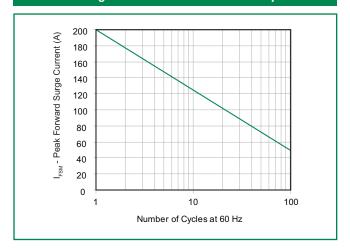


Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

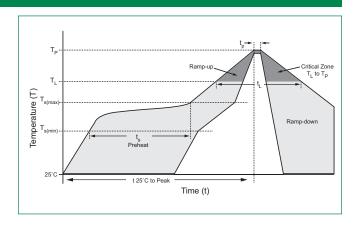


### **Soldering Parameters**

Reflow Co	ndition	Lead-free assembly	
	-Temperature Min (T <sub>s(min)</sub> )	150°C	
Pre Heat	-Temperature Max (T <sub>s(max)</sub> )	200°C	
	-Time (min to max) (t <sub>s</sub> )	60 - 120 secs	
Average ra	amp up rate (Liquidus Temp k	3°C/second max	
$T_{S(max)}$ to $T_{L}$	- Ramp-up Rate	3°C/second max	
Reflow	-Temperature (T <sub>L</sub> ) (Liquidus)	217°C	
nellow	-Time (min to max) (t <sub>s</sub> )	60 – 150 seconds	
PeakTemp	erature (T <sub>P</sub> )	260 <sup>+0/-5</sup> °C	
Time with Temperatu	in 5°C of actual peak ıre (t <sub>p</sub> )	30 seconds	
Ramp-dov	vn Rate	6°C/second max	
Time 25°C	to peak Temperature (T <sub>P</sub> )	8 minutes Max.	
Do not exc	ceed	260°C	



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

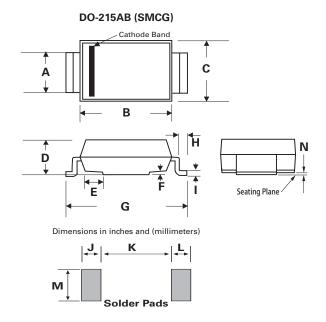


# **Environmental Specifications**

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

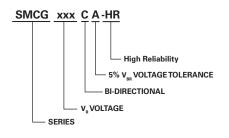
# **Transient Voltage Suppression Diodes**Surface Mount – 1500W > SMCG-HR series

#### **Dimensions**



D: .	Inc	hes	Millimeters		
Dimensions	Min	Max	Min	Max	
А	0.115	0.125	2.920	3.170	
В	0.260	0.280	6.600	7.110	
С	0.220	0.245	5.590	6.220	
D	0.075	0.095	1.900	2.410	
Е	0.038	0.058	0.970	1.470	
F	-	0.020	-	0.510	
G	0.380	0.400	9.640	10.160	
Н	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**

