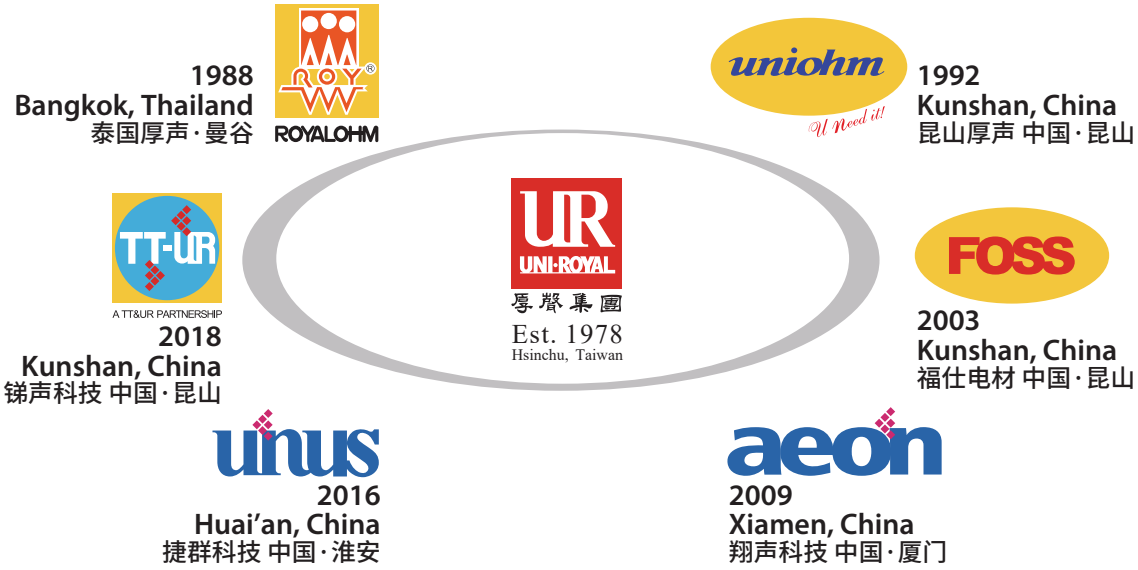
UR

UNI-ROYAL

厚聲集團

2019~2020

# 厚聲電阻




**Our Mission:**

Create value for customers, business associates and partners by providing reliable products and quality services.

**我们的使命：**

通过提供可信赖的产品和服务，为顾客、企业成员和合作伙伴创造价值。

**Our Vision:**

Become an excellent global supplier of passive components.

Be a respectable corporation to customers, business associates and partners.

**我们的愿景：**

以产品和服务成为电子制造业卓越的全球供货商。

做客户、企业成员、合作伙伴尊敬的企业。

厚声集团・昆山总部（Kunshan HQ)

UNI-ROYAL Group, founded in Hsinchu, Taiwan in 1978, has become a global leader in CHIP and DIP resistors industry. With more than 40 years of manufacturing experience, UNI-ROYAL has a profound industry insight and innovation leadership for the global electronics industry. UNI-ROYAL has a complete R&D team, manufacturing plants, global sales team and marketing service network located in Taiwan, Kunshan, Shenzhen, Xiamen, and Southeast Asia (Thailand). The group's four well-known brands: **ROYALOHM, UNIOHM, FOSS, AEON**, has become the world's favorite passive components suppliers and preferred partners.

UNI-ROYAL has successively been awarded many international standard system certifications such as QS9000, ISO14001, TL9000 and IATF16949. Products are widely used in microelectronics, mobile terminals, industrial equipment, automotive electronics, the Internet and other emerging civil and military high-tech industries. With the continuous development of the global economy, the iterative update of modern technology, especially the ever-changing application and innovation in the field of electronics, UNI-ROYAL has always provided cutting-edge technology, excellent products and leading solutions to supply a full range of products and services to well-known companies in the global industry.

厚声集团，始创于 1978 年台湾新竹，迄今已经成为全球晶片电阻和插件电阻的行业领导者。凭借逾四十年的制造经验，厚声对全球电子行业拥有深刻的行业洞察与创新领导能力。集团在台湾、昆山、深圳、厦门与东南亚（泰国）拥有完善的电阻研发团队、制造工厂及遍布全球的销售团队和营销服务网络。集团旗下四大著名品牌：**ROYALOHM**、**UNIOHM**、**FOSS**、**AEON**，已成为全球各行业备受青睐的被动元器件重要供货商和首选合作伙伴。

厚声先后获得 QS9000、ISO14001、TL9000、IATF16949 等多项国际标准体系认证。产品广泛应用于微电子、移动终端、工業設備、汽车电子、物联网等新兴民用与军工众多高科技领域。随着全球经济的不断发展、现代化技术的迭代更新，特别是电子领域日新月异的应用革新，厚声始终以前沿的技术、出色的产品和领先的解决方案，向全球行业知名企业提供全方位的产品和服务。

## Milestone

| | | |
|---|---|---|
| 1978 | Hsinchu, Taiwan | Uniroyal Taiwan |
| 1988 | Bangkok, Thailand | Royal Electronic Factory (Thailand) Co., Ltd. |
| 1992 | Kunshan, China | Uniroyal Electronics Industry Co., Ltd |
| 2003 | Kunshan, China | FOSS Electronics Material |
| 2009 | Xiamen, China | Aeon Technology (Xiamen) Corportation |
| 2014 | Kunshan, China | Uniroyal Electronics Industry Co., Ltd - New Area |
| 2016 | Kunshan, China | Uniroyal Electronics Global Co., Ltd.: KS HQ, Shenzhen Branch, Xiamen Branch |

## 厚声集团沿革

| | | |
|---|---|---|
| 1978 | 台湾新竹 | 台湾厚声 |
| 1988 | 泰国曼谷 | 泰国厚声 |
| 1992 | 中国昆山 | 昆山厚声 |
| 2003 | 中国昆山 | 昆山福仕电材 |
| 2009 | 中国厦门 | 厦门翔声科技 |
| 2014 | 中国昆山 | 昆山厚声 - 新厂区 |
| 2016 | 中国昆山 | 厚声国际贸易：昆山总公司、深圳分公司、厦门分公司 |

泰国一厂 (Thailand 1988)

厦门翔声厂 (Xiamen 2009)

昆山福仕厂 (Kunshan 2003)

泰国二厂 (Thailand 2015)

## Resistor

Resistor is a basic component in electronic circuits to control current flow and voltage. They are widely used in electronic circuits and electronic products. Uniroyal Group's products include thin film, thick film chip resistors, DIP type resistors such as DIP array resistors, carbon film, metal film, metal oxide film, metal glaze, wire-wound resistors, cement type resistors, power-type resistors and customized products of various special requirements..

## 电阻器

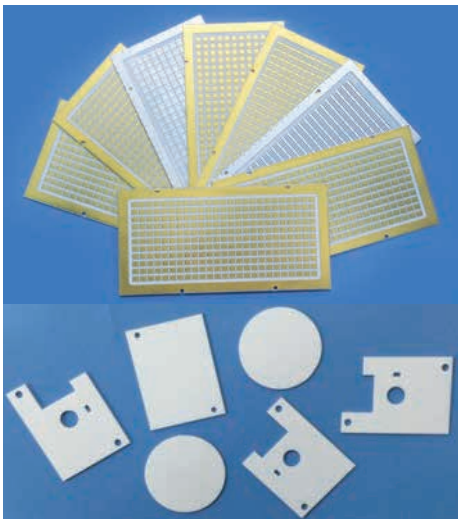
电阻器是电子线路中控制电流及电压的最基本元件 , 被广泛应用于电子电路及电子产品中 , 厚声集团的产品包括薄膜、厚膜晶片电阻，插件电阻如 DIP 排列电阻、碳膜、金属膜、金属氧化膜、玻璃釉、绕线电阻、水泥电阻、功率型电阻以及各种特殊要求的客制化产品。

## Electronics Material

Foss Electronics Material Industry Co., Ltd. is one of the world's leading supplier of high quality electronic materials. Its products include all kinds of raw materials, including ceramic rods, capped white ceramic rods, capped sorted filmed-rods, filmed ceramic rods, etc, and various types of ceramic cases and different sizes of iron caps, tin-plated iron caps, etc.

## 电子材料

福仕电子材料工业有限公司是全球主要的优质电子材料供货商之一。其产品包括各种原材料棒体，包括瓷棒、压帽白棒、组分棒、电阻着膜棒等 ; 各类陶瓷外壳及不同尺寸铁帽、镀锡铁帽等。



## Ceramic Substrate

Aeon Technology (Xiamen) provides high-quality precision ceramic substrates that can meet high-end industry applications. Its products are widely used in commercial lighting, indoor lighting, outdoor lighting and decorative lighting applications.

## 散热基板

翔声科技提供的优质高精密陶瓷散热基板，能满足高端应用，可广泛应用于商业照明、室内照明、户外照明和装饰照明等。

## High-Precision Thin Film Chip Resistors-TC

Precision thin film sputtering technology is used in this product. The resistance layer is made of high purity alloy target material. The film structure is compact and rules applied in the inter-ion alignment. It has good temperature stability, low noise coefficient and high reliability. The product can be widely used in medical equipments, precision measuring instruments, communication and precision industrial control equipments.

## 高精度薄膜晶片电阻器

产品采用精密薄膜溅射技术，电阻层采用高纯度合金靶材溅射而成，膜层结构致密，离子间排列有规则，具有良好的温度稳定性及噪音系数、可靠性高，产品可广泛应用于医疗器材、精密测量仪器、通讯及精密工业控制设备中。

## Anti-Sulfurized Thick Film Chip Resistors – NS

NS series resistor is produced by high precision thick film printing technology, use special materials and production processes. The product has excellent corrosion resistance and anti-sulfur performance capability. It is widely used in automotive electronics, instruments and meters, mining machinery, farm equipment and instruments or equipment exposed to sulfur atmosphere.

## 抗硫化厚膜晶片电阻器

电阻采用高精密厚膜印刷技术制造，特殊的材料和生产工艺生产而成。产品具有优异的耐腐蚀性能和抗硫化能力。广泛应用于汽车电子、仪表、矿山机械、农场设备及含硫环境的仪器中。

Uni-Royal can produce multiple resistors and packaged wafer resistors and lead-type single-row in-line resistors. They can also be designed to meet the customer's requirements for RC or RL network Resistors. They can also be designed with customer-made temperature detection. Functional overcurrent soft protection component.

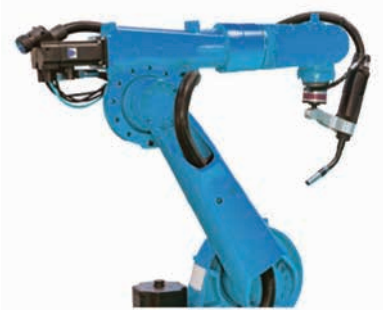
厚声电阻可生产多颗电阻封装于一体的晶片排阻和引线型单列直插式排阻，也可配合客户需求设计制做 RC 或 RL 网络排阻，还可以配合客户设计制做带温度检测功能的过流软保护元件。

## High-Voltage Thick Film Chip Resistors-HV

HV series resistor uses precision thick film printing technology, with unique product design and manufacturing process, so that the product has excellent resistance to high voltage performance, high-voltage resistance is more than twice that of conventional thick film products. It saves cost and help reduce space on the circuit boards; thus effectively reducing the final size of the equipment.

## 高压厚膜晶片电阻器

电阻采用精密厚膜印刷技术，通过特有的产品设计及制做工艺，使产品具有极好的耐高电压性能，耐高电压特性是常规厚膜产品的 2 倍多，可减小电路板的安装空间及节约产品成本，同时可有效降低设备的最终尺寸。



## Metal Foil Current Sensing Chip Resistors - MS

MS series resistor uses photolithography technology allowing circuit patterns to be transferred on to the ceramic substrate. It has excellent temperature stability. The temperature coefficient is 30 PPM/°C or even lower. The product is widely used in current detection circuits and power management applications.

## 金属带电流检测片式电阻器

产品采用黄光影像转移技术，在陶瓷基板上形成电路，具有极好的温度稳定性，温度系数 30PPM/°C，甚至更低，产品广泛应用于电流检测电路及电源管理电路中。

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| **LED Ceramic Substrate LED 陶瓷基板** | | |
| Thin-Film Ceramic Substrate — DPC 薄膜陶瓷基板 | 114.3×114.3mm×0.38/0.5/1.0mm | 167 |

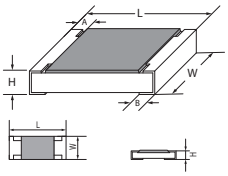

注 : 目录 / 网站参數表仅供一般参考。具体以我司提供的产品规格书为准 , 可根据要求提供所需产品。

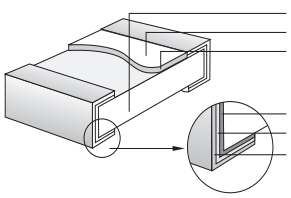
Note: Catalog/website specifications are for general reference only. Detailed Product Specification shall take precedence & is available upon request.

## Feature (特性)

- Small size & light weight 短小轻薄
- Reduction of assembly costs and matching with placement machine.
  可降低装置成本及配合机器组装
- Suitable for both wave & re-flow soldering. 适合波峰焊与回流焊
- Applications: Navigator (GPS), Mobile Phone,Telecom, PDA, Setbox, Meter.
  应用于GPS，移动电话，PDA，机顶盒，仪表

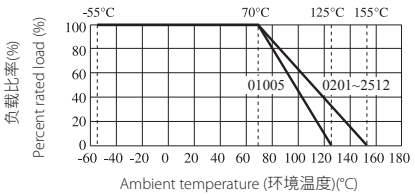
## Figures (型状)



1. High purity Alumina substrate (高纯度氧化铝基板)
2. Protective coating (保护层)
3. Resistance element (阻抗元素)
4. Termination (Inner) Ni / Cr [端面(内)镍/铬层]
5. Termination (Between) Ni Barrier [端面(中)镍层]
6. Termination (Outer) Sn [端面(外)锡层(无铅)]

## Derating Curve & Specification
## 降功率曲线及性能




| Type 类型 | 01005 | 0201 | 0402 | 0603 | 0805 | 1206 | 1210 | 1812 | 2010 | 2512 |
|---|---|---|---|---|---|---|---|---|---|---|
| Size 尺寸 | 0402 | 0603 | 1005 | 1608 | 2012 | 3216 | 3225 | 4532 | 5025 | 6432 |
| Max. Working Voltage 最大工作电压 | 15V | 25V | 50V | 75V | 150V | 200V | 200V | 200V | 200V | 200V |
| Max. Overload Voltage 最大过负荷电压 | 30V | 50V | 100V | 150V | 300V | 400V | 500V | 500V | 500V | 500V |
| Dielectric withstanding Voltage 绝缘耐压 | - | - | 100V | 300V | 500V | 500V | 500V | 500V | 500V | 500V |
| Operating Temperature 工作温度范围 | -55~+125°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C | -55~+155°C |

| Type 类型 | | 01005 | 0201 | 0402 | 0603 | 0805 | 1206 | 1210 | 1812 | 2010 | 2512 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimension 尺寸 | L(mm) | 0.40±0.02 | 0.60±0.03 | 1.00±0.10 | 1.60±0.10 | 2.00±0.15 | 3.10±0.15 | 3.10±0.10 | 4.50±0.20 | 5.00±0.10 | 6.35±0.10 |
| | W(mm) | 0.20±0.02 | 0.30±0.03 | 0.50±0.05 | 0.80±0.10 | 1.25 +0.15 -0.10 | 1.55 +0.15 -0.10 | 2.60±0.20 | 3.20±0.20 | 2.50±0.20 | 3.20±0.20 |
| | H(mm) | 0.13±0.02 | 0.23±0.03 | 0.35±0.05 | 0.45±0.10 | 0.55±0.10 | 0.55±0.10 | 0.55±0.10 | 0.55±0.20 | 0.55±0.10 | 0.55±0.10 |
| | A(mm) | 0.10±0.03 | 0.10±0.05 | 0.20±0.10 | 0.30±0.20 | 0.40±0.20 | 0.45±0.20 | 0.50±0.25 | 0.50±0.20 | 0.60±0.25 | 0.60±0.25 |
| | B(mm) | 0.10±0.03 | 0.15±0.05 | 0.25±0.10 | 0.30±0.20 | 0.40±0.20 | 0.45±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 | 0.50±0.20 |
| Resistance Value of Jumper 零欧姆电阻阻值 | | <50mΩ | | | | | | | | | |
| Rated Current of Jumper 零欧姆电阻额定电流 | | 0.5A | 0.5A | 1A | 1A | 2A | 2A | 2A | 2A | 2A | 2A |
| Max.Overload Current of Jumper 零欧姆电阻最大过负荷电流 | | 1A | 1A | 2A | 2A | 5A | 10A | 10A | 10A | 10A | 10A |

| Type 类型 | 01005 | 0201 | 0402 | 0603 | 0805 | | 1206 | | 1210 | 1812 | 2010 | 2512 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power Rating at 70°C 功率 | 1/32W | 1/20W | 1/16W | 1/10W | 1/8W | 1/4W | 1/4W | 1/3W | 1/2W | 3/4W | 3/4W | 1W |
| Resistance Range of 0.5%(E-96) 0.5% 的阻值范围 (E-96) | - | - | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ | - | 1Ω~10MΩ | - | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ | 1Ω~10MΩ |
| Resistance Range of 1%,2%(E-96) 1% ,2% 的阻值范围 (E-96) | 10Ω ~ 10MΩ | 1Ω~ 10MΩ | | 0.01Ω~ 10MΩ | 0.1Ω≤R <10MΩ | 0.01Ω ≤R <0.1 Ω | 0.1Ω≤R <10MΩ | 0.01Ω≤R <0.1Ω | 0.01Ω~10MΩ | | | |
| Resistance Range of 5%(E-24) 5% 的阻值范围 (E-24) | 1Ω~10MΩ | | | 0.01Ω~ 10MΩ | 0.1Ω≤R <10MΩ | 0.01Ω ≤R <0.1 Ω | 0.1Ω≤R <10MΩ | 0.01Ω≤R <0.1Ω | 0.01Ω~10MΩ | | | |

## Marking on the Resistors Body (电阻本体字码标示)

- For 01005, 0201, 0402 size, no marking on the body due to the small size of the resistor.
  01005, 0201, 0402因电阻本体太小，故本体无标示字码
- ±5% tolerance product: the marking is 3 digits, the first 2 digits are the significant of the resistance and the 3rd digit denotes number of zeros following.
  ±5%公差产品字码是三位数，前二位是阻值的有效数，第三位表示有几个 0
- 0805, 1206, 1210, 2010, 2512 ≤±1%: the marking is 4 digits, the first 3 digits are the significant of the resistance and the 4th digit denotes number of zeros following.
  0805, 1206, 1210, 2010, 2512 ≤±1%公差产品字码有四位数，前三位是阻值的有效数，第四位表示有几个 0
- Standard E-96 series values of 0603 ≤±1%: due to the small size of the resistor's body, 3 digits marking will be used to indicate the accurate resistance value by using the following Multiplier & Resistance Code.
  0603 ≤±1%公差 E-96系列标准阻值，因电阻本体太小，采用三位阻值代码（数字）及下列指数代码（字母）配合来指明标准的阻值。

153 = 15000Ω = 15KΩ

Below 10Ω: 6R8 = 6.8Ω
10Ω 以下标示: 6R8 = 6.8Ω

2372 = 23700Ω = 23.7KΩ

Below 10Ω : 3R24 = 3.24Ω
10Ω 以下标示: 3R24 = 3.24Ω

## Multiplier Code (for 0603 ≤±1% marking) [指数码 ( 0603≤±1% 标示)]

| Code 代 码 | A | B | C | D | E | F | G | H | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Power 幂 | $10^0$ | $10^1$ | $10^2$ | $10^3$ | $10^4$ | $10^5$ | $10^6$ | $10^7$ | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ |

## Standard E-96 series Resistance Value code (for 0603≤±1% marking) [E-96系列标准阻值代码 ( 对0603≤±1%的字码)]

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

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

1.96KΩ= 196 ×$10^1$ Ω = 29B

12.4Ω= 124 ×$10^{-1}$ = 10X

- Standard E-24 and not belong to E-96 series values (≤±1%) of 0603 size: the marking is the same as 5% tolerance but marking as underline.
  0603≤±1%公差，在标准 E-24 系列中，但不属 E-96 系列的阻值，标示和5%的公差相同，但是在字码下多加一条线

122 = 1200 = 1.2 KΩ

680 = 68Ω

## Performance Specifications (性能)

| | | | |
|---|---|---|---|
| **Temperature coefficient** | 温度系数 | 01005: 1Ω≤R<10Ω: -200~+600ppm/°C<br>10Ω≤R<100Ω: ±300ppm/°C<br>100Ω≤R≤10MΩ: ±200ppm/°C<br>0201: 1Ω≤R≤10Ω: -100~+350ppm/°C<br>>10Ω: ±200ppm/°C<br>0402: 1Ω≤R≤10Ω: ±200ppm/°C<br>>10Ω: ±100ppm/°C | 0603: 0.01Ω≤R≤0.03Ω:±1500PPM/°C<br>0.03Ω<R≤0.05Ω:±1000 PPM/°C<br>0.05Ω<R<1Ω:±800PPM/°C<br>1Ω≤R≤10Ω: ±200PPM/°C<br>>10Ω:±100PPM/°C<br>0805, 1206, 1210, 1812, 2010, 2512:<br>0.01Ω ≤ R ≤0.015Ω: ±1500ppm/°C<br>0.015Ω < R ≤0.03Ω:±1000ppm/°C<br>0.03Ω < R <1Ω: ±800ppm/°C<br>1Ω≤R≤10Ω: ±200ppm/°C<br>>10Ω: ±100ppm/°C |
| **Short-time overload** | 短时间过负荷 | ±5%, ± 2%: ±(2.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(1.0% + 0.05Ω)<br>01005 ±5% ±1% : ±(2.0% + 0.05Ω) | |
| **Insulation resistance** | 绝缘电阻 | ≥ 1,000 MΩ | |
| **Dielectric withstanding voltage** | 绝缘耐压 | No evidence of flashover, mechanical damage, arcing or insulation breakdown<br>无击穿 , 飞弧及可见机械性损伤 | |
| **Terminal bending** | 端子弯曲 | ±(1.0% + 0.05Ω) | |
| **Soldering heat** | 耐焊接热 | ±(1.0% + 0.05Ω) | |
| **Solderability** | 可焊性 | Coverage must be over 95%. | |
| **Rapid change of temperature** | 温度快速变化 | ±5%, ± 2%: ±(1.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(0.5% + 0.05Ω)<br>01005 ±5% ±1% : ±(1.0% + 0.05Ω) | |
| **Humidity (Steady State)** | 恒定湿热 | ±5%, ± 2%: ±(3.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(0.5% + 0.05Ω)<br>01005 ±5% ±1% (-55°C~125°C): ±(2.0% + 0.05Ω) | |
| **Load life in humidity** | 湿度寿命 | ±5%, ± 2%: ±(3.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(1% + 0.05Ω )<br>01005: ±(3.0% + 0.05Ω) | |
| **Load life** | 负载寿命 | ±5%, ± 2%: ±(3.0% + 0.05Ω)<br>±1%, ± 0.5%: ±(1% + 0.05Ω)<br>01005: ±(3.0% + 0.05Ω) | |

- The values which are not of standard E-24 series (2% & 5%) and not of E-96 series (1%) could be offered on a case to case basis.
  阻值如不在 E-24 系列 (2% & 5%) 及 E-96 系列 (1%) 可特别提供

## Ordering Procedure (Example: 1206 1/4W 5% 1.2 Ω T/R-5000)

## 订购方式 (例如: 1206 1/4W 5% 1.2 Ω T/R-5000)

**1 2 0 6 W 4 J 0 1 2 J T 5 E**

**Product Type ( 产品类型 ):**
Fill-in 4 digits with the Chip resistor type as follow ( 填四位数表示下列各种晶片电阻类型 ):
0105(01005), 0201, 0402, 0603, 0805, 1206, 1210, 1812, 2010, 2512, 2D02

Wattage ( 功率 ):
Fill-in 2 digits with the codes as follow ( 用下列代码填二位数 ):
WH = 1/32W WM = 1/20W WG = 1/16W
WA = 1/10W W8 = 1/8W W4 = 1/4W
W2 = 1/2W 07 = 3/4W 1W = 1W

**Tolerance ( 公差 ):**
D = ±0.5%
F = ±1%
G = ±2%
J = ±5%

**Resistance Value (阻值):**
**5% (E-24 series) :**
the 1st digit is "0", the 2nd & 3rd digits are for the significant figures of the resistance and the 4th indicate the numbers of zeros following
**5% 产品 (E-24 系列阻值 ):**
第 1 位数是 0，第 2、3 位数表示阻值的有效数，第 4 位表示有几个 0);
**≤1%( E-24, E-96 series):**
the 1st to 3rd digits are for the significant figures of the resistance and the 4th indicate the numbers of zeros following
**≤1% 产品 (E-24, E-96 系列阻值 ):**
第 1-3 位数表示阻值的有效数，第 4 位数表示有几个 0).

**Packing Type (包装类型):**
T = T/R ( 编带 / 卷带 )
B = Bulk in Poly bag ( 散装 / 袋装 )
C = Bulk in cassette ( 散装 / 盒装 )

Packing Qty. ( 包装数量 )
1=1,000pcs
2=2,000pcs
3=3,000pcs
4=4,000pcs
5=5,000pcs
C=10,000pcs
D=20,000pcs
E=15,000pcs
H=50,000pcs
J=60,000pcs

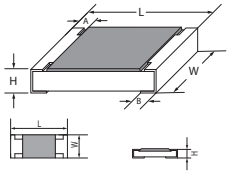
**Special Feature ( 特征 ):**
E = Lead Free (standard)
( 无铅标准品 )

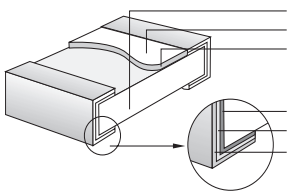
**Remark:** Please refer to page 141 for ordering guide. 注：下单请详见 P141 页说明 。

## Feature (特性)

- High Resistance 高阻值
- Suitable for reflow & wave soldering
  适合波峰焊与回流焊
- Application AV adapters, LCD back-light camera strobe etc. 适用于AV适配器, LCD背光电路, 照相机闸门等.

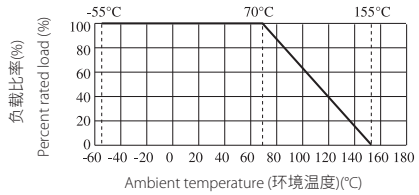
## Figures (型状)



1. High purity Alumina substrate (高纯度氧化铝基板)
2. Protective coating (保护层)
3. Resistance element (阻抗元素)
4. Termination (Inner) Ni / Cr [端面(内)镍/铬层]
5. Termination (Between) Ni Barrier [端面(中)镍层]
6. Termination (Outer) Sn [端面(外)锡层(无铅)]

## Derating Curve & Specification (降功率曲线及性能)




| Type 类型 | Max Working Voltage 最大工作电压 | Max Overload Voltage 最大过负荷电压 | Dielectric Withstanding Voltage 绝缘耐压 | Operating Temperature Range 工作温度范围 |
|---|---|---|---|---|
| **0603** | 75V | 150V | 300V | -55~+155°C |
| **0805** | 150V | 300V | 500V | |
| **1206** | 200V | 400V | 500V | |
| **1210** | 200V | 500V | 500V | |

| Type 类型 | Size 尺寸 | Power ( 功率 ) (70°C) | L (mm) | W (mm) | H (mm) | A (mm) | B (mm) | Resistance Range ( 阻值范围 ) 5% (E24) |
|---|---|---|---|---|---|---|---|---|
| **0603** | 1608 | 1/10W | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | 10M~100M |
| **0805** | 2012 | 1/8W | 2.00±0.15 | 1.25 +0.15 -0.10 | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 | |
| **1206** | 3216 | 1/4W | 3.10±0.15 | 1.55 +0.15 -0.10 | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 | |
| **1210** | 3225 | 1/2W | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | |

## Performance Specification (性能)

| | | |
|---|---|---|
| **Temperature coefficient** | 温度系数 | ±200ppm/°C |
| **Short time overload** | 短时间过负荷 | ±(2.0%+0.05Ω) |
| **Terminal bending** | 端子弯曲 | ±(1.0%+0.05Ω) |
| **Solderability** | 可焊性 | Coverage must be over 95%. |
| **Dielectric withstanding voltage** | 绝缘耐压 | No evidence of flashover, mechanical damage, arcing or insulation breakdown ( 无击穿 , 飞弧及可见机械性损伤 ) |
| **Soldering heat** | 耐焊接热 | ±(1.0%+0.05Ω) |
| **Rapid change of temperature** | 温度快速变化 | ±(1.0%+0.05Ω) |
| **Load Life in humidity** | 湿度寿命 | ±(3.0%+0.05Ω) |
| **Load life** | 负载寿命 | ±(3.0%+0.05Ω) |
| **Humidity (steady state)** | 恒定湿热 | ±(3.0%+0.05Ω) |
| **Insulation resistance** | 绝缘电阻 | ≥1,000 MΩ |

# High-Power Thick Film Chip Resistors - HP

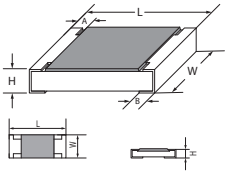
## 高功率厚膜晶片电阻器 - HP系列

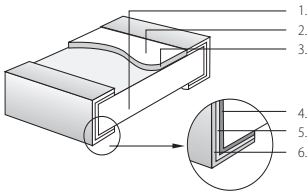


## Feature (特性)

- High power in standard size
  标准尺寸，高功率
- Suitable for both wave & re-flow soldering
  适合波峰焊与回流焊
- Application: AV adapters, LCD back-light, camera strobe etc. 适用于AV适配器, LCD背光电路，照相机闸门等

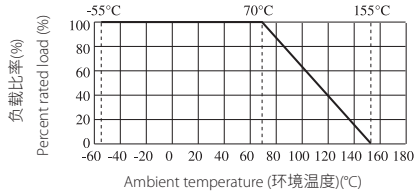
## Figures (型状)



1. High purity Alumina substrate (高纯度氧化铝基板)
2. Protective coating (保护层)
3. Resistance element (阻抗元素)
4. Termination (Inner) Ni / Cr [端面(内)镍/铬层]
5. Termination (Between) Ni Barrier [端面(中)镍层]
6. Termination (Outer) Sn [端面(外)锡层(无铅)]

## Derating Curve & Specification (降功率曲线及性能)




| Type 类型 | L(mm) | W(mm) | H(mm) | A(mm) | B(mm) |
|---|---|---|---|---|---|
| HP02 (0402) | 1.00±0.10 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| HP03 (0603) | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 |
| HP05 (0805) | 2.00±0.15 | 1.25 +0.15 -0.10 | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 |
| HP06 (1206) | 3.10±0.15 | 1.55 +0.15 -0.10 | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 |
| HP07 (1210) | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| HP10 (2010) | 5.00±0.10 | 2.50±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |
| HP11 (1812) | 4.50±0.20 | 3.20±0.20 | 0.55±0.20 | 0.50±0.20 | 0.50±0.20 |
| HP12 (2512) | 6.35±0.10 | 3.20±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |

*Special offered 特别提供 : HP12 B:1.80±0.25mm

| Type 类型 | Size 尺寸 | Power Rating at 70°C 功率 | Resistance Range of 1% & 5% 1% & 5% 的阻值范围 | Max. Working Voltage 最大工作电压 | Max. Overload Voltage 最大过负荷电压 | Dielectric Withstanding Voltage 绝缘耐压 | Operating Temperature 工作温度范围 |
|---|---|---|---|---|---|---|---|
| HP02 | 0402 (1005) | 1/10W | 1Ω~10M | 50V | 100V | 100V | -55°C~155°C |
| | | | 0Ω | | Rmax=10mΩ, Imax=3A | | |
| HP03 | 0603 (1608) | 1/5W | 0.1Ω~10M | 75V | 150V | 300V | |
| | | | 0Ω | | Rmax=8mΩ, Imax=5A | | |
| HP05 | 0805 (2012) | 1/3W | 10mΩ~10M | 150V | 300V | 500V | |
| | | | 0Ω | | Rmax=5mΩ, Imax=6A | | |
| HP06 | 1206 (3216) | 1/2W | 10mΩ~10M | 200V | 400V | 500V | |
| | | | 0Ω | | Rmax=5mΩ, Imax=10A | | |
| HP07 | 1210 (3225) | 3/4W | 0.1Ω~10M | 200V | 500V | 500V | |
| | | | 0Ω | | Rmax=4mΩ, Imax=12A | | |
| HP10 | 2010 (5025) | 1W | 10mΩ~10M | 200V | 500V | 500V | |
| | | | 0Ω | | Rmax=5mΩ, Imax=12A | | |
| HP11 | 1812 (4532) | 1.25W | 0.1Ω~10M | 200V | 500V | 500V | |
| | | | 0Ω | | Rmax=5mΩ, Imax=12A | | |
| HP12 | 2512 (6432) | 2W | 10mΩ~10M | 250V | 500V | 500V | |
| | | | 0Ω | | Rmax=5mΩ, Imax=16A | | |

## Performance Specifications (性能)

| | | |
|---|---|---|
| **Temperature coefficient** | 温度系数 | HP02: 1Ω≤R ≤ 10Ω: ±400 ppm/°C<br>10Ω<R ≤100Ω: ±200 ppm/°C<br>100Ω<R ≤10M : ±100 ppm/°C<br>HP03: 0.1Ω≤R<0.2Ω: ±200ppm/°C<br>0.2Ω≤R≤10M: ±100ppm/°C<br>HP05: 10mΩ≤R≤15mΩ: ±800ppm/°C<br>15mΩ<R≤25mΩ: ±600ppm/°C<br>25mΩ<R≤50mΩ: ±400ppm/°C<br>50mΩ<R<0.1Ω: ±200ppm/°C<br>0.1Ω≤R≤10M: ±100ppm/°C<br>HP06: 10mΩ≤R<15mΩ: ±700 ppm/°C<br>15mΩ≤R<30mΩ: ±400 ppm/°C<br>30mΩ≤R<50mΩ: ±300 ppm/°C<br>50mΩ≤R<0.1Ω: ±150 ppm/°C<br>0.1Ω≤R≤10M:±100 ppm/°C<br>HP07, HP11: ±100 ppm/°C<br>HP10: 10mΩ≤R<15mΩ: 0~+800 ppm/°C<br>15mΩ≤R<50mΩ: 0~+600 ppm/°C<br>50mΩ≤R<10M: ±100 ppm/°C<br>HP12: 10mΩ≤R<20mΩ: 0~+800ppm/°C<br>20mΩ≤R≤50mΩ: 0~+400ppm/°C<br>50mΩ<R≤10M: ±75ppm/°C |

| | | |
|---|---|---|
| **Short-time overload** | 短时间过负荷 | ±5%: ±(2.0% + 0.1Ω)<br>±1%: ±(1.0% + 0.1Ω) |
| **Dielectric withstanding voltage** | 绝缘耐压 | No Evidence of flashover, mechanical damage,arcing or insulation breakdown<br>无击穿，飞弧及可见机械性损伤 |
| **Terminal bending** | 端子弯曲 | ±(1.0% + 0.05Ω) |
| **Soldering heat** | 耐焊接热 | ±(1.0% + 0.05Ω) |
| **Solderability** | 可焊性 | Coverage must be over 95%. |
| **Rapid change of temperature** | 温度快速变化 | ±5%: ±(1.0% + 0.05Ω)<br>±1%: ±(0.5% + 0.05Ω) |
| **Humidity (Steady state)** | 恒定湿热 | ±5%: ±(3.0% + 0.1Ω)<br>±1%: ±(0.5% + 0.1Ω) |
| **Load life in humidity** | 湿度寿命 | ±5%: ±(3.0% + 0.1Ω)<br>±1%: ±(1.0% + 0.1Ω) |
| **Load life** | 负载寿命 | ±5%: ±(3.0% + 0.1Ω)<br>±1%: ±(1.0% + 0.1Ω) |

## Ordering Procedure (Example: High Power HP06 1/2W 5% 120KΩ T/R-5000)

## 订购方式 (例如: 高功率 HP06 1/2W 5% 120KΩ T/R-5000)

**H P 0 6 W 2 J 0 1 2 4 T 5 E**

**Product Type ( 产品类型 ):**
Fill-in 4 digits with the Chip resistor type as follow ( 填四位数表示产品类型 ):
HP02, HP03, HP05, HP06, HP07, HP10, HP11, HP12, SP12

**Wattage ( 功率 ):**
Fill-in 2 digits with the codes as follow ( 用下列代码填二位数 ):
WA=1/10W W5=1/5W,
W3=1/3W W2=1/2W
07 = 3/4W 1W=1W
1Q=1.25W 2W=2W
3W=3W

**Tolerance ( 公差 ):**
F = ±1%
J = ±5%

**Resistance Value (阻值):**
**5% (E-24 series):**
the 1st digit is "0", the 2nd & 3rd digits are for the significant figures of the resistance and the 4th indicate the numbers of zeros following;
**5% 产品 (E-24 系列阻值 ):**
第 1 位数是 0，第 2、3 位数表示阻值的有效数，第 4 位表示有几个 0;

**1%( E-24, E-96 series):**
the 1st to 3rd digits are for the significant figures of the resistance and the 4th indicate the numbers of zeros following.
**1% 产品 (E-24, E-96 系列阻值 ):**
第 1-3 位数表示阻值的有效数，第 4 位数表示有几个 0

**Packing Type (包装类型):**
T = T/R ( 编带 / 卷带 )
B = Bulk in Poly bag ( 散装 / 袋装 )
C = Bulk in cassette ( 散装 / 盒装 )

**Packing Qty. ( 包装数量 ):**
4=4,000pcs
5=5,000pcs
C=10,000pcs
D=20,000pcs

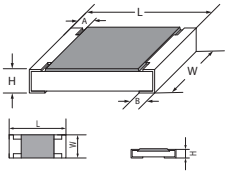
**Special Feature ( 特征 ):**
E = Lead Free (standard)
( 无铅标准品 )

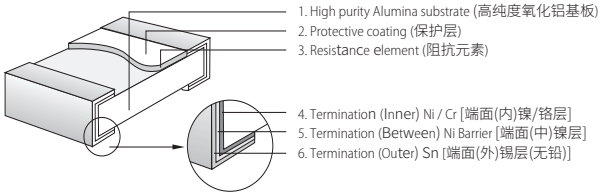
**Remark:** Please refer to page 141 for ordering guide. 注：下单请详见 P141 页说明 。

## Feature (特性)

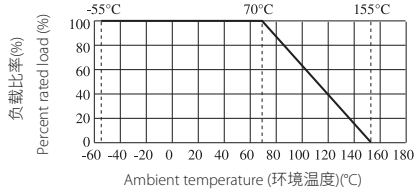
- High power rating up to 6 watts
  高功率可达6W
- Suitable for both wave & re-flow soldering
  适合波峰焊与回流焊
- Application LED lamps, Intelligent home appliances, Medical equipment, Kinds of industrial control devices & Industrial supplies
  适用于LED 灯具、智能家电产品、医疗设备、各种工业控制装置及工业电源等

## Figures (型状)




## Derating Curve & Specification (降功率曲线及性能)




| Type 类型 | L(mm) | W(mm) | H(mm) | A(mm) | B(mm) |
|---|---|---|---|---|---|
| **SP10 (2010)** | 5.00 ± 0.10 | 2.50 ± 0.15 | 1.10 ± 0.10 | 0.60 ± 0.25 | 0.50 ± 0.20 |
| **SP12 (2512)** | 6.35 ± 0.10 | 3.20 ± 0.15 | 1.10 ± 0.10 | 0.60 ± 0.25 | 1.80 ± 0.20 |
| **SP17 (2817)** | 7.10 ± 0.20 | 4.20 ± 0.20 | 1.10 ± 0.10 | 0.60 ± 0.20 | 1.80 ± 0.20 |
| **SP20 (4320)** | 11.00 ± 0.30 | 5.00 ± 0.25 | 1.10 ± 0.10 | 0.80 ± 0.20 | 2.40 ± 0.20 |
| **SP27 (4527)** | 11.60 ± 0.30 | 6.85± 0.25 | 1.10 ± 0.10 | 1.00 ± 0.20 | 2.50 ± 0.20 |

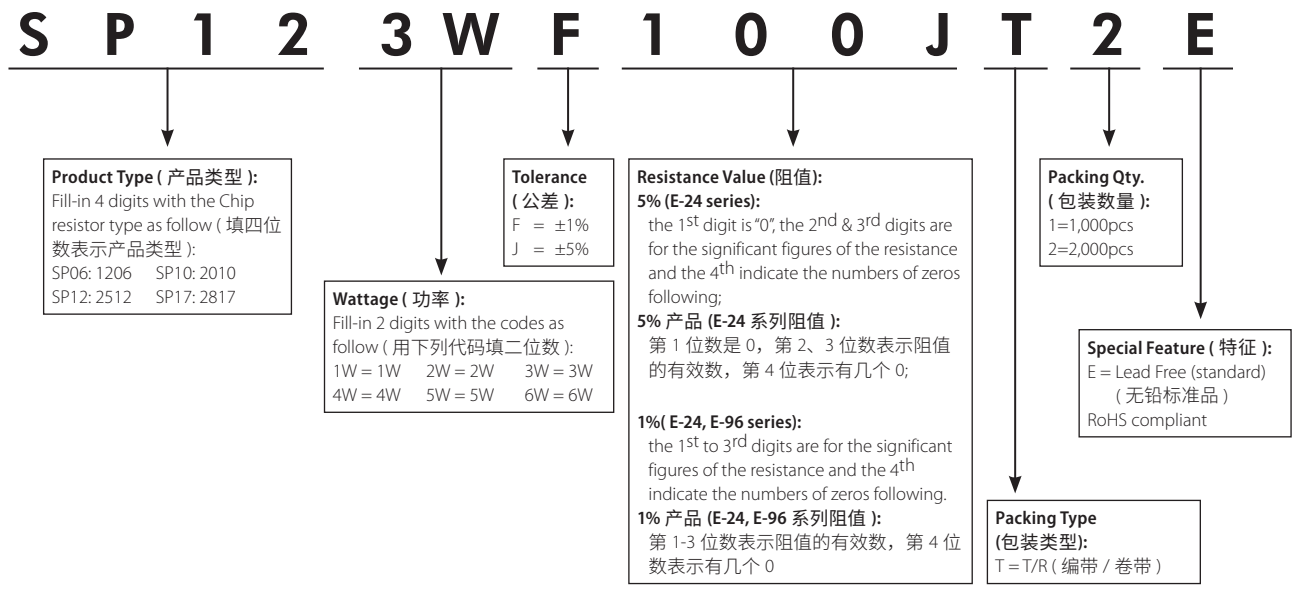
| Type 类型 | Size 尺寸 | Power Rating at 70°C 功率 | Resistance Range of 1% & 5% 1% & 5% 的阻值范围 | Max. Working Voltage 最大工作电压 | Max. Overload Voltage 最大过负荷电压 | Dielectric Withstanding Voltage 绝缘耐压 | Operating Temperature 工作温度范围 |
|---|---|---|---|---|---|---|---|
| **SP10** | 2010 (5025) | 2W | 1Ω ~ 10MΩ | 200V | 500V | 500V | -55℃~155℃ |
| **SP12** | 2512 (6432) | 3W | | 250V | 500V | 500V | |
| **SP17** | 2817 (7142) | 4W | | 250V | 500V | 500V | |
| **SP20** | 4320 (1150) | 5W | | 300V | 600V | 600V | |
| **SP27** | 4527 (1267) | 6W | | 300V | 600V | 600V | |

## Performance Specifications (性能)

| Test Item 试验项目 | Test Methods 试验方法 | Evaluation Criteria 判定标准 |
|---|---|---|
| **Temperature coefficient 温度系数** | Measure between -55℃ ~+155℃<br>测定范围：-55℃ ~+155℃ | 1Ω~10Ω ≤± 200PPM/℃<br>10.1Ω~10MΩ ≤± 100PPM/℃ |
| **Short-time overload 短时间过负荷** | 2.5x Rated voltage or Max. Overload Voltage whichever is lower for 5 seconds, then check the resistance.<br>2.5 倍额定电压或最大过负荷电压 ( 取其低者 ), 持续 5 秒钟 , 然后测阻值。 | ± 5% (2.0% + 0.1Ω)<br>± 1% (1.0% + 0.1Ω) |
| **Terminal Bending 端子弯曲** | Bending Distance 3mm, Duration: 60s±5s, then check the resistance.<br>弯曲距离：3mm，保持时间：60s±5s，然后测试阻值。 | ± (1.0% + 0.05Ω) |
| **Solderability 可焊性** | Temperature of solder: 245±3°C; Dwell time in solder: 2~3seconds.<br>锡炉温度 : 245±3°C ; 浸入时间 : 2~3 秒。 | Coverage must be over 95%.<br>覆盖率 ≥95% |
| **Soldering heat 耐焊接热** | Permanent resister change when leads immersed to a point 2.0~2.5mm from the body in 260±5℃ solder 10±1 seconds.<br>锡炉温度 260±5°C，侵入深度：离本体导线根部约 2.0~2.5mm 处，浸入时间：2~3 秒。 | ± (1.0%+0.05Ω) |
| **Dielectric withstanding voltage 绝缘耐压** | Resistor shall be clamped in the trough of 90° metallic V-block and shall be tested at AC potential respectively specified in the given list of each product type for 60~70s.<br>电阻固定在 90° 的 V 型槽中 , 根据不同产品规定交流电压 , 持续 60~70 秒 . | No evidence of flashover, mechanical damage, arcing or insulation breakdown<br>无击穿 , 飞弧及可见机械性损伤 |
| **Rapid change of temperature 温度快速变化** | 30 min at -55 ℃ and 30 min at 155 ℃; 100 cycles<br>-55 ℃ 温度放置 30min, 155 ℃ 温度放置 30min, 100 个循环 ;<br>**IEC 60115-1 4.19** | ± 5% (1.0% + 0.1Ω).<br>± 1% (0.5% + 0.1Ω). |
| **Load life 负载寿命** | 70°C，at RCWV or Max.Working Voltage whichever less,1,000 hours(1.5 hours "ON", 0.5 hours"OFF"), Measurement at 24±4 hours after test conclusion.<br>70°C，额定工作电压或最大工作电压 ( 取其低者 )，持续时间：1,000h(1.5h" 通 "，0.5h" 断 ")，试验结束 24h 后进行测试 .<br>MIL-STD-202 Method 108 | ± 5% (3.0% + 0.1Ω).<br>± 1% (1.0% + 0.1Ω). |
| **Humidity (Steady State) 恒定湿热** | Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2°C and 90~95% RH.<br>在 40±2°C 和 90~95% RH 相对湿度条件下，存放 240h 后阻值变化率 | ± 5% (3.0% + 0.1Ω) .<br>± 1% (0.5% + 0.1Ω) |
| **Load life in humidity 湿度寿命** | Resistance change after 1000 hours (1.5hours"ON"，0.5hours"OFF") at RCWV or Max.Working Voltage whichever less in a humidity test chamber controlled at 40±2°C and 90~95% RH.<br>持续时间：1000h (1.5h" 通 "，0.5h" 断 ")；试验温度：40±2°C；相对湿度：90~95% RH；试验电压：额定工作电压或最大工作电压 ( 取其低者 )。 | ± 5% (3.0% + 0.1Ω) .<br>± 1% (1.0% + 0.1Ω) |

## Ordering Procedure (Example: SP12 3W (2512) ±1% 10Ω T/R-2,000)

## 订购方式 (例如: SP12 3W (2512) ±1% 10Ω T/R-2,000)




**Remark:** Please refer to page 141 for ordering guide. 注：下单请详见 P141 页说明 。

# High-Voltage Thick Film Chip Resistors - HV

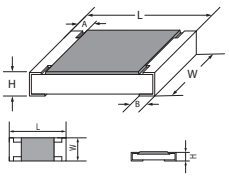
## 高压厚膜晶片电阻器 - HV系列

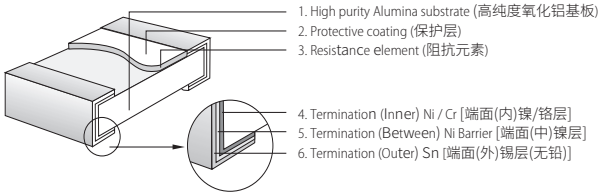


## Feature (特性)

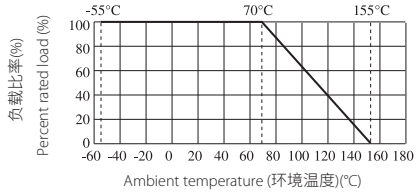
- Superiority in Max. Working Voltage performance than general thick film Chip Resistors. 在最大工作电压上优于普通厚膜晶片电阻
- Suitable for both wave & re-flow soldering 适合波峰焊及回流焊
- Application: AV adapter, LCD Backlight, Flash Light of camera 适用于AV适配器、LCD背光电路、照相机的闪光灯等

## Figures (型状)




## Derating Curve & Specification (降功率曲线及性能)




| Type 类型 | Max. Working Voltage 最大工作电压 | Max. Overload Voltage 最大过负荷电压 | Dielectric Withstanding Voltage 绝缘耐压 | Operating Temperature 工作温度范围 |
|---|---|---|---|---|
| **HV03** | 200V | 400V | 300V | -55°C~155°C |
| **HV05** | 400V | 800V | 500V | |
| **HV06** | 500V | 1000V | 500V | |
| **HV07** | 800V | 1500V | 500V | |
| **HV10** | 2000V | 3000V | 500V | |
| **HV12** | 3000V | 4000V | 500V | |

| Type 类型 | Size 尺寸 | Power Rating 功率 at 70°C | L(mm) | W(mm) | H(mm) | A(mm) | B(mm) | Resistance Range 阻值范围 1% & 5% |
|---|---|---|---|---|---|---|---|---|
| **HV03** | 0603 (1608) | 1/10W | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30± 0.20 | 36KΩ~10MΩ |
| **HV05** | 0805 (2012) | 1/8W | 2.00±0.15 | 1.25 $^{+0.15}_{-0.10}$ | 0.55±0.10 | 0.40±0.20 | 0.40± 0.20 | 100KΩ~10MΩ |
| **HV06** | 1206 (3216) | 1/4W | 3.10±0.15 | 1.55 $^{+0.15}_{-0.10}$ | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 | 100KΩ~10MΩ |
| **HV07** | 1210 (3225) | 1/2W | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | 50KΩ~10MΩ |
| **HV10** | 2010 (5025) | 3/4W | 5.00±0.10 | 2.50±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 50KΩ~10MΩ |
| **HV12** | 2512 (6432) | 1W | 6.35±0.10 | 3.20±0.20 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 | 39KΩ~10MΩ |

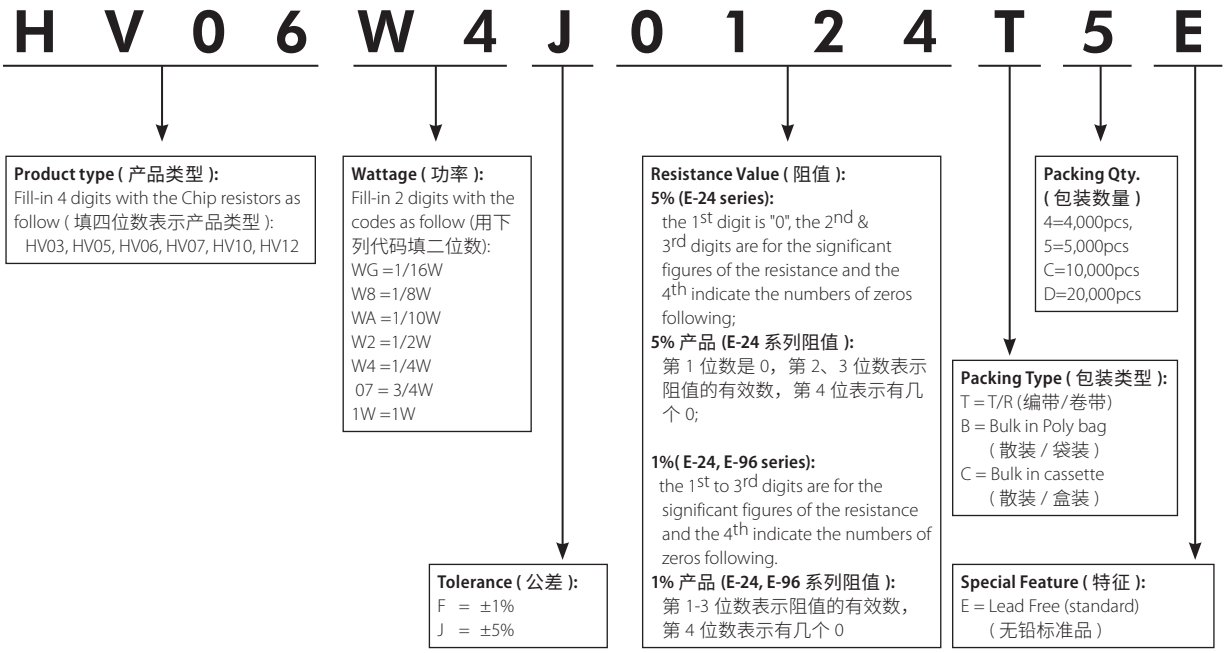
The NV series of Anti-sulfuration products are available in particular. NV系列抗硫化產品可特別提供.

## Performance Specification (性能)

| | | |
|---|---|---|
| **Temperature coefficient** | 温度系数 | ±100PPM/°C |
| **Short-time overload** | 短时间过负荷 | ±(2.0%+0.1Ω) |
| **Terminal bending** | 端子弯曲 | ±(1.0%+0.05Ω) |
| **Solderability** | 可焊性 | Coverage must be over 95%. |
| **Rapid change of temperature** | 温度快速变化 | 5% : ±(1.0%+0.05Ω)<br>1%: ±(0.5%+0.05Ω) |
| **Humidity (Steady State)** | 恒定湿热 | ±(3.0%+0.1Ω) |
| **Load life in humidity** | 湿度寿命 | ±(3.0%+0.1Ω) |
| **Load life** | 负载寿命 | ±(3.0%+0.1Ω) |
| **Insulation resistance** | 绝缘电阻 | ≥1,000MΩ |
| **Dielectric withstanding voltage** | 绝缘耐压 | No evidence of flashover, mechanical damage, arcing or insulation breakdown<br>无击穿，飞弧及可见机械性损伤 |
| **Soldering heat** | 耐焊接热 | ±(1.0% + 0.05Ω) |

## Ordering Procedure (Example: High Voltage HV06 1/4W 5% 120KΩ T/R-5000)

## 订购方式 (例如: 高压 HV06 1/4W 5% 120KΩ T/R-5000)




**Remark:** Please refer to page 141 for ordering guide. 注：下单请详见 P141 页说明 。

# Anti-Surge Thick Film Chip Resistors - AS

## Feature (特性)

- Superior Anti-Surge Voltage performance.　优越的抗浪涌电压特性
- Suitable for both wave & re-flow soldering　适合波峰焊与回流焊
- Application AV adapters, LCD back-light camera strobe etc.　适用于AV适配器、LCD背光电路、照相机的闸门等

## Specification (规格)

| Type<br>类型 | Size<br>尺寸 | Max. Working Voltage<br>最大工作电压 | Max. Overload Voltage<br>最大过负荷电压 | Dielectric Withstanding Voltage<br>绝缘耐压 | Operating Temperature<br>工作温度范围 |
|---|---|---|---|---|---|
| **AS02** | 0402 (1005) | 50V | 100V | 100V | -55~+155℃ |
| **AS03** | 0603 (1608) | 75V | 150V | 300V | |
| **AS05** | 0805 (2012) | 150V | 300V | 500V | |
| **AS06** | 1206 (3216) | 200V | 400V | 500V | |
| **AS07** | 1210 (3225) | 200V | 500V | 500V | |
| **AS10** | 2010 (5025) | 400V | 800V | 500V | |
| **AS12** | 2512 (6432) | 500V | 1000V | 500V | |

| Type<br>类型 | Power ( 功率 )<br>(70°C) | L (mm) | W (mm) | H (mm) | A (mm) | B (mm) | Resistance Range<br>阻值范围 | Tolerance<br>公 差 |
|---|---|---|---|---|---|---|---|---|
| **AS02** | 1/8W | 1.00±0.10 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 | 1Ω~10M | ±5%<br>±10%<br>±20% |
| **AS03** | 1/4W | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 | | |
| **AS05** | 1/2W | 2.00±0.15 | 1.25 $^{+0.15}_{-0.10}$ | 0.55±0.10 | 0.40±0.20 | 0.40±0.20 | | |
| **AS06** | 0.6W | 3.10±0.15 | 1.55 $^{+0.15}_{-0.10}$ | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 | | |
| **AS07** | 3/4W | 3.10±0.10 | 2.60±0.20 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 | | |
| **AS10** | | | | | | | | |