Spark Gap

1. Scope

1.1 This Specification covers the SPG Surge Protector series for manufacturing gas tube arrests with the micro-gap system.

1.2 This Specification covers the SPG Surge Protector series for manufacturing gas tube arrests with the micro-gap system. (Patents No. : Japan 11-317276 Taiwan 87119291)

2. Part Number

Example;

a. SPG -XXX M/LB/L/W MS/LF

① ② ③ ④

b. LSE -XXX W/M LF

① ② ③ ④

① Series name

② Dc Sparkover voltage

The first two digits are significant and the third is the number of zeros units in volts (v)

③ Tolerance of DC Sparkover voltage

Mark	M	W	L/LB
Tolerance	±20%	±15%;+20%,-15%	±15%

④ "LF"Abbreviate from "Lead-free Solder" marking

"MS"Abbreviate form "Mounting surface Lead-free Solder"marking

3. Temperature Range

3.1 Operating temperature rang : -40～+85℃

Storage temperature rang : -45～+125℃

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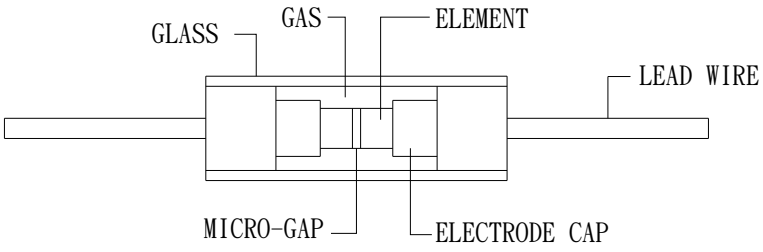
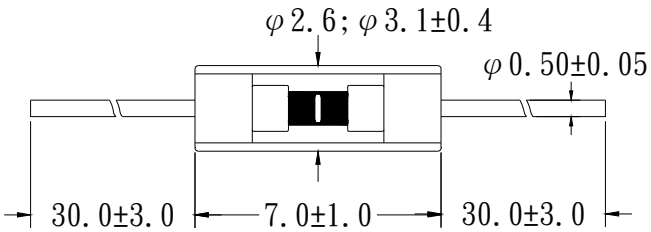
Spark Gap

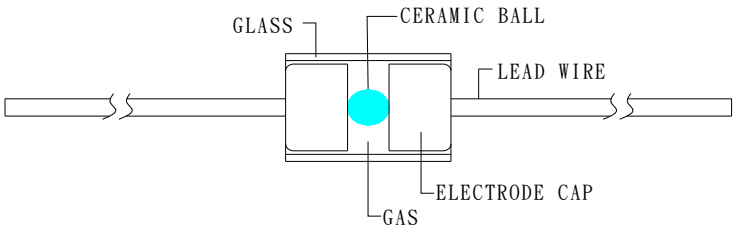
4. Structure & Dimensions

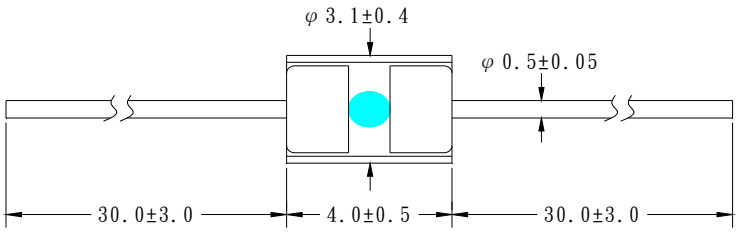
Model A



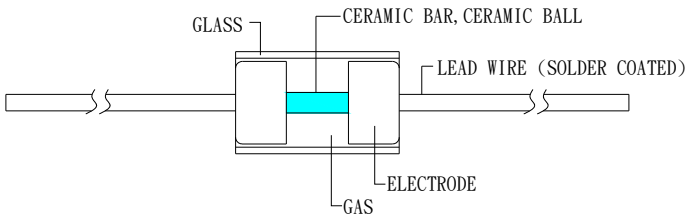


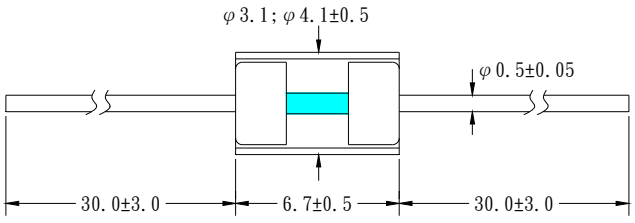
Model B





Model C





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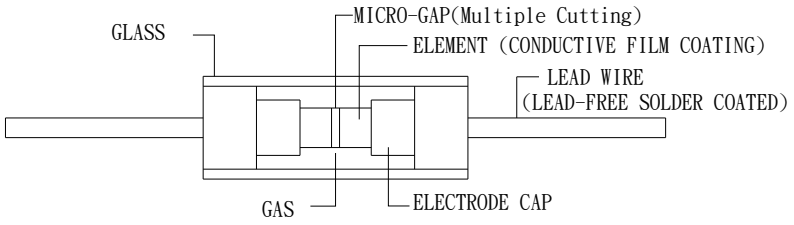
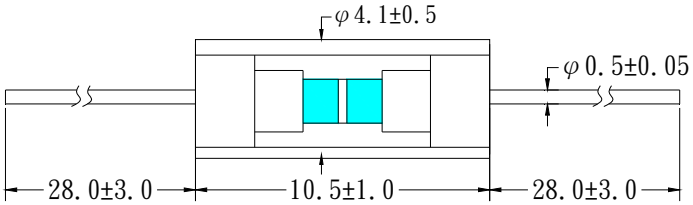
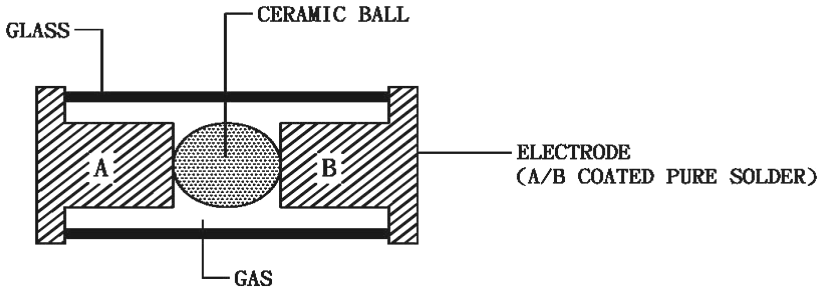
Spark Gap

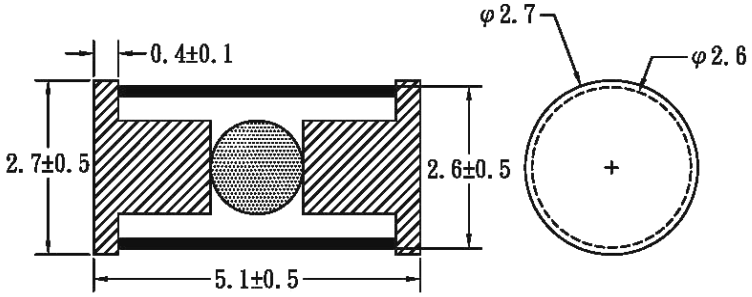
Model D





Model E SMD TYPE





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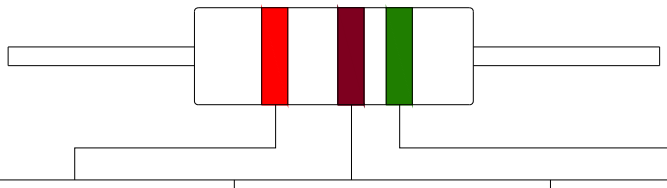
5.Marking & Rating

5.1 Model A Marking

5.1.1 SPG marking shows number and manufacturing lot number with three color bands. Distance between first color band and second color band is widely than between second and third color band.



Color	First color band	Second color band	Third color band
	Voltage	Lot No. 1	Lot No. 2
Red	200、250、270	0~9	0~9
Orange	300、350		
Yellow	400		
Green	500		
Blue	600		

5.1.2 Model A Rating(Initial Characteristics)

Model A Initial characteristics					
Part Number	Dc Sparkover Voltage Vs(V)	Insulation Resistance		Capacitance C(pf)	Surge Current Capacity (8×20) μSec
		IR (MΩ)	Applied Voltage		
SPG-201M(R)	160~240	≧100	DC 100V	≦ 1	500A
SPG-201LB	180~240	≧100	DC 100V	≦ 1	1000A
SPG-251L	212~300	≧100	DC 100V	≦ 1	500A
SPG-271L	230~310	≧100	DC 100V	≦ 1	500A
SPG-301M(R)	240~360	≧100	DC 100V	≦ 1	500A
SPG-301L(R)	255~345	≧100	DC 100V	≦ 1	500A
SPG-301LB	255~345	≧100	DC 100V	≦ 1	1000A
SPG351L	298~403	≧100	DC 100V	≦ 1	500A
SPG-401M(R)	320~480	≧100	DC 100V	≦ 1	500A
SPG-401LB	360~480	≧100	DC 100V	≦ 1	1000A
SPG-501M(R)	400~600	≧250	DC 100V	≦ 1	500A
SPG-501LB	425~575	≧250	DC 100V	≦ 1	1000A
SPG-601LB	540~720	≧250	DC 100V	≦ 1	1000A

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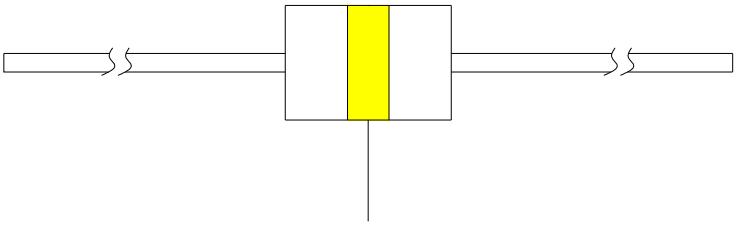
Spark Gap

5.2 Model B Marking

5.2.1 SPG marking shows DC sparkover with one color band only.



Color	One color band
	Voltage
Red	200
Orange	300、350
Yellow	400、470
Green	500

5.2.2 Model B Rating(Initial Characteristics)

Model B Initial characteristics					
Part Number	Dc Sparkover Voltage Vs(V)	Insulation Resistance		Capacitance C(PF)	Surge Current Capacity(8×20) μSec
		IR (MΩ)	Applied Voltage		
SPG-201W	170~240	≧100	DC 100V	≦1	3000A
SPG-301W	255~360	≧100	DC 100V	≦1	3000A
SPG-351W	298~420	≧100	DC 100V	≦1	3000A
SPG-401W	340~480	≧100	DC 100V	≦1	3000A
SPG-471W	400~564	≧100	DC 100V	≦1	3000A
SPG-501W	425~600	≧100	DC 100V	≦1	3000A

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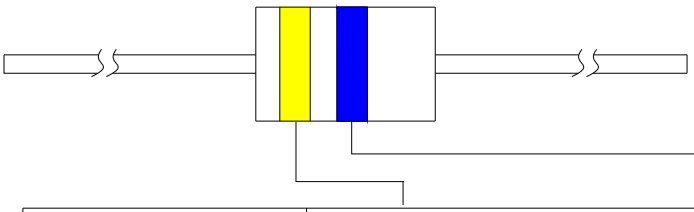
Spark Gap

5.3 Model C Marking

5.3.1 LSE marking shows DC sparkover with two color band. The two bands is significant digits.



Part Number	Color	
	One color band	Sec color band
102	BROWN	BLACK
122	BROWN	RED
152	BROWN	GREEN
202	RED	BLACK
252	RED	GREEN
302	ORANGE	BLACK
362	ORANGE	BLUE
402	YELLOW	BLACK

5.3.2 Model C Rating(Initial Characteristics)

Model C Initial characteristics					
Part Number	Dc Sparkover Voltage Vs(V)	Insulation Resistance		Capacitance C(PF)	Surge Current Capacity(8×20) μSec
		IR (MΩ)	Applied Voltage		
LSE-102W	850~1200	≧1000	DC 500V	≦1	1000A
LSE-122W	1020~1440	≧1000	DC 500V	≦1	1000A
LSE-152W	1275~1800	≧1000	DC 500V	≦1	1000A
LSE-202W	1700~2400	≧1000	DC 500V	≦1	1000A
LSE-252W	2125~3000	≧1000	DC 500V	≦1	1000A
LSE-302W	2550~3600	≧1000	DC 500V	≦1	1000A
LSE-362W	3060~4320	≧1000	DC 500V	≦1	1000A
LSE-362W-A	3600~5400	≧1000	DC 500V	≦1	1000A
LSE-362W-D	2880~4320	≧1000	DC 500V	≦1	1000A
LSE-402W	3200~4800	≧1000	DC 500V	≦1	1000A

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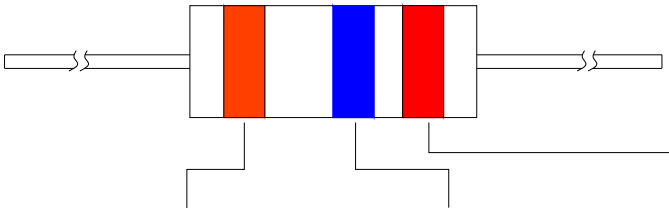
5.4 Model D Marking

5.4.1 LSE marking shows DC Sparkover with three color band. The band is significant digits.



Part Number	One Color Band	Second Color Band	Third Color Band
LSE-362M	Orange	Blue	Red
LSE-402M	Yellow	Black	Red

5.4.2 Model D Rating(Initial Characteristics)

Model D Initial characteristics					
Part Number	Dc Sparkover Voltage Vs(V)	Insulation Resistance		Capacitance C(PF)	Surge Current Capacity(8×20)μ Sec
		IR (MΩ)	Applied Voltage		
LSE-362M	2880~4320	≧1000	DC 500V	≦1	1000A
LSE-402M	3200~4800	≧1000	DC 500V	≦1	1000A

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Part Number	SPG -201 LZ-LF	REV.	0

1. SCOPE

1.1 This Specification covers the SPG surge protector series for manufacturing gas tube arrests with the micro-gap system.

1.2 The SPG surge protector series complies with RoHS(2.0) directive(2011/65/EU) and Halogen-Free requirements(IEC61249-2-21/2003) standards.

2. PART NUMBER

Example; SPG ① -201 ② LZ ③ LF ④

①Series name

②Dc Sparkover voltage

The first two digits are significant and the third is the number of zeros. Units in volts(v).

③Tolerance of DC Sparkover voltage

mark	LZ
tolerance	+20%,-10%

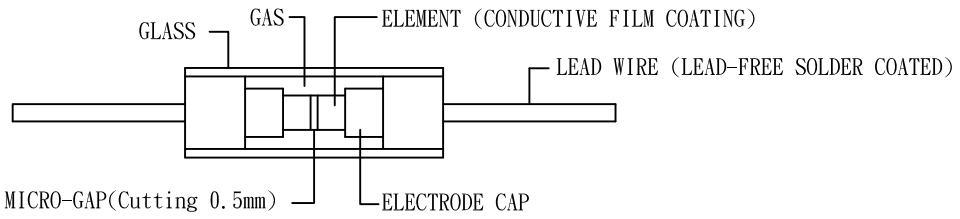
④Abbreviate form "Lead-free Solder" marking.

3. TEMPERATURE RANGE

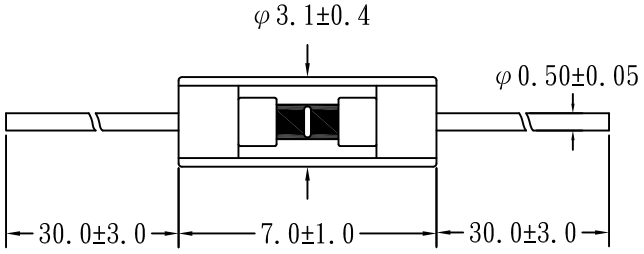
(1) Operating temperature rang：-40～+85℃

(2) Storage temperature rang：-40～+125℃

4. STRUCTURE



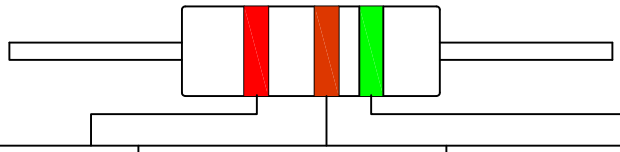
5. DIMENSION (Unit:mm)



			ITEM	SPARK GAP	DRAW NO.
			DATE	2016/08/03	
			PAGE	1/5	1

6. MARKING

SPG marking shows number and manufacturing lot number with three color bands. Distance between first color band and second color band is wider than between second and third color band.



Part Number	One Color Band	Second Color Band		Third Color Band	
	Color	Lot No.1		Lot No.2	
SPG-201LZ-LF	Red	Black	0	Black	0
		Brown	1	Brown	1
		Red	2	Red	2
		Orange	3	Orange	3
		Yellow	4	Yellow	4
		Green	5	Green	5
		Blue	6	Blue	6
		Purple	7	Purple	7
		Gray	8	Gray	8
		White	9	White	9

7. RATING(Initial characteristics)

Part Number	DC Sparkover Voltage Vs(V)	Insulation Resistance		Capacitance C(pF)	Impulse sparkover voltage Vim(V) max.	Surge Current Capacity(8×20)μSec
		IR(MΩ)	Applied Voltage			
SPG-201LZ-LF	180~240	≧100	DC100V	≦1	700V	1000A

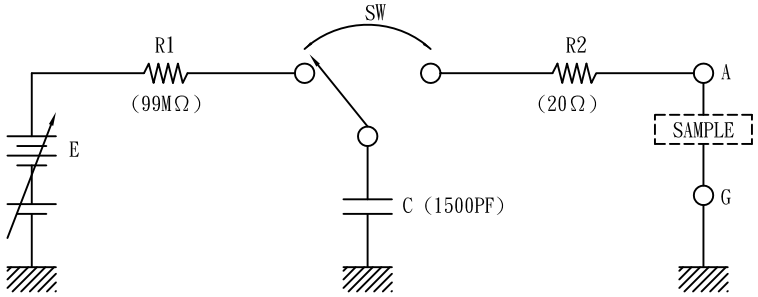
No.	Item	Test Conditions	Standard Value
7-1	Dc sparkover voltage	Measure starting discharge voltage (Vs) by gradually increasing applies DC voltage. Test current is 1mA max. And test period is one second MAX.	Meet Specified Value
7-2	Insulation resistance	Measure the insulation resistance across the terminal at regulated voltage.	100 MΩ or more
7-3	Electrostatic capacitance	Measure the electrostatic capacitance by applying a voltage of less than 6V (at 1KHz) between terminals.	1pF or less

8. ENVIROMENTAL CHARACTERISTICS

NO.	ITEM	TEST CONDITION	REQUIREMENTS
a	appearance	Outer appearance shall be visually examines.	Meet specified value
b	Cold resistance	The specimen shell be subjected to -40±3℃ for 1000 hours without load and then stored at room temperature and humidity for 4 hours. Thereafter, the characteristics of Item 7 rating shall bemeasured. (in accordance with JIS C 0020)	Meet specified value
c	Heat resistance	The specimen shall be subjected to 125±2℃ for 1000 hours without load then stored at room temperature and humidity for 4 hours, the characteristics of Item 7 Rating shall be measured.(in accordance with JIS C 0021)	Meet specified value
d	Temperature cycle	Repeat the temperature cycle shown below 200 times then store parts at room temperature and humidity for 4 hours. Thereafter, the characteristics of Item 7 Rating shall be measured. Step / Temperature / Period: 1 / -40±3℃ / 30 minutes; 2 / Room Temp / 3 minutes; 3 / 125±2℃ / 30 minutes; 4 / Room Temp / 3 minutes (in accordance with JIS C 0025)	Meet specified value
e	Lead wire pull strength	After gradually applying a 0.5lkgf load, Keep the unit fixed for 10±1 seconds. Thereafter, the characteristics of Item 7 Rating shall be measured. (in accordance with JIS 0051)	Meet specified value

NO.	ITEM	TEST CONDITION	REQUIREMENTS
f	Lead wire Bending strength.	The unit shall be secured with its lead wire kept vertical and a 0.25kgf weight applied below in the axial direction. The lead wire shall gradually be bent to 90° in one direction at point of 2 mm form the body along the radius of curvature (0.75～0.80mm) and again back to the original position. This shall be repeated 2 times. Thereafter, the characteristics of Item 7 Rating shall be measured. (in accordance with JIS C 0051)	Meet specified value
g	Solder ability	After dipping the lead wire within 2mm of the body in 245±3℃solder for 5±0.5 seconds, the lead wire shall be visually examined. (in accordance with SS-00254-1)	Lead wire is almost evenly Covered with solder. (covered 90%)
h	Resistance to soldering heat	After dipping the lead wire within 2mm of the body in 350±5℃ solder for 5±1 seconds, the characteristics of Item 7 Rating shall be measured. (in accordance with JIS C 0050)	Meet specified value
i	Surge life test	Charge a 1500pF capacitor up to DC 10KV and apply it to the sample through a 20Ω resistance. Do this 200 times at 10 seconds intervals. Thereafter, the characteristics of Item 7 Rating shall be measured.	|△Vs/Vs| ≦30%, characteristics of Item＞Rating must meet the specified value.

9. Electrostatic Discharge test Circuit

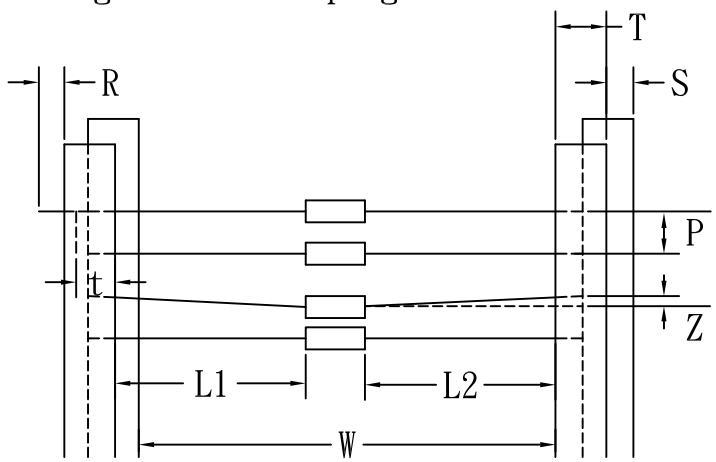


10. Packing

This specification covers the packaging of the SPG Surge protector Series.

(1) Axial taping

Fig.1 Axial taping



Symbol	Dimension (mm)
W	Axial taping
	52.0+1.5, -0.0
P	5.0±0.5
L1-L2	1 MAX.
T	6.0±1.0
Z	1.2 MAX.
R	Terminal must not project from the tape.
t	3.2 MIN.
s	0.8 MAX.

11. PACKAGING

(1) Flat pack

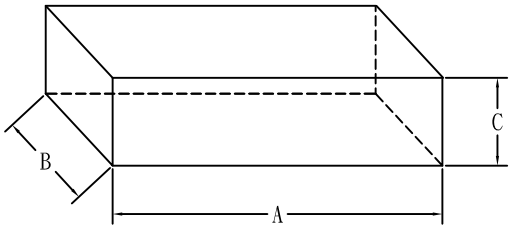


Fig.2 Flat pack

Item	Contents
	Flat pack-2
Size	A =255 mm
	B = 75 mm
	C = 68 mm
Quantity	1,500 pcs.
Marking	Part number, Quantity, Lot No.
Packaging	Packaging includes cushioning
	material to protect parts from damage.

(2) PACKAGING FOR SHIPMENT

Bagged components are packaged in a shipping box.

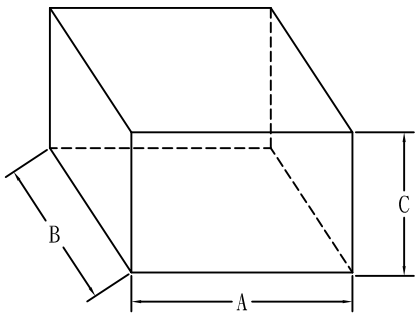
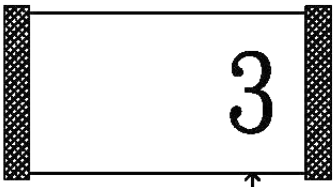


Fig.3 Packaging box for shipment

Item	Contents
	Large box
Size	A=310mm
	B=290mm
	C=380mm
Quantity (max.)	30,000pcs.

Spark Gap

5.5 Model E Marking



Mark Number	Rated voltage(v)
3	300

Explanation:

Mark Number	Rated voltage(v)
1	140
2	200
3	300
4	400
5	500

Model E Initial characteristics

Part Number	Dc Sparkover Voltage Vs(V)	Insulation Resistance		Capacitance C(pf)	Surge Current Capacity (8×20) μSec
		IR (MΩ)	Applied Voltage		
SPG-201M-MS	160~240	≧100	DC 100V	≦ 1	2000A
SPG-301M-MS	240~360	≧100	DC 100V	≦ 1	2000A
SPG-401M-MS	320~480	≧100	DC 100V	≦ 1	2000A
SPG-501M-MS	400~600	≧100	DC 100V	≦ 1	2000A

No.	ITEM	TSET CONDITINS	STANDARD VALUE
5-4	Dc sparkover voltage	Measure starting discharge voltage (Vs) by gradually increasing applies DC voltage. Test current is 1mA or 2mA. And test period is one second MAX.	Meet Specified value
5-5	Insulation resistance	Measure the insulation resistance across the terminal at regulated voltage.	100MΩor more
5-6	Electrostatic capacitance	Measure the electrostatic capacitance by applying a voltage of less than 6V (at 1KHz) between terminals.	1pF or less

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6. Environmental I Characteristics

<table>
<tr><th>NO.</th><th>ITEM</th><th>TEST CONDITION</th><th>REQUIREMENTS</th></tr>
<tr><td>a</td><td>appearance</td><td>Outer appearance shall be visually examines.</td><td>Meet specified value</td></tr>
<tr><td>b</td><td>Cold resistance</td><td>The specimen shell be subjected to -40±3℃ for 1000 hours without load and then stored at room temperature and humidity for 4 hours.
Thereafter, the characteristics of shall be measured.
(in accordance with JIS C 0020)</td><td>Meet specified value</td></tr>
<tr><td>c</td><td>Heat resistance</td><td>The specimen shall be subjected to 125±2℃ for 1000 hours without load then stored at room temperature, the characteristics of Item 7 Rating shall be measured.
(in accordance with JIS C 0021)</td><td>Meet specified value</td></tr>
<tr><td>d</td><td>Temperature cycle</td><td>Repeat the temperature cycle shown below 25 times then store parts at room temperature and humidity for 4 hours.
Thereafter, the characteristics of Item 7 Rating shall be measured.
<table>
<tr><th>Step</th><th>Temperature</th><th>Period</th></tr>
<tr><td>1</td><td>-40±3℃</td><td>30 minutes</td></tr>
<tr><td>2</td><td>Room Temp</td><td>3 minutes</td></tr>
<tr><td>3</td><td>125±2℃</td><td>30 minutes</td></tr>
</table>
(in accordance with JIS C 0025)</td><td>Meet specified value</td></tr>
<tr><td>e</td><td>Lead wire pull strength</td><td>After gradually applying a 0.5lkgf load, Keep the unit fixed for 10±1 seconds.
Thereafter, the characteristics of Item 7 Rating shall be measured.
(in accordance with JIS 0051)</td><td>Meet specified value</td></tr>
</table>

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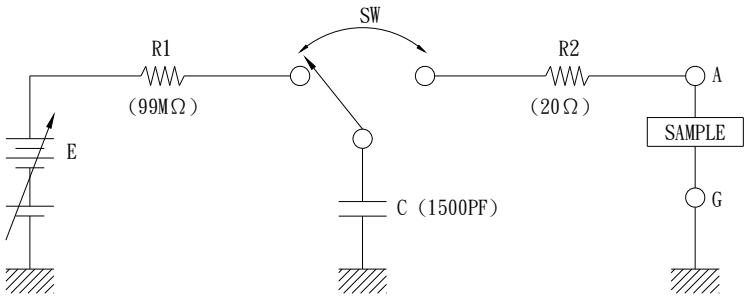
Spark Gap

NO.	ITEM	TEST CONDITION	REQUIREMENTS
f	Lead wire Bending strength.	The unit shall be secured with its lead wire kept vertical and a 0.25kgf weight applied below in the axial direction. The lead wire shall gradually be bent to 90° in one direction at point of 2 mm form the body along the radius of curvature (0.75～0.80mm) and again back to the original position. This shall be repeated 2 times. Thereafter, the characteristics of Item 7 Rating shall be measured. (in accordance with JIS C 0051)	Meet specified value
g	Solder ability	After dipping the lead wire within 2mm of the body in 235±5℃solder for 5±0.5 seconds, the lead wire shall be visually examined. (in accordance with JIS C 0050, 4-6)	Lead wire is almost evenly Covered with solder. (covered 90%)
h	Resistance to soldering heat	After dipping the lead wire within 2mm of the body in 260±5℃ solder for 10±1 seconds, the characteristics of Item 7 Rating shall be measured. (in accordance with JIS C 0050)	Meet specified value
i	Surge life test	Charge a 1500pF capacitor up to DC 10KV and apply it to the sample through a 20Ω resistance. Do this 200 times at 10 seconds intervals. Thereafter, the characteristics of Item 7 Rating shall be measured.	|△Vs/Vs| ≦30%, characteristics of Item>Rating must meet the specified value.

Electrostatic Discharge test Circuit

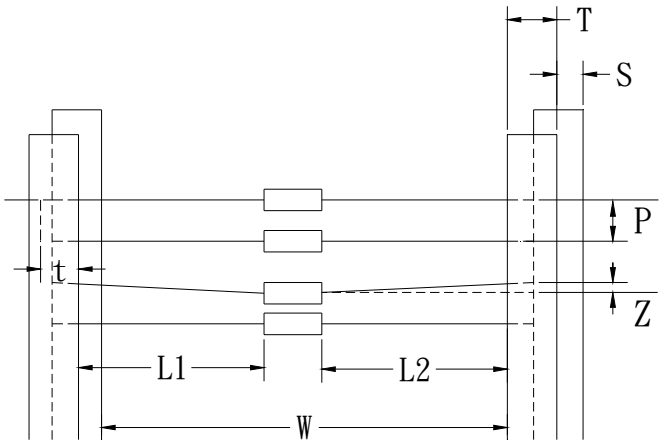


7.Packing

This specification covers the packaging of the SPG Surge protector Series.

(1) Axial taping

Fig.1 Axial taping



Symbol	Dimension (mm)
W	Axial taping
	52.0+2.0, -1.0
P	5.0±0.5
L1-L2	1 MAX.
T	6.0±1.0
Z	1.2 MAX.
R	Terminal must not project from the tape.
t	3.2 MIN.
s	0.8 MAX.

(2)Flat Pack

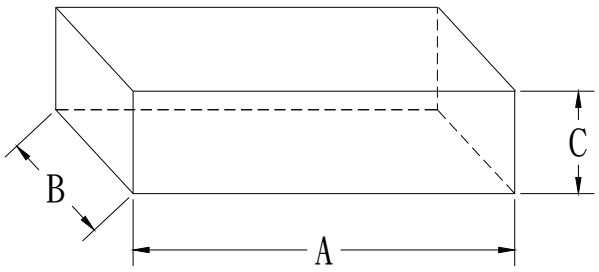


Fig.2 Flat pack

Item	Contents	
	Flat pack-2	
Size	A =255 mm	A =255 mm
	B = 75 mm	B = 75 mm
	C = 68 mm	C = 75 mm
Quantity	1500 or 2000 pcs.	1000 pcs.
Marking	Part number, Quantity, Lot No.	
Packaging	Packaging includes cushioning	
	material to protect parts from damage.	

8.Carton Packing

(1) Packaging For Shipment

Bagged components are packaged in a shipping box.

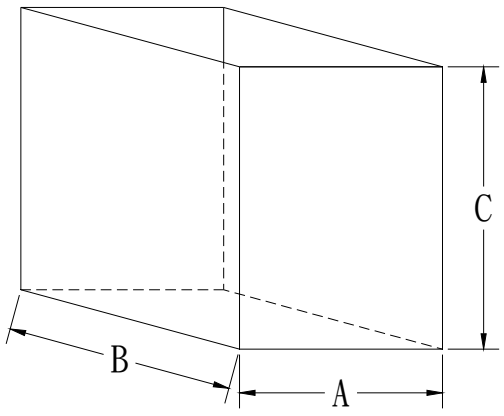


Fig.3 Packaging box for shipment

Item	Contents
	Large box
Size	A=295mm
	B=310mm
	C=380mm
Quantity (max.)	30,000 pcs. or 40,000pcs.

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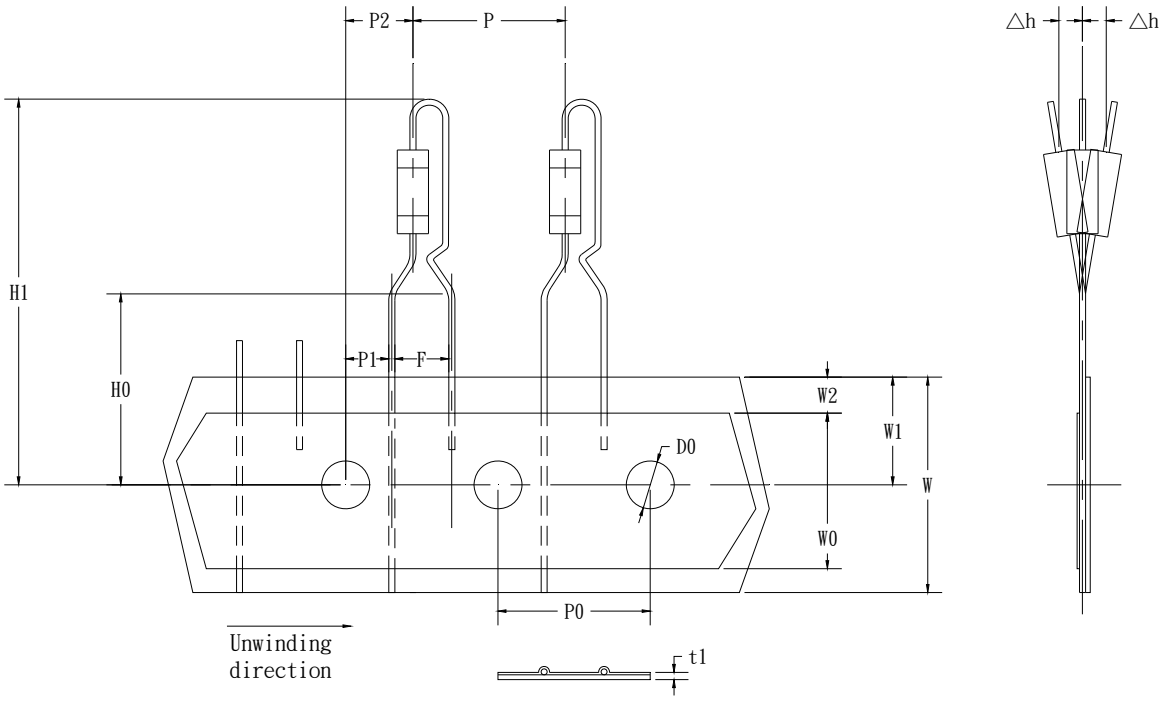
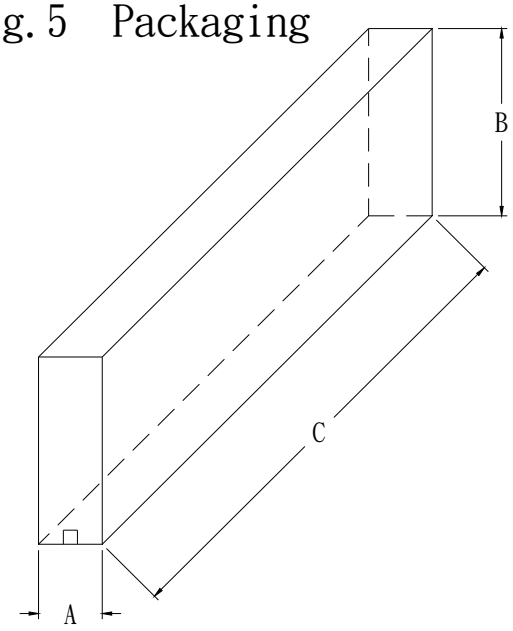
Fig.4 Radial Taping



	P	P0	P1	P2	F	W	W0	W1	W2	H0	D0	△h	H1	t1
Dimensions	12.7	12.7	3.85	6.35	5.0	18.0	13.0	9.0	3.0	16.0	4.0	2.0	32.2	0.6
Tolerance	±1.0	±0.3	±0.5	±0.1	±0.5	+1.0 −0.5	±0.5	±0.5	MAX.	±0.5	±0.2	MAX.	MAX.	±0.3

Notes 1) Adhesive tape shall not protrude out of paper backing.

Fig.5 Packaging



Item	CONTENTS
Size	A = 45mm, B =133mm, C =330mm
Quantity	1,000 PCS./BOX
Marking	Part Number, Quantity, Lot No.
Packaging	10,000PCS/CARTON

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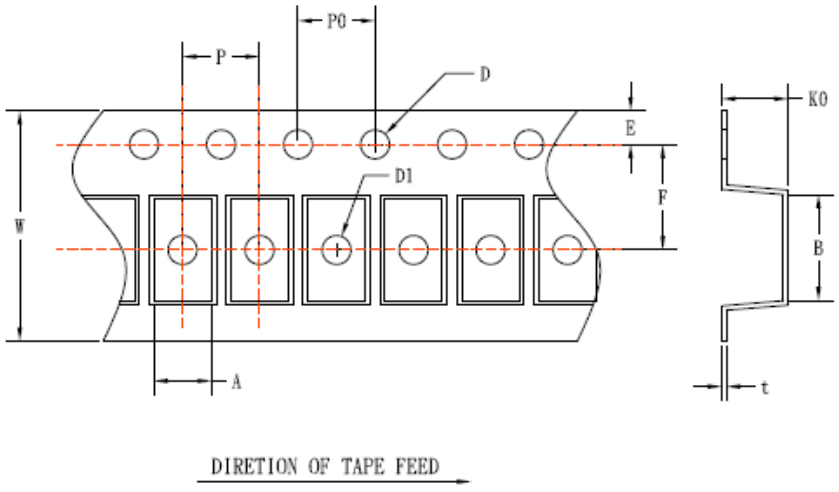
9.SMD Packing

This specification covers the packing of surface mount surge protector

(1) Reel packaging

ITEM	SPEC.
W	12.00±0.20
K0	3.00±0.10
P	4.00±0.10
F	5.5±0.05
E	1.75±0.10
D	φ1.5±0.10
D1	φ1.5±0.10
P0	4.00±0.10
t	0.25±0.05
B	4.7±0.10
A	3.0±0.10



Our surface-mount componeents are placed in embossed cavities of antistatic/conductive carrier tape, and sealed with a cover tape. The taped devices are supplied with reeel in protective boxes.

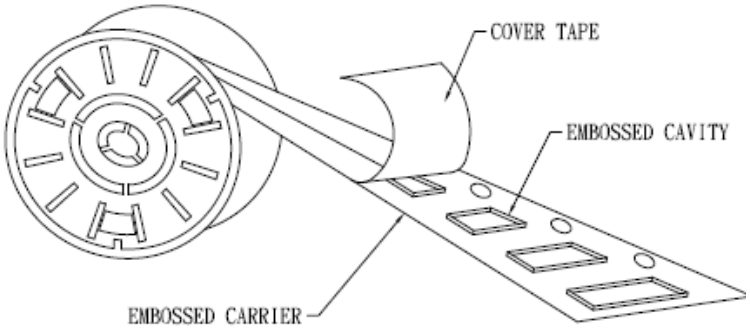


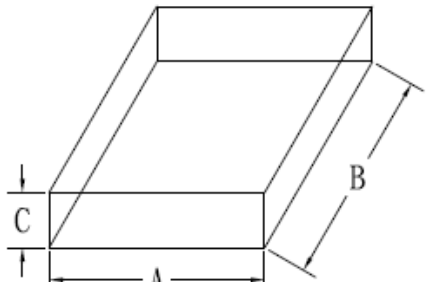
Fig. 1 Reel Packaging

NOTES:

A. Taped devices are supplied on a reel of following dimensions:
   Reel diameter: 330mm±5mm
   Reel axial hole: 102mm±0.5mm

B. 5000 pcs per reel.(13")
   5 reels per inner box.
   2 inner box per carton.

(2) Packaging inside box



Item	Contents
Size	A=335mm B=340mm C= 90mm
Quantity	25,000 Pcs
Marking	Part Number、Quantity、Lot No.
Packaging	Packaging includes cushioning material to protect parts from damage.

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