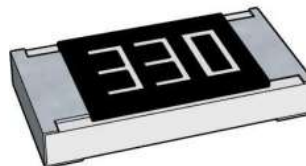


## ■ 车用厚膜晶片电阻 Automotive Thick Chip Resistor



### ■ 应用 (Application)

- Automotive electronics
- Navigation equipment TPMS
- Heating, Ventilating and Air conditioning
- Indoor lighting, Central door locking, Wiper module
- 汽车电子
- 导航设备、胎压监测
- 暖气系统、通风系统、空调
- 室内照明、中央门锁、雨刮器模块

### ■ 特性 (Features)

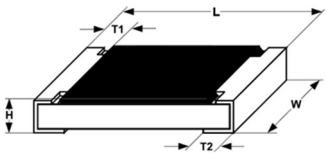
- Small size and lightweight
- Reliability, high quality
- CCD visual quality inspection
- Comply with AEC-Q200 standard
- 体积小、重量轻
- 可靠性、高质量
- 通过 CCD 外观品质检测
- 符合 AEC-Q200 标准

### ■ 料号说明 (Parts Number Explanation)

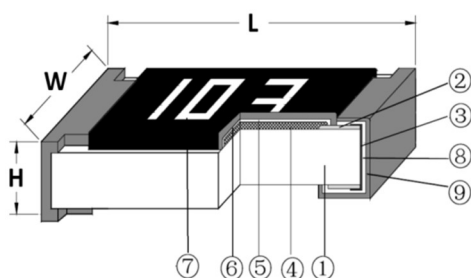
示例: Example: FRQ0805J102TS

| <b>F</b><br>公司名 | <b>R</b><br>产品别 | <b>Q</b><br>功能别 | <b>0805</b><br>型别 | <b>J</b><br>公差 | <b>102</b><br>字码 | <b>I</b><br>包装别 | <b>S</b><br>端电极  | 特殊型          |
|-----------------|-----------------|-----------------|-------------------|----------------|------------------|-----------------|------------------|--------------|
| FOJAN           | R:Resistor      | Q:Auto-motive   | 0201              | B:±0.1%        | ±5%:E24          | T: 7 inch reel  | S: Sn            | N:           |
|                 |                 |                 | 0402              | C:±0.25%       | 3-digits+blank   | Q:10 inch reel  | C: Cu            | Normal       |
|                 |                 |                 | 0603              | D:±0.5%        | 102=1KΩ          | R:13 inch reel  | A: Au            |              |
|                 |                 |                 | 0805              | F:±1%          | 1R0=1Ω           | B: Bulk         |                  |              |
|                 |                 |                 | 1206              | J:±5%          |                  |                 |                  |              |
|                 |                 |                 | 1210              | P: Jumper      | ±1%&Below:       |                 |                  |              |
|                 |                 |                 | 2010              |                | E24+E96:         |                 |                  |              |
|                 |                 |                 | 1812              |                | 4-digits         |                 |                  |              |
|                 |                 |                 | 2512              |                | 1001=1KΩ         |                 |                  |              |
|                 |                 |                 |                   |                | 1R00=1Ω          |                 |                  |              |
| Company code    | Type code       | Functional code | Size code         | Tolerance code | Resistance code  | Packaging code  | Termination code | Special code |

## 尺寸 (Dimension)

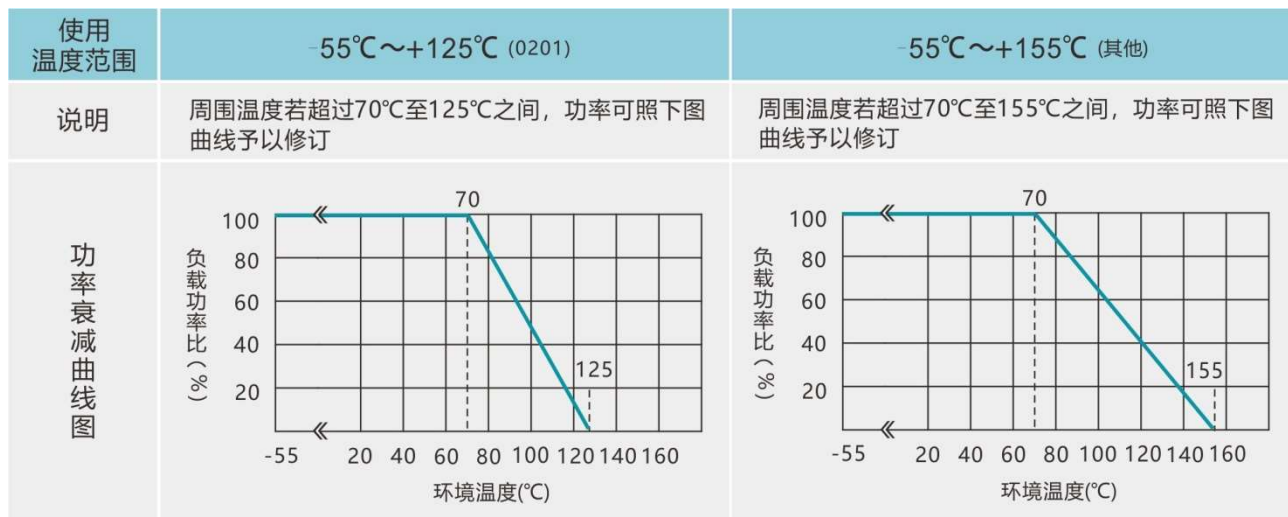
| 尺寸<br>dimension |  |           |           |           |           |           |
|-----------------|---|-----------|-----------|-----------|-----------|-----------|
|                 | 型别 (Type)   | L         | W         | H         | T1        | T2        |
|                 | 0201  | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.10±0.05 | 0.15±0.05 |
|                 | 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 | 2.50±0.15 | 0.55±0.10 | 0.45±0.15 | 0.50±0.20 |
|                 | 2010  | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.45±0.15 | 0.50±0.20 |
|                 | 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 | 0.90±0.20 |

## 电阻结构 (Construction)



| NO. | 结构<br>construction             | 主要材料<br>Major material                  |
|-----|--------------------------------|---|
| 1   | 陶瓷基板<br>Ceramic substrate      | 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 |         |         |         |
|---------|--------------------------|---------|---------|---------|
|         | 0.5%, 0.1%               | 1%      | 2%      | 5%      |
| 0201    | -                        | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ |
| 0402    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 0603    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 0805    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 1206    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 1210    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 2010    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 1812    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |
| 2512    | 100Ω~1MΩ                 | 1Ω~10MΩ | 1Ω~22MΩ | 1Ω~22MΩ |

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### 电气特性 (Electrical characteristics)

| 型别 Type                                     | 0201  | 0402  | 0603  | 0805  | 1206  | 1210  | 2010  | 2512  |
|---|-------|-------|-------|-------|-------|-------|-------|-------|
| 绝缘耐压<br>Dielectric Withstanding Voltage     | 75V   | 100V  | 100V  | 300V  | 500V  | 500V  | 500V  | 500V  |
| 零欧姆阻值 ±5%<br>Resistance Value of Jumper ±5% | <50mΩ | <50mΩ | <50mΩ | <50mΩ | <50mΩ | <50mΩ | <50mΩ | <50mΩ |
| 零欧姆额定电流<br>Rated Current of Jumper          | 0.5A  | 1A    | 1A    | 2A    | 2A    | 2A    | 2A    | 2A    |
| 零欧姆电阻最大电流<br>Max Current of Jumper          | 1A    | 2A    | 2A    | 5A    | 10A   | 10A   | 10A   | 10A   |

## ■ 电性规格 (Standard Electrical Specifications)

| 型别<br>Type | 额定功率<br>(Power Rating<br>at 70°C) | 最高工作电压<br>Max. RCWV | 最大过负荷电压<br>Max. Overload<br>Voltage | T.C.R.<br>(PPM/°C) | 阻值范围<br>Resistance Range |
|------------|-----------------------------------|---------------------|-------------------------------------|--------------------|--------------------------|
| 0201       | 1/20W                             | 25V                 | 50V                                 | -100~+300          | 1Ω~10Ω                   |
|            |                                   |                     |                                     |                    | 10 MΩ~22 MΩ              |
|            |                                   |                     |                                     | ± 200              | 10Ω~10MΩ                 |
| 0402       | 1/16W                             | 50V                 | 100V                                | ±200               | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |
| 0603       | 1/10W                             | 75V                 | 150V                                | ± 200              | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |
| 0805       | 1/8W                              | 150V                | 300V                                | ± 200              | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |
| 1206       | 1/4W                              | 200V                | 400V                                | ± 200              | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |
| 1210       | 1/2W                              | 200V                | 500V                                | ± 200              | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |
| 2010       | 3/4W                              | 200V                | 500V                                | ± 200              | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |
| 2512       | 1W                                | 200V                | 500V                                | ± 200              | 1Ω~10Ω                   |
|            |                                   |                     |                                     | ± 100              | 10 MΩ~22 MΩ<br>10Ω~10MΩ  |

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## ■ 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 |
|-------------------------------|----------------------|---|---------------------|
| 短时间过负荷<br>Short-time overload | JIS C 5201 4.13      | 加载 2.5 倍的额定电压, 时间 5 秒后测量试验前后的阻值变化率。<br>Applied 2.5 times of rated voltage for 5 second.<br>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   |
|---|---------------------------|---|---|
| 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℃)                   | 0201 规格:<br>$1\Omega \leq R \leq 10\Omega$ :<br>$-100 \sim +300 \text{PPM}/^\circ\text{C}$<br>$10\Omega < R \leq 10\text{M}\Omega$ :<br>$\pm 200 \text{PPM}/^\circ\text{C}$<br>0402~2512 规格:<br>$1\Omega \leq R \leq 10\Omega$ :<br>$\pm 200 \text{PPM}/^\circ\text{C}$<br>$10\Omega < R \leq 10\text{M}\Omega$ :<br>$\pm 100 \text{PPM}/^\circ\text{C}$<br>$10\text{M}\Omega < R \leq 22\text{M}\Omega$ :<br>$\pm 200 \text{PPM}/^\circ\text{C}$ |
| 焊锡性 Solderability                             | JIS C 5201 4.17           | 沾助焊剂后浸入锡炉, 锡炉温度 $245 \pm 5^\circ\text{C}$ , 时间 $3 \pm 0.5$ 秒。<br>Dip the terminal in a flux and then dip into a soldering bath at $245 \pm 5^\circ\text{C}$ for $3 \pm 0.5 \text{sec}$ .  | $> 95\%$ 面积上锡<br>( $> 95\%$ coverage)   |
| 抗焊锡热<br>Resist to soldering<br>heat           | MIL-STD-202<br>METHOD 210 | 沾助焊剂后浸入锡炉, 锡炉温度 $260 \pm 5^\circ\text{C}$ , 时间 $10 \pm 0.5$ 秒, 测量试验前后的阻值变化率。<br>Dip the terminal in a flux and then dip into a soldering bath at $260 \pm 5^\circ\text{C}$ for $10 \pm 0.5 \text{sec}$ . Measure the variation of resistance. | $\pm(1.00\% + 0.05\Omega)$  |
| 绝缘电阻<br>Insulation<br>resistance              | JIS C 5201 4.6            | 电阻本体上加载绝缘耐压 $60 \pm 5$ 秒后, 测量绝缘阻抗。<br>Applied the dielectric withstanding voltage on the center of body for $60 \pm 5 \text{seconds}$ . Then measure insulation resistance.   | $> 10\text{G}\Omega$  |
| 绝缘耐压<br>Dielectric<br>withstanding<br>voltage | JIS C 5201 4.7            | 电阻本体上加载绝缘耐压 $60 \pm 5$ 秒。<br>Applied the dielectric withstanding voltage on the center of body for $60 \pm 5 \text{seconds}$ .  | 无击穿、飞弧及可见机械性损伤<br>No evidence of flashover, mechanical damage arcing or insulation breakdown  |

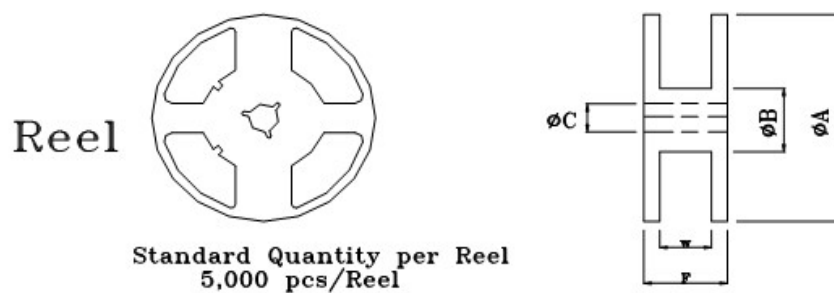
| 内容<br>Item                  | 测试方法<br>Test Methods      | 测试条件<br>Test Conditions  | 规格<br>Specification |
|-----------------------------|---------------------------|--|---------------------|
| 端子弯曲<br>Terminal bending    | AEC-Q200-005              | 电阻焊接在测试板上进行弯折,弯折保持时间 20±1 秒, 1206(含) 以下的尺寸弯曲 5+0.2/0 mm; 1210 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 | JESD22<br>METHOD JA-104   | -55℃~+ 155℃, 循环 1000 次 在每一个极限温度持续时间不超过 30 分钟, 且温度转换时间不超过 1 分钟, 试验结束 24±4 小时后进行测试.<br>1000 Cycles (-55℃ to +155℃) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme. 1min. maximum transition time.   | ±(2.00% +0.05Ω)     |
| 耐湿特性<br>Humidity            | MIL-STD-202<br>METHOD 103 | 加载 10%额定功率, 85℃/85%RH,<br>持续通电 1000H,试验结束 24±4 小时后进行测试<br>1000 hours 85℃/85%RH.<br>Note: Specified conditions: 10% of operating power.<br>Measurement<br>at 24±4 hours after test conclusion.  | ±(2.00% +0.05Ω)     |
| 负荷寿命<br>Load life           | MIL-STD-202<br>METHOD 108 | 电阻放入恒温箱中, 温度 125±2℃, ON TIME:1.5H, OFF TIME:0.5H, 通电额定电压 1000 <sup>+24</sup> / <sub>-0</sub> 小时, 量测试验前后阻值变化率.<br>Put the specimen in a chamber at 125±2℃ temperature, ON TIME:1.5H, OFF TIME:0.5H, and applied rated voltage for 1000 <sup>+24</sup> / <sub>-0</sub> H. Measure the variation of resistance.   | ±(2.00% +0.05Ω)     |

| 内容<br>Item                                    | 测试方法<br>Test Methods      | 测试条件<br>Test Conditions  | 规格<br>Specification |
|---|---------------------------|--|---------------------|
| 温湿循环<br>Moisture resistance                   | MIL-STD-202<br>METHOD 106 | 25°C~65°C,90~100%RH, 2.5 小时; 65°C<br>90~100%RH, 3 小时; 65°C~25°C,80~100%RH,2.5 小<br>时,10 个循环,试验结束 24±4 小时后进行测试.<br>25°C~65°C,90~100%RH, 2.5H; 65°C 90~100%RH,<br>3H; 65°C~25°C<br>80~100%RH, 2.5H, 10 cycles, Measurement at 24±4<br>hours after test conclusion.   | ±(2.00% +0.05Ω)     |
| 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 24±4 小时<br>后进行测试.<br>1000 hrs. @ T=155°C. Unpowered. Measurement at<br>24±4 hours after test conclusion   | ±(1.00%+0.05Ω)      |
| ESD 试验<br>ESD test                            | AEC-Q200-002              | 加载规定静电电压2次/间隔1秒,<br>0201/0402规格:0.5KV, 0603规格:1KV,<br>其它规格2KV.<br>0201/0402: 0.5KV, 0603: 1.0KV, Other:2KV,<br>2times/1s   | ±(3.0%+0.05Ω)       |
| 抗硫化试验<br>Sulfuration test                     | ASTM-B-809-95             | 方法一: 温度60°C, 湿热蒸硫粉试验 (加饱和硝酸钾)<br>750hrs<br>方法二: 切削油:硫粉=96.5:3.5, 温度60°C, 100 hrs;<br>预处理: 前后先经历3次回流焊+100次温冲<br>Method 1: steam sulfur powder test (with saturated<br>potassium nitrate) at 60°C with humidity and heat<br>(750hrs)<br>Method 2: cutting oil: sulfur powder =96.5:3.5,<br>temperature 60°C, 100 hrs;<br>Pretreatment: before and after three reflow soldering<br>+100 thermal shock | ±(1.0% +0.05Ω)      |

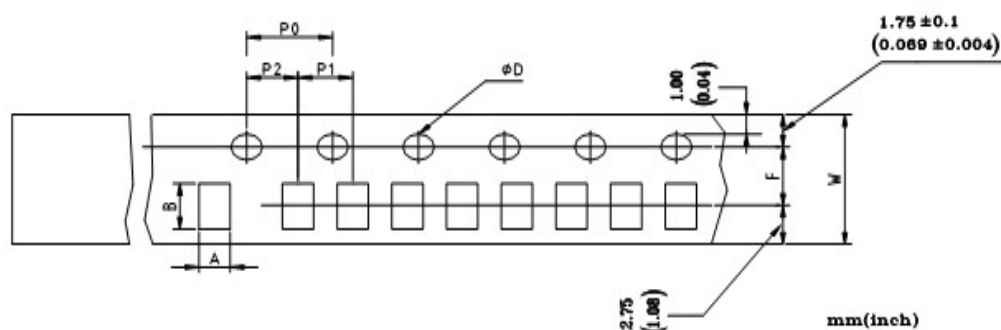
## ■ 包装规格 (Tapping Specification)

### -卷盘尺寸 (Reel dimension)

| Type                | Size |                                   | Unit | A       | B         | C        | F        | W        |
|---------------------|------|-----------------------------------|------|---------|-----------|----------|----------|----------|
| 0201/0402           | 7"   | 10K/Reel<br>15K/Reel 0201<br>only | 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   | 330±2.0 | 100.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0603/0805/1206/1210 | 7"   | 5K/Reel                           | mm   | 178±2.0 | 60.0±1.0  | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0603/0805/1206      | 10"  | 10K/Reel                          | mm   | 254±2.0 | 100.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 0603/0805/1206      | 13"  | 20K/Reel                          | mm   | 330±2.0 | 100.0±1.0 | 13.5±0.5 | 11.4±0.1 | 9.00±0.3 |
| 2010/2512           | 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

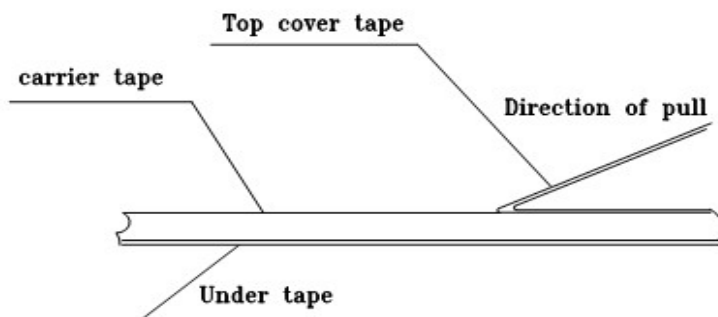


| Dimensions | A         | B         | D  | F         | P0        | P1        | P2        | W         |
|------------|-----------|-----------|--|-----------|-----------|-----------|-----------|-----------|
| 0201       | 0.38±0.05 | 0.68±0.05 | 1.50± $\begin{smallmatrix} 0.1 \\ 0.0 \end{smallmatrix}$ | 3.50±0.05 | 4.00±0.10 | 2.00±0.10 | 2.00±0.05 | 8.00±0.20 |
| 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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