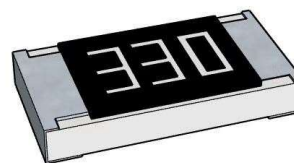


FRS-Series  
Anti-Surge Thick Film Chip Resistor  
**FRS 系列抗浪涌厚膜晶片电阻器规格说明书**



■ 抗浪涌厚膜晶片电阻 (Anti-Surge Thick Film Chip Resistor)



■应用(Application)

- Telecommunications
- Power supplies
- Car electronics
- 电信
- 电源供应器
- 汽车电力

■特性(Features)

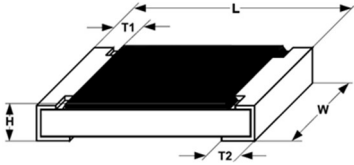
- Small size and light weight
- Reliability, high quality
- Special material and design for high working voltage require
- 体积小, 重量轻
- 可靠性, 高质量
- 对高工作电压要求的特殊材质和设计

■料号说明(Parts Number Explanation):

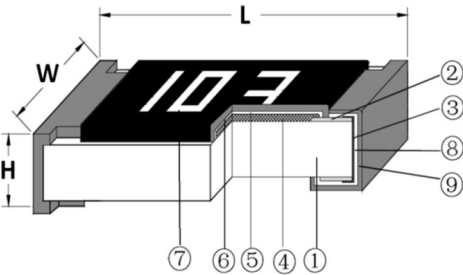
示例 Example: FRS1206J103TS

| F<br>公司名     | R<br>产品别                                                            | S<br>功能别                                                                                                                                                         | 1206<br>型别                                                   | J<br>公差                                                                                          | 103<br>字码                                                                                                                                                      | I<br>包装别                                                        | S<br>端电极                | 特殊型                    |
|--------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------|------------------------|
| FOJAN        | R: Resistor<br>C: Capacitor<br>L: Inductor<br>D: Diode<br>A: Audion | C: Normal<br>P: Hi-Power<br>L: Low ohmic<br>A: Array<br>S: Surge<br>H: Hi-Precision<br>V: Hi-Voltage<br>Q: Auto-motive<br>R: Anti-sulfur<br>M: Metal<br>D: (LED) | 0201<br>0402<br>0603<br>0805<br>1206<br>1210<br>2010<br>2512 | B: $\pm 0.1\%$<br>C: $\pm 0.25\%$<br>D: $\pm 0.5\%$<br>F: $\pm 1\%$<br>J: $\pm 5\%$<br>P: Jumper | $\pm 5\%$ : E24<br>3-digits+blank<br>102=1K $\Omega$<br>1R0=1 $\Omega$<br><br>$\pm 1\%$ &Below:<br>E24+E96:<br>4-digits<br>1001=1K $\Omega$<br>1R00=1 $\Omega$ | T: 7 inch reel<br>Q: 10 inch reel<br>R: 13 inch reel<br>B: Bulk | S: Sn<br>C: Cu<br>A: Au | N:<br>Normal<br>D: LED |
| Company code | Type code                                                           | Functional code                                                                                                                                                  | Size code                                                    | Tolerance code                                                                                   | Resistance code                                                                                                                                                | Packaging code                                                  | Termination code        | Special code           |

尺寸 (Dimension)

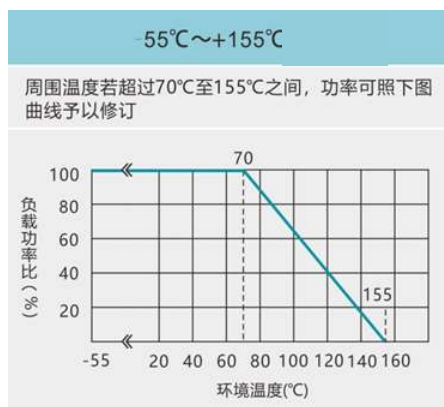
| 尺寸<br>dimension | <br>单位 (unit) : mm |           |           |           |           |
|-----------------|-----------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|
| 型别 (Type)       | L                                                                                                   | W         | H         | T1        | T2        |
| 0603            | 1.60±0.10                                                                                           | 0.80±0.10 | 0.45±0.10 | 0.25±0.15 | 0.25±0.15 |
| 0805            | 2.00±0.10                                                                                           | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.35±0.20 |
| 1206            | 3.10±0.10                                                                                           | 1.60±0.10 | 0.55±0.10 | 0.45±0.20 | 0.40±0.20 |
| 1210            | 3.10±0.10                                                                                           | 2.50±0.15 | 0.55±0.10 | 0.45±0.15 | 0.50±0.20 |
| 2010            | 5.00±0.10                                                                                           | 2.50±0.15 | 0.55±0.10 | 0.45±0.15 | 0.50±0.20 |
| 2512            | 6.35±0.10                                                                                           | 3.10±0.15 | 0.55±0.10 | 0.60±0.20 | 0.90±0.20 |

电阻结构 (Construction)



| NO. | 结构<br>construction             | 主要材料<br>Major material                  |
|-----|--------------------------------|-----------------------------------------|
| 1   | 陶瓷基板<br>Ceramic substrate      | 氧化铝<br>$\text{Al}_2\text{O}_3$          |
| 2   | 银电极<br>Conductive layer        | 银<br>Ag                                 |
| 3   | 侧电极<br>Side conductive layer   | 镍铬合金<br>NiCr                            |
| 4   | 阻体层<br>Resistive layer         | 氧化钌+玻璃<br>$\text{RuO}_2 + \text{glass}$ |
| 5   | 内保护层<br>Inner protective layer | 玻璃<br>Glass                             |
| 6   | 外保护层<br>Outer Protective layer | 环氧树脂<br>Epoxy                           |
| 7   | 文字<br>Marking                  | 环氧树脂<br>Epoxy                           |
| 8   | 镍电极<br>Ni plating layer        | 镍<br>Ni                                 |
| 9   | 锡电极<br>Sn plating layer        | 锡<br>Matte Tin                          |

## ■功率衰减曲线 ( Derating Curve)



## ■阻值范围 (Resistance range) :

| 型别 Type | 阻值范围<br>Resistance Range |         |         |          |          |
|---------|--------------------------|---------|---------|----------|----------|
|         | D (±0.5%)                | F (±1%) | J (±5%) | K (±10%) | M (±20%) |
| 0603    | 1Ω~1MΩ                   | 1Ω~1MΩ  | 1Ω~10MΩ | 1Ω~10MΩ  | 1Ω~10MΩ  |
| 0805    | 1Ω~1MΩ                   | 1Ω~1MΩ  | 1Ω~10MΩ | 1Ω~10MΩ  | 1Ω~10MΩ  |
| 1206    | 1Ω~1MΩ                   | 1Ω~1MΩ  | 1Ω~10MΩ | 1Ω~10MΩ  | 1Ω~10MΩ  |
| 1210    | 1Ω~1MΩ                   | 1Ω~1MΩ  | 1Ω~10MΩ | 1Ω~10MΩ  | 1Ω~10MΩ  |
| 2010    | 1Ω~1MΩ                   | 1Ω~1MΩ  | 1Ω~10MΩ | 1Ω~10MΩ  | 1Ω~10MΩ  |
| 2512    | 1Ω~1MΩ                   | 1Ω~1MΩ  | 1Ω~10MΩ | 1Ω~10MΩ  | 1Ω~10MΩ  |

如有非标准品的需求,请联系我们的业务部门 For non-standard parts, please contact our sales dept.

## ■电气特性 (Electrical characteristics)

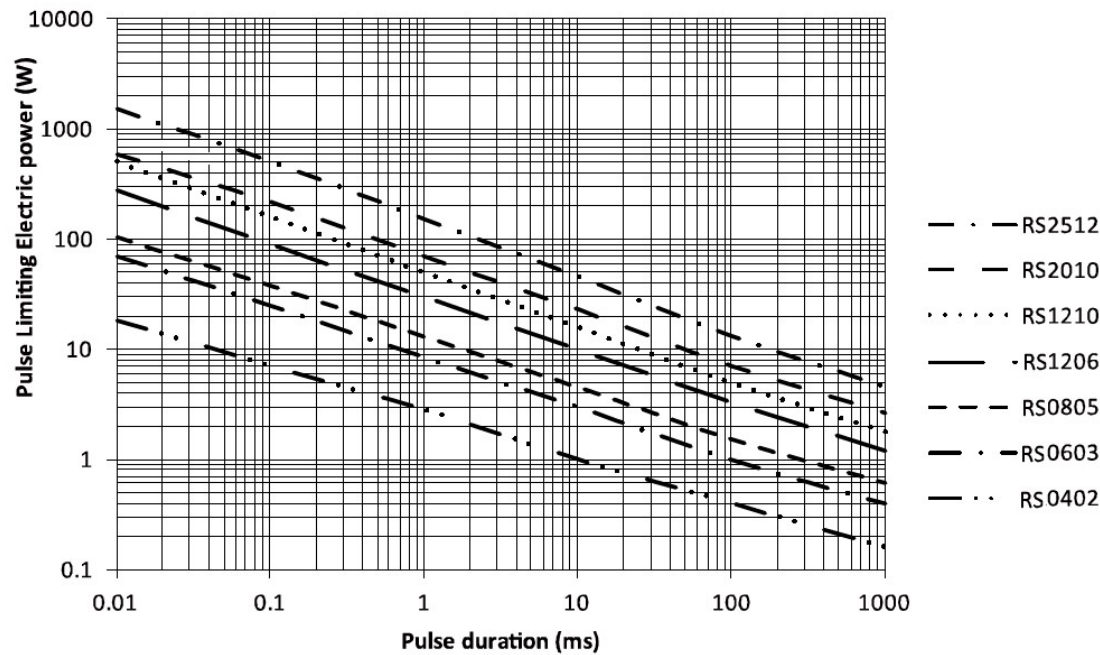
| 型别 Type                                 | 0603 | 0805 | 1206 | 1210 | 2010 | 2512 |
|-----------------------------------------|------|------|------|------|------|------|
| 绝缘耐压<br>Dielectric Withstanding Voltage | 150V | 300V | 500V | 500V | 500V | 500V |

电性规格 (Standard Electrical Specifications)

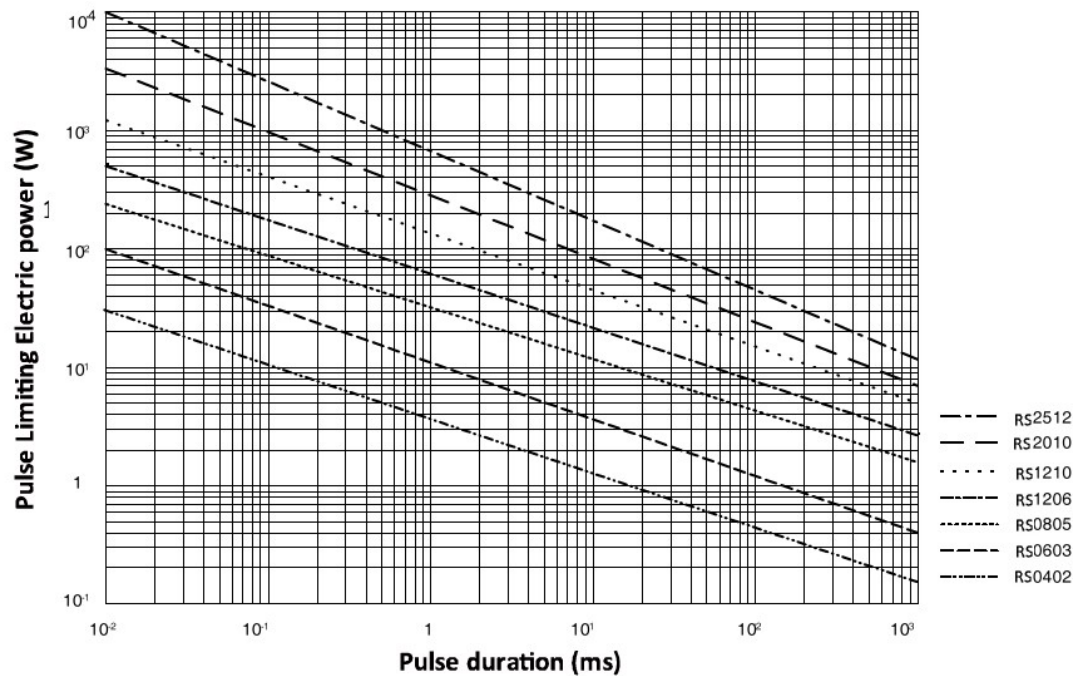
| 型别<br>Type | 额定功率<br>(Power Rating<br>at 70°C) | 最高工作电压<br>Max. RCWV | 最大过负荷电压<br>Max. Overload Voltage | T.C.R.<br>(PPM/°C)       | 阻值范围<br>Resistance Range |
|------------|-----------------------------------|---------------------|----------------------------------|--------------------------|--------------------------|
| 0603       | 1/10W                             | 75V                 | 150V                             | ±200PPM/°C<br>±100PPM/°C | 1Ω~10Ω<br>10Ω~10MΩ       |
| 0805       | 1/8W                              | 150V                | 300V                             |                          |                          |
| 1206       | 1/4W                              | 200V                | 400V                             |                          |                          |
| 1210       | 1/2W                              | 200V                | 400V                             |                          |                          |
| 2010       | 3/4W                              | 200V                | 400V                             |                          |                          |
| 2512       | 1W                                | 200V                | 400V                             |                          |                          |

脉冲曲线 (Pulse Load Behavior)

公差 Tolerance: ±0.50%、±1.00%如下:



公差 Tolerance: ±5.00%、±10.00%、±20.00%如下:



性能 (Performance Specifications)

| 内容<br>Item                         | 测试方法<br>Test Methods | 测试条件<br>Test Conditions                                                                                                                                                                                                                       | 规格<br>Specification                                  |
|------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| 温度系数<br>Temperature<br>Coefficient | JIS C 5201 4.8       | $TCR = (R - R_0) / (t - t_0) R_0 \times 10^6 \text{ (ppm)}$<br>R0 电阻在室温下的阻值(resistance<br>at room temperature)<br>R 电阻在 125℃或-55℃下的阻值<br>(resistance at 125℃ or -55℃)<br>t0 室温(room temperature)<br>t 测试温度 (test temperature 125℃<br>or -55℃) | 1Ω<R≤10Ω:<br>±200 PPM/℃<br>10Ω<R≤10MΩ:<br>±100 PPM/℃ |

| 内容<br>Item                              | 测试方法<br>Test Methods | 测试条件<br>Test Conditions                                                                                                                                                                                                                      | 规格<br>Specification                                                                          |
|-----------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 短时间过负荷<br>Short-time overload           | JIS C 5201 4.13      | 加载 2.5 倍的额定电压, 时间 5 秒后测量试验前后的阻值变化率。<br>Applied 2.5 times of rated voltage for 5 second. Measure the variation of resistance.                                                                                                                 | $\pm(1.00\% + 0.05\Omega)$                                                                   |
| 焊锡性 Solderability                       | JIS C 5201 4.17      | 沾助焊剂后浸入锡炉, 锡炉温度 $245\pm 5^{\circ}\text{C}$ , 时间 $3\pm 0.5$ 秒。<br>Dip the terminal in a flux and then dip into a soldering bath at $245\pm 5^{\circ}\text{C}$ for $3\pm 0.5\text{sec}$ .                                                      | > 95%面积上锡<br>( > 95% coverage)                                                               |
| 抗焊锡热<br>Resist to soldering heat        | JIS C 5201 4.18      | 沾助焊剂后浸入锡炉, 锡炉温度 $260\pm 5^{\circ}\text{C}$ , 时间 $10\pm 0.5$ 秒, 测量试验前后的阻值变化率。<br>Dip the terminal in a flux and then dip into a soldering bath at $260\pm 5^{\circ}\text{C}$ for $10\pm 0.5\text{sec}$ . Measure the variation of resistance. | $\pm(1.00\% + 0.05\Omega)$                                                                   |
| 绝缘电阻<br>Insulation resistance           | JIS C 5201 4.6       | 电阻本体上加载绝缘耐压 $60\pm 5$ 秒后, 测量绝缘阻抗。<br>Applied the dielectric withstanding voltage on the center of body for $60\pm 5\text{seconds}$ . Then measure insulation resistance.                                                                     | > $10\text{G}\Omega$                                                                         |
| 绝缘耐压<br>Dielectric withstanding voltage | JIS C 5201 4.7       | 电阻本体上加载绝缘耐压 $60\pm 5$ 秒。<br>Applied the dielectric withstanding voltage on the center of body for $60\pm 5\text{seconds}$ .                                                                                                                  | 无击穿、飞弧及可见机械性损伤<br>No evidence of flashover, mechanical damage arcing or insulation breakdown |

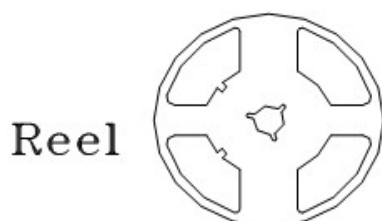
| 内容<br>Item                  | 测试方法<br>Test Methods | 测试条件<br>Test Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                   | 规格<br>Specification        |
|-----------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 端子弯曲<br>Terminal bending    | JIS C 5201 4.33      | <p>电阻焊接在测试板上进行弯折,弯折保持时间 <math>20\pm 1</math> 秒, 1206(含) 以下的尺寸弯曲 <math>5+0.2/0</math> mm; 1206 以上的尺寸弯曲 <math>2+0.2/0</math> mm; 量测试验前后阻值变化率</p> <p>Specimen shall be mounted on test board, then bend the board and maintained for <math>20\pm 1</math>s. the distance of bending is <math>5+0.2/0</math> mm for resistors which size no larger than 1206 or <math>2+0.2/0</math> mm which size larger than 1206. Measure the variation of resistance.</p> | $\pm(1.00\% + 0.05\Omega)$ |
| 温度循环<br>Temperature Cycling | JIS C 5201 4.19      | <p>电阻放入温度循环机中, 温度 <math>155\pm 2^{\circ}\text{C}</math> 至 <math>-55\pm 3^{\circ}\text{C}</math>, 共 5 个循环。量测试验前后阻值变化率。</p> <p>Put specimen in a chamber which temperature can be changed to <math>155\pm 2^{\circ}\text{C}</math> or <math>-55\pm 3^{\circ}\text{C}</math>, repeated 5 times. Measure the variation of resistance.</p>                                                                                                                     | $\pm(2.00\% + 0.05\Omega)$ |
| 耐湿特性<br>Humidity            | JIS C 5201 4.24      | <p>电阻放入恒温恒湿箱, 温度 <math>40\pm 2^{\circ}\text{C}</math>, 湿度 90~95 %RH;通电额定电压 1.5 小时, 断电 0.5 小时; 重复通断电至试验时间 <math>1000^{+48}/_{-0}</math> 小时。量测试验前后阻值变化率。</p> <p>Put the specimen in a chamber at <math>40\pm 2^{\circ}\text{C}</math> temperature and 90~95% relative humidity, then applied rated voltage for 1.5H and rested for 0.5H repeatedly till total test time is <math>1000^{+48}/_{-0}</math> H. Measure the variation of resistance.</p>        | $\pm(2.00\% + 0.05\Omega)$ |

| 内容<br>Item                  | 测试方法<br>Test Methods   | 测试条件<br>Test Conditions                                                                                                                                                                                                                                                                                                                                                                                                                                   | 规格<br>Specification        |
|-----------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 负荷寿命<br>Load life           | JIS C 5201 4.25.1      | 电阻放入恒温箱中, 温度 $70\pm 2^{\circ}\text{C}$ , ON TIME:1.5H, OFF TIME:0.5H, 通电额定电压 1000 $^{+24}/_{-0}$ 小时, 量测试验前后阻值变化率.<br>Put the specimen in a chamber at $70\pm 2^{\circ}\text{C}$ temperature, ON TIME:1.5H, OFF TIME:0.5H, and applied rated voltage for 1000 $^{+24}/_{-0}$ H. Measure the variation of resistance.                                                                                                                                       | $\pm(2.00\% + 0.05\Omega)$ |
| 温湿循环<br>Moisture resistance | MIL-STD-202 METHOD 106 | 25 $^{\circ}\text{C}$ ~65 $^{\circ}\text{C}$ , 90~100%RH, 2.5 小时;<br>65 $^{\circ}\text{C}$ 90~100%RH, 3 小时;<br>65 $^{\circ}\text{C}$ ~25 $^{\circ}\text{C}$ , 80~100%RH, 2.5 小时, 10 个循环, 试验结束 24 $\pm$ 4 小时后进行测试.<br>25 $^{\circ}\text{C}$ ~65 $^{\circ}\text{C}$ , 90~100%RH, 2.5H; 65 $^{\circ}\text{C}$ 90~100%RH, 3H; 65 $^{\circ}\text{C}$ ~25 $^{\circ}\text{C}$ 80~100%RH, 2.5H, 10 cycles, Measurement at 24 $\pm$ 4 hours after test conclusion. | $\pm(2.00\% + 0.05\Omega)$ |

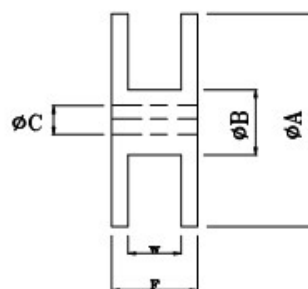
## 包装规格 (Tapping Specification)

### -卷盘尺寸 (Reel dimension)

| Type                | Size |          | Unit | A             | B               | C              | F              | W              |
|---------------------|------|----------|------|---------------|-----------------|----------------|----------------|----------------|
| 0603/0805/1206/1210 | 7"   | 5K/Reel  | mm   | 178 $\pm$ 2.0 | 60.0 $\pm$ 1.0  | 13.5 $\pm$ 0.5 | 11.4 $\pm$ 0.1 | 9.00 $\pm$ 0.3 |
| 0603/0805/1206      | 10"  | 10K/Reel | mm   | 254 $\pm$ 2.0 | 100.0 $\pm$ 1.0 | 13.5 $\pm$ 0.5 | 11.4 $\pm$ 0.1 | 9.00 $\pm$ 0.3 |
| 0603/0805/1206      | 13"  | 20K/Reel | mm   | 330 $\pm$ 2.0 | 100.0 $\pm$ 1.0 | 13.5 $\pm$ 0.5 | 11.4 $\pm$ 0.1 | 9.00 $\pm$ 0.3 |
| 2010/2512           | 7"   | 4K/Reel  | mm   | 178 $\pm$ 2.0 | 60.0 $\pm$ 1.0  | 13.5 $\pm$ 0.5 | 15.4 $\pm$ 1.0 | 13.0 $\pm$ 0.3 |

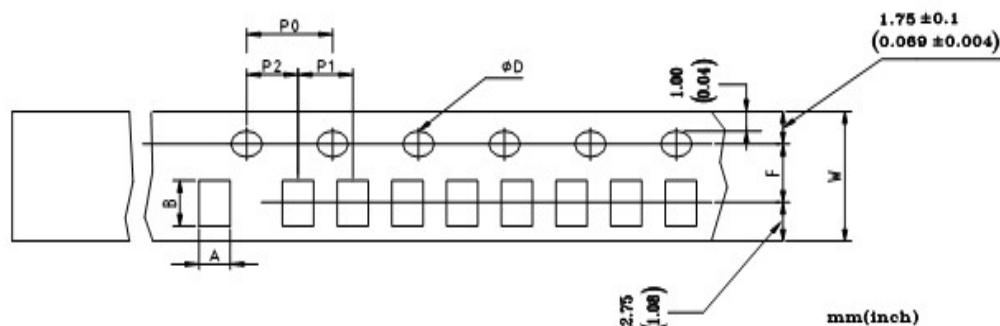


Standard Quantity per Reel  
5,000 pcs/Reel





## -包装尺寸 (packing dimension)



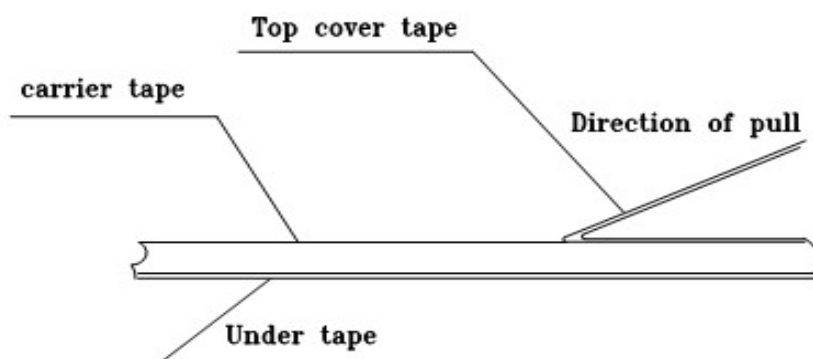
Unit: mm

| Dimensions | A         | B         | D                                                        | F         | P0        | P1        | P2        | W         |
|------------|-----------|-----------|----------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|
| 0603       | 1.10±0.10 | 1.90±0.10 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 8.00±0.20 |
| 0805       | 1.65±0.20 | 2.40±0.20 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 8.00±0.20 |
| 1206       | 1.90±0.20 | 3.50±0.20 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 8.00±0.20 |
| 1210       | 2.80±0.20 | 3.50±0.20 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 3.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 8.00±0.20 |
| 2010       | 2.90±0.10 | 5.30±0.10 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 5.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 12.0±0.10 |
| 2512       | 3.40±0.10 | 6.60±0.10 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 5.50±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 12.0±0.10 |

## ■ 上胶带剥离力测试 (Peel force of top cover tape)

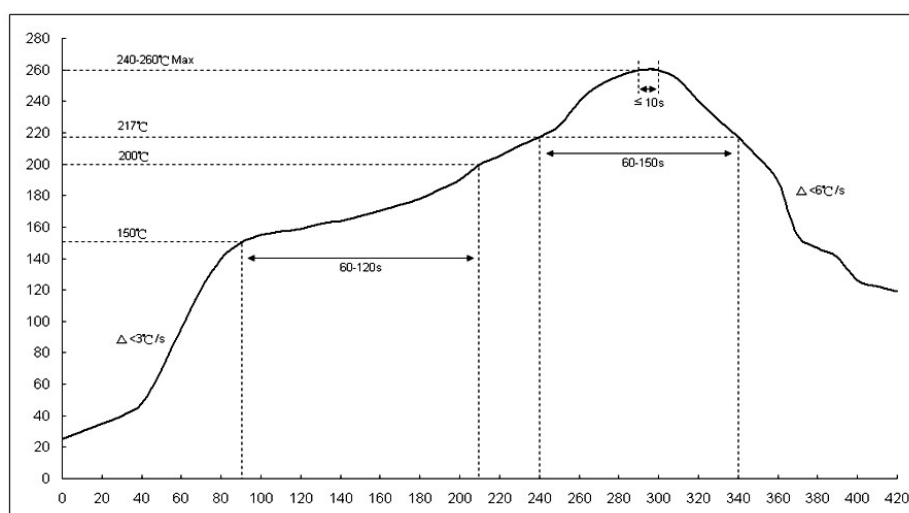
上胶带以 200mm/分钟的速度，沿 165~180 度角的方向进行剥离，如下图所示。纸带的剥离力范围为 10g~70g；载带的剥离力范围为 30~100g。

The top cover tape is pulled at a speed of 200 mm/min with the angle between the tape during peel and the direction of unreeling maintained at 165 to 180 degree as following picture. The peel force of paper carrier tape shall be 0.1N to 0.7N(10 to 70 g), the peel force of plastic carrier tape shall be 0.3N to 1N (30 to 100 g)

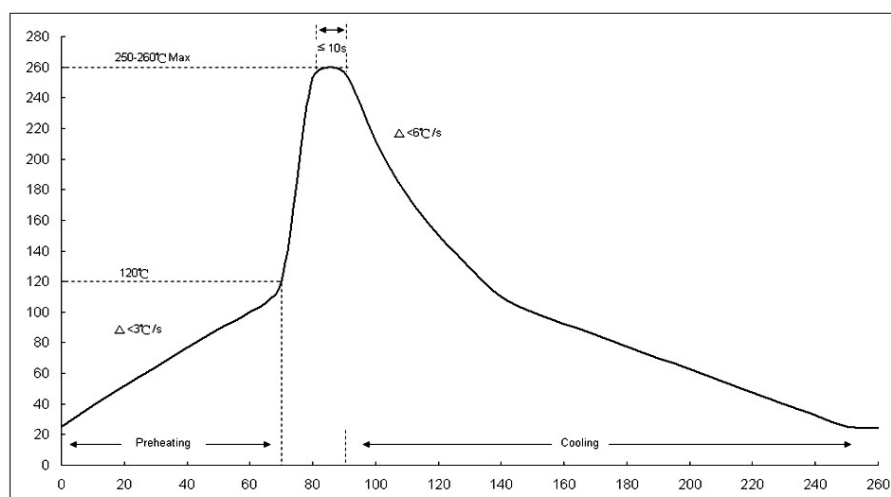


## ■ 焊接 (soldering)

### -建议回流焊曲线 ( Recommend reflow soldering profile )



### -建议波峰焊曲线 ( Recommend wave soldering profile )



FRS-Series

Anti-Surge Thick Film Chip Resistor

**FRS 系列抗浪涌厚膜晶片电阻器规格说明书**



**-手工焊温度 ( hand soldering temperature )**

烙鐵溫度  $350\pm 10^{\circ}\text{C}$  3 秒之內，避免烙鐵接觸電阻本體

The iron temperature is  $350\pm 10^{\circ}\text{C}$ , hand soldering time less than 3S. Avoid solder iron tip direct touch the components body

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[MCR01MZPJ121](#) [MCR01MZPJ751](#) [MCR03EZPFX2004](#) [MCR10EZPF1102](#) [RC1005F2052CS](#) [RC1005F471CS](#) [RC1005J122CS](#)  
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[RCWP72251K47FKWB](#) [RMCF0201FT49R9](#) [RMCF0603FT300K](#) [RMCF0805FT221K](#) [RMCF1210JT20R0](#) [RMCF1210JT68K0](#)  
[RMCF1210ZT0R00](#) [RMCF2512FT1R00](#) [RMCF2512JT20R0](#) [RMCF2512JT7K50](#) [RMCF2512JT910R](#) [NRC04F1000TRF](#) [NRC04F1004TRF](#)  
[NRC04F10R0TRF](#) [NRC04F1132TRF](#) [NRC04F2001TRF](#) [NRC04F2002TRF](#) [NRC04F2203TRF](#) [NRC04F3011TRF](#) [NRC04F33R0TRF](#)  
[NRC04F51R1TRF](#) [NRC04J103TRF](#) [NRC04J204TRF](#)