



# APPROVAL SHEET

## Customer Information

<b>Customer :</b>			
<b>Part Name :</b>			
<b>Part No. :</b>			
<b>Model No. :</b>			
<b>COMPANY</b>	<b>PURCHASE</b>	<b>R&amp;D</b>	

## Vendor Information

<b>Name:</b>	<b>SFI ELECTRONICS TECHNOLOGY CORP. INC.</b>
<b>Part Name</b>	<b>Chip TVS</b>
<b>Part No.</b>	<b>2220ML C LF Series</b>
<b>Lot No.</b>	

<b>SFI ELECTRONICS TECHNOLOGY INC.</b>			
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<b>Quality Control</b>	<b>Document Control</b>	<b>Business Issue</b>	
 TÜV CERT DIN EN ISO 9001 Certificate: 01 100 008833	REV : E	Prepared	Check
			



**PART NO. SFI 2220ML C LF Series**

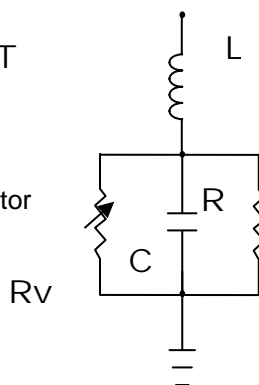
**1.1 Performance Characteristics**

Part Number	Working Voltage		Breakdown Voltage <sup>(*1)</sup>	Clamping Voltage	Peak Current	Energy	Capacitance
	AC	DC					
Symbol	AC	DC	V ( 1mA )	V <sup>(*2)</sup>	A <sup>(*3)</sup>	J	PF <sup>(*4)</sup> (kHz)
2220ML120C-LF	6	9	12(10.2~13.8 )	< 24	> 1000	> 1.9	36500
2220ML150C-LF	8	11	15( 12.75~17.25 )	< 28	> 1000	> 2.3	18400
2220ML180C-LF	11	14	18( 15.3~20.7 )	< 35	> 1000	> 2.7	15300
2220ML220C-LF	12	16.5	22( 19.8~24.2 )	< 40	> 1000	> 2.9	12500
2220ML240C-LF	14	18	24( 21.6~26.4 )	< 45	> 1000	> 3.1	11800
2220ML270C-LF	17	22	27( 24.3~29.7 )	< 50	> 1000	> 3.8	10400
2220ML330C-LF	20	26	33( 29.7~36.3 )	< 60	> 1000	> 4.3	8900
2220ML390C-LF	25	30	39( 35.1~42.9 )	< 72	> 1000	> 5.5	7500
2220ML470C-LF	30	38	47( 42.3~51.7 )	< 85	> 1000	> 6.3	4600
2220ML560C-LF	35	45	56( 51.52~60.48 )	< 100	> 1000	> 7.7	4000
2220ML680C-LF	40	56	68( 62.56~73.44 )	< 120	> 1000	> 8.8	3500
2220ML820C-LF	50	65	82( 75.44~88.66 )	< 150	> 1000	> 5.6	2850
2220ML101C-LF	60	85	100(92~108)	< 180	> 1000	> 6.8	1800
2220ML111C-LF	70	90	110( 101.2~118.8 )	< 200	> 1000	> 6.8	1500

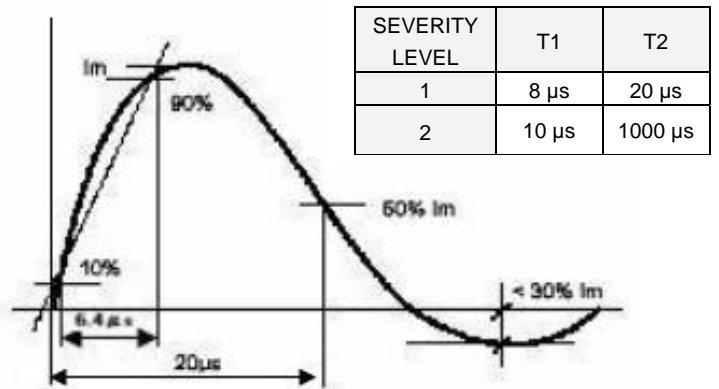
- \* 1 The varistor voltage was measured at 1 mA current , tolerance at 5~8V(+20%) , 12~18V(+15%) , exceed 22V (+10%)
- \* 2 The Clamping voltage was measured at standard 10A current
- \* 3 The Peak Current was tested at 8/20 us waveform
- \* 4 The capacitance value and Energy only for customer reference , it's not formal specification

**EQUIVALENT CIRCUIT**

- L** Body Inductance
- C** Device Capacitance
- Rv** Voltage Variable Resistor
- R** Insulation Resistor



**Wave shape "Short circuit" (Current Isc)**



**8/20 μs waveform current ( A )**

<b>Part No. :</b>	SFI 2220ML C LF Series	<b>Document No.</b>	AS-RD2220_C_LF_Series	<b>REV.</b>	E
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# SFI Electronics Technology

## SMD Transient Voltage Suppressors

### 1.2 Reference Data

	Symbol		Value	Unit
Maximum Energy Absorption *5	E	>	1.9	J
Response time	T <sub>rise</sub>	<	1	ns
Leakage current at V <sub>1mA</sub> ×80%	I <sub>VV</sub>	<	50	uA
Leakage current at V <sub>1mA</sub> ×80% (After reality Test)	I <sub>VVA</sub>	<	200	uA
Operation ambient temperature			-55 +85	
Storage temperature			-55 +125	
Reflow solder profile temperature(Recommend)			250	

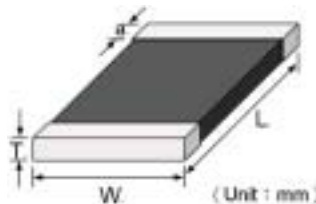
5. Testing condition :8×20 μ s waveform.

### 1.3 Other Data

	Symbol		Value	Unit
Body			ZnO	
End termination			Ag/Ni/Sn	
Packaging			Reel	
Marking			None	
Lead content		<	1000	ppm

## 2 .Size

Model	2220(5750)Series
Length(L)	5.7 ±0.2mm
Width(W)	5.0 ±0.2mm
Thickness(T)	2.5 mm Max
Termination(a)	0.50+0.3/-0.1mm



## 3. Enviromental Reliability Test

Characteristic	Test method and description			
High Temperature Storage	The specimen shall be subjected to 150 ± 2 for 1000 ± 12 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. The change of varistor voltage shall be within 10 % .			
Temperature Cycle	The temperature cycle of specified temperature shall be repeated five times and then stored at room temperature and humidity for one or two hours. The change of varistor voltage shall be within 10 % and mechanical damage shall be examined.	Step	Temperature	Period
		1	-40±3	30Min±3
		2	Room Temperature	1~2 hours
		3	125±2	30Min±3
4	Room Temperature	1~2 hours		
High Temperature Load	After being continuously applied the maximum allowable voltage at 85 ± 2 for 1000± 2 hours, the specimen shall be stored at room temperature and humidity for one or two hours, the change of varistor voltage shall be within 10 % .			
Damp Heat Load/ Humidity Load	The specimen should be subjected to 40 ± 2 , 90 to 95 % RH environment, and the maximum allowable voltage applied for 1000 hours, then stored at room temperature and humidity for one or two hours. The change of varistor voltage shall be within 10 % .			
Low Temperature Storage	The specimen should be subjected to -40 ± 2 , without load for 500 hours and then stored at room temperature for one or two hours. The change of varistor voltage shall be within 10 % .			

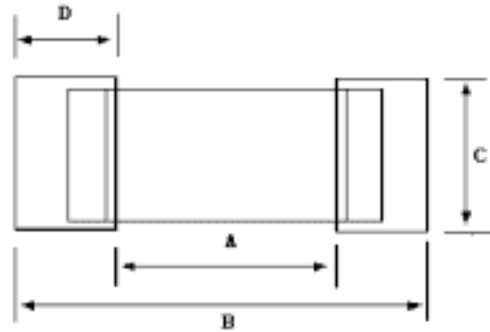


## 4. Soldering Recommendations

### 4.1 Recommended solder pad layout

( Unit : mm )

	A	B	C	D
0402	0.4~0.6	1.4~1.8	0.5~0.6	0.6~1.2
0603	0.8~1.2	2.2~2.8	0.6~1.0	0.9~1.5
0805	1.0~1.5	2.6~3.2	1.2~1.5	1.1~1.8
1206	1.8~2.5	4.2~5.2	1.2~1.8	1.2~1.8
1210	1.8~2.5	4.2~5.2	2.2~3.0	1.3~2.0
1812	2.5~3.3	5.5~6.7	2.8~3.6	1.3~2.2
2220	3.8~4.6	6.6~7.8	4.8~5.5	1.3~2.2

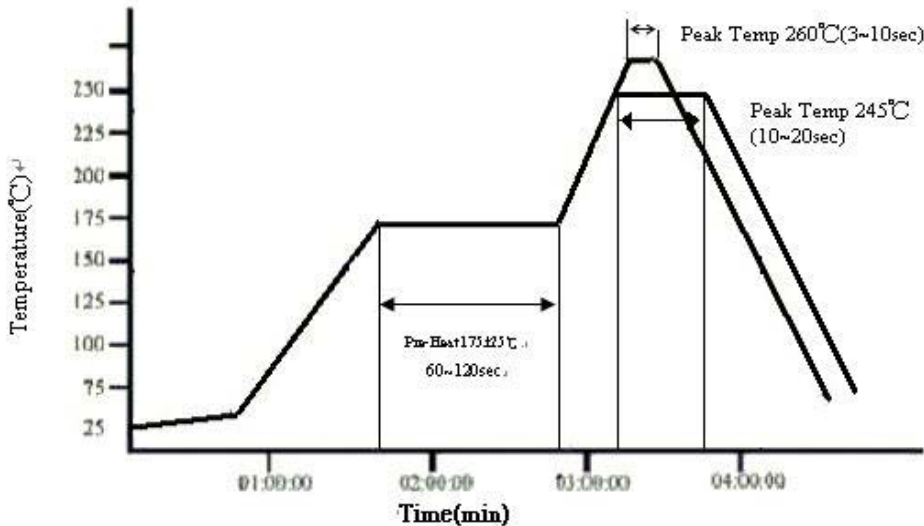


### 4.2 The SIR test of the solder paste shall be done ( Based on JIS-Z-3284 )

### 4.3 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

### 4.4 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 to Peak) + 3 /second max
- (3) Temp. maintain at 175 +/-25 180 seconds max
- (4) Temp. maintain above 217 60-150 seconds

<b>Part No. :</b>	SFI 2220ML C LF Series	<b>Document No.</b>	AS-RD2220_C_LF_Series	<b>REV.</b>	E
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# SFI Electronics Technology

## SMD Transient Voltage Suppressors

- (5) Peak temperature range 245 +20 / -10 time within 5 of actually peak temperature (tp)  
10~20 seconds
- (6) Ramp down rate +6 /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.

4.5 Resistance to soldering heat-High Temperature Resistance:260 ,10sec-3times.

#### 4.6 Hand Soldering

In hand soldering of the Varistors. Large temperature gradient between preheated the Varistors 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.

##### 4.6.1 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 Varistors 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 Varistors shall be cooled gradually at room ambient temperature.

##### 4.6.2 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 Varistors.

#### 4.7 Post Soldering Cleaning

- 4.7.1 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 Varistors 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.
- 4.7.2. When an ultrasonic cleaning is applied to the mounted Varistors 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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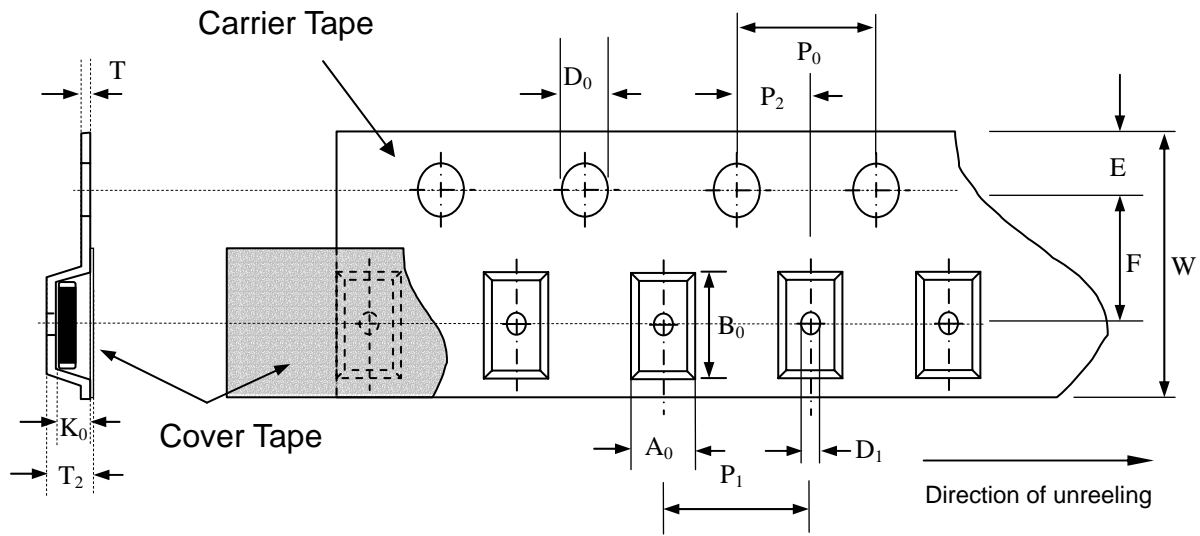


## 5. Packaging Specification

5.1 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.

5.2 The adhesion of the heat-sealed cover tape shall be  $40 \pm 20 / - 15$ grams.

5.3 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.

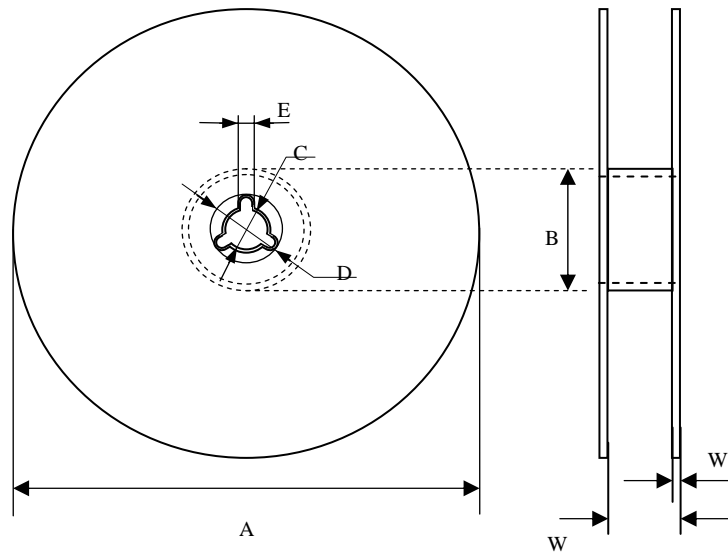


Symbol	$A_0$ $\pm 0.10$	$B_0$ $\pm 0.10$	$K_0$ $\pm 0.10$	$T$ $\pm 0.05$	$T_2$ $\pm 0.05$	$D_0$ $+0.10$ $-0.00$	$D_1$ $\pm 0.05$	$P_1$ $\pm 0.10$	$P_2$ $\pm 0.05$	$P_0$ $\pm 0.05$	$W$ $\pm 0.20$	$E$ $\pm 0.10$	$F$ $\pm 0.05$
<b>0402</b>	0.85	1.25	0.65	0.22	0.87	1.50	1.00	3.00	2.00	4.00	8.00	1.75	3.50
<b>0603</b>	1.08	1.88	0.95	0.22	1.17	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
<b>0805</b>	1.42	2.30	1.04	0.22	1.26	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
<b>1206</b>	1.88	3.50	1.27	0.22	1.49	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
<b>1210</b>	2.78	3.46	1.55	0.22	1.77	1.50	1.00	4.00	2.00	4.00	8.00	1.75	3.50
<b>1812</b>	3.66	4.95	1.74	0.25	1.99	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50
<b>2220</b>	5.10	5.97	2.80	0.25	3.05	1.50	1.50	8.00	2.00	4.00	12.00	1.75	5.50

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### 6.Reel Dimension



Symbol	A	B	C	D	E	W	W <sub>1</sub>
<b>0805</b>	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
<b>1206</b>	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
<b>1210</b>	178.0±1.0	60.0±0.5	13.0±0.2	21.0±0.2	2.0±0.5	9.0±0.50	1.5±0.15
<b>1812</b>	178.0±1.0	60.0±0.5	13.5±0.1	21.0±0.2	2.0±0.5	13.6±0.2	1.5±0.15
<b>2220</b>	178.0±1.0	60.0±0.5	13.5±0.1	21.0±0.2	2.0±0.5	13.6±0.2	1.5±0.15

### 7.Standard Packaging

Size	0402	0603	0805	1206	1210	1812	2220
Pcs	10000	4000	3000	3000	2000	1000	1000