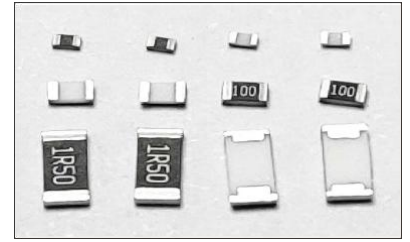


抗浪涌厚膜片式固定电阻器

Anti-Surge Thick Film Chip Fixed Resistor



■特点 Features

- 高功率、大幅提高抗浪涌能力。
- 体积小、重量轻。
- 适应再流焊与波峰焊。
- 电性能稳定，可靠性高。
- 装配成本低，并与自动贴装设备匹配。
- 机械强度高、高频特性优越。
- 符合 RoHS 指令要求
- 符合无卤要求
- 潮敏等级
- High power ,substantially increase the ability of anti-surge
- Miniature and light weight.
- Suit for reflow and wave flow solder.
- Stable electrical capability, high reliability.
- Low assembly cost, suit for automatic SMT equipment.
- Superior mechanical and frequency characteristics.
- Compliant with RoHS Directive
- Halogen free requirement
- MSL1 MSL Class:MSL1

■应用领域 Application

开关电源、音响设备的过电流保护、电压调节器、充电器、汽车引擎控制器、工业控制等。

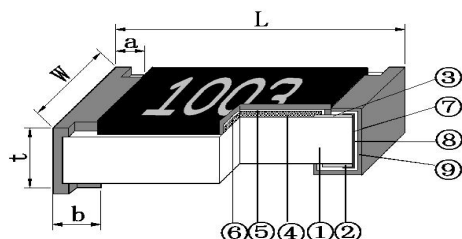
Switching Power Supply,Over Current Protection of audio equipment,Voltage Regulation,Charger、

Automobile Engine Controller、Industrial control, etc.

■型号表示方法 Part Number

| RA | Q | — | 03 | K | 1003 | F | T | 13 | | | | | | | | |
|--|----------------------------|---------------------|-------------------|------------|--|------------|---------------------|---|------------|---------------------------------------|------------|------------------------------|------------|-----------------------------|----|------------------------------|
| 产品代号 Product Code | 额定功率代号 Rated Power Code | | 型号代号 Type Code | | 电阻温度系数代号 T.C.R Code | | | 电阻值代号 Resistance Value Code | | 阻值误差精度代号 Resistance Tolerance Code | | 包装方式代号 Packing Style Code | | 卷盘方式代号 Reel Type Code | | |
| 抗浪涌厚膜片式固定电阻器 Anti-Surge Thick Film Chip Fixed Resistors | 代号 Code | 额定功率 Rated Power | 代号 Code | 型号 Type | 型号 Type | 代号 Code | T. C. R (ppm/°C) | 三位数（E-24 系列）：前两位表示有效数字，第三位表示有效数字后零的个数。 Three digits (E-24 series): The first two digits are significant figures and the third one denotes number of zeros. 四位数（E-96 系列）：前三位表示有效数字，第四位表示有效数字后零的个数。 Four digits (E-96 series): The first three digits are significant figures and the four one denotes number of zeros. 小数点用 R 表示。Decimal point should be expressed by "R". 例如 Example: 103=10kΩ （E-24） 1003=100kΩ （E-96） 1R0=1.0Ω （E-24） | 代号 Code | 误差精度 Tolerance | 代号 Code | 包装方法 Packing Style | 代号 Code | 卷盘方式 Reel Type | | |
| | C | 1/16W | 02 | 0402 | 0402 | K | ±100 | | D | ±0.5% | T | 编带包装 Tape & Reel | 空位 | 7 英寸 卷盘 7inch Reel | | |
| | D | 1/10W | 03 | 0603 | | W | ±200 | | | | | | | | | |
| | Q | 1/5W | 05 | 0805 | 0603 0805 1206 1210 2010 2512 | K | ±100 | | F | ±1% | | | | | 13 | 13英寸 卷盘 13inch Reel |
| | F | 1/4W | 06 | 1206 | | W | ±200 | | | | | | | | | |
| | R | 1/3W | 1210 | 1210 | | | | | | | | | | | | |
| | G | 1/2W | 10 | 2010 | | | | | L | ±250 | | | | | | |
| | H | 3/4W | 12 | 2512 | | | | | | | | | | | | |
| | J | 1W | | | | | J | | ±5% | | | | | | | |
| | L | 2W | | | | | | | | | | | | | | |

■ 结构 construction

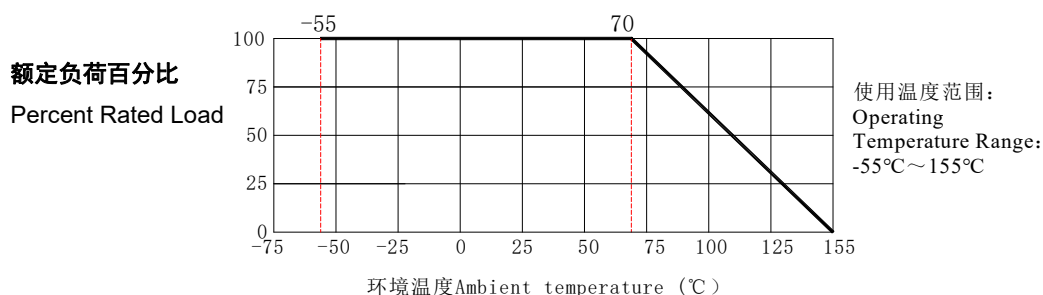


- ① 陶瓷基板 Ceramic Substrate
- ② 背电极 Bottom Electrode
- ③ 面电极 Top Electrode
- ④ 电阻体 Resistor Layer
- ⑤ 一次保护 Primary Overcoat
- ⑥ 二次保护 Secondary Overcoat
- ⑦ 端电极 Edge Electrode
- ⑧ 中间电极 Barrier Layer
- ⑨ 外部电极 External Electrode

■ 规格尺寸 Dimensions

| 型号 Type | 尺寸 Dimensions (mm) | | | | |
|------------|--------------------|-----------|-----------|-----------|-----------|
| | L | W | t | a | b |
| 0402 | 1.00±0.05 | 0.50±0.05 | 0.30±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 | 0.30±0.20 |
| 0805 | 2.00±0.10 | 1.25±0.15 | 0.50±0.10 | 0.25±0.15 | 0.40±0.20 |
| 1206 | 3.20±0.20 | 1.60±0.15 | 0.55±0.10 | 0.50±0.20 | 0.50±0.20 |
| 1210 | 3.20±0.20 | 2.50±0.20 | 0.55±0.10 | 0.30±0.20 | 0.50±0.20 |
| 2010 | 5.00±0.20 | 2.50±0.20 | 0.55±0.10 | 0.35±0.20 | 0.60±0.20 |
| 2512 | 6.30±0.20 | 3.20±0.20 | 0.55±0.10 | 0.35±0.20 | 0.60±0.20 |

■ 负荷下降曲线 Derating Curve



注: 当电阻使用的环境温度超过 70°C 时, 其额定负荷 (额定功率) 按上述曲线下降。

Note: For resistors operated in ambient over 70°C, rated load (rated power) shall be derated in accordance with the above figure.

■ 额定值 Ratings

| 型号 Type | 70℃下额定功率 Rated Power at 70℃ (W) | 元 件 极 限 电 压 Limiting Element Voltage (V) | 最大过负荷电压 Max. Overload Voltage (V) | 阻值范围 Resistance Range |
|------------|---|--|---|--------------------------|
| 0402 | 1/16、1/10 | 50 | 100 | 1Ω~10MΩ |
| 0603 | 1/5 | 50 | 100 | |
| 0805 | 1/4 | 150 | 300 | |
| 1206 | 1/3、1/2 | 200 | 400 | |
| 1210 | 1/2、3/4 | 200 | 500 | |
| 2010 | 3/4、1 | 200 | 500 | |
| 2512 | 1、2 | 200 | 500 | |
| 注 Note | 1、电压为直流或交流有效值。 Voltage of DC or AC RMS value. 2、 $F=\sqrt{P\times R}$ 或元件极限电压两者中的较小值。 $E=\sqrt{P\times R}$ or Limiting element voltage whichever is lower. E: 额定电压 Rated voltage (V) P: 额定功率 Rated power (W) R: 标称阻值 Normal resistance (Ω) | | | |

■ 额定值 Ratings

| 型号 Type | 阻值范围 Resistance Range | 电阻温度系数 T.C.R (ppm/°C) | | | |
|-------------------------------------|---------------------------------|-------------------------------|--------------|--------------|--------------|
| | | 标称阻值允许偏差 Resistance Tolerance | | | |
| | | ±0.5% | ±1% | ±2% | ±5% |
| 0402 | $1\Omega \leq R < 10\Omega$ | / | ±200 | ±200 | ±200 |
| | $10\Omega \leq R \leq 1M\Omega$ | ±100 | ±100 | ±100 | ±100 |
| | $1M\Omega < R \leq 10M\Omega$ | / | ±200 | ±200 | ±200 |
| 0603 0805 1206 1210 2010 2512 | $1\Omega \leq R < 10\Omega$ | / | ±250 or ±200 | ±250 or ±200 | ±250 or ±200 |
| | $10\Omega \leq R \leq 1M\Omega$ | ±100 | ±100 | ±100 | ±100 |
| | $1M\Omega < R \leq 10M\Omega$ | / | ±250 or ±200 | ±250 or ±200 | ±250 or ±200 |

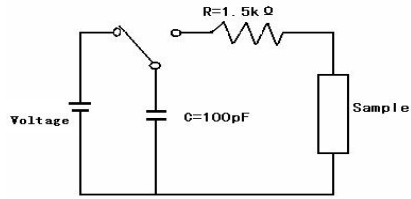
■ 特性 Characteristics

| 项目 Item | 标准 Specifications | 测试方法 (IEC 60115-1) Test Methods (IEC 60115-1) |
|--|--|---|
| 可焊性 Solderability | 可焊面积≥95% 95% Cover Min | IEC 60115-1 4.17 245°C ±5°C 锡槽, 保持 3s ±0.3s Lead-free solder bath at 245°C ±5°C for 3s ±0.3s |
| 耐焊热 Resistance to Soldering Heat | 无可见损伤 No mechanical damage $\Delta R \leq \pm (1.0\%R + 0.05\Omega)$ | IEC 60115-1 4.18 270°C ±5°C 锡槽, 保持 10s ±1s Lead-free solder bath at 270°C ±5°C for 10s ±1s |
| 基板弯曲试验 Substrate Bending Test | 无可见损伤 No mechanical damage $\Delta R \leq \pm (1.0\%R + 0.05\Omega)$ | IEC 60115-1 4.33 弯曲距离(Bending distance): 0402、0603、0805: 5mm; 1206、1210: 4mm; 2010、2512: 2mm 保持时间(Duration): 60s ±5s |
| 剪切力试验 Shear Test | 外观无可见损伤 No mechanical damage | IEC 60115-1 4.32 施加力 (Applying force) : 0402、0603: 5 N, 0805: 9N, 1206、1210: 25N; 2010、2512: 45N 保持时间(Duration): 10s ±1s |
| 电阻温度系数 T.C.R | 在规定值内 Within specified T.C.R | IEC 60115-1 4.8 +20°C/-55°C/+20°C/+125°C/+20°C |
| 温度快速变化 Rapid Change of Temperature | 无可见损伤 No mechanical damage 0.5%、1%: $\Delta R \leq \pm (0.5\%R + 0.05\Omega)$ 5%: $\Delta R \leq \pm (1.0\%R + 0.05\Omega)$ | IEC 60115-1 4.19 -55°C (30 分钟) ~ 常温 (5 分钟) ~ 155°C (30 分钟) , 300 个循环。 -55°C (30min) ~ normal temperature (5min) ~ 155°C (30min) , 300 cycles |
| 短时间过负载 Short Time Overload | 无可见损伤 No mechanical damage 0.5%、1%: $\Delta R \leq \pm (1.0\%R + 0.05\Omega)$ 5%: $\Delta R \leq \pm (2.0\%R + 0.05\Omega)$ | IEC 60115-1 4.13 2.5 倍额定电压或最大过负荷电压 (取较小值), 持续 5 秒。 2.5 times rated voltage or max. overload voltage whichever is lower for 5s |
| 断续过负载 Periodic Pulse Overload Test | 无可见损伤 No mechanical damage $\Delta R \leq \pm (5.0\%R + 0.05\Omega)$ | IEC 60115-1 4.39 2.5 倍额定电压或最大过负荷电压 (取较小值), 通 1 秒/断 25 秒, 10000 个循环 2.5 times rated voltage or max. overload voltage whichever is lower for 1s ON/ 25s OFF, 10000 cycles |

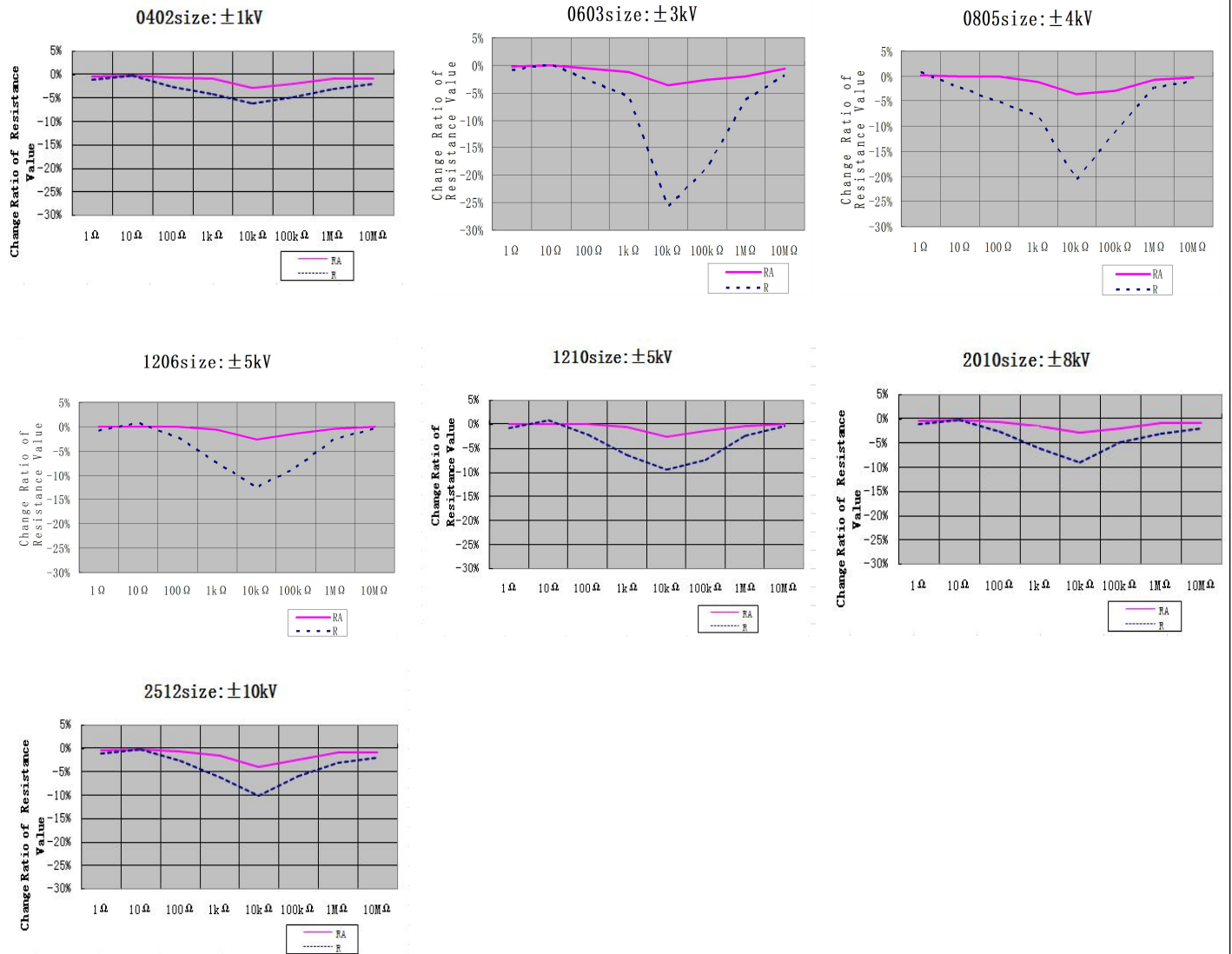
■ 特性 Characteristics

| 项目 Item | 标准 Specifications | 测试方法 (IEC 60115-1) Test Methods (IEC 60115-1) |
|--|--|--|
| 稳态湿热 Damp Heat, Steady State | 无可见损伤 No mechanical damage 0.5%、1%: $\Delta R \leq \pm(1.0\%R + 0.05 \Omega)$ 5%: $\Delta R \leq \pm(2.0\%R + 0.05 \Omega)$ | IEC 60115-1 4. 24 40°C±2°C, 93%RH±3%RH, 1000h, 额定电压或元件极限电压 (取较小值), 通 1.5 小时/断 0.5 小时. 40°C±2°C, 93%RH±3%RH, 1000h, rated voltage or limiting element voltage whichever is lower for 1.5h ON/0.5h OFF |
| 70°C耐久性 Endurance at 70°C | 无可见损伤 No mechanical damage 0.5%、1%: $\Delta R \leq \pm(1.0\%R + 0.05 \Omega)$ 5%: $\Delta R \leq \pm(2.0\%R + 0.05 \Omega)$ | IEC 60115-1 4. 25. 1 70°C±2°C, 1000 小时, 额定电压或元件极限电压 (取较小值), 通 1.5 小时/断 0.5 小时 70°C±2°C, 1000h, rated voltage or limiting element voltage whichever is lower for 1.5h ON/0.5h OFF |
| 上限类别温度 耐久性 Endurance at Upper Category Temperature | 无可见损伤 No mechanical damage 0.5%、1%: $\Delta R \leq \pm(1.0\%R + 0.05 \Omega)$ 5%: $\Delta R \leq \pm(2.0\%R + 0.05 \Omega)$ | IEC 60115-1 4. 25. 3 155°C±2°C, 1000 小时 155°C±2°C, 1000h |
| 低温负载 Operation at Low Temperature | 无可见损伤 No mechanical damage 0.5%、1%: $\Delta R \leq \pm(1.0\%R + 0.05 \Omega)$ 5%: $\Delta R \leq \pm(2.0\%R + 0.05 \Omega)$ | IEC 60115-1 4. 36 -55°C±5°C, 无负载 1 小时, 额定电压或元件极限电压 (取较小值) 45 分钟, 无负载 15 分钟 -55°C±5°C, 1h without load, rated voltage or limiting element voltage whichever is lower for 45min, 15 min without load |
| 绝缘电阻 Insulation Resistance | 1000MΩ Min | IEC 60115-1 4. 6 在电极与基片间施加 100V±15V 直流电压, 保持 1 分钟, 然后测绝缘电阻值 Apply DC 100V±15V between substrate and terminations for 1 min, then check insulation resistance |
| 耐电压 Voltage Proof | 无击穿或飞弧 No breakdown or flashover | IEC 60115-1 4. 7 在电极与基片间以大约 100V/s 的速率施加有效值为最大过负荷电压的交流电压, 保持 60s±5s Apply max. overload voltage of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60s±5s |
| 耐溶剂 Component Solvent Resistance | 无可见损伤 No mechanical damage $\Delta R \leq \pm(1.0\%R + 0.05\Omega)$ | IEC 60115-1 4.29 异丙醇 (IPA), 23°C±5°C, 浸 10 小时 Iso-propyl alcohol (IPA), 23°C±5°C, 10h |
| 静电放电 Electrostatic Discharge (ESD) | 无可见损伤 No mechanical damage $\Delta R \leq \pm(5.0\%R + 0.05\Omega)$ | IEC 60115-1 4.38 0402: 1kV, ±3 次(Times), 间隔 (Space) 1s 0603: 3kV, ±3 次(Times), 间隔 (Space) 1s 0805: 4kV, ±3 次(Times), 间隔 (Space) 1s 1206: 5kV, ±3 次(Times), 间隔 (Space) 1s 1210: 5kV, ±3 次(Times), 间隔 (Space) 1s 2010: 8kV, ±3 次(Times), 间隔 (Space) 1s 2512: 10kV, ±3 次(Times), 间隔 (Space) 1s |

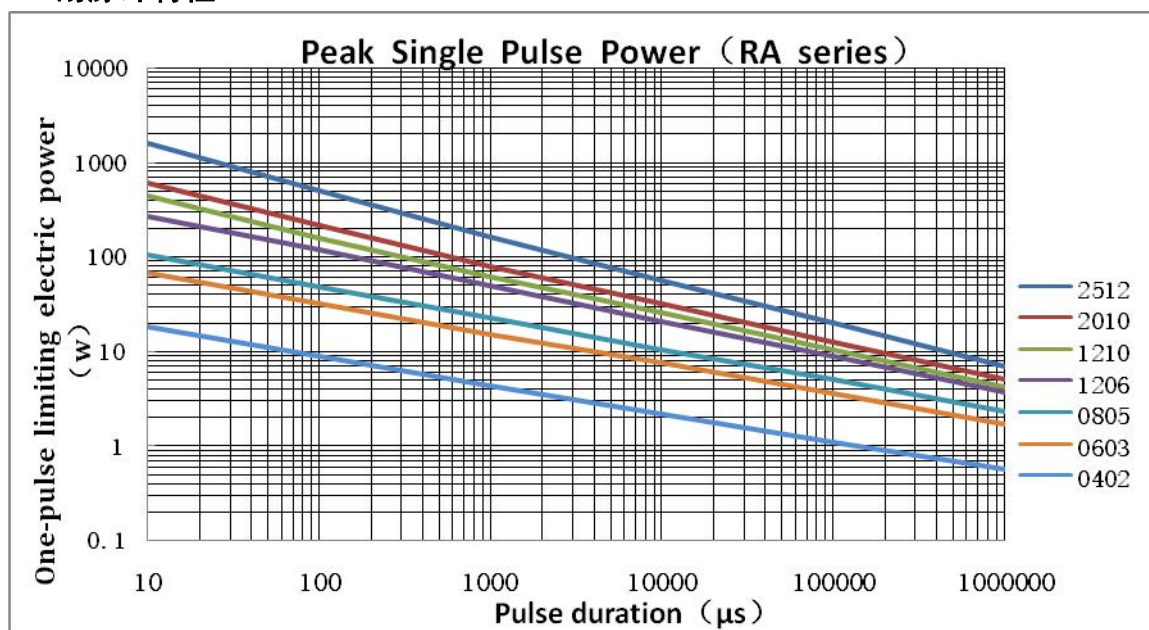
ESD 特性 ESD Characteristics



—— 表示抗浪涌电阻 ESD 特性 (RA 型号)
Anti-Surge Thick Film Chip Resistor (RA Type)
- - - 表示常规厚膜电阻 ESD 特性 (R 型号)
Thick Film Chip Resistor (R Type)



■ 耐脉冲特性 Resistance to Power Pulse



注：U= $\sqrt{P \times R}$ 或最大过负荷电压（取较小值），此处的 P 指上述单脉冲曲线相对应的单脉冲限制功率；本数据为参考值，使用时需在实际机器上确认。

Note : U= $\sqrt{P \times R}$ or maximum overload voltage (whichever is smaller), where P refers to the single pulse limited power corresponding to the above single pulse curve; This data is a reference value, which needs to be confirmed on the actual machine.

■ 包装 Packaging

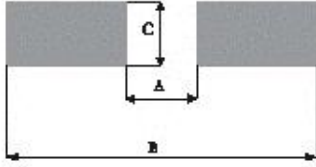
包装方式见附录 Packaging can refer to the Appendix .

附录 Appendix I

◆推荐焊盘尺寸 Recommend Solder Pad Size

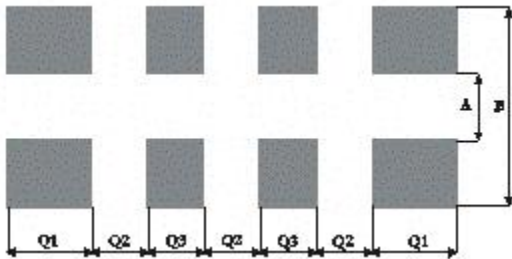
* 片式固定电阻器 Chip fixed resistor

单位unit: mm



| 厚膜电阻及薄膜电阻 Thick Film Resistor and Thin Film Resistor | | | |
|---|-----------|-----------|-----------|
| 型号Type | A | B | C |
| 01005 | 0.17±0.03 | 0.60±0.03 | 0.22±0.03 |
| 0201 | 0.23±0.05 | 0.84±0.05 | 0.38±0.05 |
| 0402 | 0.45±0.05 | 1.45±0.05 | 0.60±0.05 |
| 0603 | 0.80±0.05 | 2.50±0.05 | 0.95±0.05 |
| 0805 | 1.05±0.1 | 3.25±0.1 | 1.40±0.1 |
| 1206 | 1.90±0.1 | 4.50±0.1 | 1.75±0.1 |
| 1210 | 2.00±0.1 | 4.60±0.1 | 2.70±0.1 |
| 2010 | 3.50±0.1 | 6.50±0.1 | 2.70±0.1 |
| 2512(1W、1.5W) | 4.80±0.1 | 7.80±0.1 | 3.40±0.1 |
| 2512(2W) | 2.70±0.1 | 7.80±0.1 | 3.60±0.1 |
| 0508 | 0.60±0.1 | 2.20±0.1 | 2.00±0.1 |
| 0612 | 0.60±0.1 | 2.90±0.1 | 3.30±0.1 |
| 1225 | 1.40±0.1 | 4.50±0.1 | 6.40±0.1 |

* 厚膜片式网络电阻器 Thick film chip network resistor



单位unit: mm

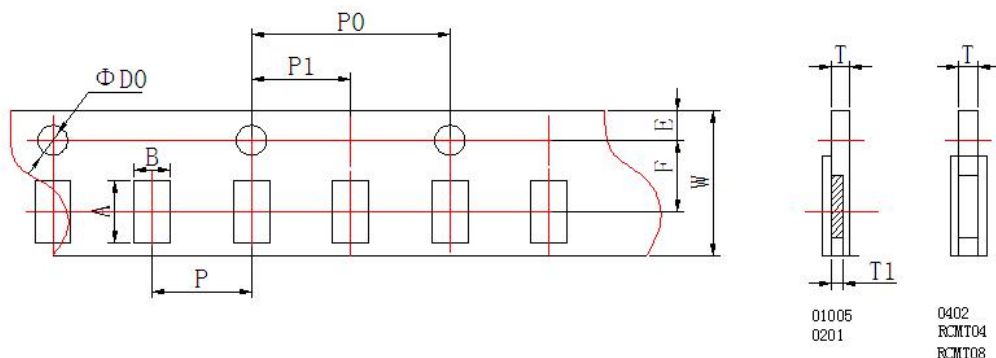
| 型号Type | A | B | Q1 | Q2 | Q3 |
|---------------|---|-----------|-----------|-----------|-----------|
| 2R01 | 0.30±0.05 | 0.90±0.05 | 0.30±0.05 | 0.20±0.05 | --- |
| 4R01 | 0.30±0.05 | 0.90±0.05 | 0.20±0.05 | 0.20±0.05 | 0.20±0.05 |
| 2R02 | 0.35±0.05 | 1.25±0.05 | 0.65±0.05 | 0.20±0.05 | 0.30±0.05 |
| 4R02 | 0.38±0.05 | 1.60±0.05 | 0.40±0.05 | 0.20±0.05 | --- |
| 4R03 | 0.80±0.05 | 2.70±0.05 | 0.60±0.05 | 0.40±0.05 | 0.40±0.05 |
| 备注 Remarks | 1、2R01型号包含including:RC-MY04、RCMY04、RH-MY04、RHMY04 2、4R01型号包含including:RC-MY08、RCMY08、RH-MY08、RHMY08 3、2R02型号包含including:RC-MT04、RCMT04、RH-MT04、RHMT04 4、4R02型号包含including:RC-MT08、RCMT08、RH-MT08、RHMT08 5、4R03型号包含including:RC-ML08、RCML08、RH-ML08、RHML08 6、上述型号说明适用于附录中所有型号。 The above description applies to all types in the appendix. | | | | |

◆包装 Packaging

* 纸带编带 Paper Taping

适用于01005、0201、0402、2R01、4R01、2R02、4R02:

For 01005、0201、0402、2R01、4R01、2R02、4R02:



单位unit: mm

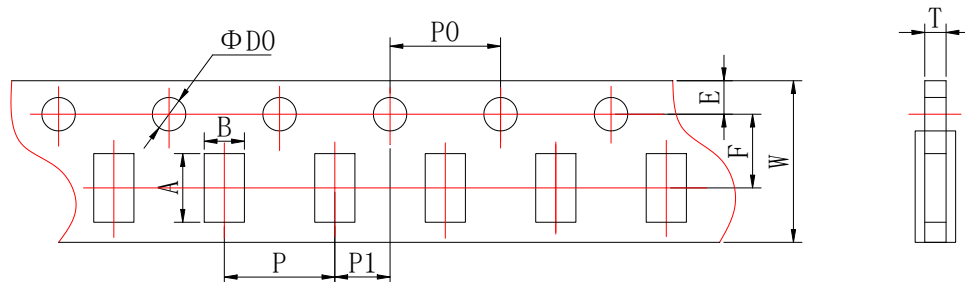
| 型号Type | A | B | W | F | E |
|--------|-----------|-----------|-----------|-----------|-----------|
| 01005 | 0.45±0.02 | 0.25±0.02 | 8.00±0.02 | 3.50±0.05 | 1.75±0.05 |
| 0201 | 0.70±0.10 | 0.40±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 0402 | 1.15±0.10 | 0.65±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 2R01 | 0.97±0.05 | 0.77±0.05 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 4R01 | 1.57±0.05 | 0.77±0.05 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 2R02 | 1.45±0.10 | 1.20±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 4R02 | 2.20±0.10 | 1.20±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |

单位unit: mm

| 型号Type | P | P0 | P1 | ΦD0 | T1 | T |
|--------|-----------|-----------|-----------|-----------|-----------|-----------|
| 01005 | 2.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.55±0.02 | 0.17±0.02 | 0.31±0.02 |
| 0201 | 2.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.28±0.04 | 0.42±0.05 |
| 0402 | 2.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | / | 0.44±0.05 |
| 2R01 | 2.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | / | 0.60±0.10 |
| 4R01 | 2.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | / | 0.60±0.10 |
| 2R02 | 2.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | / | 0.60±0.10 |
| 4R02 | 2.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | / | 0.60±0.10 |

适用于0603、0805、0508、1206、0612、1210、4R03:

For 0603、0805、0508、1206、0612、1210、4R03:



单位unit: mm

| 型号Type | A | B | W | F | E |
|--------|-----------|-----------|-----------|-------------|-----------|
| 0603 | 1.80±0.10 | 1.05±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 0805 | 2.30±0.10 | 1.50±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 0508 | 2.30±0.10 | 1.50±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 1206 | 3.50±0.20 | 1.90±0.20 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 0612 | 3.50±0.20 | 1.90±0.20 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 1210 | 3.50±0.20 | 2.80±0.20 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 |
| 4R03 | 3.50±0.20 | 1.90±0.20 | 8.00±0.20 | 3.50 ± 0.05 | 1.75±0.10 |

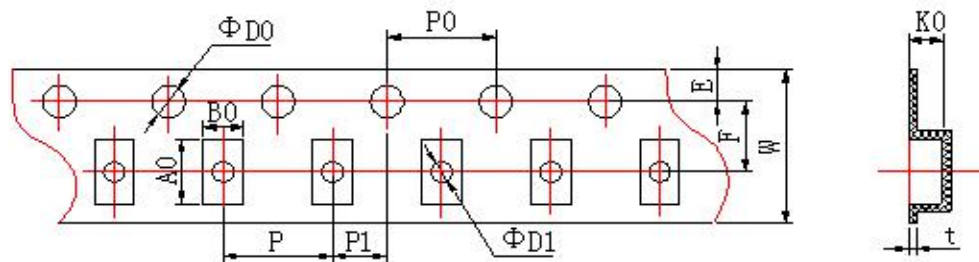
单位unit: mm

| 型号Type | P | P0 | P1 | ΦD0 | T | |
|--------|-----------|-----------|-----------|-----------|--|------------------------------------|
| | | | | | 厚膜电阻及薄膜电阻 Thick Film Resistor and Thin Film Resistor | 合金片式固定电阻 Metal Foil resistor |
| 0603 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.60±0.10 | 0.75±0.10 |
| 0805 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 | 0.95±0.10 |
| 0508 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 | 0.95±0.10 |
| 1206 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 | 0.95±0.10 |
| 0612 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 | 0.95±0.10 |
| 1210 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 | --- |
| 4R03 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 | --- |

* 塑料带编带 Embossed Taping

适用于2010、2512、1225:

For 2010、2512、1225:



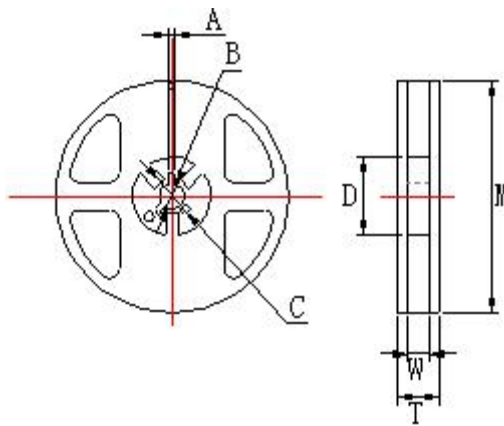
单位unit: mm

| 型号Type | A0 | B0 | W | F | E | t |
|--------|-----------|-----------|------------|-----------|-----------|-----------|
| 2010 | 5.50±0.15 | 2.82±0.15 | 12.00±0.10 | 5.50±0.10 | 1.75±0.10 | 0.25±0.05 |
| 2512 | 6.78±0.15 | 3.45±0.15 | 12.00±0.10 | 5.50±0.10 | 1.75±0.10 | 0.25±0.05 |
| 1225 | 6.78±0.15 | 3.45±0.15 | 12.00±0.10 | 5.50±0.10 | 1.75±0.10 | 0.25±0.05 |

单位unit: mm

| 型号Type | P | P0 | P1 | ΦD0 | ΦD1 | K0 | |
|--------|-----------|-----------|-----------|--------------|-----------|--|---------------------------------|
| | | | | | | 厚膜电阻及薄膜电阻 Thick Film Resistor and Thin Film Resistor | 合金片式固定电阻 Metal Foil resistor |
| 2010 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50+0.10/-0 | 1.50±0.10 | 0.84±0.10 | 0.84±0.10 |
| 2512 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50+0.10/-0 | 1.50±0.10 | 0.81±0.10 | 1.00±0.10 |
| 1225 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50+0.10/-0 | 1.50±0.10 | 0.81±0.10 | 1.00±0.10 |

* 卷盘 Reel



单位unit: mm

| 卷盘尺寸 Reel Type | 型号Type | M | W | T | A | B | C | D |
|-----------------------------|--|---------|----------|----------|---------|----------|----------|-----------|
| 7英寸 7inch dia.Reel | 01005、0201 0402、0603 0805、1206 1210、2R01 4R01、2R02 4R02、4R03 0508、0612 | 178±2.0 | 9.5±1.0 | 12.5±1.5 | 2.0±0.5 | 13.0±0.5 | 21.0±0.5 | 58.0±2.0 |
| | 2010、2512 | 178±2.0 | 13.0±0.5 | 15.5±1.5 | 2.0±0.5 | 13.0±0.5 | 21.0±0.5 | 57.0±2.0 |
| | 1225 | 178±2.0 | 13.0±0.5 | 15.5±1.5 | 2.0±0.5 | 13.0±0.5 | 21.0±0.5 | 57.0±2.0 |
| 13英寸 13 inch dia.Reel | 0201、0402 0603、0805 1206 | 330±2.0 | 9.5±1.0 | 13.4±1.0 | 2.0±0.5 | 13.0±0.5 | 21.0±0.5 | 100.0±1.0 |

◆ 编带包装能力 Taping Ability

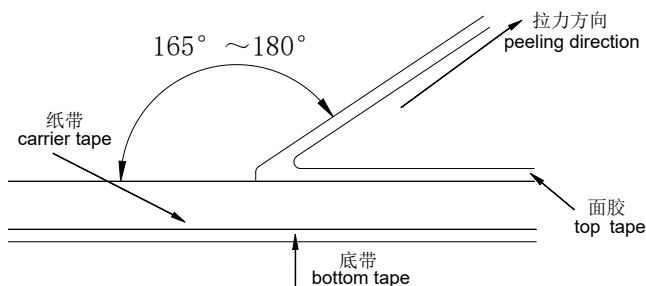
面带拉力 Top tape peel strength

面带拉力强度未11g~70g (0.1N~0.7N) , 速度: 300mm/min, 经下列试验后不允许有破裂断带现象。

Peel strength is 11g~70g (0.1N~0.7N),with speed of 300mm/min,and should not have flash and

tear after peeling.

测试方法 Test method:



电阻松动自如，无粘面胶带、底胶带现象。

Resistor is free, no sticking to top tape and bottom tape.

电阻易从纸带中取出，且晶片孔无机械损伤。

Resistor is easy to take out from carrier tape and chip hole have no mechanical damage.

◆包装数量 Packaging Quantity

| 包装方法 Packaging style | 7英寸 7inch dia.Reel | | | | | 13英寸 13 inch dia.Reel | |
|-------------------------|-----------------------|-------|--------------------------------|---|--------------------|--------------------------|--------------------|
| 型号 Type | 01005 | 0201 | 0402、2R01 2R02、4R01 4R02 | 0603、0805 1206、1210 4R03、0508 0612 | 2010、2512 、1225 | 0201、 0402 | 0603、0805、 1206 |
| 数量 Quantity (pcs) | 20000 | 15000 | 10000 | 5000 | 4000 | 50000 | 50000 |

◆IEC E-24、E-96系列电阻值代码对照表 IEC E-24、E-96 Series Resistance Cross-reference List

* E-24 系列 E-24 series (×10ⁿΩ)

(单位unit: 0.001Ω、0.01Ω、0.1Ω、1Ω、10Ω、100Ω、1kΩ、10kΩ、100kΩ、1MΩ、10MΩ、100MΩ、1000MΩ)

表一 Table One:

| | | | | | |
|-----|-----|-----|-----|-----|-----|
| 1.0 | 1.5 | 2.2 | 3.3 | 4.7 | 6.8 |
| 1.1 | 1.6 | 2.4 | 3.6 | 5.1 | 7.5 |
| 1.2 | 1.8 | 2.7 | 3.9 | 5.6 | 8.2 |
| 1.3 | 2.0 | 3.0 | 4.3 | 6.2 | 9.1 |

* E-96系列 E-96 series (×10ⁿΩ)

(单位unit: 0.001Ω、0.01Ω、0.1Ω、1Ω、10Ω、100Ω、1kΩ、10kΩ、100kΩ、1MΩ、10MΩ、100MΩ、1000MΩ)

表二 Table Two:

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| 1.00 | 1.33 | 1.78 | 2.37 | 3.16 | 4.22 | 5.62 | 7.50 |
| 1.02 | 1.37 | 1.82 | 2.43 | 3.24 | 4.32 | 5.76 | 7.68 |
| 1.05 | 1.40 | 1.87 | 2.49 | 3.32 | 4.42 | 5.90 | 7.87 |
| 1.07 | 1.43 | 1.91 | 2.55 | 3.40 | 4.53 | 6.04 | 8.06 |
| 1.10 | 1.47 | 1.96 | 2.61 | 3.48 | 4.64 | 6.19 | 8.25 |
| 1.13 | 1.50 | 2.00 | 2.67 | 3.57 | 4.75 | 6.34 | 8.45 |
| 1.15 | 1.54 | 2.05 | 2.74 | 3.65 | 4.87 | 6.49 | 8.66 |
| 1.18 | 1.58 | 2.10 | 2.80 | 3.74 | 4.99 | 6.65 | 8.87 |
| 1.21 | 1.62 | 2.15 | 2.87 | 3.83 | 5.11 | 6.81 | 9.09 |
| 1.24 | 1.65 | 2.21 | 2.94 | 3.92 | 5.23 | 6.98 | 9.31 |
| 1.27 | 1.69 | 2.26 | 3.01 | 4.02 | 5.36 | 7.15 | 9.53 |
| 1.30 | 1.74 | 2.32 | 3.09 | 4.12 | 5.49 | 7.32 | 9.76 |

* E-96系列0603型号《乘数代码对照表》及《电阻值代码对照表》

E-96 series(0603)《multiplied Cross-reference List》And《Resistance Cross-reference List》

表三 Table Three:

| 乘数multiplied | $\times 10^0$ | $\times 10^1$ | $\times 10^2$ | $\times 10^3$ | $\times 10^4$ | $\times 10^5$ | $\times 10^6$ | $\times 10^7$ | $\times 10^{-1}$ | $\times 10^{-2}$ | $\times 10^{-2}$ | $\times 10^{-3}$ |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------------------|------------------|------------------|------------------|
| 代码code | A | B | C | D | E | F | G | H | X | Y | Y | Z |

表四 Table Four:

| 代号 code | E-96系列电阻 E-96 resistance | 代号 code | E-96系列电阻 E-96 resistance | 代号 code | E-96系列电阻 E-96 resistance | 代号 code | E-96系列电阻 E-96 resistance |
|------------|-----------------------------|------------|-----------------------------|------------|-----------------------------|------------|-----------------------------|
| 01 | 100 | 25 | 178 | 49 | 316 | 73 | 562 |
| 02 | 102 | 26 | 182 | 50 | 324 | 74 | 576 |
| 03 | 105 | 27 | 187 | 51 | 332 | 75 | 590 |
| 04 | 107 | 28 | 191 | 52 | 340 | 76 | 604 |
| 05 | 110 | 29 | 196 | 53 | 348 | 77 | 619 |
| 06 | 113 | 30 | 200 | 54 | 357 | 78 | 634 |
| 07 | 115 | 31 | 205 | 55 | 365 | 79 | 649 |
| 08 | 118 | 32 | 210 | 56 | 374 | 80 | 665 |
| 09 | 121 | 33 | 215 | 57 | 383 | 81 | 681 |
| 10 | 124 | 34 | 221 | 58 | 392 | 82 | 698 |
| 11 | 127 | 35 | 226 | 59 | 402 | 83 | 715 |
| 12 | 130 | 36 | 232 | 60 | 412 | 84 | 732 |
| 13 | 133 | 37 | 237 | 61 | 422 | 85 | 750 |
| 14 | 137 | 38 | 243 | 62 | 432 | 86 | 768 |
| 15 | 140 | 39 | 249 | 63 | 442 | 87 | 787 |
| 16 | 143 | 40 | 255 | 64 | 453 | 88 | 806 |
| 17 | 147 | 41 | 261 | 65 | 464 | 89 | 825 |
| 18 | 150 | 42 | 267 | 66 | 475 | 90 | 845 |
| 19 | 154 | 43 | 274 | 67 | 487 | 91 | 866 |
| 20 | 158 | 44 | 280 | 68 | 499 | 92 | 887 |
| 21 | 162 | 45 | 287 | 69 | 511 | 93 | 909 |
| 22 | 165 | 46 | 294 | 70 | 523 | 94 | 931 |
| 23 | 169 | 47 | 301 | 71 | 536 | 95 | 953 |
| 24 | 174 | 48 | 309 | 72 | 549 | 96 | 976 |

◆厚膜电阻阻值代码及标记规则

Description for Resistance Value Code and Marking of Thick Film Chip Resistor

* 阻值代码 Resistance Value Code

所有厚膜电阻的阻值代码与其标记是相对的。

All the resistance value code of thick film chip resistor is corresponding with the marking.

* 标记 Marking

* E-24系列（0603、 $\geq \pm 5\%$ ）：采用三位数字表示，前二位表示电阻值有效数字，第三位表示乘以10的次方数。

E-24 series: Express resistance value on the glass side with three digits, the first two digits should be significant and the third one denotes number of zeros.

例For example



30K Ω



33 Ω

*E-24系列 (0603、 $\leq \pm 1\%$)：在三位数字标记下方增加下横线识别。

E-24 series(0603、 $\leq \pm 1\%$): One short bar under marking letter.

例For example:



*E-96系列和E-24系列 (0508、0805、0612、1206、1225、1210、2010、2512、 $\pm 1\%$ & $\pm 0.5\%$)：

▲采用四位数字表示，前三位表示电阻值有效数字，第四位表示乘以10的次方数。

E-96 series & E-24 series (0508、0805、0612、1206、1225、1210、2010、2512、 $\pm 1\%$ & $\pm 0.5\%$): Express the resistance value with four digits, the first three digits are significant figures and the fourth de notes the number of zeros.

例For example:



*E-96系列 (0603、 $\leq \pm 1\%$)：

▲采用三位代码表示，前两位表示E-96系列阻值代码，后一位字母表示乘数代码（见表三和表四）。

Express the resistance value with three code, the first two digit code denote the resistance of E-96 series, and the third code of letter denote the multiplier (see the table three and four).

例For example:



*小数点以“R”表示 The decimal point should be expressed by “R” .

例For example:



*跨接电阻以“0”表示 The jumper should be expressed by “0”

例For example:



* \leq 0402产品不作标记：For the chip resistor (\leq 0402) , there is no mark on the glass side.

例For example:



*非IEC标准系列的电阻值标记表示方法：一般以最接近IEC E24系列标称阻值的标记表示方法。

For the resistance values which don't belong to IEC serial, use the resistance of IEC serial which is most close to the required resistance of non-IEC serial for replacement.

*客户对标记有特殊要求时，则按照协商的结果印刷标记。

To get agreement by both party if the customers have special requirements for the marking.

◆薄膜电阻阻值代码及标记规则

Description for Resistance Value Code and Marking of Thin of Thin Film Chip Resistor

* 阻值代码 Resistance Value Code

所有薄膜电阻全尺寸统一采用四位数阻值代码表示。

All resistance value code of thin film chip resistor used four digits.

例Example

TD03G4701BT

四位数代号表示，如：4701=4.7K Ω ；1R50=1.5 Ω

To use four digits codes represent resistance value,

例Example 4701=4.7K Ω 1R50=1.5 Ω

* 标记 Marking

* 当阻值同时存在于E24和E96系列时，优先采用E96系列。

When resistance value belongs to E24 as well as E96 series, we suggest preferentially use E96 series.

例Example 10K=1002, \neq 103

* \geq 0805产品标记 For the chip resistor (\geq 0805) :

▲采用四位数字表示，前三位表示电阻值有效数字，第四位表示10 的次方数。

Express the resistance value with four digits, the first three digits are significant figures and the fourth denotes the number of zeros.

例Example



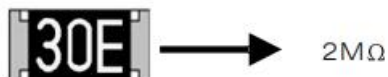
*0603标记 Marking for 0603 Size Resistor

▲0603-E96系列：采用三位代码表示，前二位表示E-96系列阻值代码，后一位字母表示乘数代码（见表三和表四）；

Express the resistance value with three code, the first two digit code denote the resistance of E-

96 series, and the third code of letter denote the multiplier (see the table three and four).

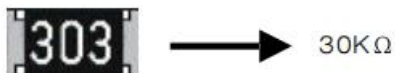
例Example



▲0603-E24系列：采用三位数字表示，前二位表示电阻值有效数字，第三位表示10 的次方数。

Express the resistance value on the glass side with three digits, the first two digits should be significant and the third denote number of zeros.

例Example



*▲小数点以“R”表示 The decimal point should be expressed by“R”.

例Example



* \leq 0402 产品：不作标记 For the chip resistor (\leq 0402), there is no mark on the glass side.

例Example



◆电流检测电阻阻值代码及标记规则

Description for resistance Value Code and Marking of Current Sensing Thick Film Chip Resistor

* 阻值代码 Resistance Value Code

所有电流检测电阻全尺寸统一采用四位数阻值代码表示。

All resistance value code of current sensing thick film chip resistor used four digits.

例Example

RBF03MR010FT

四位数代号表示，如：R010=10mΩ；30M1=30.1mΩ

To use four digits codes represent resistance value,

例Example R010=10mΩ；30M1=30.1mΩ

* 标记 Marking

*E-24和E-96系列（0508、0805、0612、1206、1225、1210、2010、2512， $\leq \pm 5\%$ ）：采用四位标记代码。

For（0508、0805、0612、1206、1225、1210、2010、2512， $\leq \pm 5\%$ ），when resistance value belongs to E24 and E96 series, we suggest preferentially use four digits.

| 标记代码 Mark Code | 阻值范围 Resistance Value | 示例 Sample |
|-------------------|---|--------------|
| R00× | $1\text{m}\Omega \leq R \leq 9\text{m}\Omega$ | R005=5mΩ |
| R0× | $10\text{m}\Omega \leq R \leq 99\text{m}\Omega$ | R033=33mΩ |
| R× | $100\text{m}\Omega \leq R \leq 999\text{m}\Omega$ | R100=100mΩ |
| × | $1\text{m}\Omega < R < 10\text{m}\Omega$ （包含小数点后两位有效数字） (Contains two significant digits after the decimal point.) | 5M10=5.1mΩ |
| × | $10\text{m}\Omega < R < 100\text{m}\Omega$ （包含小数点后一位数字） (Contains one significant digit after the decimal point.) | 30M1=30.1mΩ |

* E-24和E-96系列（0603， $\leq \pm 5\%$ ）：采用三位标记代码。

For the chip resistor (0603, $\leq \pm 5\%$), when resistance value belongs to E024 and E96 series, we suggest preferentially use three digits.

| 标记代码 Mark Code | 阻值范围 Resistance Value | 示例 Sample |
|-------------------|--|--------------|
| V0× | $1\text{m}\Omega \leq R \leq 9\text{m}\Omega$ | V05=5mΩ |
| V× | $10\text{m}\Omega \leq R \leq 99\text{m}\Omega$ | V33=33mΩ |
| R× | $100\text{m}\Omega \leq R \leq 999\text{m}\Omega$ | R100=100mΩ |
| × | $1\text{m}\Omega < R < 10\text{m}\Omega$ （包含小数点后一位有效数字） (Contains one significant digit after the decimal point.) | 5M10=5.1mΩ |

* ≤ 0402 产品不印刷标记。

For the chip resistor（ ≤ 0402 ），there is no mark on the glass side.

*非IEC标准系列的电阻标记表示方法：一般以最接近IEC E24系列标称阻值的标记表示方法。

For the resistance values which don't belong to IEC serial, use the resistance of IEC serial which is most close to the required resistance of non-IEC serial for replacement.

* 客户对标记有特殊要求时，则按照协商的结果印刷标记。

To get agreement by both party if there special requirement for the marking.

◆ 片式电阻器使用说明 Chip Resistor Instructions For Use

* 本产品在以下特殊环境下应用，性能可能会受到影响：

- 1、在各种类型的液体，包括水、油、化学品、有机溶剂的使用。
- 2、在户外直接暴露在阳光的地方，或在灰尘多的地方使用。
- 3、在产品暴露的地方，有海风或腐蚀性气体，包括氯气、硫化氢、氨气、二氧化硫、二氧化氮。
- 4、在产品暴露于静电或电磁波的地方使用。
- 5、在产生热量的部件、塑料线，或其他易燃物品附近使用。
- 6、在用树脂或其他涂层材料密封产品的情况下使用。
- 7、焊接后使用不洁焊料或使用水或水溶性清洗剂清洗产品。
- 8、片状电阻器的基材是氧化铝。由于和安装基板的热膨胀系数不同，在反复施加提供热循环等热应力时，接合部的焊锡（焊锡部）有时会发生裂纹。如果环境温度反复发生很大的变动，并且载荷反复进行ON/OFF，则需要注意龟裂的发生。因热应力而发生的龟裂，取决于所安装的焊盘的大小、焊锡量、安装基板的散热性等，因此在环境温度有很大的变化或者载荷NO/OFF的条件下使用时，请充分注意以进行设计。

* Application of the products in a special environment can deteriorate product performance:

- 1、Use in various types of liquid, including water, oils, chemicals, and organic solvents.
- 2、Use outdoors where the products are exposed to direct sunlight, or in dusty places.
- 3、Use in places where the products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂ etc.
- 4、Use in places where the products are exposed to static electricity or electromagnetic waves.
- 5、Use in proximity to heat-producing components, plastic cords, or other flammable items.
- 6、Use involving sealing or coating the products with resin or other coating materials.
- 7、Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering.
- 8、The substrate of chip resistors is alumina. Cracks may occur at the connection of solder (solder fillet portion) due to the difference of the coefficient of thermal expansion from a mounting board when heat stresses like heat cycle, etc. are repeatedly given to them. Care should be taken to the occurrence of the cracks when the change in ambient temperature or ON/OFF of load is repeated. The occurrence of the crack by heat stress may be influenced by the size of a pad, solder volume, heat radiation of mounting board etc., so please pay careful attention to designing when a big change in ambient temperature and conditions for use like ON/OFF of load can be assumed.

◆ 储存方法 Storage Conditions

温度5℃~30℃，相对湿度30%RH~70%RH。建议在符合上述储存条件下十二个月内使用。

T: 5℃~30℃, RH: 30%RH~70%RH. The products are suggested to be used within twelve months when received, and the storage condition mentioned above should be followed.

◆ 产品使用注意事项

- 1、避免采用超过正常额定功率的功率，超过额定功率的稳态负载条件下可能会对产品性能和可靠性产生负面影响。
- 2、用镊子拿起产品时要小心，有可能会将保护或电阻体夹碎。
- 3、手动安装产品时，烙铁头勿触碰产品。
- 4、用于车载设备、医疗设备、航空设备以及其他涉及人身安全、或可能引起重大损失的设备上时，请务必事先与我公司联系。这些产品在这类用途中出现故障或失灵可能导致人身事故或严重损坏。

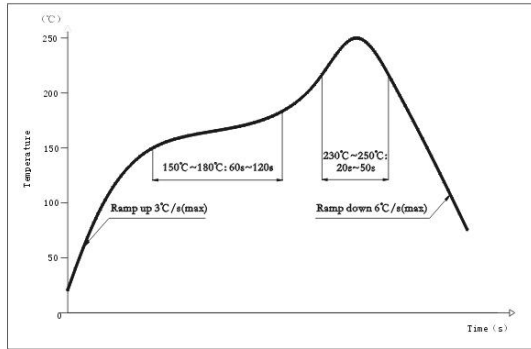
◆ Precautions on use of products

- 1、Avoid applying power exceeding normal rated power, exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 2、Be careful when pick up the products with tweezers. There may be a care that the overcoat and / or the body can be chipped.

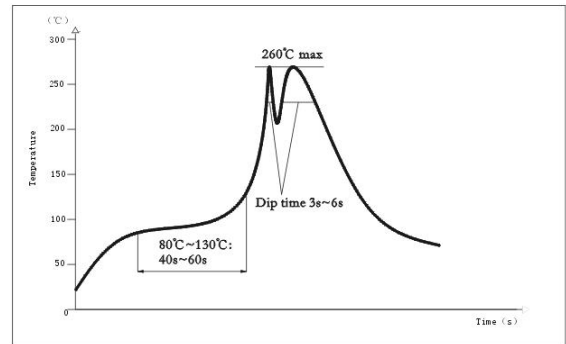
- 3、Soldering tip shall not touch the product when install product manually.
- 4、Contact our sales representatives before you use our products for applications including automotive, medical equipment and aerospace equipment. Malfunction or failure of the products in such applications may cause loss of human life or serious damage.

◆焊接Soldering

* 推荐的回流焊曲线 Recommended reflow profile



*推荐的波峰焊曲线Recommended wave solder profile



* 推荐的焊膏类型 Recommended solder alloy: 96.5Sn-3.0Ag-0.5Cu

◆修订履历 Revision History

| 版本 Version | 日期 Date | 修订内容 Change Description | 修订确认 Checked by |
|------------|------------|--|-------------------|
| V10.0 | 2025-09-04 | -附录: 修改储存方法。 - Appendix: Modify the storage conditions. | 刘瀚阳 Hanyang Liu |
| V9.0 | 2025-05-24 | -新增: 0402: 1/10W、1210: 3/4W、2010: 1W 和 2512: 2W 型号、功率及相关指标。 Add:0402:1/10W,1210:3/4W. 2010:1W and 2512:2W models, power and related indicators. -更新脉冲曲线 Update the pulse curve. | 卢振强 Zhengqiang Lu |
| V8.0 | 2023-12-18 | -特点: 增加潮敏等级 MSL1 Features:add the MSL 1 -品名构成:增加 13 寸卷盘代号, 删除+2%、+10%、+20%精度 Part number: add 13inch reel code,delete tolerance of +2%、+10%、+20%. -附录:增加 13 寸卷盘编带尺寸;增加 0508、0612、1225 包装、阻值代码及标记规则。 Appendix: add the dimentions of 13 inch reel;Add the parametere of 0508、0612、1225. | 卢振强 Zhengqiang Lu |
| V7.0 | 2023-02-20 | -附录:增加 RH-MY04, RH-MY08 产品编带包装参数。 Appendix: Add the taping parameters of RH-MY04,RH-MY08. -附录:修改 0201,0402,0603,0805 编带包装 A,B,T 参数 Appendix: Modify the taping parameters A,B,T of 0201,0402,0603,0805. | 卢振强 Zhengqiang Lu |
| V6.0 | 2022-11-29 | -增加耐脉冲特性曲线。 Add the curve of resistance to power pulse. | 卢振强 Zhengqiang Lu |
| V5.0 | 2022-04-25 | -修改产品标记由数码体改为手写体。 Modify the product marking from digital to handwritten. | 杜建业 Jianye Du |
| V4.0 | 2022-02-25 | -附录中“包装数量”: 修改 0201 尺寸为 15K 包装数量 Reviae the quantity of 0201 15kpcs to Packeging Quantity. | 杜建业 Jianye Du |
| V3.0 | 2021-08-13 | -增加 “应用领域” Add the application. - 附录中“推荐焊盘尺寸”: 增加偏差值。 Add the tolerance to Recommend Solder Pad Size. | 卢振强 Zhengqiang Lu |
| V2.0 | 2021-04-23 | -增加 0402. 1210, 2010, 2512 产品参数 Add the parameters of 0402.1210.2010,2512 chip resistor. -删除电阻值误差精度 10%、20%。 Delete the resistance tolerance 10%,20% -增加 0603~1206 型号 $1\Omega \leq R < 10\Omega$ $1M\Omega < R \leq 10M\Omega$ 阻值对应的 T.C.R $\pm 200\text{ppm}/^\circ\text{C}$ 。 Add the T.C.R $\pm 200\text{ppm}/^\circ\text{C}$ to the resistance range of $1\Omega \leq R < 10\Omega$, $1M\Omega < R \leq 10M\Omega$ for 0603~1206 chip resistor. -增加 0402, 1210, 2010, 2512 型号 ESD 特性图 Add the ESD Characteristics diagram of 0402, 1210,2010,2512 chip resistor. | 卢振强 Zhenqiang Lu |

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|-----------|------------|--|-----------------|
| | | -删除 E-24 系列 客户特殊要求标记说明 | |
| V2020.1.0 | 2021-02-24 | Delete marking instructions for special requirements of customers. | 杜建业 Jianye Du |
| V2020.0 | 2020-06-23 | 原版 The original version. | 吴晓玲 Xiaoling Wu |

注:上述所提供之内容为产品规格说明。在产品未变更时,风华保有修改此内容不另行通知之所有权利,任何产品变更将会以 PCN 通知客户。

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