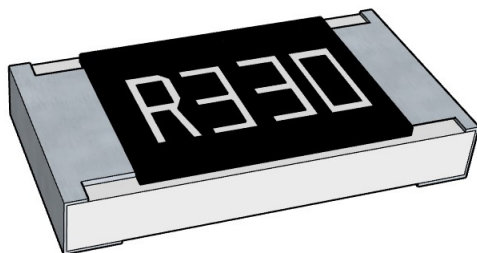


## 低阻厚膜晶片电阻 (Low Resistance Thick Film Chip Resistor)



### 应用 (Application)

- Entertainment: Stereo, TV tuners, Tape recorder
- Appliance: Air conditioner, Refrigerator
- Computer & relative products : Main board, PDA
- Communication equipment: Cell phone, Fax machine
- Power equipment: Power supply , II Lumination equipment
- Measuring instrument: Electric meter, Navigation equipment
- 娱乐: 立体声, 电视调谐器, 录音机
- 电器: 空调、冰箱
- 电脑及相关产品: 主板、掌上电脑
- 通讯设备: 手机、传真机
- 电源设备: 电源、二级照明设备
- 测量仪器: 电表、导航设备

### 特点 (Features)

- Small size and light weight
- Reliability, high quality
- Low Resistance & Suitable for Large Current Application
- Ultra-low Value
- 体积小, 重量轻
- 可靠性, 高质量
- 低阻值, 适合大电流通过
- 超低阻值

### 料号说明 (Parts Number Explanation) :

示例 Example: FRL1206JR470TS

| F<br>公司名        | R<br>产品别   | L<br>功能别  | 1206<br>型别   | F<br>公差   | R470<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:Lowohmic<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 | 0402<br>0603<br>0805<br>1206<br>1210<br>2010<br>1812<br>2512 | B:±0.1%<br>C:±0.25%<br>D:±0.5%<br>F:±1%<br>J:±5%<br>P: Jumper | ±5%:E24<br>3-digits+blank<br>102=1KΩ<br>1R0=1Ω<br>±1%&Below:<br>E24+E96:<br>4-digits<br>1001=1KΩ<br>1R00=1Ω | 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<br>code | Type code  | Functional<br>code  | Size code  | Tolerance<br>code   | Resistance code   | Packaging code   | Termination<br>code     | Special<br>code        |

## 尺寸 (Dimension)

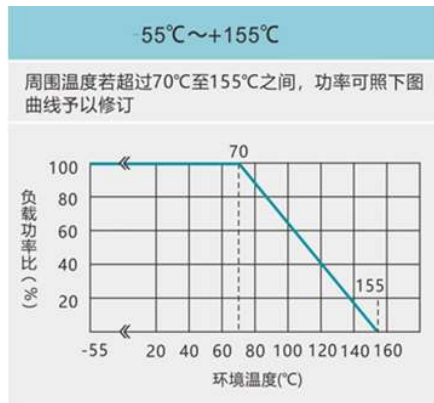
| 尺寸<br>dimension |  |           |           |           |           |
|-----------------|---|-----------|-----------|-----------|-----------|
|                 | 单位 (unit) : mm  |           |           |           |           |
| 型别 (Type)       | L   | W         | H         | T1        | T2        |
| 0402            | 1.00±0.05   | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| 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   | 2.60±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 |
| 1812            | 4.50±0.20   | 3.10±0.20 | 0.55±0.10 | 0.55±0.20 | 0.70±0.20 |
| 2512            | 6.35±0.10   | 3.10±0.15 | 0.55±0.10 | 0.60±0.20 | 0.50±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      | 三氧化二铝<br>Al <sub>2</sub> O <sub>3</sub> |
| 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>RuO <sub>2</sub> + 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 |         |
|---------|--------------------------|---------|
|         | 1%                       | 5%      |
| 0402    | 0R1~1Ω                   | 0R1~1Ω  |
| 0603    | 0R01~1Ω                  | 0R01~1Ω |
| 0805    | 0R01~1Ω                  | 0R01~1Ω |
| 1206    | 0R01~1Ω                  | 0R01~1Ω |
| 1210    | 0R01~1Ω                  | 0R01~1Ω |
| 2010    | 0R01~1Ω                  | 0R01~1Ω |
| 1812    | 0R01~1Ω                  | 0R01~1Ω |
| 2512    | 0R01~1Ω                  | 0R01~1Ω |

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### 电气特性 (Electrical characteristics)

| 型别<br>Type | 额定功率<br>(Power Rating at 70°C) | 绝缘耐压<br>Dielectric Withstandin<br>g Voltage | 额定电流<br>Rated Current of Jumper | 最大电流<br>Max Current of Jumper | T.C.R.<br>(PPM/°C)   | 阻值范围<br>Resistance Range |
|------------|--------------------------------|---|---------------------------------|-------------------------------|--|--------------------------|
| 0402       | 1/16W                          | 100V  | 0.79A                           | 1.97A                         | 0.02Ω~0.06(含):<br>±1200PPM/°C<br>0.06Ω~0.2(含):<br>±600PPM/°C<br>0.2Ω~0.5(含):<br>±300PPM/°C<br>>0.5Ω:±200PPM/°C | 0R1~1Ω                   |
| 0603       | 1/10W                          | 100V  | 2.23A                           | 5.59A                         |  | 0R01~1Ω                  |
| 0805       | 1/8W                           | 300V  | 2.5A                            | 6.25A                         |  |                          |
| 1206       | 1/4W                           | 500V  | 3.53A                           | 8.83A                         |  |                          |
| 1210       | 1/3W                           | 500V  | 5A                              | 12.50A                        |  |                          |
| 2010       | 3/4W                           | 500V  | 6.12A                           | 15.30A                        |  |                          |
| 2512       | 1W                             | 500V  | 7.07A                           | 17.67A                        |  |                          |

## 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       | $TCR = (R - R_0) / (t - t_0) R_0 \times 10^6$ (ppm)<br>R0 电阻在室温下的阻值(resistance at room temperature)<br>R 电阻在 125℃或-55℃下的阻值 (resistance at 125℃ or -55℃)<br>t0 室温(room temperature)<br>t 测试温度 (test temperature 125℃ or -55℃) | 0.02Ω~0.06(含):<br>±1200PPM/℃<br>0.06Ω~0.2(含):<br>±600PPM/℃<br>0.2Ω~0.5(含):<br>±300PPM/℃<br>>0.5Ω:<br>±200PPM/℃ |
| 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<br>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.   | ±(1.00% +0.05Ω)  |
| 焊锡性 Solderability                   | JIS C 5201 4.17      | 沾助焊剂后浸入锡炉, 锡炉温度 245±5℃,<br>时间 3±0.5 秒。<br>Dip the terminal in a flux and then dip into a soldering bath at 245±5℃ for 3±0.5sec.  | > 95%面积上锡<br>( > 95% coverage)   |
| 抗焊锡热<br>Resist to soldering<br>heat | JIS C 5201 4.18      | 沾助焊剂后浸入锡炉, 锡炉温度 260±5℃,<br>时间 10±0.5 秒, 测量试验前后的阻值变<br>化率。<br>Dip the terminal in a flux and then dip into a soldering bath at 260±5℃ for 10±0.5sec. Measure the variation of resistance.                                     | ±(1.00% +0.05Ω)  |
| 内容<br>Item                          | 测试方法<br>Test Methods | 测试条件<br>Test Conditions  | 规格<br>Specification  |

|   |                              |   |  |
|---|------------------------------|---|--|
| 绝缘电阻<br>Insulation resistance           | JIS C 5201 4.6               | 电阻本体上加载绝缘耐压 60±5 秒后, 测量绝缘阻抗。<br>Applied the dielectric withstanding voltage on the center of body for 60±5seconds. Then measure insulation resistance.  | >10GΩ  |
| 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±5 秒。<br>Applied the dielectric withstanding voltage on the center of body for 60±5seconds.   | 无击穿、飞弧及可见机械性损伤<br>No evidence of flashover, mechanical damage arcing or insulation breakdown |
| 端子弯曲<br>Terminal bending                | JIS C 5201 4.33              | 电阻焊接在测试板上进行弯折, 弯折保持时间 20±1 秒, 1206(含) 以下的尺寸弯曲 5+0.2/0 mm; 1206 以上的尺寸弯曲 2+0.2/0 mm; 量测试验前后阻值变化率<br>Specimen shall be mounted on test board, then bend the board and maintained for 20±1s. the distance of bending is 5+0.2/0 mm for resistors which size no larger than 1206 or 2+0.2/0 mm which size larger than 1206. Measure the variation of resistance. | ±(1.00% +0.05Ω)  |
| 温度循环<br>Temperature Cycling             | JIS C 5201 4.19              | 电阻放入温度循环机中, 温度 155±2℃至 -55±3℃, 共 5 个循环。量测试验前后阻值变化率。<br>Put specimen in a chamber which temperature can be changed to 155±2℃ or -55±3℃, repeated 5 times. Measure the variation of resistance.   | ±(2.00% +0.05Ω)  |
| <b>内容<br/>Item</b>                      | <b>测试方法<br/>Test Methods</b> | <b>测试条件<br/>Test Conditions</b>   | <b>规格<br/>Specification</b>  |

|                             |                        |   |                           |
|-----------------------------|------------------------|---|---------------------------|
| 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>   | $\pm(2.00\% +0.05\Omega)$ |
| 负荷寿命<br>Load life           | JIS C 5201 4.25.1      | <p>电阻放入恒温箱中, 温度 <math>70\pm 2^{\circ}\text{C}</math>, ON TIME:1.5H, OFF TIME:0.5H, 通电额定电压 <math>1000^{+24}/_{-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>70\pm 2^{\circ}\text{C}</math> temperature, ON TIME:1.5H, OFF TIME:0.5H, and applied rated voltage for <math>1000^{+24}/_{-0}</math>H. Measure the variation of resistance.</p>  | $\pm(2.00\% +0.05\Omega)$ |
| 温湿循环<br>Moisture resistance | MIL-STD-202 METHOD 106 | <p><math>25^{\circ}\text{C}\sim 65^{\circ}\text{C}</math>,90~100%RH, 2.5 小时; <math>65^{\circ}\text{C}</math> 90~100%RH, 3 小时;</p> <p><math>65^{\circ}\text{C}\sim 25^{\circ}\text{C}</math>,80~100%RH,2.5 小时,10 个循环,试验结束 <math>24\pm 4</math> 小时后进行测试.</p> <p><math>25^{\circ}\text{C}\sim 65^{\circ}\text{C}</math>,90~100%RH, 2.5H; <math>65^{\circ}\text{C}</math> 90~100%RH, 3H; <math>65^{\circ}\text{C}\sim 25^{\circ}\text{C}</math> 80~100%RH, 2.5H, 10 cycles,</p> <p>Measurement at <math>24\pm 4</math> hours after test conclusion.</p> | $\pm(2.00\% +0.05\Omega)$ |

■ 包装规格 (Tapping Specification)

-卷盘尺寸 (Reel dimension)

| Type                         | Size |              | Unit | A       | B        | C        | F        | W        |
|------------------------------|------|--------------|------|---------|----------|----------|----------|----------|
| 0402                         | 7"   | 10K/Reel     | mm   | 178±2.0 | 60.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0402                         | 13"  | 40K/50K Reel | mm   | 178±2.0 | 60.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0603<br>0805<br>1206<br>1210 | 7"   | 5K/Reel      | mm   | 178±2.0 | 60.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0603<br>0805<br>1206         | 10"  | 10K/Reel     | mm   | 178±2.0 | 60.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0603<br>0805<br>1206         | 13"  | 20K/Reel     | mm   | 178±2.0 | 60.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 2010<br>2512                 | 7"   | 4K/Reel      | mm   | 178±2.0 | 60.0±1.0 | 13.5±0.5 | 15.4±1.0 | 13.0±0.3 |



-包装尺寸 (packing dimension)



Unit: mm

| Dimensions | A         | B         | D  | F         | P0        | P1        | P2        | W         |
|------------|-----------|-----------|--|-----------|-----------|-----------|-----------|-----------|
| 0402       | 0.65±0.10 | 1.15±0.10 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 3.50±0.05 | 4.00±0.10 | 2.00±0.10 | 2.00±0.05 | 8.00±0.20 |
| 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 )



-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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