



# APPROVAL SHEET

## Customer Information

|             |          |     |  |
|-------------|----------|-----|--|
| Customer :  |          |     |  |
| Part Name : |          |     |  |
| Part No. :  |          |     |  |
| Model No. : |          |     |  |
| COMPANY     | PURCHASE | R&D |  |
|             |          |     |  |

## Vendor Information

|           |                                       |
|-----------|---------------------------------------|
| Name:     | SFI ELECTRONICS TECHNOLOGY CORP. INC. |
| Part Name | Chip TVS                              |
| Part No.  | SFI0805ML470C-LF                      |
| Lot No.   |                                       |

|  |   |                |       |
|--|---|----------------|-------|
| SFI ELECTRONICS TECHNOLOGY INC.  |   |                |       |
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| Quality Control  | Document Control  | Business Issue |       |
| <br>ISO 9001:2000<br>ISO 14001:2004 | REV : H   | Prepared       | Check |
|  |  |                |       |

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### PART NO. SFI0805ML470C-LF

#### 1.1 Technology Data

|   | Symbol      | Value         | Unit |
|---|-------------|---------------|------|
| Maximum allowable continuous AC voltage at 50-60 Hz | $V_{RMS}$   | 30            | V    |
| Maximum allowable continuous DC voltage             | $V_{DC}$    | 38            | V    |
| Varistor voltage measured                           | $V_V$       | 47(42.3~51.7) | V    |
| Maximum clamping voltage                            | $V_{CLAMP}$ | < 77          | V    |
| Maximum Peak Current                                | $I_{Peak}$  | 100           | A    |

#### 1.2 Reference Data

|   |            |   |          |    |
|---|------------|---|----------|----|
| Maximum Energy Absorption *4                              | E          | > | 0.3      | J  |
| Typical capacitance value measured at 1K Hz               | C          |   | 150      | pF |
| Response time   | $T_{rise}$ | < | 1        | ns |
| Leakage current at $V_V \times 80\%$                      | $I_{VV}$   | < | 50       | uA |
| Leakage current at $V_V \times 80\%$ (After reality Test) | $I_{VVA}$  | < | 200      | uA |
| Operation ambient temperature                             |            |   | -50~ +85 | °C |
| Storage temperature                                       |            |   | -50~+125 | °C |

#### 1.3 Other Data

|                        |  |   |              |
|------------------------|--|---|--------------|
| Body                   |  |   | ZnO          |
| End termination        |  |   | Ag/Ni/Sn     |
| Packaging              |  |   | Reel         |
| Complies with Standard |  |   | IEC61000-4-5 |
| Lead Content           |  | < | 1000 ppm     |
| Marking                |  |   | None         |

#### Notes :

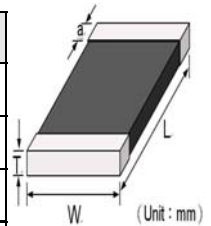
- \* 1 The varistor voltage was measured at 1 mA current.
- \* 2 The Clamping voltage was measured at 8\*20 us standard current.
- \* 3 The Leakage current was measured working voltage.
- \* 4 The Energy only for customer reference.
- \* 5 The components shall be employed within 1 year, in the nitrogen condition.

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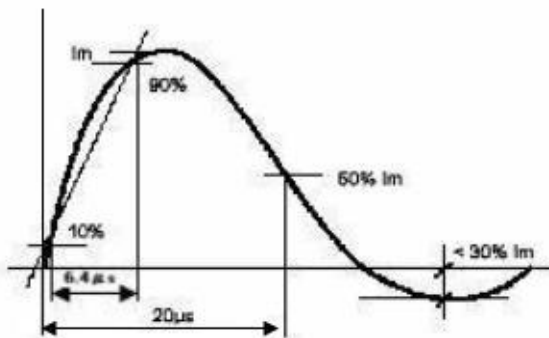
### 2. Size

| Model          | 0402(1005) | 0603(1608) | 0805(2012) | 1206(3216) | 1210(3225) | 1812(4532)   | 2220(5750)   |
|----------------|------------|------------|------------|------------|------------|--------------|--------------|
| Length(L)      | 1.00 ±0.10 | 1.60±0.15  | 2.00±0.20  | 3.20±0.20  | 3.20±0.20  | 4.50±0.20    | 5.70±0.20    |
| Width(W)       | 0.50 ±0.10 | 0.80±0.10  | 1.25±0.15  | 1.60±0.15  | 2.50±0.20  | 3.20±0.20    | 5.00±0.20    |
| Thickness(T)   | 0.60 max   | 0.90 max   | 1.20 max   | 1.50 max   | 1.50 max   | 2.00 max     | 2.50 max     |
| Termination(a) | 0.25±0.1   | 0.3±0.1    | 0.3±0.1    | 0.5±0.2    | 0.5±0.2    | 0.5+0.3/-0.1 | 0.5+0.3/-0.1 |



### 3. Surge Wave Form

Wave shape "Short circuit" (Current  $I_{sc}$ )



8/20  $\mu$ s waveform current (A)

### IEC61000-4-5 Standards

| SEVERITY LEVEL | T1         | T2           |
|----------------|------------|--------------|
| 1              | 8 $\mu$ s  | 20 $\mu$ s   |
| 2              | 10 $\mu$ s | 1000 $\mu$ s |

### 4. Environment Reliability Test

| Characteristic                   | Test method and description  |      |                           |               |
|----------------------------------|--|------|---------------------------|---------------|
| High Temperature Storage         | The specimen shall be subjected to $125 \pm 2^\circ\text{C}$ for $1000 \pm 12$ hours in a thermostatic bath without load and then stored at room temperature and normal 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 normal 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    | $-40 \pm 3^\circ\text{C}$ | 30Min $\pm$ 3 |
|                                  |  | 2    | Room Temperature          | 1 hour        |
|                                  |  | 3    | $125 \pm 3^\circ\text{C}$ | 30Min $\pm$ 3 |
| High Temperature Load            | After being continuously applied the maximum allowable voltage at $85 \pm 2^\circ\text{C}$ for $1000 \pm 2$ hours, the specimen shall be stored at room temperature and normal humidity for one or two hours, the change of varistor voltage shall be within 10% .               |      |                           |               |
| Damp Heat Load/<br>Humidity Load | The specimen should be subjected to $40 \pm 2^\circ\text{C}$ , 90 to 95 % RH environment, and the maximum allowable voltage applied for 1000 hours, then stored at room temperature and normal humidity for one or two hours. The change of varistor voltage shall be within 10% |      |                           |               |
| Low Temperature Storage          | The specimen should be subjected to $-40 \pm 2^\circ\text{C}$ , 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 %   |      |                           |               |

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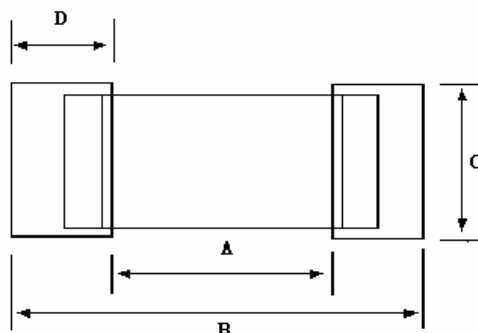


### 5. Soldering Recommendations

#### 5.1 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 | 0.9~1.2 | 2.7~3.2 | 0.7~1.0 | 0.9~1.2 |
| 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 |

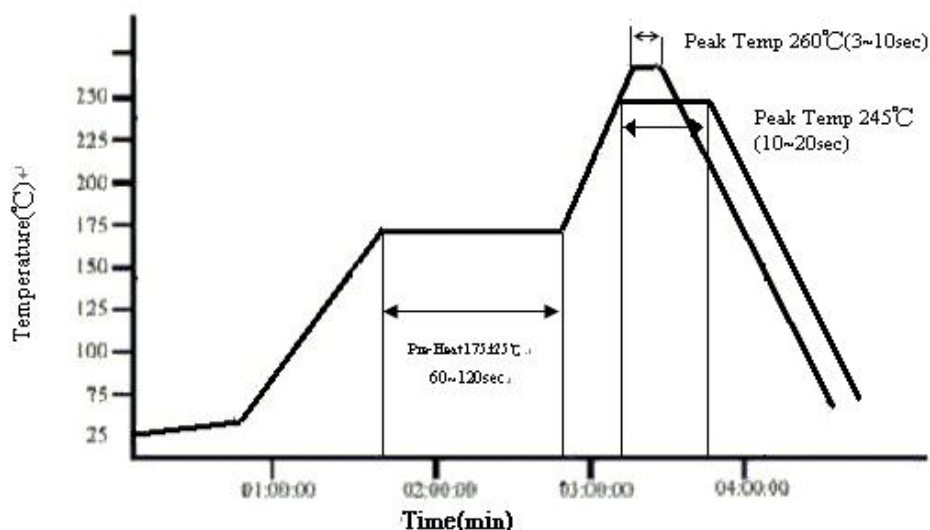


#### 5.2 The SIR test of the solder paste shall be done (Based on JIS-Z-3284)

#### 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  $\mu$ m
- (2) Ramp-up rate (217°C to Peak) + 3°C/second max
- (3) Temp. maintain at 175  $\pm$  25°C 180 seconds max
- (4) Temp. maintain above 217 °C 60-150 seconds

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- (5) Peak temperature range 245°C +20°C/ -10 °C time within 5 °C of actually peak temperature (tp) 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.

5.5 Resistance to soldering heat-High Temperature Resistance:260°C,10sec-3times.

### 5.6 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.

#### 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 Varistors shall be preheated so that Temperature Gradient between the devices and the tip of soldering iron is 150°C or below.
- (3) Soldering Iron  
Rated Power of 20w max with 3mm soldering tip in diameter.  
Temperature of soldering iron tip 380°C 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.

#### 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 Varistors.

### 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 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.
- 5.7.2. 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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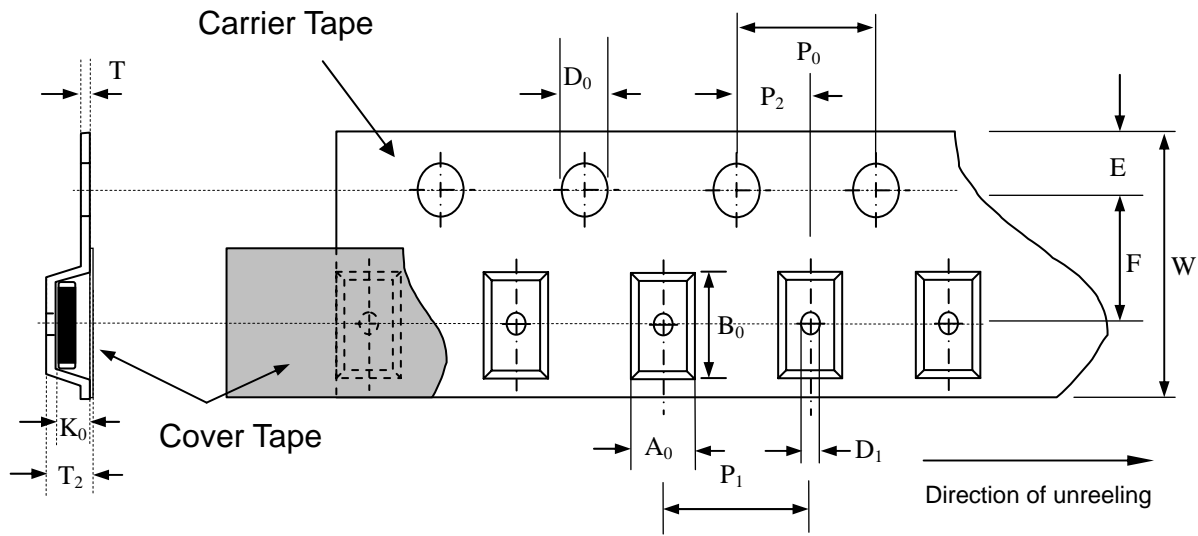


## 6. Packaging Specification

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  $40 \pm 20 / - 15$  grams.

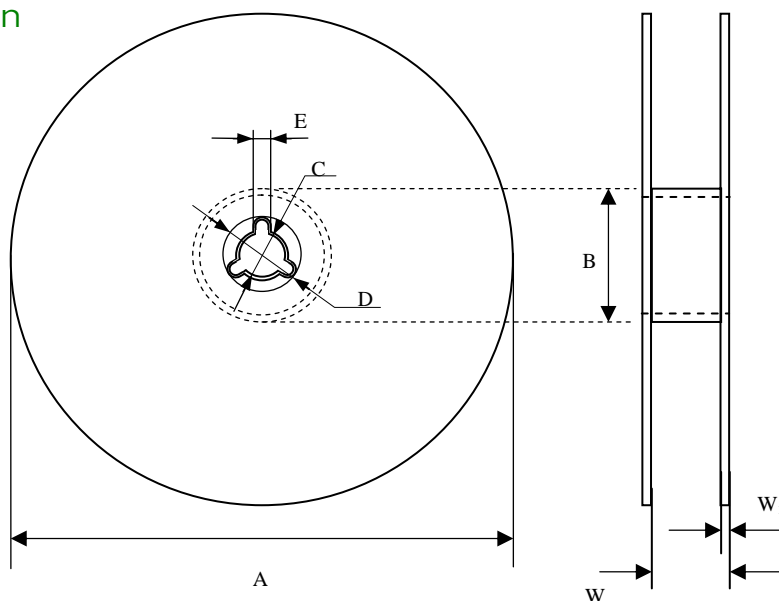
6.3 Both the head and the end portion of the taping shall be empty for reel package and SMT auto-pickup machine. And a normal paper tape shall be connected in the head of taping for the operator to handle.



| Symbol | $A_0$<br>$\pm 0.10$ | $B_0$<br>$\pm 0.10$ | $K_0$<br>$\pm 0.10$ | $T$<br>$\pm 0.05$ | $T_2$<br>$\pm 0.05$ | $D_0$<br>$+0.10$<br>$-0.00$ | $D_1$<br>$\pm 0.05$ | $P_1$<br>$\pm 0.10$ | $P_2$<br>$\pm 0.05$ | $P_0$<br>$\pm 0.05$ | $W$<br>$\pm 0.20$ | $E$<br>$\pm 0.10$ | $F$<br>$\pm 0.05$ |
|--------|---------------------|---------------------|---------------------|-------------------|---------------------|-----------------------------|---------------------|---------------------|---------------------|---------------------|-------------------|-------------------|-------------------|
| 0805   | 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              |
| 1206   | 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              |
| 1210   | 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              |
| 1812   | 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              |
| 2220   | 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              |



### 7. Reel Dimension



| Symbol      | A         | B        | C        | D        | E       | W        | W <sub>1</sub> |
|-------------|-----------|----------|----------|----------|---------|----------|----------------|
| <b>0402</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>0603</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>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       |

### 8. Standard Packaging

| Size | <b>0402</b> | <b>0603</b> | <b>0805</b> | <b>1206</b> | <b>1210</b> | <b>1812</b> | <b>2220</b> |
|------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Pcs  | 10000       | 4000        | 3000        | 3000        | 2000        | 1000        | 1000        |