

规格书

**SPECIFICATION**

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## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

#### 1. 范围 (scope) :

##### 1.1 适用于本公司所生产的无铅、车规厚膜贴片电阻 QR 系列

This specification applies to Automotive thick film chip resistors which meet requirements of Pb free.

##### 1.2 本公司的无铅产品指的贴片电阻端电极无铅，而存在于电阻层的玻璃中的符合 RoHS 豁免条款。

There no lead exists in terminal of resistor, and lead which exist in glass of resistor layer meets RoHS exemption.

##### 1.3 符合 AEC-Q200 條款

The relevant provisions of the AEC-Q200

#### 2. 产品料号 (part number) :

0603 1/10W 5% 100 Ω

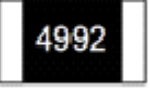
QR0603JA0101G

| QR          | 0603     | J         | A           | 0101             | G                  |                  |
|-------------|----------|-----------|-------------|------------------|--------------------|------------------|
| ↓           | ↓        | ↓         | ↓           | ↓                | ↓                  | ↓                |
| 类型(Type)    | 尺寸(Size) | 公差        | 额定功率        | 阻值               | 包装代码               | 区别码              |
| QR: 车规厚     | 0402     | Tolerance | Rated Power | Resistance value | Packing Code       | Distinction Code |
| 膜贴片电阻       | 0603     | B=±0.1%   | 1= 1W       | ±0.5%, ±1% :     | G=成品, 7 inch reel  | 空码 = 无指定         |
| (Automotive | 0805     | D=±0.5%   | 2= 3/4W     | 49R9=49.9 Ω      | 常规包装量              | - “X “= 特别指      |
| thick film  | 1206     | F=±1%     | 3= 1/2W     | 1002=10K Ω       | H=成品, 10 inch reel | 定, 不同字母代表        |
| chip        | 1210     | G=±2%     | 4= 1/4W     | ±2%, ±5% :       | 两倍包装量              | 不同指定             |
| resistors)  | 1812     | J=±5%     | 8= 1/8W     | 06R8=6.8 Ω       | Z=成品, 15K包装量       |                  |
|             | 2010     |           | A= 1/10W    | 0564=560K Ω      | S=成品, 20K包装量       |                  |
|             | 2512     |           | F= 1/16W    |                  | U=成品, 50K包装        |                  |
|             |          |           |             |                  | V=bulk (散料)        |                  |

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#### 3. 电阻本体字码标示 (Marking on the Resistor's Body):

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                      |                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------|
| <p>※ 0402 因本体太小，本体上无字码标示<br/>For 0402 size, no marking on the body due to the small size of the resistor.</p> <p>※ 公差±5%的产品，以三字码标示，前两位表示阻值的有效数字，最后一位表示 10 的乘幂<br/>±5% Tolerance product: the marking is 3 digits, the first 2 digits are significant figures of resistance value and the 3rd one denotes the power number of 10, (10X).</p> <p>※ ±0.5%，±1%的产品，以四字码标示，前三位表示阻值的有效数字，最后一位表示 10 的乘幂<br/>±0.5% ,±1% tolerance product: the marking is 4 digits, the first 3 digits are significant figures of resistance value and the 4th one denotes the power number of 10, (10X).</p> <p>※ 0603 ±1% E96 系列的标准阻值，因电阻本体太小，采用三位代码标示。<br/>Standard E96 series values of 0603 ±1%: due to the small size of the resistor's body, use 3digits code to indicate the resistance value.</p> |    | No Marking                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    | $472=47 \times 10^2=4.7K \Omega$                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    | 10Ω 以下标示：5R6=5.6Ω<br>Below 10Ω: 5R6=5.6Ω                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    | $4992=499 \times 10^2=49.9K \Omega$                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   | 100Ω 以下标示：6R81=6.81Ω<br>Below 100Ω: 6R81=6.81Ω          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | 0603 ±1% E96 系列<br>$38Y=243 \times 10^{-2}=2.43 \Omega$ |

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### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

0603 ±1% E96 系列的标准阻值代码(Standard E96 Series Resistance Value Code for 0603 ±1% Marking)

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

0603 ±1% E96 系列的指数代码(Multiplier Code for 0603 ±1% Marking)

| 代码 Code       | Y         | X         | A      | B      | C      | D      | E      | F      |
|---------------|-----------|-----------|--------|--------|--------|--------|--------|--------|
| 指数 Multiplier | $10^{-2}$ | $10^{-1}$ | $10^0$ | $10^1$ | $10^2$ | $10^3$ | $10^4$ | $10^5$ |

阻值标示如下(So the resistance value are marked as the following examples)



$$10D=124 \times 10^3=124K \Omega$$



$$38Y=243 \times 10^{-2}=2.43 \Omega$$

0603 ±1%的产品，在标准 E24 系列中，但不属于 E96 系列，标示与 5%的字码相同，但是在字码下加一条线  
 Standard E24 and not belong to E96 series values of 0603 ±1%, the marking is the same as 5% tolerance but marking as underline



$$\underline{331}=33 \times 10^1=330 \Omega$$

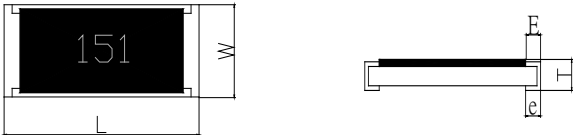


$$\underline{560}=56 \times 10^0=56 \Omega$$

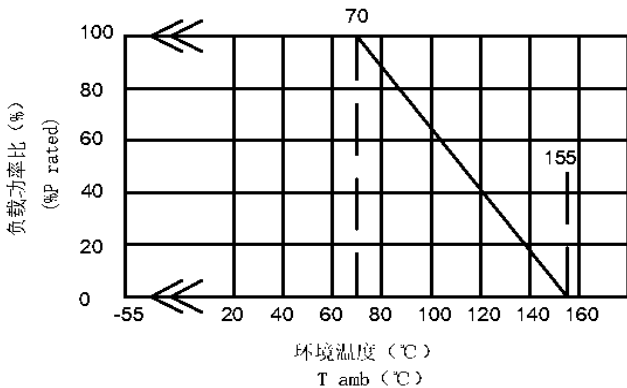
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#### 4. 尺寸 (dimension) :

| 尺寸<br>dimension |  |           |           |           |           | 单位 (unit) : mm |
|-----------------|-----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------------|
| 型别 (Type)       | L                                                                                 | W         | T         | E         | e         |                |
| QR0402          | 1.00±0.05                                                                         | 0.50±0.05 | 0.30±0.05 | 0.15±0.10 | 0.20±0.10 |                |
| QR0603          | 1.60±0.10                                                                         | 0.80±0.10 | 0.40±0.10 | 0.30±0.20 | 0.30±0.10 |                |
| QR0805          | 2.00±0.10                                                                         | 1.25±0.10 | 0.50±0.15 | 0.30±0.15 | 0.40±0.15 |                |
| QR1206          | 3.05±0.10                                                                         | 1.60±0.10 | 0.55±0.15 | 0.40±0.20 | 0.50±0.20 |                |
| QR1210          | 3.05±0.10                                                                         | 2.50±0.15 | 0.55±0.15 | 0.50±0.20 | 0.50±0.20 |                |
| QR1812          | 4.50±0.10                                                                         | 3.10±0.15 | 0.55±0.15 | 0.55±0.20 | 0.70±0.20 |                |
| QR2010          | 5.00±0.20                                                                         | 2.50±0.15 | 0.55±0.10 | 0.60±0.20 | 0.60±0.20 |                |
| QR2512          | 6.30±0.20                                                                         | 3.20±0.15 | 0.55±0.10 | 0.60±0.20 | 0.60±0.20 |                |

#### 5. 功率衰减曲线 ( Derating Curve) :

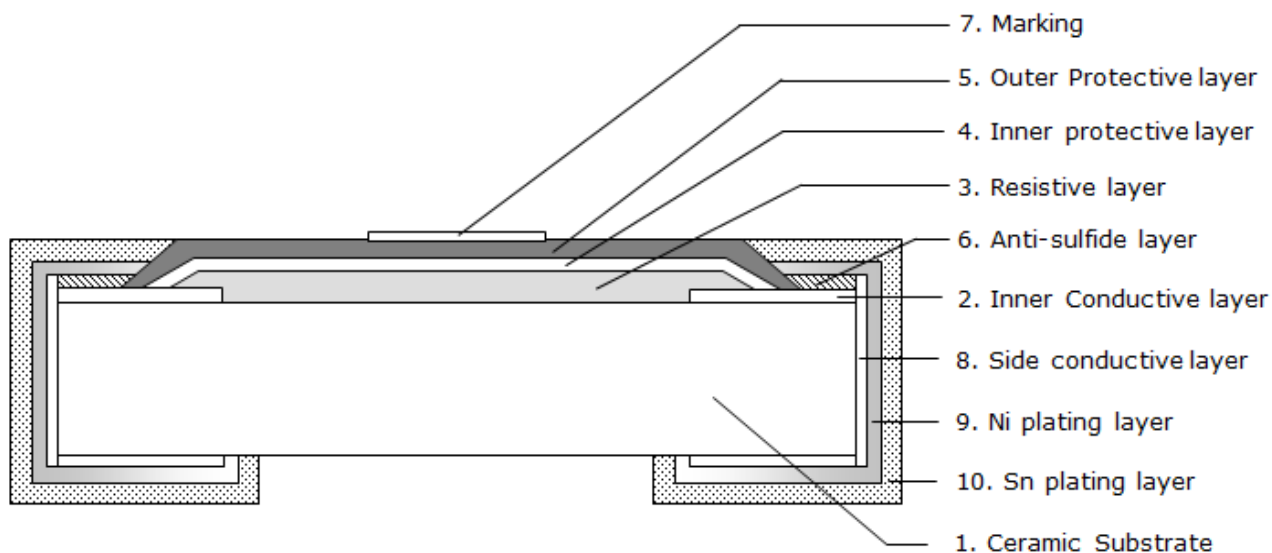
| 使用温度范围 | -55℃~+155℃                                                                                                                                   |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 说明     | 电阻的额定功率基于环境温度-55℃到 70℃，周围温度若超遇 70℃至 155℃之间，功率可照下图曲线予以修定之。                                                                                    |
| 功率衰减曲线 |  <p>负载功率比 (%P rated)</p> <p>环境温度 (°C)<br/>T amb (°C)</p> |

储存条件及期限 (storage condition or Data) : 25±5℃，60±20%RH；有效期 2 年。

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#### 6.电阻结构（Construction）：



| No. | 结构<br>construction          | 主要材料<br>Major material               |
|-----|-----------------------------|--------------------------------------|
| 1   | 陶瓷基板 Ceramic substrate      | 三氧化二铝 Al <sub>2</sub> O <sub>3</sub> |
| 2   | 内电极 Inner Conductive layer  | 银 Ag-Pd                              |
| 3   | 阻体层 Resistive layer         | 氧化钌+玻璃 RuO <sub>2</sub> + glass      |
| 4   | 内保护层 Inner protective layer | 玻璃 Glass                             |
| 5   | 外保护层 Outer Protective layer | 环氧树脂 Epoxy                           |
| 6   | 抗硫化层 Anti-Sulfide layer     | 银 Ag                                 |
| 7   | 文字 Marking                  | 环氧树脂 Epoxy                           |
| 8   | 侧电极 Side conductive layer   | 镍铬合金 Ni-Cr                           |
| 9   | 镍电极 Ni plating layer        | 镍 Ni                                 |
| 10  | 锡电极 Sn plating layer        | 雾锡 Matte Tin                         |

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#### 7. 阻值范围 (resistance range) :

##### 7.1. $R \geq 1\Omega$ 阻值范围 (resistance range)

| 型别<br>Type | 温度系数 T.C.R<br>(PPM/°C) | 阻值范围<br>Resistance Range         |                                  |                |
|------------|------------------------|----------------------------------|----------------------------------|----------------|
|            |                        | B: $\pm 0.1\%$<br>D: $\pm 0.5\%$ | F: $\pm 1.0\%$<br>G: $\pm 2.0\%$ | J: $\pm 5.0\%$ |
| QR0402     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR0603     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR0805     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR1206     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR1210     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR1812     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR2010     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |
| QR2512     | $\pm 400$              | -                                | $1\Omega \leq R < 10\Omega$      |                |
|            | $\pm 100$              | $10\Omega \leq R \leq 1M\Omega$  | $10\Omega \leq R \leq 10M\Omega$ |                |
|            | $\pm 200$              | -                                | $10M\Omega < R \leq 30M\Omega$   |                |

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#### 7.2. $0\Omega < R < 1\Omega$ 低阻值范围 (Low Ohm resistance range)

| 型别<br>Type | 额定功率<br>Rated power | 额定电压范围<br>Rated Voltage Range | 最大过载电压<br>Max Overload Voltage | T.C.R.<br>(PPM/°C) | 阻值范围 (mΩ)                        |
|------------|---------------------|-------------------------------|--------------------------------|--------------------|----------------------------------|
|            |                     |                               |                                |                    | F: $\pm 1.0\%$<br>J: $\pm 5.0\%$ |
| QR0402     | 1/16W               | 0.12~0.25V                    | 0.624V                         | $\pm 1000$         | $200 \leq R \leq 450$            |
|            |                     |                               |                                | $\pm 800$          | $450 < R < 1000$                 |
| QR0603     | 1/10W               | 0.09~0.31V                    | 0.775V                         | $\pm 1000$         | $75 \leq R < 100$                |
|            |                     |                               |                                | $\pm 800$          | $100 \leq R \leq 330$            |
|            |                     |                               |                                | $\pm 600$          | $330 < R < 1000$                 |
| QR0805     | 1/8W                | 0.04~0.35V                    | 0.875V                         | $\pm 1800$         | $10 \leq R < 50$                 |
|            |                     |                               |                                | $\pm 800$          | $50 \leq R < 100$                |
|            |                     |                               |                                | $\pm 600$          | $100 \leq R < 1000$              |
| QR1206     | 1/4W                | 0.05~0.5V                     | 1.25V                          | $\pm 1800$         | $10 \leq R < 50$                 |
|            |                     |                               |                                | $\pm 800$          | $50 \leq R < 100$                |
|            |                     |                               |                                | $\pm 600$          | $100 \leq R < 1000$              |
| QR1210     | 1/2W                | 0.07~0.7V                     | 1.75V                          | $\pm 1800$         | $10 \leq R \leq 50$              |
|            |                     |                               |                                | $\pm 800$          | $50 < R \leq 100$                |
|            |                     |                               |                                | $\pm 600$          | $100 < R < 1000$                 |
| QR1812     | 3/4W                | 0.08~0.8V                     | 2.15V                          | $\pm 1800$         | $10 \leq R < 50$                 |
|            |                     |                               |                                | $\pm 800$          | $50 \leq R < 100$                |
|            |                     |                               |                                | $\pm 600$          | $100 \leq R < 1000$              |
| QR2010     | 3/4W                | 0.08~0.8V                     | 2.15V                          | $\pm 1800$         | $10 \leq R < 50$                 |
|            |                     |                               |                                | $\pm 800$          | $50 \leq R < 100$                |
|            |                     |                               |                                | $\pm 600$          | $100 \leq R < 1000$              |
| QR2512     | 1W                  | 0.1~0.99V                     | 2.475V                         | $\pm 1800$         | $10 \leq R < 50$                 |
|            |                     |                               |                                | $\pm 800$          | $50 \leq R < 100$                |
|            |                     |                               |                                | $\pm 600$          | $100 \leq R < 1000$              |

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#### 8. 电气特性 (electricS characteristics) :

| 型别<br>Type | 额定功率<br>Rated power | 最大工作<br>电压<br>Max Working<br>Voltage | 最大过负<br>荷电压<br>Max Overload<br>Voltage | 零欧姆阻值<br>Resistance Value of<br>Jumper | 零欧姆额<br>定电流<br>Rated Current of<br>Jumper |
|------------|---------------------|--------------------------------------|----------------------------------------|----------------------------------------|-------------------------------------------|
| QR0402     | 1/16W               | 50V                                  | 100V                                   | <50mΩ                                  | 1.0A                                      |
| QR0603     | 1/10W               | 75V                                  | 150V                                   | <50mΩ                                  | 1.0A                                      |
| QR0805     | 1/8W                | 150V                                 | 300V                                   | <50mΩ                                  | 2.0A                                      |
| QR1206     | 1/4W                | 200V                                 | 400V                                   | <50mΩ                                  | 2.0A                                      |
| QR1210     | 1/2W                | 200V                                 | 400V                                   | <50mΩ                                  | 2.0A                                      |
| QR1812     | 3/4W                | 200V                                 | 400V                                   | <50mΩ                                  | 2.0A                                      |
| QR2010     | 3/4W                | 200V                                 | 400V                                   | <50mΩ                                  | 2.0A                                      |
| QR2512     | 1W                  | 200V                                 | 400V                                   | <50mΩ                                  | 2.0A                                      |

#### 备注 (remark) :

※ 额定电压计算公式 (The rated voltage is calculated by the following formula) :

**$R \geq 1\Omega$  :**

$$E = \sqrt{RP}$$

E : 额定电压 (Rated Voltage) (V)

P : 额定功率 (Rated Power) (W)

R : 电阻阻值 (Resistance) (ohm)

※ 如果计算出的电压超过此型别的最大工作电压, 则此型别的最大工作电压为此电阻的额定电压。

In case the value calculated by the formula exceed the maximum working voltage as above table 9, the maximum working voltage shall be regarded as rated voltage.

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#### 9.性能信赖性测试 (Performance Reliability Test Methods)

| 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 of<br>Resistance<br>(T.C.R.)□ | JIS C 5201 4.8<br>IEC-60115-1 4.8   | $TCR = (R - R_0) / (t - t_0) R_0 \times 10^6 \text{ (ppm)}$<br>$R_0$ 电阻在室温下的阻值(resistance at room temperature)<br>$R$ 电阻在 155°C或-55°C下的阻值(resistance at 155°C or -55°C)<br>$t_0$ 室温(room temperature)<br>$t$ 测试温度(test temperature 155°C or -55°C)                                                                                                                   | 参照 7 项                                                                                                 |
| 绝缘电阻<br>Insulation<br>resistance                                 | JIS C 5201 4.6<br>IEC-60115-1 4.6   | 电阻本体上加载 100V (DC) 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.<br>Then measure insulation resistance                                                                                                                                                                                                   | ≥ 10GΩ                                                                                                 |
| 短时间过负荷<br>Short-time<br>overload                                 | JIS C 5201 4.13<br>IEC-60115-1 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.<br>OR 加载如下电流 5 秒后测量阻值<br>0201=1A<br>0402/0603=2.5A<br>0805/1206/1210/1812/2010/2512=5A<br>$\Delta R\% = \frac{R_2 - R_1}{R_1} * 100 \text{-----} (\%)$<br>$R_1$ = 试验前阻值(resistance before test)<br>$R_2$ = 试验后阻值(resistance after test) | 0.5%, 1%:<br>±(1.00%+0.05Ω)<br>5%:<br>±(2.00%+0.10Ω)<br>$R < 1\Omega$ :<br>±(2.00%+0.10Ω)<br>0R: <50mΩ |

## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

| 内容<br>Item                              | 测试方法<br>Test Methods                       | 测试条件<br>Test Conditions                                                                                                                                                                                                                                                                              | 规格<br>Specification                                                                                                         |
|-----------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 抗焊锡热<br>Resistance to<br>soldering heat | JIS C 5201 4.18<br>IEC-60115-1<br>4.18     | <p>锡炉温度 260±5℃, 时间 10±0.5 秒, 测量试验前后的阻值变化率。</p> <p>Dip the resistance in a tin furnace at 260±5℃ for 10±0.5sec. Measure the variation of resistance.</p> $\Delta R\% = \frac{R_2 - R_1}{R_1} * 100 \text{-----} (\%)$ <p>R1 = 试验前阻值(resistance before test)<br/>R2 = 试验后阻值(resistance after test)</p> | <p>0.5%, 1%:<br/>±(0.50%+0.05Ω)</p> <p>5%:<br/>±(1.00%+0.05Ω)</p> <p>R &lt; 1Ω :<br/>±(1.00%+0.05Ω)</p> <p>0R: &lt;50mΩ</p> |
| 溶蚀<br>Leaching                          | JIS C 5201 4.18<br>IEC-60068-2-58<br>8.2.1 | <p>锡炉温度 260±5℃, 时间 30+1/-0 秒, 取出置于显微镜下观察焊锡面积。</p> <p>Dip the resistance in a tin furnace at 260±5℃ for 30+1/-0seconds, then take it out and observe the solder area under a microscope;</p>                                                                                                          | <p>单边未吃锡面积 ≤ 5%</p> <p>Individual leaching area ≤ 5%</p> <p>总未吃锡面积 ≤ 10%</p> <p>Total leaching area ≤ 10%</p>               |
| 耐溶剂<br>Resistance to<br>Solvent         | MIL-STD-202<br>Method 215                  | <p>浸于洁净的 OKEM 化学水溶液中或同等水溶液中。</p> <p>Add Aqueous wash chemical-OKEM clean or equivalent</p> $\Delta R\% = \frac{R_2 - R_1}{R_1} * 100 \text{-----} (\%)$ <p>R1 = 试验前阻值(resistance before test)<br/>R2 = 试验后阻值(resistance after test)</p>                                                              | <p>0.5%, 1%:<br/>±(0.50%+0.05Ω)</p> <p>5%:<br/>±(0.50%+0.05Ω)</p> <p>0R: &lt;50mΩ</p>                                       |

## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

| 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>Operational<br>Life | MIL-STD-202<br>Method 108 | 恒定温度 125℃加载额定电压, 通电 1.5H, 断电 0.5H, 共持续 1000+24/-0 小时<br>Put the specimen in a chamber at 125℃ temperature, ON TIME:1.5H, OFF TIME:0.5H, rated voltage 1000 +24/-0 hours<br>$\Delta R\% = \frac{R_2 - R_1}{R_1} * 100 \text{-----} (\%)$ R1 = 试验前阻值(resistance before test)<br>R2 = 试验后阻值(resistance after test)                                                                   | 0.5%, 1%:<br>$\pm(1.00\% + 0.05\Omega)$<br>5%:<br>$\pm(3.00\% + 0.10\Omega)$ |
| 耐湿特性<br>Biased<br>Humidity  | MIL-STD-202<br>Method 103 | 电阻放入恒温恒湿箱, 温度 85±2℃, 湿度 85±2%RH; 通 10%的电额定电压 1000 +48/-0 小时. 量测试验前后阻值变化率.<br>Put the specimen in a chamber at 85±2℃ temperature and 85% relative humidity, 10% of operating power, is 1000 +48/-0 .. Measure the variation of resistance.<br>$\Delta R\% = \frac{R_2 - R_1}{R_1} * 100 \text{-----} (\%)$ R1 = 试验前阻值(resistance before test)<br>R2 = 试验后阻值(resistance after test) | 0.5%, 1%:<br>$\pm(1.00\% + 0.05\Omega)$<br>5%:<br>$\pm(3.00\% + 0.05\Omega)$ |

## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

| 内容<br>Item                                    | 测试方法<br>Test Methods       | 测试条件<br>Test Conditions                                                                                                                                                                                                                                                                                                                           | 规格<br>Specification                                                      |
|-----------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 温度循环<br>Temperature<br>cycling                | JESD22<br>Method JA-104    | 电阻放入温度循环机中, 温度 125°C至-55°C,<br>共 1000 个循环。量测试前后阻值变化率。<br>Put specimen in a chamber which<br>temperature can be changed to 155°C or<br>-55°C, repeated 5 times. Measure the<br>variation of resistance.<br>$\Delta R\% = \frac{R_2 - R_1}{R_1} * 100 \text{-----} (\%)$<br>R1 = 试验前阻值(resistance before test)<br>R2 = 试验后阻值(resistance after test) | 0.5%, 1%:<br>$\pm(0.50\%+0.05\Omega)$<br>5%:<br>$\pm(1.00\%+0.10\Omega)$ |
| 高温储存<br>High Temperature<br>Exposure(Storage) | MIL-STD-202<br>Method 108  | 155°C下放置 1000h, 不加载功率, 试验结束<br>24±4 小时后进行测试。<br>1000 hrs. @ T=155°C. Unpowered.<br>Measurement at 24±4 hours after test<br>conclusion.                                                                                                                                                                                                            | 0.5%, 1%:<br>$\pm(0.50\%+0.05\Omega)$<br>5%:<br>$\pm(2.00\%+0.05\Omega)$ |
| 外观检<br>External Visual                        | MIL-STD-883<br>Method 2009 | 无需焊锡, 检查本体外观字码和电极尺寸。<br>Electrical test not required.<br>Inspect device construction, marking and<br>workmanship.                                                                                                                                                                                                                                 | -                                                                        |
| 机械冲击<br>Mechanical Shock                      | MIL-STD-202<br>Method 213  | 波形: 半正弦冲击脉冲波, 峰值 100 克, 持续<br>时间为 6ms<br>Wave Form : Tolerance for half sine shock<br>pulse. Peak value is 100g' s. Normal<br>duration(D) is 6(ms)                                                                                                                                                                                                | 0.5%, 1%:<br>$\pm(1.0\%+0.05\Omega)$<br>5%:<br>$\pm(2.00\%+0.1\Omega)$   |

## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

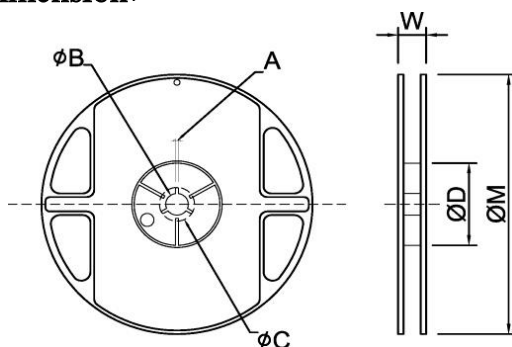
| 内容<br>Item                         | 测试方法<br>Test Methods                 | 测试条件<br>Test Conditions                                                                                                                       | 规格<br>Specification                                                      |
|------------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 振动<br>Vibration                    | MIL-STD-202<br>Method 204            | 5 克 20 分钟, 12 个循环, 每个循环 3 个<br>方向。测试频率为 10-2000 H<br>5 g's for 20 min., 12 cycles each of 3<br>orientations. Note: Test from 10-2000 Hz       | 0.5%, 1%:<br>$\pm(1.0\%+0.05\Omega)$<br>5%:<br>$\pm(2.00\%+0.1\Omega)$   |
| 静电<br>ESD                          | AEC-Q200- 002<br>or ISO/DIS<br>10605 | 加载规定静电电压2次, 间隔1秒,<br>0402/0603: 1KV; 0805 含以上: 2KV<br>Human body model<br>0402/0603: 1KV; 0805 and above: 2KV                                 | $\pm(3.0\%+0.05\Omega)$                                                  |
| 焊锡性<br>Solderability               | J-STD-002                            | 干热 155 度 4 小时后浸入 245±5°C锡炉 3 秒<br>4 hrs155°C dry heat, 245±5°C 3 sec.                                                                         | 0.5%, 1%:<br>$\pm(0.50\%+0.05\Omega)$<br>5%:<br>$\pm(1.00\%+0.05\Omega)$ |
| 端子强度<br>Terminal Strength<br>(SMD) | AEC Q200-006                         | 施加压力保持 60 秒。<br>压力: 0402/0603: 8N ;<br>0805 (含) 以上 : 17.7N<br>Pressurizing force for 60 seconds<br>0402 / 0603: 8N ;<br>0805 and above: 17.7N | 无破损<br>No broken                                                         |
| 弯折<br>Board Flex                   | AEC Q200-005                         | 弯曲一次保持 60 秒<br>弯曲度: 2010/2512: 2mm<br>其它尺寸: 3mm<br>Bending once for 60 seconds<br>2010, 2512 sizes: 2mm Other sizes: 3mm                      | 0.5%, 1%:<br>$\pm(1.0\%+0.05\Omega)$<br>5%:<br>$\pm(1.00\%+0.05\Omega)$  |

## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

#### 10. 包装规格 (Tapping Specification)

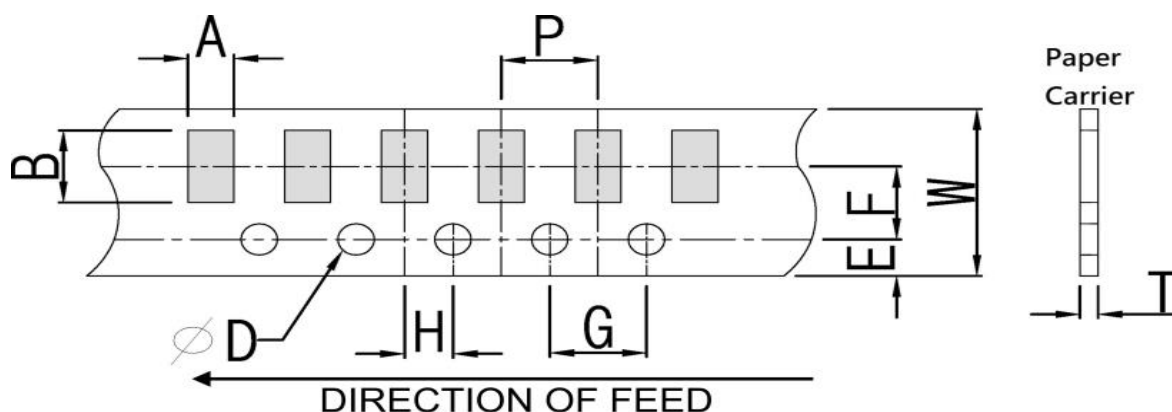
##### 10.1 卷盘尺寸 (reel dimension)



Unit: mm

| Type                         | Size |              | A       | φ B      | φ C    | φ D     | W        | φ M     |
|------------------------------|------|--------------|---------|----------|--------|---------|----------|---------|
| 0402                         | 7"   | 10K Reel     | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0  | 11.5±2.0 | 178±2.0 |
|                              | 13"  | 40K/50K Reel | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 100±1.0 | 11.5±2.0 | 330±2.0 |
| 0603<br>0805<br>1206<br>1210 | 7"   | 5K Reel      | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0  | 11.5±2.0 | 178±2.0 |
| 0603<br>0805<br>1206         | 10"  | 10K Reel     | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 100±1.0 | 11.5±2.0 | 254±2.0 |
|                              | 13"  | 20K Reel     | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 100±1.0 | 11.5±2.0 | 330±2.0 |
| 2010<br>2512<br>1812         | 7"   | 4K Reel      | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0  | 16.0±2.0 | 178±2.0 |

##### 10.2 包装尺寸 (packing dimension)



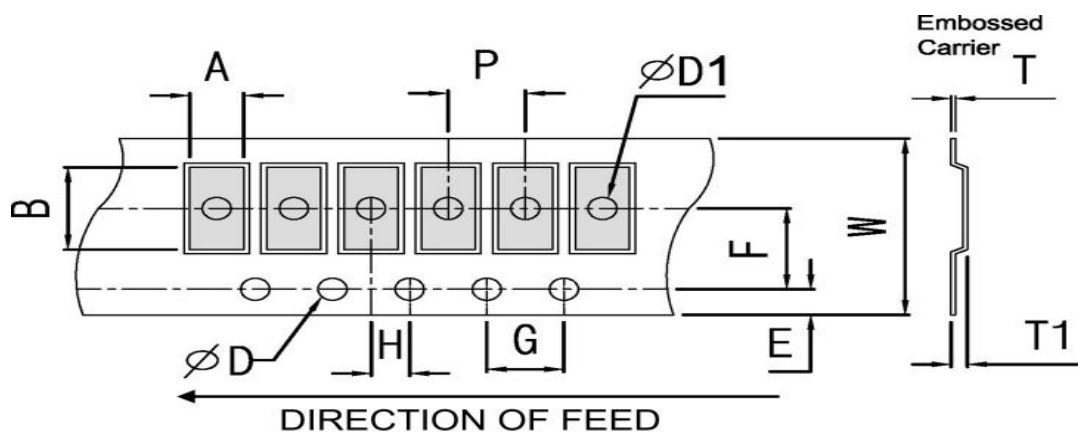
## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

Unit: mm

Paper Type

| Type | A        | B        | W       | E        | F        | G       | H        | T        | ΦD                                  | P       |
|------|----------|----------|---------|----------|----------|---------|----------|----------|-------------------------------------|---------|
| 0402 | 0.70±0.1 | 1.20±0.1 | 8.0±0.2 | 1.75±0.1 | 3.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.45±0.1 | 1.50± <sup>0.1</sup> <sub>0.0</sub> | 2.0±0.1 |
| 0603 | 1.05±0.2 | 1.80±0.2 | 8.0±0.2 | 1.75±0.1 | 3.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.60±0.1 |                                     | 4.0±0.1 |
| 0805 | 1.55±0.2 | 2.30±0.2 | 8.0±0.2 | 1.75±0.1 | 3.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.75±0.1 |                                     | 4.0±0.1 |
| 1206 | 1.90±0.2 | 3.50±0.2 | 8.0±0.2 | 1.75±0.1 | 3.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.75±0.1 |                                     | 4.0±0.1 |
| 1210 | 2.85±0.2 | 3.50±0.2 | 8.0±0.2 | 1.75±0.1 | 3.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.75±0.1 |                                     | 4.0±0.1 |

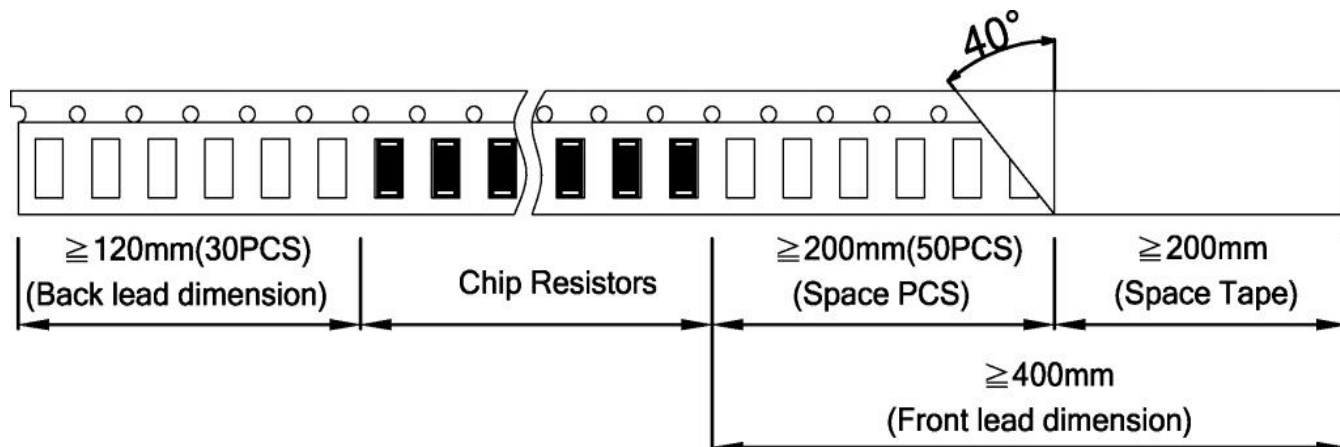


Unit: mm

Embossed Type

| Type | A        | B        | W      | E        | F        | G       | H        | T        | ΦD                                  | ΦD1     | T1        | P       |
|------|----------|----------|--------|----------|----------|---------|----------|----------|-------------------------------------|---------|-----------|---------|
| 2010 | 2.80±0.2 | 5.60±0.2 | 12±0.1 | 1.75±0.1 | 5.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.23±0.1 | 1.50± <sup>0.1</sup> <sub>0.0</sub> | 1.5±0.1 | 0.85±0.15 | 4.0±0.1 |
| 2512 | 3.40±0.2 | 6.70±0.2 | 12±0.1 | 1.75±0.1 | 5.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.23±0.1 |                                     | 1.5±0.1 | 0.85±0.15 | 4.0±0.1 |
| 1812 | 3.30±0.2 | 4.60±0.2 | 12±0.1 | 1.75±0.1 | 5.5±0.05 | 4.0±0.1 | 2.0±0.05 | 0.23±0.1 |                                     | 1.5±0.1 | 0.85±0.15 | 4.0±0.1 |

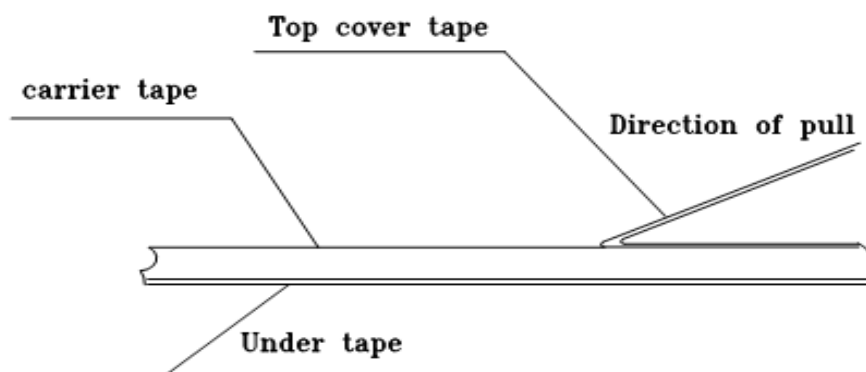
#### 10.3 前后引线尺寸 (Front & Back Lead Dimension)



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

上胶带以 300mm/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 15g~80g

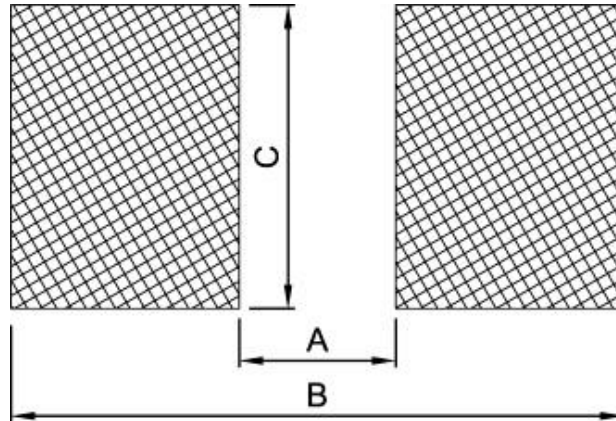
The top cover tape is pulled at a speed of 300 mm/min with the angle between the tape during peel and the direction of unreeling maintained at 165 to 180 degree as following picture. The peel force of paper carrier tape shall be 10 g to 70 g, the peel force of plastic carrier tape shall be 15 g to 80 g



## 车规厚膜贴片电阻规格书- QR 系列

### Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

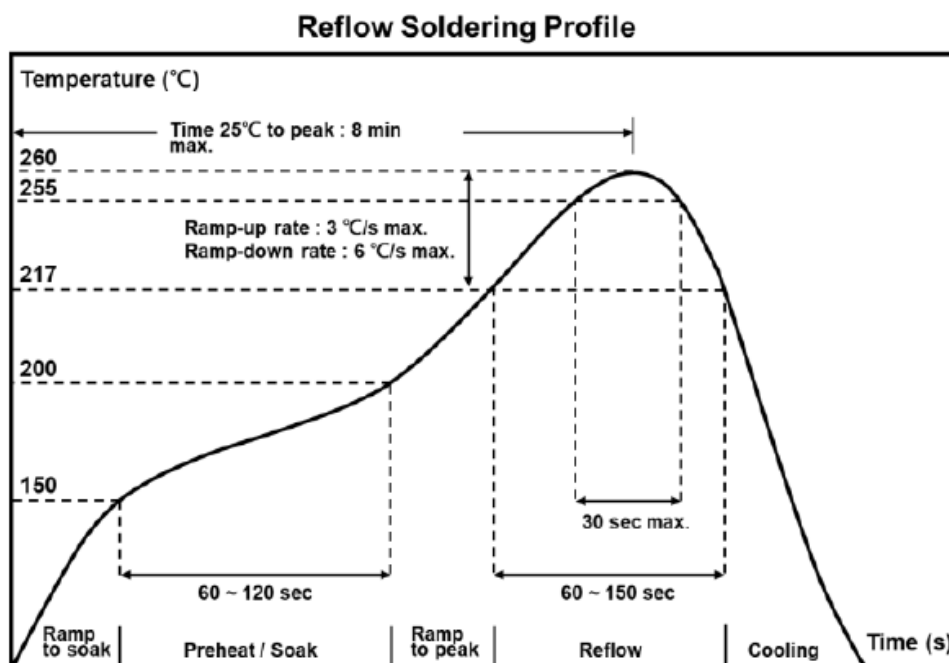
#### 12. 焊盘尺寸 (Recommended land patterns):



| Type | Dimensions (mm) |      |      |      |      |      |      |      |
|------|-----------------|------|------|------|------|------|------|------|
| Item | 0402            | 0603 | 0805 | 1206 | 1210 | 1812 | 2010 | 2512 |
| A    | 0.60            | 0.80 | 1.30 | 2.20 | 2.00 | 3.11 | 3.80 | 4.90 |
| B    | 1.60            | 2.40 | 2.90 | 4.20 | 4.40 | 5.91 | 6.60 | 8.10 |
| C    | 0.70            | 1.00 | 1.40 | 1.70 | 2.70 | 3.00 | 2.70 | 3.40 |

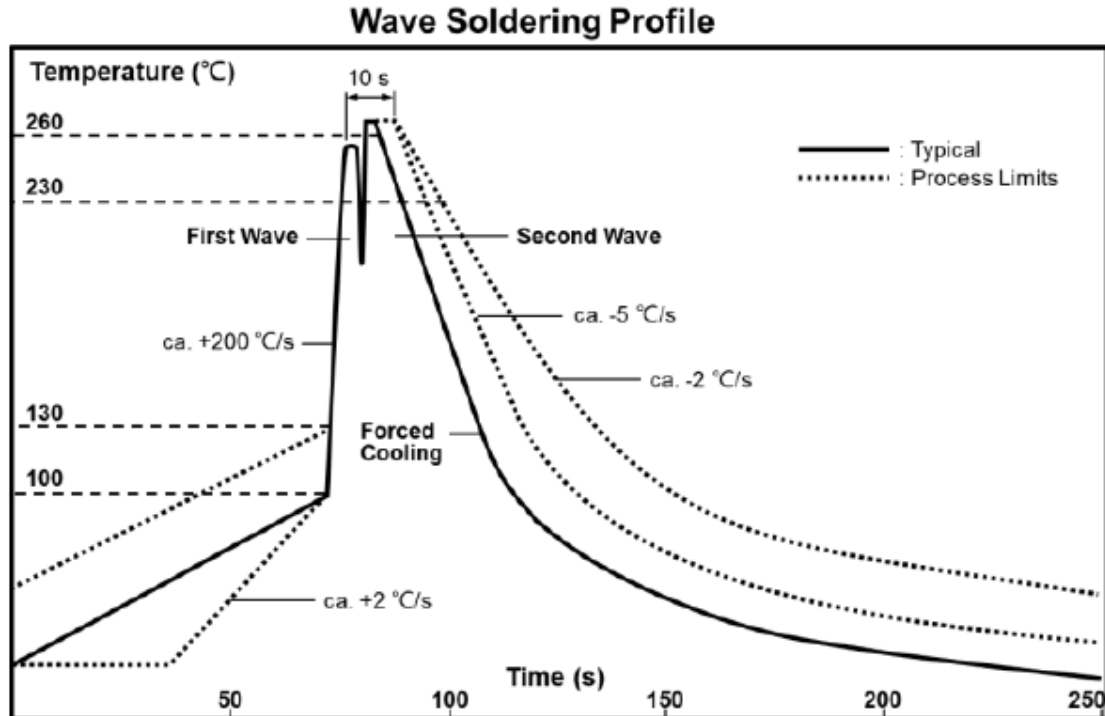
#### 13. 焊接 (soldering)

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



## Approval Specification for Automotive Thick Film Chip Resistors-Type **QR**

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



### 13.3 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.

产品规格及资料如有更改，恕不另行通知。

All product specification and data are subject to change without notice.