



# 承认书

## APPROVAL SHEET

客户名称(Customer): \_\_\_\_\_

产品名称(Part Name): \_\_\_\_\_ 压敏电阻 Zinc Oxide Varistor

产品规格(Model/Type): \_\_\_\_\_ FNR-10K470

风华物料号(FENGHUA NO.): \_\_\_\_\_ FNR10K470BASN1NN

客户物料号(Customer NO.): \_\_\_\_\_

版本号(Version): \_\_\_\_\_ 20240402

日期(Date): \_\_\_\_\_ 2024. 04. 02

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| 制造       |     |     | 客户       |    |    |
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| 黄群喜      | 黄杰萍 | 梁戈仁 |          |    |    |



## 修订履历

### Modify resume

| 日期<br>Date   | 版本号<br>Version number | 描述<br>Describe | 作者<br>Writer |
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| 序号<br>No | 目 录<br>TABLE OF CONTENTS                  |
|----------|-------------------------------------------|
| 1.0      | 概述 Summary                                |
| 2.0      | 结构及尺寸 Structure And Dimensions            |
| 3.0      | 订货方式 How To Order                         |
| 4.0      | 电气性能 Performance Specification            |
| 5.0      | 可靠性 Reliability Data                      |
| 6.0      | 包装 Package                                |
| 7.0      | 环保情况说明 Environmental Protection Statement |
| 8.0      | 推荐使用的焊接曲线 Recommended soldering profile   |
| 9.0      | 贮存方法 Storage Methods                      |
| 10.0     | 使用注意事项 Precautions For Use                |
|          |                                           |

## 1.0 概述 Summary

### 产 品 性 能 Product performance

氧化锌压敏电阻器是以氧化锌为主要材料制造的半导体无极性电子陶瓷元件。

当施加在压敏电阻器两端的电压达到某一阈值时，压敏电阻器的电阻值迅猛变小，

从而在电子（电力）线路上起降压作用，达到保护其它元器件的目的。

Zinc Oxide Varistor are non-linear resistors utilizing semiconductor ceramic element which mainly composed of zinc oxide. When the applied voltage on both termination reach the surge value, the voltage of electronic circuit would be reduced to protect the other components.

#### 1.1 氧化锌压敏电阻特性如下图：

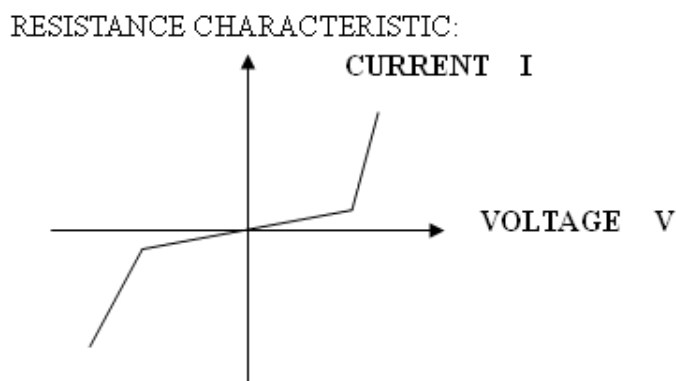


图 1 氧化锌压敏电阻电压 — 电流特性曲线  
ZINC OXIDE VARISTOR VOLTAGE-CURRENT CHARACTERISTIC CURVE

## 2.0 结构及尺寸 Structure And Dimensions

单位:mm

UNIT:mm

| 规格型号<br>TYPE | D    | $\phi d$   | F         | e         | H    | T   | L    |
|--------------|------|------------|-----------|-----------|------|-----|------|
|              | Max  | $\pm 0.08$ | $\pm 1.0$ | $\pm 1.0$ | Max  | Max | Min  |
| FNR-10K470   | 12.5 | 0.8        | 7.5       | 1.8       | 16.0 | 4.5 | 10.0 |

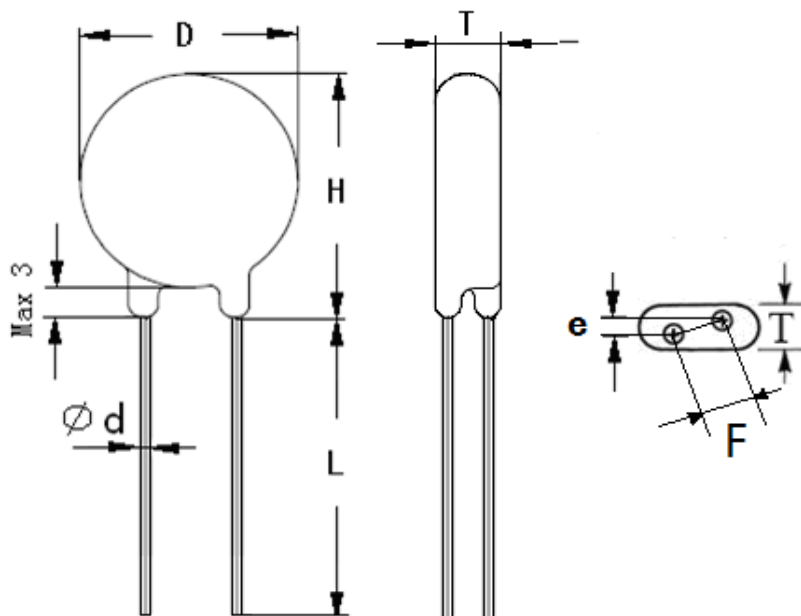
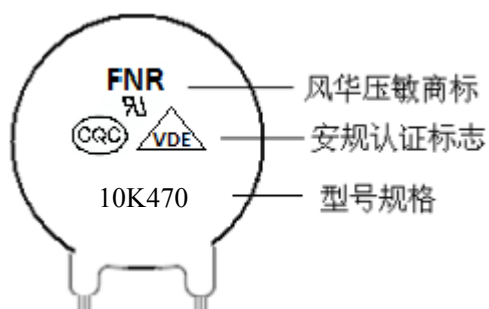


图 2

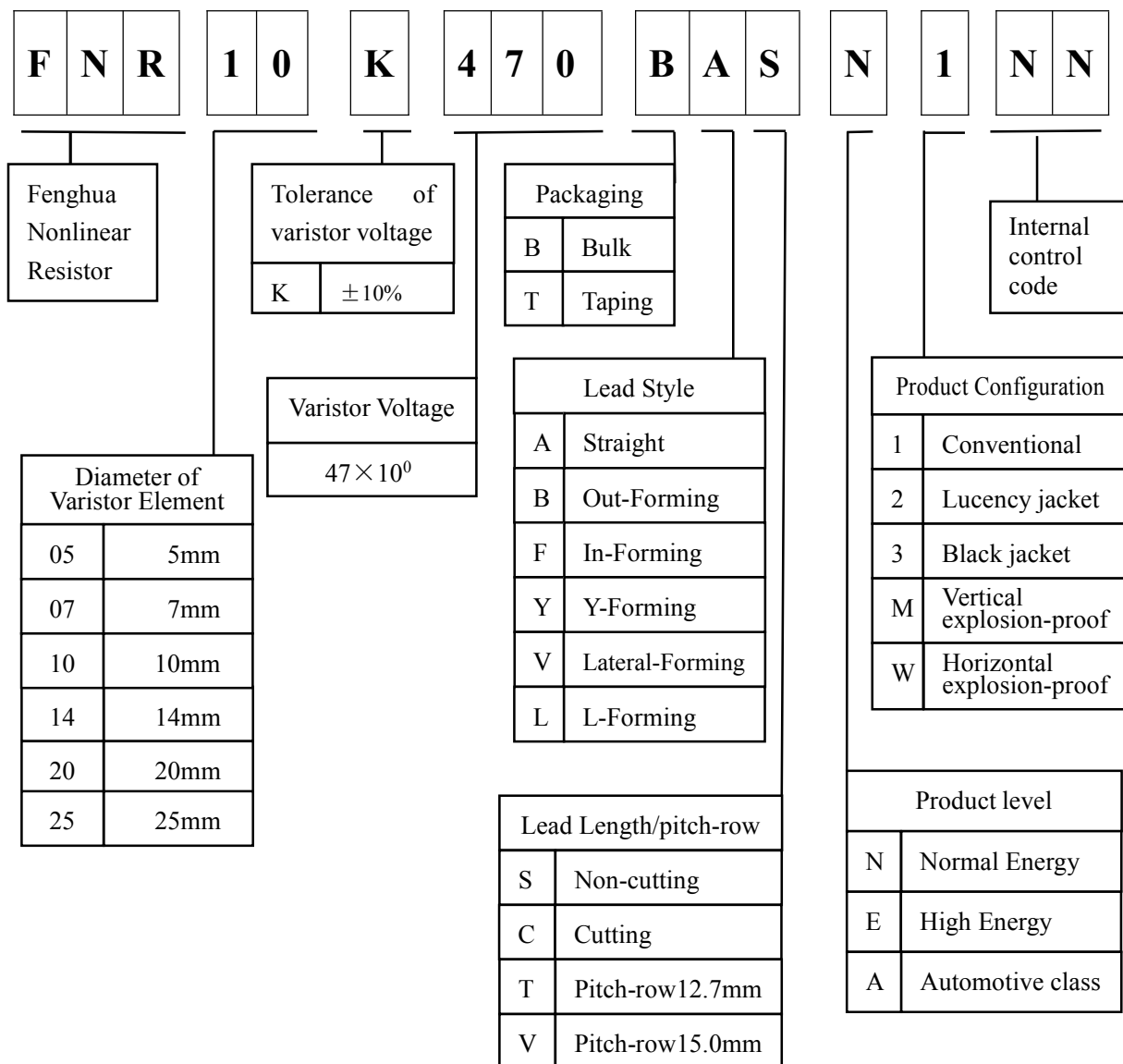
Graph 2

## 2.1 本体标识说明 Marking on Products





### 3.0 订货方式 How To Order



### 3.1 安规认证 Safety certification

| Safety certification<br>安规认证 | Certification number<br>证书编号 |
|------------------------------|------------------------------|
| UL                           | VZCA2.E325462                |
| VDE                          | 40008242                     |
| CQC                          | 05K: CQC14001111451          |
|                              | 07K: CQC14001111447          |
|                              | 10K: CQC14001111568          |
|                              | 14K: CQC14001111589          |
|                              | 20K: CQC14001111567          |



## 4.0 电气性能 Performance Specification

### 4.1 技术参数 Technical parameters

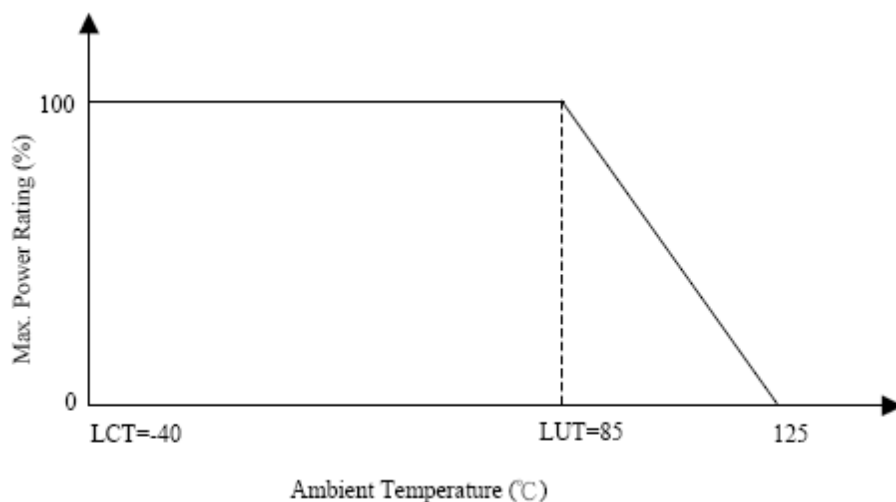
| 型号规格<br>Part No. | 压敏电压<br>Varistor Voltage | 最大允许使用电压<br>Max. Allowing Voltage |                    | 最大限制电压<br>Max. Clamping Voltage |                    | 最大通流容量<br>(8×20μs)<br>Max. Withstanding Surge Current |
|------------------|--------------------------|-----------------------------------|--------------------|---------------------------------|--------------------|-------------------------------------------------------|
|                  | V <sub>1mA</sub> (v)     | A <sub>c</sub> (v)                | D <sub>c</sub> (v) | V <sub>c</sub> (v)              | I <sub>p</sub> (A) | 1 Times                                               |
| FNR-10K470       | 47 (42.3~51.7)           | 30                                | 38                 | 93                              | 5                  | 500A                                                  |

| 型号规格<br>Part No. | 能量耐量<br>Energy 2mS | 额定功率<br>Rated Wattage | 静态电容量<br>(参考值)<br>Typical Capacitance | 工作温度<br>Operating Temperature | 存储温度<br>Storage Temperature |
|------------------|--------------------|-----------------------|---------------------------------------|-------------------------------|-----------------------------|
|                  | (J)                | W                     | Pf                                    | ℃                             | ℃                           |
| FNR-10K470       | 5.5                | 0.05                  | 2200                                  | -40~85                        | -40~125                     |

### 4.2 功率降额曲线 Power Derating Curve

在室温下操作超过85℃功率会按下图降级。

For operation at ambient temperature in excess of 85℃, the power should be derated in accordance with below figure.





## 5.0 可靠性 Reliability Data

| 序号<br>NO | 项目<br>Item                                                     | 测试方法<br>Test method                                                                                                                                                                                                                 | 特性<br>Performance                                                    |
|----------|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 5.1      | 最大允许使用电压<br>Maximum allowable voltage                          | 在使用温度范围内，连续施加在元件上，波形基本上是正弦波的最大交流电压和最大直流电压。<br>The maximum sine wave Voltage(rms) that can be applied continuously or maximum DC Voltage in the specified environ mental temperature range.                                          | 参见 4.0 电气性能<br>Performance Specification                             |
| 5.2      | 压敏电压<br>Varistor Voltage                                       | 在规定直流下所测得压敏电阻器两端电压<br>Voltage between both terminals of FNR measured when cmA of DC current is applied under standard conditions it is calledvc measuring. The Varistor Voltage should be made promptly to avoid heat affection.    | 参见 4.0 电气性能<br>Performance Specification                             |
| 5.3      | 限制电压<br>Clamping Voltage                                       | 在规定 8/20 $\mu$ S 冲击电流施加在压敏电阻器上时，其引出端间出现的电压峰值。<br>The maximum Voltage between two terminals with the specified standard impulse current (8/20 $\mu$ S)                                                                               | 参见 4.0 电气性能<br>Performance Specification                             |
| 5.4      | 最大通流容量<br>Maximum peak current<br>(withstanding surge current) | 在规定环境温度下，对于规定的脉冲次数而言，压敏电阻器中允许通过的每个规定脉冲的最大电流值。<br>The maximum current within the varistor voltage change of $\pm 10\%$ with the standard impulse (8/20 $\mu$ S) applied by the specified condition.                                  | 参见 4.0 电气性能<br>Performance Specification<br>$ \Delta V/V  \leq 10\%$ |
| 5.5      | 能量耐量<br>Maximum energy                                         | 在规定的最大冲击电流冲击下，压敏电压冲击前后变化率 $\leq \pm 10\%$<br>The maximum energy within the Varistor Voltage change of $\pm 10\%$ when the specified impulse is applied.                                                                             | 参见 4.0 电气性能<br>Performance Specification<br>$ \Delta V/V  \leq 10\%$ |
| 5.6      | 电压温度系数<br>Temperature coefficient of varistor Voltage          | 在规定温度下显示压敏电压的变化值。<br>Coefficient indicating dependency of Varistor Voltage on Specified temperature.                                                                                                                                | $TCR \leq \pm 0.05\%/^{\circ}\text{C}$                               |
| 5.7      | 静态电容量<br>Capacitance                                           | 在环境温度为 $20 \pm 2^{\circ}\text{C}$ ，测试频率为 $1\text{KHz} \pm 10\%$ ， $1\text{Vrms}$ (max) 下所测得的介电损失。<br>Dielectric loss tangent shall be measured at $1\text{KHz} \pm 10\%$ , $1\text{Vrms}$ max bias and $20 \pm 2^{\circ}\text{C}$ . | 参见 4.0 电气性能<br>Performance Specification                             |





## 5.0 可靠性 Reliability Data

| 序号<br>NO                      | 项目<br>Item                   | 测试方法<br>Test method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 特性<br>Performance                                                                                     |                          |                          |           |    |   |            |    |    |        |    |    |                                    |
|-------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|-----------|----|---|------------|----|----|--------|----|----|------------------------------------|
| 5.8                           | 端子强度<br>Terminal strength    | <p>端子抗拉强度:<br/>逐渐施加规定的力, 并保持装置固定 10±1 秒。<br/>Tensile Strength of Terminals:<br/>Gradually applying the force specified and keepingthe unit fixed for 10±1 sec.</p> <p>引线弯折试验:<br/>固定试样, 并将以下规定的力施加到每个引脚上。<br/>将样品弯曲至 90°, 然后回到原样位置。在相反的方向上重复此步骤。<br/>Bending Strength of Terminals:<br/>Hold specimen and apply the force specified below to each lead. Bend the specimen to 90°, then return to the original position. Repeat the procedure in the opposite direction.</p> <table><tr><td>引线直径<br/>Terminal diameter(mm)</td><td>抗拉拉力<br/>Tensile Force(N)</td><td>弯折拉力<br/>Bending Force(N)</td></tr><tr><td>0.5&lt;d≤0.8</td><td>10</td><td>5</td></tr><tr><td>0.8&lt;d≤1.25</td><td>20</td><td>10</td></tr><tr><td>1.25&lt;d</td><td>40</td><td>20</td></tr></table> | 引线直径<br>Terminal diameter(mm)                                                                         | 抗拉拉力<br>Tensile Force(N) | 弯折拉力<br>Bending Force(N) | 0.5<d≤0.8 | 10 | 5 | 0.8<d≤1.25 | 20 | 10 | 1.25<d | 40 | 20 | 外观无可见损伤。<br>No outstarding damage. |
| 引线直径<br>Terminal diameter(mm) | 抗拉拉力<br>Tensile Force(N)     | 弯折拉力<br>Bending Force(N)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                       |                          |                          |           |    |   |            |    |    |        |    |    |                                    |
| 0.5<d≤0.8                     | 10                           | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                       |                          |                          |           |    |   |            |    |    |        |    |    |                                    |
| 0.8<d≤1.25                    | 20                           | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                       |                          |                          |           |    |   |            |    |    |        |    |    |                                    |
| 1.25<d                        | 40                           | 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                       |                          |                          |           |    |   |            |    |    |        |    |    |                                    |
| 5.9                           | 振动试验<br>Resistance Vibration | <p>在重复进行一个单一谐振（振幅：0.75mm，频率范围:10~55Hz）循环 3 次持续时间 3 小时后,检查压敏电阻。<br/>After repeatedly applying a single harmonic vibration (amplitude; 0.75mm; double amplitude; 1.5mm with 1 minute vibration frequency cycles (10Hz~55Hz~10hZ) to each of three perpendicular directions for 2 hours. The varistor shall then be visually examined.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1、外观无可见损伤。<br>No outstarding damage.<br>2、 △V/V ≤5%                                                   |                          |                          |           |    |   |            |    |    |        |    |    |                                    |
| 5.10                          | 可焊性<br>Solderability         | <p>方法：槽焊法<br/>焊锡温度：235±5℃<br/>浸入时间：2±0.5 秒<br/>浸入深度：至引线根部 1.5~2.0mm<br/>浸入速度：25±2.5mm/sec<br/>Solder bath method<br/>Temperature of solder: 235±5℃<br/>Dipping Time: 2±0.5ses.<br/>Depth of immersion: up to 1.5~2.0mm from the root of the lead wire covered with thermal screen.<br/>Speed of immersion:25±2.5mm/sec.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                              | 上锡面积大于所浸总面积的 95%，且上锡面不应集中在一处。<br>Minimum 95% of the terminals should be covered with solder niformly. |                          |                          |           |    |   |            |    |    |        |    |    |                                    |



## 5.0 可靠性 Reliability Data

| 序号<br>NO | 项目<br>Item                                     | 测试方法<br>Test method                                                                                                                                                                                                                                                                                                 | 特性<br>Performance                                                                                                       |
|----------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 5.11     | 耐溶剂性<br>Permanency of marking                  | 70%的 1.1.2 三氯三氟乙烷和 30%的异丙醇的混合物；室温，浸渍 5min；用脱脂棉在正反两方向各擦拭 5 次，共 10 次<br>70±5% Diethylenglycoldibutylether, 30±5% 2-propanol).<br>Rubbing material: Cotton wool<br>F = 5±0,5 N, 10 strokes                                                                                                                             | 无损伤、标志清楚，容易辨认。There shall be no damage and legibly marked. Marking can be deciphered easily.<br>$ \Delta V/V  \leq 5\%$ |
| 5.12     | 耐焊接热<br>Resistance to soldering heat           | 槽焊法<br>焊锡温度：260±5℃<br>浸入时间：10±1 秒<br>浸入深度：至引线根部 1.5~2.0mm<br>浸入速度：25±2.5mm/sec<br>Solder bath method<br>Temperature of solder: 260±5℃<br>Dipping Time: 10±1ses.<br>Depth of immersion: up to 1.5~2.0mm from the root of the lead wire covered with thermal screen.<br>Speed of immersion: 25±2.5mm/sec.             | $ \Delta V/V  \leq 5\%$                                                                                                 |
| 5.13     | 稳态湿热<br>Resistance to damp heat (steady state) | 试验温度：40±2℃<br>试验时间：1000h<br>相对湿度：90~95%RH<br>试验后，电阻器在标准大气条件下 1~2 小时，然后测试参数。<br>Test Temperature: 40±2℃.<br>Test time: 1000h<br>Relative humidity: 90~95%.<br>After completion of test, the varistor shall be subjected to standard atmospheric conditions for 1 to 2 hours. After which measurements shall be made. | 1、外观无可见损伤。<br>No outstarding damage<br>2、 $ \Delta V/V  \leq 10\%$                                                      |
| 5.14     | 上限类别温度耐久性<br>High temperature load             | 施加电压：最大连续交流电压。<br>试验温度：85±2℃<br>试验时间：1000h<br>After being continuously applied the maximum allowable voltage at 85±2℃ for 1000 hours, the specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of Vc shall be measured.                                               | 1、外观无可见损伤。<br>No outstarding damage.<br>2、 $ \Delta V/V  \leq 10\%$                                                     |

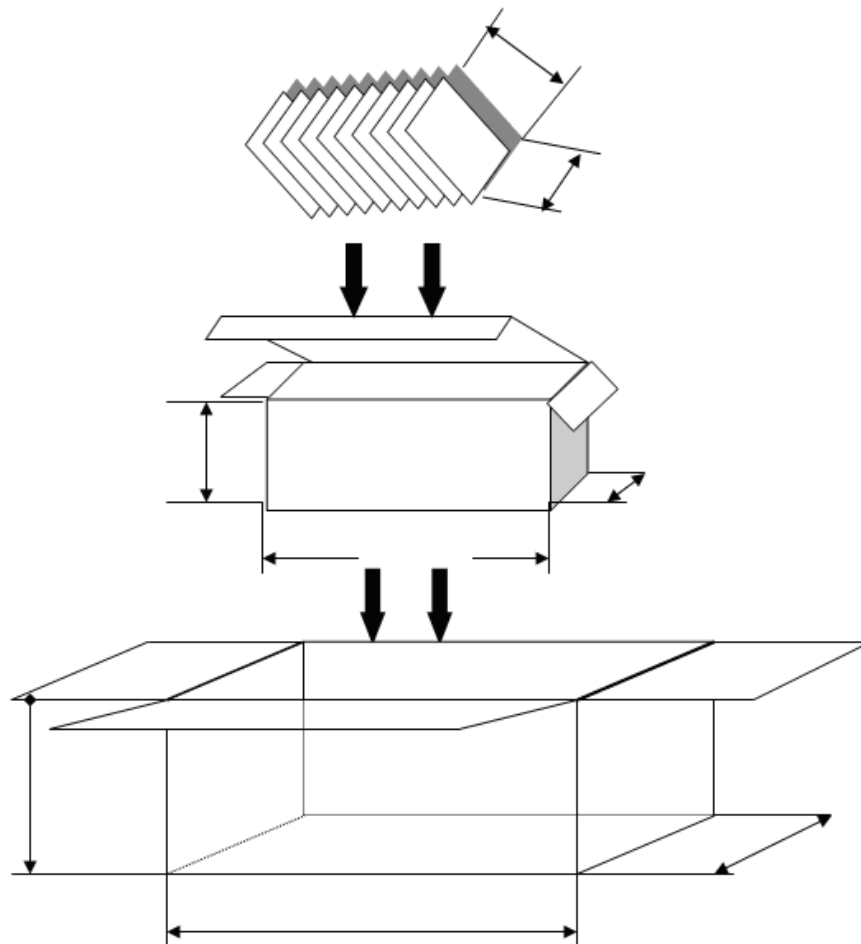


## 5.0 可靠性 Reliability Data

| 序号<br>NO | 项目<br>Item                         | 测试方法<br>Test method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 特性<br>Performance                                   |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
|----------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------|--------|---|--------|-------|---|------------|-------|---|--------|-------|---|------------|-------|-----------------------------------------------------|
| 5.15     | 高温贮存试验<br>Shelf life test          | 在 125±2℃ 环境下无负荷贮 1000h。<br>The Zinc oxide varistor are then stored with no voltage applied at a temperature of 125±2℃ for 1000h.                                                                                                                                                                                                                                                                                                                                                                               | 1、外观无可见损伤。<br>No outstarding damage<br>2、 △V/V ≤5%  |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 5.16     | 温度快速变化<br>Temperature cycling      | 温度循环应重复 5 次，并在室温和湿度下保存 1 至 2 小时。检查 VC 和机械损伤的变化。<br>The temperature cycling shall be repeated 5 times and stored at room temperature and humidity for 1 to 2 hours. The change of Vc as well as mechanical damage shall be examined. <table><tr><td>Step</td><td>Temp.</td><td>Period</td></tr><tr><td>1</td><td>-40±3℃</td><td>30min</td></tr><tr><td>2</td><td>Room Temp.</td><td>15min</td></tr><tr><td>3</td><td>+85±2℃</td><td>30min</td></tr><tr><td>4</td><td>Room Temp.</td><td>15min</td></tr></table> | Step                                                | Temp. | Period | 1 | -40±3℃ | 30min | 2 | Room Temp. | 15min | 3 | +85±2℃ | 30min | 4 | Room Temp. | 15min | 1、外观无可见损伤。<br>No outstarding damage.<br>2、 △V/V ≤5% |
| Step     | Temp.                              | Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                     |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 1        | -40±3℃                             | 30min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 2        | Room Temp.                         | 15min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 3        | +85±2℃                             | 30min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 4        | Room Temp.                         | 15min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 5.17     | 低温贮存试验<br>Cold temperature storage | 在-40±2℃ 环境下无负荷贮放 1000h。<br>The specimen shall be subjected to -40±2℃ without load for 1000 hours and then stored at room temperature for 1 to 2 hours. Thereafter, the change of Vc shall be measured.                                                                                                                                                                                                                                                                                                         | 1、外观无可见损伤。<br>No outstarding damage<br>2、 △V/V ≤5%  |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |
| 5.18     | 脉冲寿命<br>Impulse life               | 固定冲击电流用 8/20μS 标准波冲击 10000 次，时间间隔 10S，恢复时间室温 1～2 小时。<br>After the specified impulse is applied 10000 times continuously with the interval 10 seconds at room temperature. The specimen shall be stored at room temperature and humidity for 1 to 2 hours. Thereafter,                                                                                                                                                                                                                                          | 1、外观无可见损伤。<br>No outstarding damage<br>2、 △V/V ≤10% |       |        |   |        |       |   |            |       |   |        |       |   |            |       |                                                     |



## 6.0 包装 Package



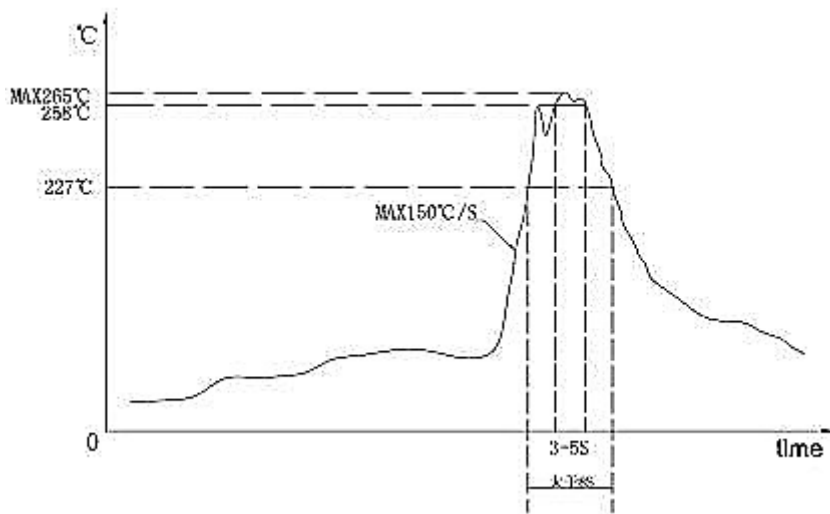
## 7.0 环保情况说明 Environmental Protection Statement

我司提供的所有压敏电阻物料均符合最新欧盟 ROHS 指令及 Reach 法规要求，请贵司放心使用。

We provide all varistor materials conform to the requirements of the latest eu ROHS directive and the Reach regulation, please rest assured to use.

## 8.0 推荐使用的焊接曲线 Recommended soldering profile

### 8.1 波峰焊接曲线要求 Wave soldering curve requirements:



注意:

- A) 焊接最高温度为 265℃，物料最大承受温度应满足在 265℃ 5S 的焊接时间。
- B) 元件引脚能承受 150℃/S 的热冲击, 且能循环 2 次以上。
- C) 插件元器件的本体塑封（塑胶部分）必须在 60-90 秒内耐 120℃ 高温。
- D) 能保证在 227℃-265℃ 承受 8S 连续焊接时间，258℃-265℃ 5S 的焊接时间。

## 9.0 贮存方法 Storage Methods

元器件必须储存在清洁、通风、无腐蚀性气体的仓库内；除另有规定外，仓库的温度和相对湿度必须满足如下要求：a.温度：5~30℃；b 相对湿度： 20%~75%；存储期限：1 年。

Components must be stored in a clean, ventilated, non-corrosive gases warehouse; Unless otherwise specified, the warehouse temperature and relative humidity must meet the following requirements: a.Temperature: 5 ~ 30 °C;b. Relative humidity: 20% ~ 75%; Period of Storage: 1 year.

## 10.0 使用注意事项 Precautions For Use

1、工作环境温度应该在技术条件规定的范围以内。

Working environment temperature should be within the prescribed scope of technical conditions.

2、不应该靠近发热或可燃元器件安装，最好有大于 3 毫米的间隔，以免损坏元器件。

Near a fever or flammable components should not be installed, it is better to have more than 3 mm intervals, so as not to damage the components.

3、接触引脚时请先佩戴手套。

Please wear gloves when the contact pin.