



Approval Sheet

Customer Information

Customer :			
Part Name :			
Part No. :			
Model No. :			
Company	Purchase	R&D	

Vendor Information

Name:	SFI Electronics Technology INC.
Part Name	Chip Surge Protection Device (CSPD) Series
Part No.	Super High Voltage (SHV) Device – SFI2220SV391-501A
Lot No.	

SFI ELECTRONICS TECHNOLOGY INC.

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Quality Control	Document Control	Business Issue	
 ISO 9001:2008 ISO 14001:2004 ISO/TS 16949:2009 Management System www.tuv.com ID 1100008833	REV : E	Prepared	Check
			

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**PART NO. SFI2220SV391-501A****1.1 Technology Data**

	Symbol	Value	Unit
Maximum allowable continuous AC voltage at 50-60 Hz	V_{RMS}	250	V
Maximum allowable continuous DC voltage	V_{DC}	320	V
Breakdown voltage measured	V_V	390(±10%)	V
Maximum clamping voltage	V_{CLAMP}	< 647	V
Surge voltage (1.2/50 μ s, 2 Ω) (1 time)	V_{Peak}	1.0	KV
Surge current (8/20 μ s) (1 time)	I_{Peak}	500	A
Surge current (8/20 μ s) (15 time)	I_{Peak}	250	A

1.2 Reference Data

Typical capacitance value measured at 1K Hz	C	235	pF
Response time	T_{rise}	< 1	ns
Non-linear coefficient	α	> 20	
Leakage current at $V_V \times 80\%$	I_{VV}	< 20	μ A
Leakage current at $V_V \times 80\%$ (After surge Test)	I_{VVA}	< 100	μ A
Operation ambient temperature		-40~+85	°C
Storage temperature		-40~+125	°C

1.3 Other Data

Body		Nano Special Ceramic
End termination		Ag/Ni/Sn
Packaging		Reel
Complies with Standard		UL 1449, File No. E334409-VZCA
Complies with RoHs Standard		Yes
Lead Content	<	1000 ppm
Marking		None

Notes :

- * 1 The breakdown voltage was measured at 1 mA current.
- * 2 The Clamping voltage was measured at 8*20 μ s standard current, 2220(10A).
- * 3 The surge current was tested at 8/20 μ s waveform.
- * 4 The capacitance value only for customer reference, it's not formal specification.
- * 5 The components shall be employed within 1 year, in the nitrogen condition.

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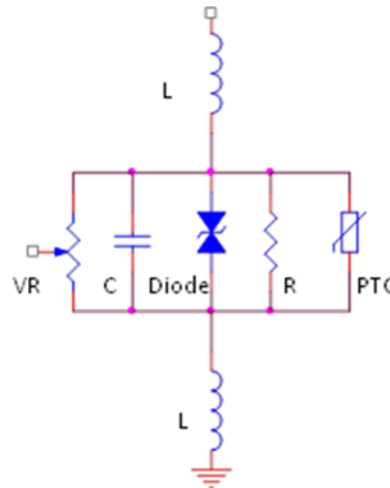


1.4 Features of SHV Series

1. RoHS compliant
2. SMD type Body size 2220
3. Meet IEC61000-4-5 and UL1449 Standard
4. Bidirectional and symmetrical V/I characteristics
5. Large withstanding surge voltage capability : 1KV (@1.2/50 μ s, 2 Ω)
6. Large withstanding surge current capability : 500A (@8/20 μ s)
7. Excellent low leakage current <20 μ A
8. Operating temperature range : -40 ~ +85°C
9. Multi-Layers construction provides higher power dissipation

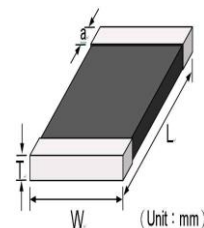
Equivalent Circuit

- ☆L Body Inductance
- ☆C Device Capacitance
- ☆VR Voltage Variable Resistor
- ☆R Insulation Resistor
- ☆Diode Voltage clamped
- ☆PTC For low leakage current



2.Size

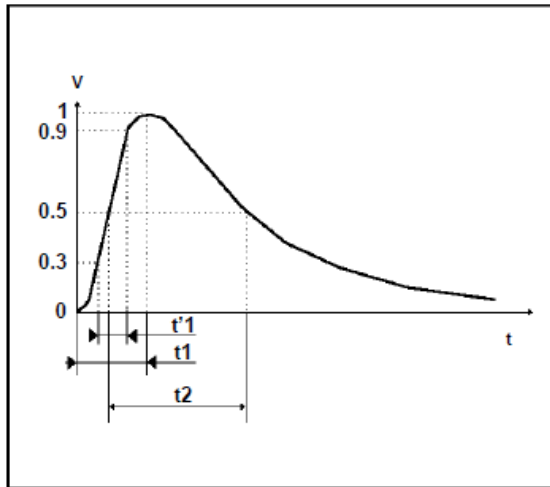
Model	2220 Series
Length(L)	6.0 +0.7/-0.3mm
Width(W)	5.3 +0.5/-0.3mm
Thickness(T)	3.60 mm Max
Termination(a)	0.5+0.35/-0.1mm



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3. Surge Wave Form



8/20 μ s waveform current

IEC61000-4-5 Standards

SEVERITY LEVEL	t1 (=1.67t'1)	t2
1	8 μ s	20 μ s

4. Enviromental Reliability Test

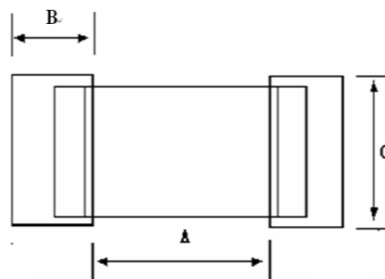
Item	Requirement	Test condition
High Temperature Storage	1.Breakdown voltage change : within $\pm 10\%$ 2.No mechanical damage	1.Temperature : $125\pm 2^{\circ}\text{C}$ 2.Time : 1000 ± 2 hours 3.Test after placing in ambient temperature for 24 hours.
Low Temperature Storage	1.Breakdown voltage change : within $\pm 10\%$ 2.No mechanical damage	1.Temperature : $-40\pm 2^{\circ}\text{C}$ 2.Time : 1000 ± 2 hours 3.Test after placing in ambient temperature for 24 hours.
Temperature Cycle	1.Breakdown voltage change : within $\pm 10\%$ 2.No mechanical damage	1.Step 1 : $-40\pm 3^{\circ}\text{C}$; time : 30 ± 3 min 2.Step 2 : 25°C ; time : 1 hour 3.Step 3 : $125\pm 3^{\circ}\text{C}$; time : 30 ± 3 min 4.Step 4 : 25°C ; time : 1 hour 5.Number of cycle : 5 times 6.Test after placing in ambient temperature for 24 hours.
High Temperature Load	1.Breakdown voltage change : within $\pm 10\%$ 2.No mechanical damage	1.Temperature : $85\pm 2^{\circ}\text{C}$ 2.Rated working voltage applied 3.Time : 1000 ± 2 hours 4.Test after placing in ambient temperature for 24 hours.
Damp Heat Load/ Humidity Load	1.Breakdown voltage change : within $\pm 10\%$ 2.No mechanical damage	1.Temperature : $40\pm 2^{\circ}\text{C}$ 2.Humidity : 90~95% RH 3.Rated working voltage applied 4.Time : 500 ± 2 hours 5.Test after placing in ambient temperature for 24 hours.

5. Soldering Recommendations

5.1 Recommended solder pad layout

(Unit : mm)

	A	B	C
2220	3.8~4.6	1.3~2.2	4.8~5.5

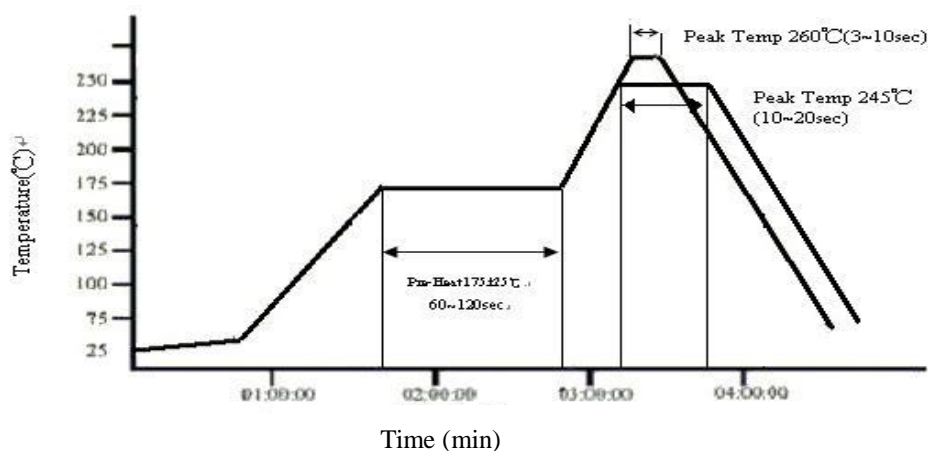


5.2 The SIR test of the solder paste shall be done (Based on JIS-Z-3284)

5.3 Steel plate and foot distance printing

Foot distance printing (mm)	Steel Plate thickness (mm)
> 0.65mm	0.18mm
0.65mm~0.5mm	0.15mm
0.50mm~0.40mm	0.12mm
<=0.40 mm	0.10mm

5.4 The IR Reflow and Temperature of Soldering for Pb Free



☆ IR reflow Pb Free Process suggestion profile

- (1) The solder recommend is Sn96.5/Ag 3.5 of 120 to 150 μ m
- (2) Ramp-up rate (217°C to Peak) + 3°C/second max
- (3) Temp. maintain at 175 +/-25°C 180 seconds max
- (4) Temp. maintain above 217 °C 60-150 seconds
- (5) Peak temperature range 245°C +20°C/ -10 °C time within 5 °C of actually peak temperature 10~20 seconds
- (6) Ramp down rate +6 °C/second max.

※Perform adequate test in advance as the reflow temperature profile will vary according to the conditions of the manufacturing process, and the specification of the reflow furnace.

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5.5 Resistance to Soldering Heat-High Temperature Resistance:260, 10sec- 3 times.

5.6 Hand Soldering

In hand soldering of the SHV devices. Large temperature gradient between preheated the SHV devices and the tip of soldering iron may cause electrical failures and mechanical damages such as crackings or breakings of the devices. The soldering shall be carefully controlled and carried out so that the temperature gradient is kept minimum with following recommended conditions for hand soldering.

5.6.1 Recommended Soldering Condition 1

- (1) Solder :
0.12~0.18mm Thread solder (Sn96.5:Ag3.5) with soldering flux in the core.
Rosin-based and non-activated flux is recommended.
- (2) Preheating
The SHV devices shall be preheated so that Temperature Gradient between the devices and the tip of soldering iron is 150℃ or below.
- (3) Soldering Iron
Rated Power of 20w max with 3mm soldering tip in diameter.
Temperature of soldering iron tip 380℃ max, 3-5sec (The required amount of solder shall be melted in advance on the soldering tip.)
- (4) Cooling
After soldering. The SHV devices shall be cooled gradually at room ambient temperature.

5.6.2 Recommended Soldering Condition 2 (Without preheating)

- (1) Solder iron tip shall not directly touch to ceramic dielectrics.
- (2) Solder iron tip shall be fully preheated before soldering while soldering iron tip to the external electrode of the SHV devices.

5.7 Post Soldering Cleaning

5.7.1 Residues of corrosive soldering fluxes on the PC board after cleaning may greatly have influences on the electrical characteristic and the reliability (such as humidity resistance)of the SHV devices which have been mounted on the board. It shall be confirmed that the characteristic and the reliability of the devices are not affected by the applied cleaning conditions.

5.7.2. When an ultrasonic cleaning is applied to the mounted SHV devices on PC Boards.

Following conditions are recommended for preventing failures or damages of the devices due to the large vibration energy and the resonance caused by the ultrasonic waves.

- (1) Frequency 29MHz max
- (2) Radiated Power 20w/lithr max
- (3) Period 5minuets max

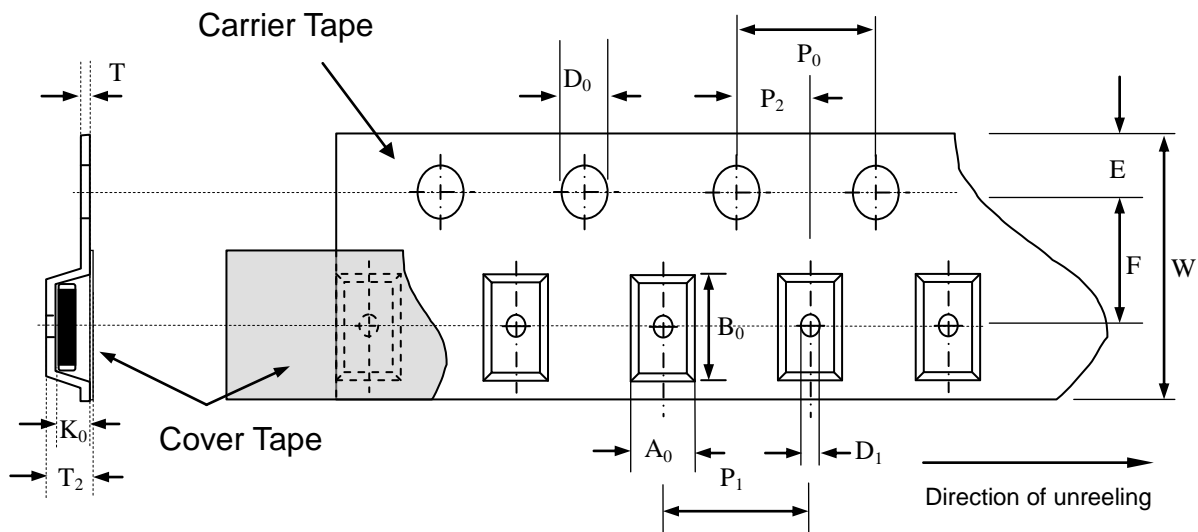
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6. Packaging Specification

6.1 Carrier tape and transparent cover tape should be heat-sealed to carry the products, and the reel should be used to reel the carrier tape.

6.2 The adhesion of the heat-sealed cover tape shall be 40 +20/-15 grams.

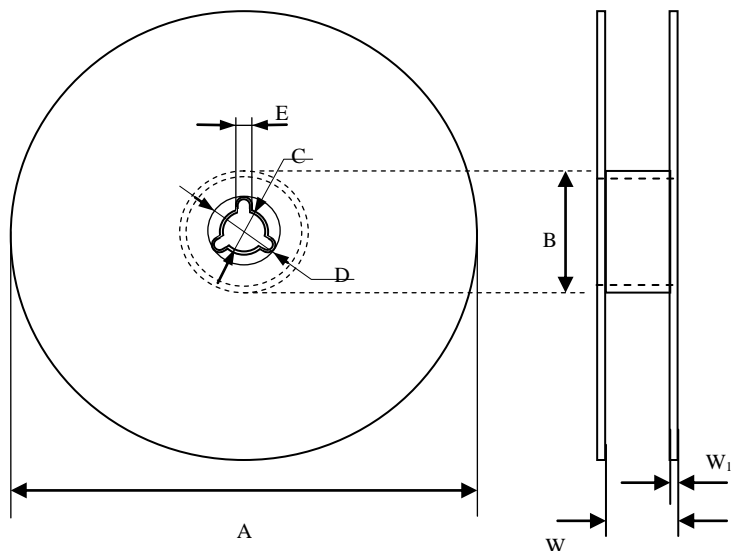
6.3 Both the head and the end portion of the taping shall be empty for reel package and SMT auto-pickup machine. And a normal paper tape shall be connected in the head of taping for the operator to handle.



Symbol	A_0 ± 0.10	B_0 ± 0.10	K_0 ± 0.10	T ± 0.05	T_2 ± 0.05	D_0 $+0.10$ -0.00	D_1 ± 0.05	P_1 ± 0.10	P_2 ± 0.05	P_0 ± 0.05	W ± 0.20	E ± 0.10	F ± 0.05
2220	5.90	6.80	3.75	0.25	3.90	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50



7.Reel Dimension



Symbol	A	B	C	D	E	W	W ₁
2220	178.0±1.0	60.2±0.5	13.0±0.5	21.0±0.2	2.5±0.5	13.6±0.2	1.5±0.15

8.Standard Packaging

Size	2220
Pcs	500