

# 抗硫化厚膜片式固定電阻器

ANTI-SULFURATED THICK FILM CHIP FIXED RESISTOR

## ■ 抗硫化厚膜片式固定電阻器

Anti-Sulfurated Thick Film Chip Fixed Resistor

### ● 特點 Features

- \* 體積小、重量輕  
Miniature and light weight
- \* 適應再流焊與波峰焊  
Suit for reflow and wave flow solder
- \* 電性能穩定，可靠性高  
Stable electrical capability, high reliability
- \* 裝配成本低，並與自動貼裝設備匹配  
Low assembly cost, suit for automatic SMT equipment
- \* 機械强度高、高頻特性優越  
Superior mechanical and frequency characteristics
- \* 具有優越的抗硫化性能  
With excellent sulfuration-resistant performance
- \* 符合RoHS指令要求  
Compliant with RoHS directive
- \* 符合無鹵素要求  
Halogen free requirement



### ● 品名構成 Type Designation

| RH   | S                          | —                               | 03                | K          | 1003                   | F          | T                              |  |  |   |                                |            |                   |            |                         |
|--|----------------------------|---------------------------------|-------------------|------------|------------------------|------------|--------------------------------|--|--|---|--------------------------------|------------|-------------------|------------|-------------------------|
| 產品代號<br>Product Code   | 額定功率代號<br>Rated Power Code |                                 | 型號代號<br>Type Code |            | 電阻溫度系數代號<br>T.C.R Code |            | 電阻值代號<br>Resistance Value Code |  | 電阻值誤差精度代號<br>Resistance Tolerance Code |   | 包裝方式代號<br>Packaging Style Code |            |                   |            |                         |
| 抗硫化厚膜片式固定電阻器<br>Anti-Sulfurated Thick Film Chip Fixed Resistor | 代號<br>Code                 | 額定功率系列<br>Rated Power Series    | 代號<br>Code        | 型號<br>Type | 型號<br>Type             | 代號<br>Code | T.C.R<br>(ppm/C)               | 三位數(E-24系列): 前兩位表示有效數字, 第三位表示有效數字後零的個數。<br>Three digits (E-24 series): The first two digits are significant figures and the third one denotes number of zeros.<br>四位數(E-96系列): 前三位表示有效數字, 第四位表示有效數字後零的個數。<br>Four digits (E-96 series): The first three digits are significant figures and the four one denotes number of zeros.<br>小數點用R表示Decimal point should be expressed by "R".<br>例如 Example:<br>103=10kΩ (E-24)<br>1003=100kΩ(E-96)<br>1R0=1.0Ω(E-24)<br>000=0Ω |  |   |                                | 代號<br>Code | 誤差精度<br>Tolerance | 代號<br>Code | 包裝方法<br>Packaging Style |
|  | C                          | 常規功率系列<br>Normal Power Series   | 01                | 0201       | 0201                   | W          | ±200                           | D  | ±0.5%                                  | T | 編帶包裝<br>Tape & Reel            |            |                   |            |                         |
|  | S                          | 提升功率系列<br>Upgraded Power Series | 02                | 0402       | 0402                   | U          | ±400                           | F  | ±1%                                    | C | 塑料袋<br>Case                    |            |                   |            |                         |
|  |                            |                                 | 03                | 0603       |                        | K          | ±100                           | G  | ±2%                                    |   |                                |            |                   |            |                         |
|  |                            | 05                              | 0805              |            | W                      | ±200       | J                              | ±5%  |  |   |                                |            |                   |            |                         |
|  |                            | 06                              | 1206              | 0603       | K                      | ±100       | K                              | ±10%   | 跨接電阻<br>Chip Jumper                    |   | F                              | ≤10mΩ      |                   |            |                         |
|  |                            | 1210                            | 1210              | 0805       | L                      | ±250       | G                              | ≤20mΩ  |  |   | J                              | ≤50mΩ      |                   |            |                         |
|  |                            | 10                              | 2010              | 1206       | 跨接電阻<br>Chip Jumper    |            | 無表示                            |  |  |   |                                |            |                   |            |                         |
|  |                            | 12                              | 2512              | 1210       |                        |            |                                |  |  |   |                                |            |                   |            |                         |

### ● 結構 Construction



- ① 陶瓷基板 Ceramic Substrate
- ② 背電極 Bottom Electrode
- ③ 面電極 Top Electrode
- ④ 電阻體 Resistor Layer
- ⑤ 一次保護 Primary Overcoat
- ⑥ 二次保護 Secondary Overcoat
- ⑦ 端電極 Edge Electrode
- ⑧ 中間電極 Barrier Layer
- ⑨ 外部電極 External Electrode

## • 規格尺寸 Dimensions

| 型號<br>Type | 尺寸 Dimensions(mm) |           |           |           |           |
|------------|-------------------|-----------|-----------|-----------|-----------|
|            | L                 | W         | t         | a         | b         |
| 0201       | 0.60±0.03         | 0.30±0.03 | 0.23±0.03 | 0.17±0.05 | 0.15±0.05 |
| 0402       | 1.00±0.05         | 0.50±0.05 | 0.35±0.05 | 0.25±0.10 | 0.25±0.10 |
| 0603       | 1.60±0.10         | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 |
| 0805       | 2.00±0.10         | 1.25±0.15 | 0.55±0.10 | 0.35±0.20 | 0.40±0.20 |
| 1206       | 3.20±0.20         | 1.60±0.15 | 0.55±0.10 | 0.45±0.20 | 0.50±0.20 |
| 1210       | 3.20±0.20         | 2.50±0.20 | 0.55±0.10 | 0.45±0.20 | 0.50±0.20 |
| 2010       | 5.00±0.20         | 2.50±0.20 | 0.55±0.10 | 0.65±0.20 | 0.60±0.20 |
| 2512       | 6.30±0.20         | 3.20±0.20 | 0.55±0.10 | 0.80±0.20 | 0.60±0.20 |

## • 負荷下降曲線 Derating Curve



注1: 曲線①適用於0201產品; 曲線②適用於0402、0603、0805、1206、1210、2010、2512產品。

Note 1: 0201 product be the same with curve ①; 0402、0603、0805、1206、1210、2010、2512 be the same with curve ②.

注2: 當電阻使用的環境溫度超過70°C時, 其額定負荷(額定功率或額定電流)按上述曲線下降。

Note 2: For resistors operated in ambient over 70°C, rated load (rated power or rated current) shall be derated in accordance with the above figure.

## • 額定值 Ratings

| 型號<br>Type | 70°C下額定功率<br>Rated Power at 70°C<br>(W) |  | 元件極限電壓<br>Limiting Element<br>Voltage(V) |  | 最大過負荷電壓<br>Max.Overload<br>Voltage(V) |  | 跨接電阻70°C<br>下額定電流<br>Rated Current for<br>Chip Jumper at 70°C<br>(A) | 跨接電阻最大<br>過負荷電流<br>Max.Overload Current<br>for Chip Jumper<br>(A) |
|------------|---|--|--|--|---------------------------------------|--|--|---|
|            | 常規功<br>率系列<br>Normal<br>Power Series    | 提升功<br>率系列<br>Upgraded<br>Power Series | 常規功<br>率系列<br>Normal<br>Power Series     | 提升功<br>率系列<br>Upgraded<br>Power Series | 常規功<br>率系列<br>Normal<br>Power Series  | 提升功<br>率系列<br>Upgraded<br>Power Series |  |   |
| 0201       | 1/20                                    | /                                      | 25                                       | /                                      | 50                                    | /                                      | 0.5  | 1   |
| 0402       | 1/16                                    | /                                      | 50                                       | /                                      | 100                                   | /                                      | 1  | 2   |
| 0603       | 1/16                                    | 1/10                                   | 50                                       | 50                                     | 100                                   | 100                                    | 1  | 3   |
| 0805       | 1/10                                    | 1/8                                    | 100                                      | 150                                    | 200                                   | 300                                    | 2  | 5   |
| 1206       | 1/8                                     | 1/4                                    | 200                                      | 200                                    | 400                                   | 400                                    | 2  | 5   |
| 1210       | 1/4                                     | 1/3                                    | 200                                      | 200                                    | 400                                   | 400                                    | 2  | 5   |
| 2010       | 1/2                                     | 3/4                                    | 200                                      | 200                                    | 400                                   | 400                                    | 2  | 5   |
| 2512       | 1                                       | /                                      | 200                                      | /                                      | 400                                   | /                                      | 2  | 5   |

注  
Note

1、電壓、電流為直流或交流有效值。  
Voltage, current of DC or AC RMS value.

2、 $E = \sqrt{P \times R}$  或元件極限電壓兩者中的較小值。  
 $E = \sqrt{P \times R}$  or Limiting element voltage whichever is lower.

E: 額定電壓 Rated voltage(V)  
P: 額定功率 Rated power(W)  
R: 標稱阻值 Normal resistance(Ω)

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ANTI-SULFURATED THICK FILM CHIP FIXED RESISTOR

## ● 額定值 Ratings

| 型號<br>Type                             | 阻值範圍<br>Resistance<br>Range     | 電阻溫度係數 T.C.R(ppm/°C)          |              |              |              |              |
|--|---------------------------------|-------------------------------|--------------|--------------|--------------|--------------|
|  |                                 | 標稱阻值允許偏差 Resistance Tolerance |              |              |              |              |
|  |                                 | ±0.5%                         | ±1%          | ±2%          | ±5%          | ±10%         |
| 0201                                   | $1\Omega \leq R < 10\Omega$     | /                             | ±400         | ±400         | ±400         | ±400         |
|  | $10\Omega \leq R \leq 1M\Omega$ | ±200                          | ±200         | ±200         | ±200         | ±200         |
|  | $1M\Omega < R \leq 10M\Omega$   | /                             | ±400         | ±400         | ±400         | ±400         |
| 0402                                   | $1\Omega \leq R < 10\Omega$     | /                             | ±400         | ±400         | ±400         | ±400         |
|  | $10\Omega \leq R \leq 1M\Omega$ | ±100 or ±200                  | ±100 or ±200 | ±100 or ±200 | ±100 or ±200 | ±100 or ±200 |
|  | $1M\Omega < R \leq 10M\Omega$   | /                             | ±400         | ±400         | ±400         | ±400         |
| 0603, 0805<br>1206, 1210<br>2010, 2512 | $1\Omega \leq R < 10\Omega$     | /                             | ±250         | ±250         | ±250         | ±250         |
|  | $10\Omega \leq R \leq 1M\Omega$ | ±100                          | ±100         | ±100         | ±100         | ±100         |
|  | $1M\Omega < R \leq 10M\Omega$   | /                             | ±250         | ±250         | ±250         | ±250         |

## ● 特性 Characteristics

| 項目<br>Item                               | 標準<br>Specifications   |   | 測試方法 (IEC 60115-1)<br>Test Methods (IEC 60115-1)   |
|--|--|---|--|
|  | 片式電阻器<br>Resistor  | 跨接電阻<br>Jumper  |  |
| 可焊性<br>Solderability                     | 可焊面積 ≥ 95%<br>95% Cover Min  | 可焊面積 ≥ 95%<br>95% Cover Min   | IEC 60115-1 4.17<br>245°C ± 5°C 錫槽, 保持 3s ± 0.3s.<br>Lead-free solder bath at 245°C ± 5°C for 3s ± 0.3s.   |
| 耐焊接熱<br>Resistance to<br>Soldering Heat  | 無可見損傷<br>No mechanical damage<br>$\Delta R \leq \pm(1.0\%R + 0.05\Omega)$  | 無可見損傷<br>No mechanical damage<br>R < 50 mΩ (J級)<br>R < 20 mΩ (G級)<br>R < 10 mΩ (F級) | IEC 60115-1 4.18<br>270°C ± 5°C 錫槽, 保持 10s ± 1s.<br>Lead-free solder bath at 270°C ± 5°C for 10s ± 1s.   |
| 基板彎曲試驗<br>Substrate<br>Bending<br>Test   | 外觀無可見損傷<br>No mechanical damage<br>$\Delta R \leq \pm(1.0\%R + 0.05\Omega)$  | 無可見損傷<br>No mechanical damage<br>R < 50 mΩ (J級)<br>R < 20 mΩ (G級)<br>R < 10 mΩ (F級) | IEC 60115-1 4.33<br>彎曲距離 (Bending distance):<br>0201, 0402, 0603, 0805: 5mm;<br>1206, 1210: 4mm;<br>2010, 2512: 2mm.<br>保持時間 (Duration): 60s ± 5s.   |
| 剪切力試驗<br>Shear Test                      | 外觀無可見損傷<br>No mechanical damage  | 外觀無可見損傷<br>No mechanical damage   | IEC 60115-1 4.32<br>施加力 (Applying force): 0201: 2N; 0402, 0603: 5N;<br>0805: 9N; 1206, 1210: 25N; 2010, 2512: 45N.<br>保持時間 (Duration): 10s ± 1s.   |
| 電阻溫度係數<br>T.C.R                          | 在規定值內<br>Within specified T.C.R  | /   | IEC 60115-1 4.8<br>+20°C/-55°C/+20°C/+125°C/+20°C  |
| 溫度快速變化<br>Rapid Change of<br>Temperature | 無可見損傷<br>No mechanical damage<br>0.5%, 1%:<br>$\Delta R \leq \pm(0.5\%R + 0.05\Omega)$<br>2%, 5%, 10%:<br>$\Delta R \leq \pm(1.0\%R + 0.05\Omega)$ | 無可見損傷<br>No mechanical damage<br>R < 50 mΩ (J級)<br>R < 20 mΩ (G級)<br>R < 10 mΩ (F級) | IEC 60115-1 4.19<br>0201: -55°C(30分鐘) ~ 常溫(5分鐘) ~ 125°C(30分鐘), 300個循環;<br>0201: -55°C(30min) ~ normal temperature(5min) ~<br>125°C(30min), 300 cycles;<br>0402, 0603, 0805, 1206, 1210, 2010, 2512:<br>-55°C(30分鐘) ~ 常溫(5分鐘) ~ 155°C(30分鐘), 300個循環。<br>0402, 0603, 0805, 1206, 1210, 2010, 2512: -55°C(30min) ~<br>normal temperature(5min) ~ 155°C(30min), 300cycles. |
| 短時間過負載<br>Short Time<br>Overload         | 無可見損傷<br>No mechanical damage<br>0.5%, 1%:<br>$\Delta R \leq \pm(1.0\%R + 0.05\Omega)$<br>2%, 5%, 10%:<br>$\Delta R \leq \pm(2.0\%R + 0.05\Omega)$ | 無可見損傷<br>No mechanical damage<br>R < 50 mΩ (J級)<br>R < 20 mΩ (G級)<br>R < 10 mΩ (F級) | IEC 60115-1 4.13<br>2.5倍額定電壓或最大過負荷電壓/電流(取最小值), 持續5秒。<br>2.5 times rated voltage or max. overload voltage<br>(current) whichever is lower for 5s.   |
| 斷續過負載<br>Intermittent<br>Overload        | 無可見損傷<br>No mechanical damage<br>$\Delta R \leq \pm(5.0\%R + 0.05\Omega)$  | 無可見損傷<br>No mechanical damage<br>R < 100mΩ (J級)<br>R < 40mΩ (G級)<br>R < 20mΩ (F級)   | IEC 60115-1 4.39<br>2.5倍額定電壓或最大過負荷電壓/電流(取最小值)通1秒/<br>斷25秒, 10000個循環。<br>2.5 times rated voltage or max. overload voltage<br>(current) whichever is lower for 1s ON/ 25s OFF,<br>10000 cycles.  |

## ● 特性 Characteristics

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| 項目<br>Item   | 標準<br>Specifications  |  | 測試方法 (IEC 60115-1)<br>Test Methods (IEC 60115-1)   |
|--|---|--|--|
|  | 片式電阻器<br>Resistor   | 跨接電阻<br>Jumper   |  |
| 穩態濕熱<br>Damp Heat,<br>Steady State                             | 無可見損傷<br>No mechanical damage<br>0.5%、1%:<br>$\Delta R \leq \pm(1.0\%R+0.05\Omega)$<br>2%、5%、10%:<br>$\Delta R \leq \pm(2.0\%R+0.05\Omega)$ | 無可見損傷<br>No mechanical damage<br>$R \leq 100 \text{ m}\Omega$ (J級)<br>$R \leq 40 \text{ m}\Omega$ (G級)<br>$R \leq 20 \text{ m}\Omega$ (F級) | IEC 60115-1 4.24<br>40°C ± 2°C, 93% ± 3%RH, 1000小時, 額定電壓(電流)或元件極限電壓(取較小值)通1.5小時/斷0.5小時。<br>40°C ± 2°C, 93% ± 3%RH, 1000h, rated voltage (current) or limiting element voltage whichever is lower for 1.5h ON/0.5h OFF.   |
| 70°C 耐久性<br>Endurance<br>at 70°C                               | 無可見損傷<br>No mechanical damage<br>0.5%、1%:<br>$\Delta R \leq \pm(1.0\%R+0.05\Omega)$<br>2%、5%、10%:<br>$\Delta R \leq \pm(2.0\%R+0.05\Omega)$ | 無可見損傷<br>No mechanical damage<br>$R \leq 100 \text{ m}\Omega$ (J級)<br>$R \leq 40 \text{ m}\Omega$ (G級)<br>$R \leq 20 \text{ m}\Omega$ (F級) | IEC 60115-1 4.25.1<br>70°C ± 2°C, 1000小時, 額定電壓(電流)或元件極限電壓(取較小值)通1.5小時/斷0.5小時。<br>70°C ± 2°C, 1000h, rated voltage(current)or limiting element voltage whichever is lower for 1.5h ON/0.5h OFF.   |
| 上限類別溫度<br>耐久性<br>Endurance at<br>Upper Category<br>Temperature | 無可見損傷<br>No mechanical damage<br>0.5%、1%:<br>$\Delta R \leq \pm(1.0\%R+0.05\Omega)$<br>2%、5%、10%:<br>$\Delta R \leq \pm(2.0\%R+0.05\Omega)$ | 無可見損傷<br>No mechanical damage<br>$R \leq 100 \text{ m}\Omega$ (J級)<br>$R \leq 40 \text{ m}\Omega$ (G級)<br>$R \leq 20 \text{ m}\Omega$ (F級) | IEC 60115-1 4.25.3<br>0201: 125°C ± 2°C, 1000h.<br>0402、0603、0805、1206、1210、2010、2512:<br>155°C ± 2°C, 1000h.  |
| 低溫負載<br>Operation at Low<br>Temperature                        | 無可見損傷<br>No mechanical damage<br>0.5%、1%:<br>$\Delta R \leq \pm(1.0\%R+0.05\Omega)$<br>2%、5%、10%:<br>$\Delta R \leq \pm(2.0\%R+0.05\Omega)$ | 無可見損傷<br>No mechanical damage<br>$R \leq 50 \text{ m}\Omega$ (J級)<br>$R \leq 20 \text{ m}\Omega$ (G級)<br>$R \leq 10 \text{ m}\Omega$ (F級)  | IEC 60115-1 4.36<br>-55°C ± 5°C, 無負載1小時, 額定電壓(電流)或元件極限電壓(取較小值)45分鐘, 無負載15分鐘。<br>-55°C ± 5°C, 1h without load, rated voltage (current) or limiting element voltage whichever is lower for 45min, 15 min without load.   |
| 絕緣電阻<br>Insulation<br>Resistance                               | 1000MΩ Min  | 1000MΩ Min   | IEC 60115-1 4.6<br>在電極與基片間施加100V ± 15V直流電壓, 保持1分鐘, 然後測絕緣電阻值。<br>Apply DC 100V ± 15V between substrate and terminations for 1 min, then check insulation resistance.  |
| 耐電壓<br>Voltage Proof   | 無擊穿或飛弧<br>No breakdown or<br>flashover  | 無擊穿或飛弧<br>No breakdown or<br>flashover   | IEC 60115-1 4.7<br>在電極與基片間以大約100V/s的速率施加有效值為最大過負荷電壓的交流電壓, 保持60s ± 5s。<br>Apply max. overload voltage of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60s ± 5s.  |
| 耐溶劑<br>Component Solvent<br>Resistance                         | 無可見損傷<br>No mechanical damage<br>$\Delta R \leq \pm(1.0\%R+0.05\Omega)$   | 無可見損傷<br>No mechanical damage<br>$R \leq 50 \text{ m}\Omega$ (J級)<br>$R \leq 20 \text{ m}\Omega$ (G級)<br>$R \leq 10 \text{ m}\Omega$ (F級)  | IEC 60115-1 4.29<br>異丙醇 (IPA), 23°C ± 5°C, 浸10小時。<br>Iso-propyl alcohol (IPA), 23°C ± 5°C, 10h.  |
| 抗硫化性能<br>Sulfuration-<br>Resistant                             | 無可見損傷<br>No mechanical damage<br>$\Delta R \leq \pm(5.0\%R+0.05\Omega)$   | 無可見損傷<br>No mechanical damage<br>$R \leq 100 \text{ m}\Omega$ (J級)<br>$R \leq 40 \text{ m}\Omega$ (G級)<br>$R \leq 20 \text{ m}\Omega$ (F級) | 0201:<br>切削油: 硫磺粉, 恒溫: 105°C ± 3°C, 放置時間: 500小時<br>Cutting oil :sulphur powder ,constant temperature:<br>105°C ± 3°C,for 500 h.<br>0402、0603、0805、1206、1210、2010、2512:<br>切削油: 硫磺粉, 恒溫: 105°C ± 3°C, 放置時間: 1000小時<br>Cutting oil :sulphur powder ,constant temperature:<br>105°C ± 3°C,for 1000 h. |

## ● 包裝 Packaging

包裝方式見附錄105 ~ 113頁      Packaging see the appendix 105-113 Page .