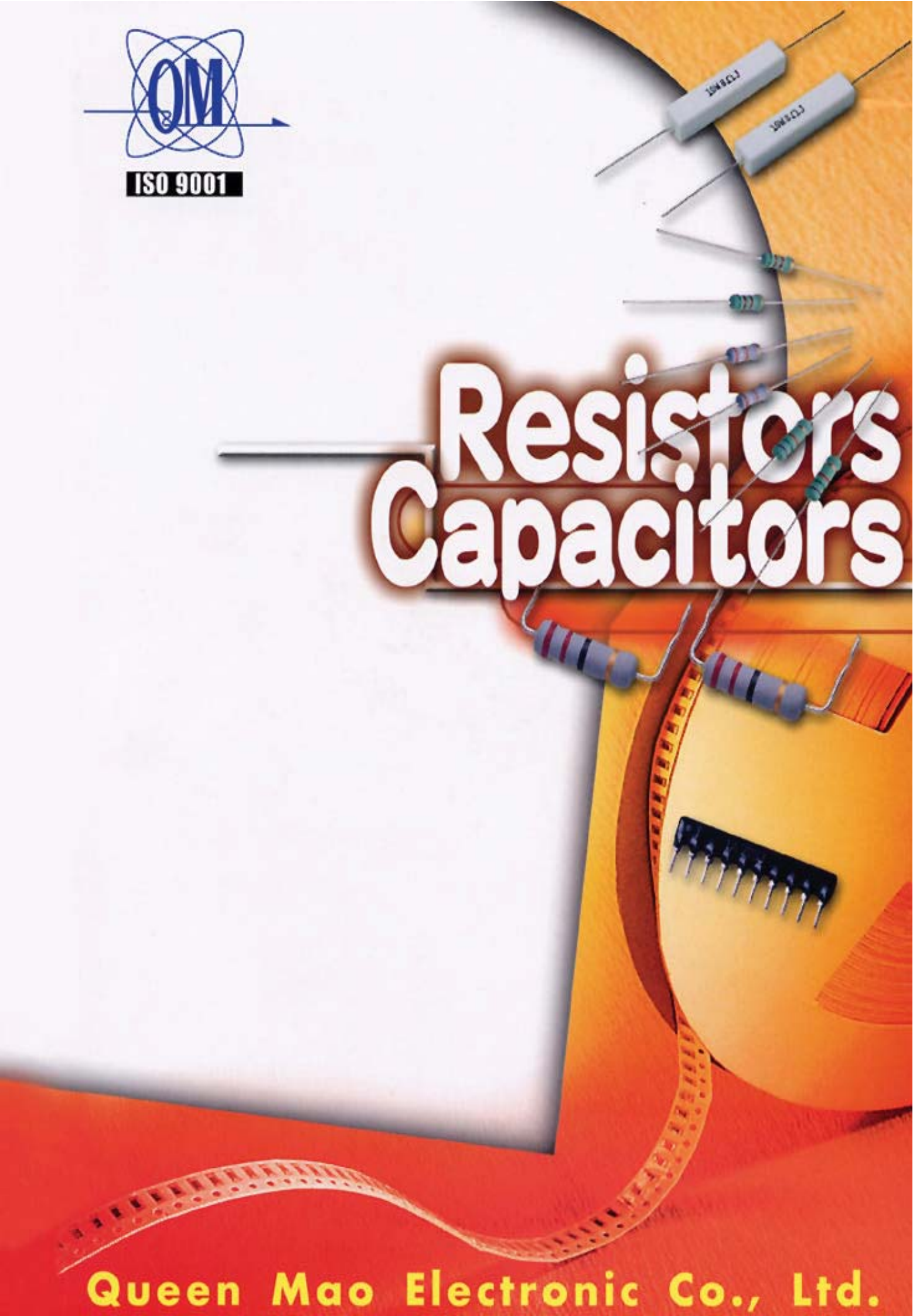
ISO 9001

# Resistors Capacitors



Queen Mao Electronic Co., Ltd.

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## Leaded Resistor Color Codes, Standard Values and Symbo

# Introduction

Queen Mao Electronic Co, Ltd. was established in 1983 in Shijr City, Taiwan by a group of engineers with over 20 years of experience in the productions of resistive and capacitor components. Since then we have grown to become one of Taiwan's larger manufacturers of resistors and capacitors. Our production output now reaches over 1 billion pieces per month. Queen Mao's success stems from the integrity of our employees and our devotion to assure that we only sell the best quality at the lowest possible price.

# History Outline

1983 Rented a 1,500 square ft. factory.
Only manufactured Carbon Film Fixed Resistors.
Starting Capital: US$220,000.
Annual Sale: US$2,000,000.

1989 Began producing Metal Film Fixed Resistors.

1990 Began producing Metal Oxide Film Fixed Resistors.

1991 Purchased a new factory in Shijr City, Taipei County (area 25,000 square feet).
Capital: US$2,000,000.

1996 Certified by ISO 9002

1997 Capital: US$3,500,000
Annual Sale: US$5,500,000
Established an office and warehouse in Hong Kong.
Set up manufacturing facilities in Suzhou for the market in China.

2003 Set up a factory in Tongguan, China
Certificated by ISO 9001

# We Manufacture:

- Carbon Film Fixed Resistors
- Metal Film Fixed Resistors
- Metal Oxide Film Fixed Resistors
- Wirewound Resistors
- Cement Fixed Resistors
- Thick Film Resistor Networks
- Thick Film Chip Resistors
- Multilayer Ceramic Chip Capacitors

# Quality & Clients

Queen Mao's commitment to quality is evident through our certification of the international standard ISO 9001. Furthermore, we are constantly investing in the latest technology in order to upgrade our workforce ability and to satisfy our customer's most demanding needs.

Queen Mao upholds one of the strictest quality control tests among Taiwanese resistor manufacturers. The resulted high quality products have won us the business of major monitor and P. C. product manufacturers such as :

*Acer Peripherals Co., Ltd.; Compal Electronics, Inc.; Liton Electronic Co., AOC Corporation, and Mitac Interational Corp.; Foxconn Electronics Inc.; Hipro Electronics Co., Ltd.; Foxlink Co., Ltd.; ADI Corporation.*

# Carbon Film Fixed Resistors (RD Series)

## 碳膜固定電阻器(RD 系列)

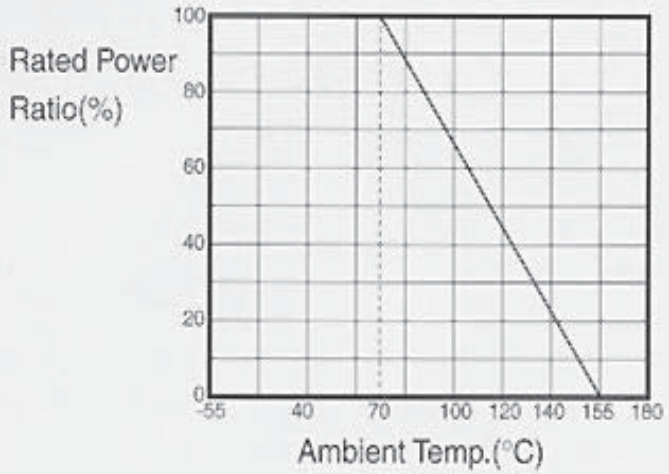
### FEATURES

- Formed from the crystallization of cabon on ceramic rods, under a high temp. of 1000°C, making it highly stable.
- Large range of Ω value.
- Widely used as standard parts in consumer electronic appliances.
- Automated mass production, low price.

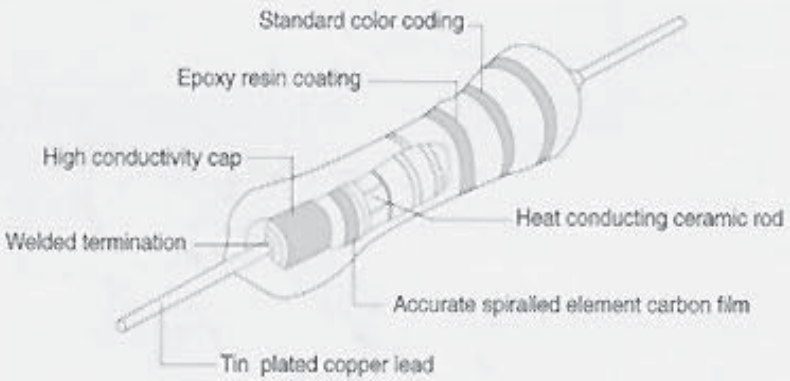
### CHARACTERISTIC PERFORMANCE

| Description | Requirements | | | | | Test Method MIL-R-10509 MIL-STD-202F |
|---|---|---|---|---|---|---|
| Nominal Resistance | E 24 Series | | | | | |
| Operating Temp. Range | -55°C ~ +155°C | | | | | |
| Resistance Value | Within Specified Tolerance | | | | | Method 303 |
| Resistance Temp. Coefficient (PPM/°C) | TCR | 0 ~ ±350 | 0 ~ -600 | 0 ~ -1000 | 0 ~ -1300 | Method 304 |
| | Type | | | | | |
| | 0.125W | under 1kΩ | 1.1kΩ-47kΩ | 51kΩ-510kΩ | 560kΩ-1MΩ | |
| | 0.25W | under 10kΩ | 11kΩ-150kΩ | 160kΩ-2.2MΩ | 2.4MΩ-5.1MΩ | |
| | 0.5 W &over | under 22kΩ | 24kΩ-470kΩ | 510kΩ-2.2MΩ | 2.4MΩ-10MΩ | |
| Short-time Overload | Within ± (0.75%+0.05Ω) No major visible damage | | | | | MIL-R-10509 |
| Insulation Resistance | At least 1000MΩ | | | | | Method 302 |
| Withstanding Voltage | No flashover, scorching or insulation breakdown | | | | | Method 301 |
| Resistance to Vibration | Within ± (0.5%+0.05Ω) No mechanical damage | | | | | Method 204 |
| Solder-heat Resistance | Within ± (0.75%+0.05Ω) No mechanical damage | | | | | Method 210 |
| Temperature Cycle | Within ± (0.75%+0.05Ω) No major visible damage | | | | | Method 102 |
| Load Life in Moisture | R ≤ 100KΩ : Within ±3% | | | | | Method 106 |
| | R > 100KΩ : Within ±5% No major visible damage | | | | | |
| Load Life | R ≤ 100KΩ : Within ±3% | | | | | Method 108 |
| | R > 100KΩ : Within ±5% No major visible damage | | | | | |

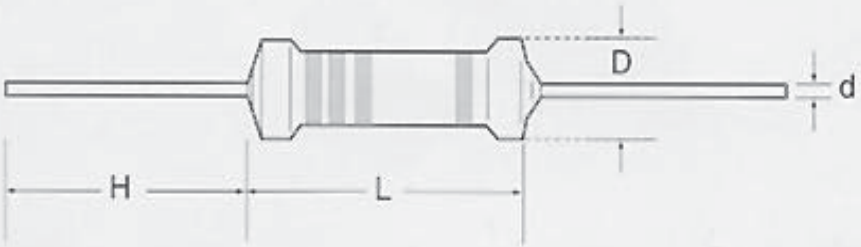
## DERATING CURVE




## STRUCTURE & MATERIAL




## DIMENSIONS




| Style | Dimensions (mm) | | | | Max. | Max. | Resistance Range | |
|---|---|---|---|---|---|---|---|---|
| | L | D | d | H (Min) | Working V. | Overload V. | ±2% (G) | ±5% (J) |
| RD 1/8W | 3.3±0.2 | 1.7±0.2 | 0.45±0.05 | 27 | 200V | 400V | 10-470KΩ | 1-4.7MΩ |
| RD 1/6W | 3.3±0.2 | 1.7±0.2 | 0.45±0.05 | 27 | 200V | 400V | 10-470KΩ | 1-4.7MΩ |
| RD 1/4WS | 3.3±0.2 | 1.7±0.2 | 0.45±0.05 | 27 | 300V | 500V | 10-1MΩ | 1-10MΩ |
| RD 1/4W | 6.5±0.5 | 2.3±0.2 | 0.55±0.05 | 27 | 300V | 500V | 10-1MΩ | 1-10MΩ |
| RD 1/2WS | 6.5±0.5 | 2.3±0.2 | 0.55±0.05 | 27 | 350V | 700V | 10-1MΩ | 1-10MΩ |
| RD 1/2W | 9±0.5 | 3.0±0.4 | 0.65±0.05 | 27 | 350V | 700V | 10-1MΩ | 1-10MΩ |
| RD 1W | 11±1 | 4.5±0.5 | 0.75±0.05 | 27 | 500V | 1000V | 10-1MΩ | 1-10MΩ |
| RD 2W | 15±1 | 5.0±0.5 | 0.75±0.05 | 27 | 500V | 1000V | 10-1MΩ | 1-10MΩ |

• Note: "WS" represents small size

# Metal Film Fixed Resistors (RN Series)

## 金屬皮膜固定電阻器（RN系列）

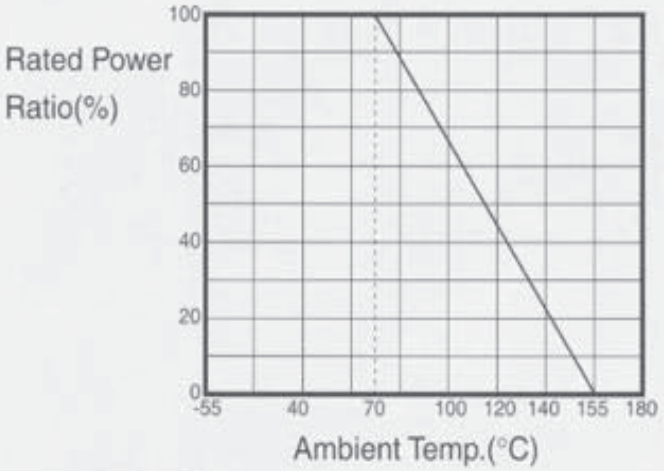
### FEATURES

- Formed by spattering Ni-Cr alloy onto highly $Al_2O_3$ concentrated ceramic rods.
- Makes an excellent precise resistor due to its low temperature coefficient resistance; ±0.1% to ±1% tolerance.
- Long term reliability and stability because of its special film and moisture proof resin for protective coating.

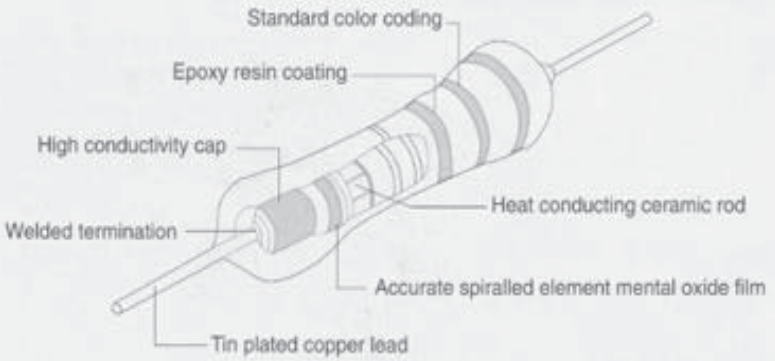
### CHARACTERISTIC PERFORMANCE

| Description | Requirements | Test Method MIL-R-10509 MIL-STD-202F |
|---|---|---|
| Nominal Resistance | E48, E96 Series | |
| Operating Temp. Range | -55°C ~ +155°C | |
| Resistance Value | Within Specified Tolerance | Method 303 |
| Resistance Temp. Coefficient (PPM/°C) | TCR: E: Within ±25PPM/°C<br>C: Within ±50PPM/°C<br>K: Within ±100PPM/°C | Method 304 |
| Short-time Overload | Within ± (0.5% + 0.05Ω) No major visible damage | MIL-R-10509 |
| Insulation Resistance | At least 1000MΩ | Method 302 |
| Withstanding Voltage | No flashover, scorching or insulation breakdown | Method 301 |
| Resistance to Vibration | Within ± (0.5% + 0.05Ω) No major visible damage | Method 204 |
| Solder-heat Resistance | Within ± (0.5% + 0.05Ω) No major visible damage | Method 210 |
| Temperature Cycle | Within ± (0.5% + 0.05Ω) No major visible damage | Method 102 |
| Load Life in Moisture | Within ± (1.5% + 0.05Ω) No major visible damage | Method 106 |
| Load Life | Within ± (1% + 0.05Ω) No major visible damage | Method 108 |

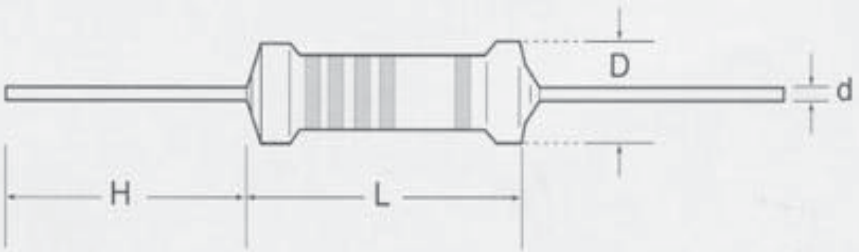
## DERATING CURVE




## STRUCTURE & MATERIAL




## DIMENSIONS




| Style | Dimensions (mm) | | | | Max. Working V. | Max. Overload V. | Resistance Range | | |
|---|---|---|---|---|---|---|---|---|---|
| | L | D | d | H (Min) | | | ± 0.1% (B) | ± 0.25% (C) | ± 0.5% (D); ± 1% (F) |
| RN 1/8W | 3.3±0.2 | 1.7±0.2 | 0.45±0.05 | 27 | 200V | 400V | 100-100KΩ | 51-510KΩ | 10-1MΩ |
| RN 1/6W | 3.3±0.2 | 1.7±0.2 | 0.45±0.05 | 27 | 200V | 400V | 100-100KΩ | 51-510KΩ | 10-1MΩ |
| RN 1/4WS | 3.3±0.2 | 1.7±0.2 | 0.45±0.05 | 27 | 300V | 500V | 100-100KΩ | 51-510KΩ | 10-1MΩ |
| RN 1/4W | 6.5±0.5 | 2.3±0.2 | 0.55±0.05 | 27 | 300V | 500V | 10-150KΩ | 10-10MΩ | 10-1MΩ |
| RN 1/2WS | 6.5±0.5 | 2.3±0.2 | 0.55±0.05 | 27 | 350V | 700V | 10-150KΩ | 10-10MΩ | 10-1MΩ |
| RN 1/2W | 9±0.5 | 4.5±0.4 | 0.65±0.05 | 27 | 350V | 700V | 10-150KΩ | 10-10MΩ | 10-1MΩ |

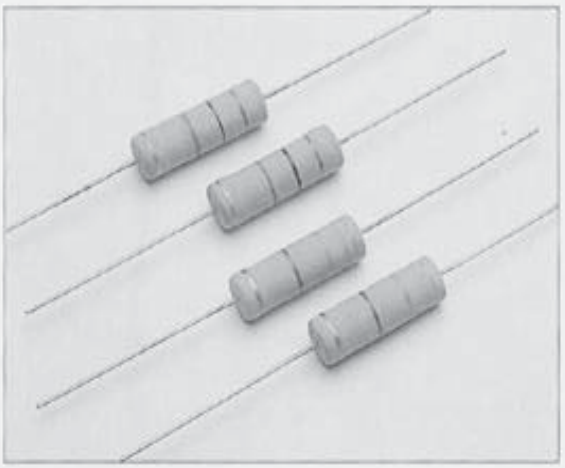
*Note: "WS" represents small size.

# Metal Oxide Film Fixed Resistors (RSF Series)

## 氧化金屬皮膜固定電阻器（RSF 系列）

### FEATURES

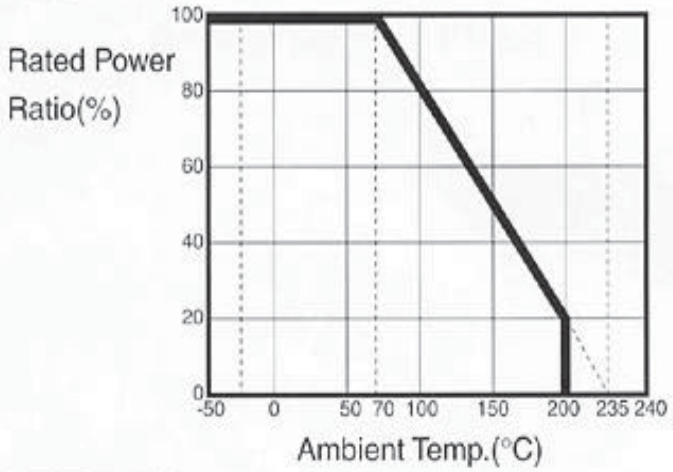
- Formed by a Sn-Sb base metal oxide smoked onto highly $Al_2O_3$ concentrated ceramic rods.
- Excellent heat resistance due to its special non-flammable coating.
- Will not ignite during overload.
- Able to make large watts.



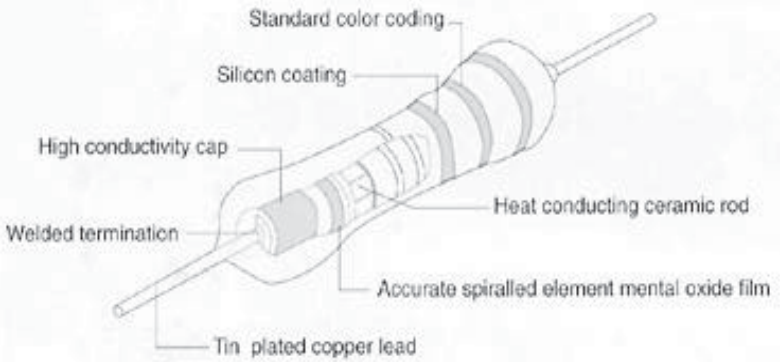
### CHARACTERISTIC PERFORMANCE

| Description | Requirements | Test Method MIL-R-10509 MIL-STD-202F |
|---|---|---|
| Nominal Resistance | E24 Series | |
| Operating Temp. Range | -55°C ~ +235°C | |
| Resistance Value | Within Specified Tolerance | Method 303 |
| Resistance Temp. Coefficient (PPM/°C) | T.C.R: E: Within ±350PPM/°C | Method 304 |
| Short-time Overload | Within ± (1% + 0.05Ω) No major visible damage | MIL-R-10509 |
| Insulation Resistance | At least 1000MΩ | Method 302 |
| Withstanding Voltage | No flashover, scorching or insulation breakdown | Method 301 |
| Resistance to Vibration | Within ± (1% + 0.05Ω) No major visible damage | Method 204 |
| Solder-heat Resistance | Within ± (1% + 0.05Ω) No major visible damage | Method 210 |
| Temperature Cycle | Within ± (1% + 0.05Ω) No major visible damage | Method 102 |
| Load Life in Moisture | Within ± (5% + 0.05Ω) No major visible damage | Method 106 |
| Load Life | Within ± (5% + 0.05Ω) No major visible damage | Method 108 |

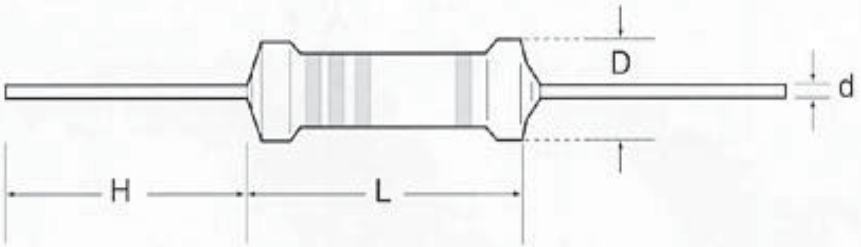
## DERATING CURVE




## STRUCTURE & MATERIAL




## DIMENSIONS



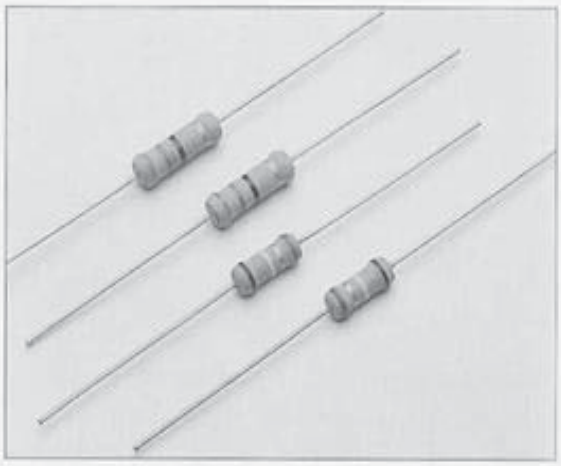

| Style | Dimensions (mm) | | | | Max. Working V. | Max. Overload V. | Resistance Range ±5% (J) |
|---|---|---|---|---|---|---|---|
| | L | D | d | H (Min) | | | |
| RSF 1/2W | 9.0±0.5 | 3.0±0.4 | 0.65±0.05 | 27 | 300V | 600V | 0.1-1MΩ |
| RSS 1WS | 9.0±0.5 | 3.0±0.4 | 0.65±0.05 | 27 | 350V | 700V | 0.1-1MΩ |
| RSF 1W | 11±1 | 4.5±0.4 | 0.75±0.05 | 27 | 350V | 700V | 0.1-1MΩ |
| RSS 2WS | 11±1 | 4.5±0.4 | 0.75±0.05 | 27 | 350V | 700V | 0.1-1MΩ |
| RSF 2W | 15±1 | 5.0±0.5 | 0.75±0.05 | 27 | 350V | 700V | 0.1-1MΩ |
| RSS 3WS | 15±1 | 5.0±0.5 | 0.75±0.05 | 27 | 500V | 1000V | 0.5-1MΩ |
| RSF 3W | 24±1 | 8.5±0.5 | 0.75±0.05 | 33 | 500V | 1000V | 0.5-1MΩ |
| RSS 5WS | 24±1 | 8.5±0.5 | 0.75±0.05 | 33 | 750V | 1000V | 10-1MΩ |

• Note: "WS" represents small size.

# Wirewound Resistors (RW Series)

## 繞線電阻器（RW系列）

### FEATURES

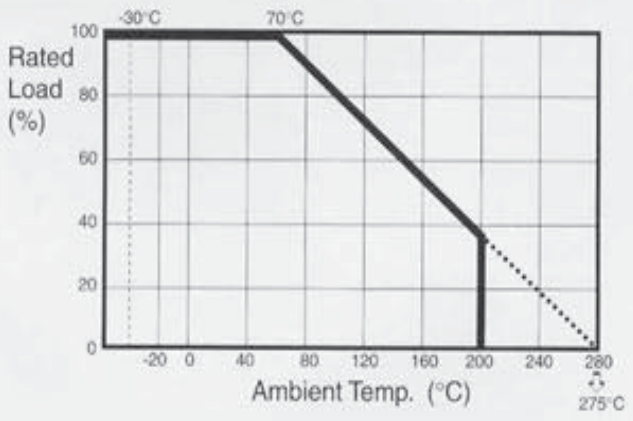


- Formed by winding a resistance wire around a alkaliless ceramic base.
- Is coated with a non-corrosive, high insulating, non-flammable material.
- Super heat dissipation, small linear temperature coefficient.
- Low noise.

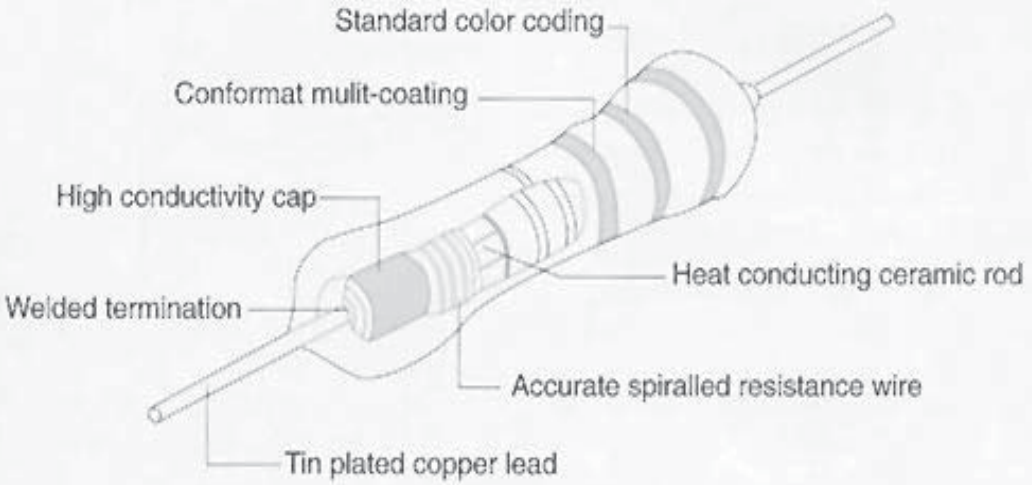
### CHARACTERISTIC PERFORMANCE

| Description | Requirements | | Test Method MIL-R-10509 MIL-STD-202F |
|---|---|---|---|
| Resistance Temp. Coefficient | -30°C ~ 200°C | ±300 PPM/°C | Method 304 |
| Short -time Overload | 10 times of rated wattage for 5 Sec. | ±(2%+0.05Ω) | MIL-R-10509 |
| Voltage Durability | 500V AC 1 Min. | ±( 0.5%+0.05Ω ) | |
| Insulation Resistance | 500V | 500MΩ | Method 302 |
| Temp. Cycle | -30°C ~ 85°C 5 Cycles | ±(1%+0.05Ω) | Method 102 |
| Load Life | 70°C on-off cycle 1000hrs. | ±(5%+0.05Ω) | Method 108 |
| Moisture-proof Load Life | 40°C 95% RH on-off cycle 500 hrs. | ±(3%+0.05Ω) | Method 106 |
| Flame Resistance | 6 times of rated wattage For 5 min. | Not flammable | |

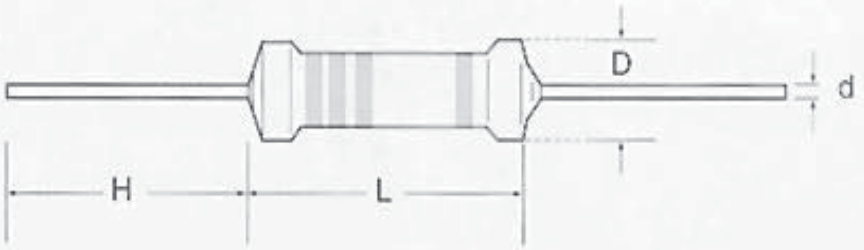
### DERATING CURVE



## STRUCTURE & MATERIAL




## DIMENSIONS



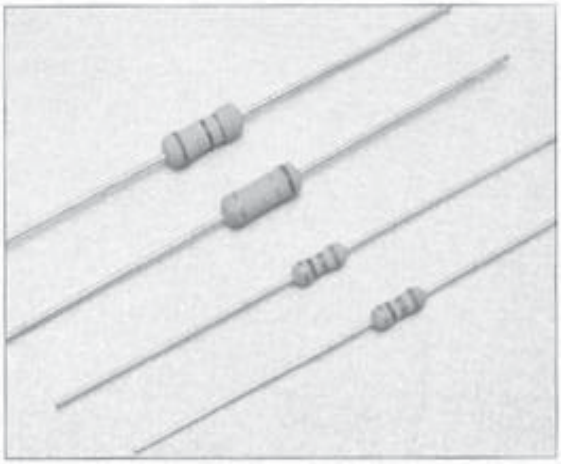

| Style | Power Rating | Dimension (mm) | | | | Resistance Range |
|---|---|---|---|---|---|---|
| | | D±1.0 | L±1.5 | H(MIN) | d±0.05 | |
| KNP 1/2W | 1/2W | 3.5 | 9.0 | 27 | 0.65 | 0.1-100Ω |
| KNP 1W | 1W | 4.5 | 11.0 | 27 | 0.8 | 0.1-150Ω |
| KNP 2W | 2W | 5.0 | 15.0 | 27 | 0.8 | 0.1-200Ω |
| KNP 3W | 3W | 5.0 | 15.0 | 27 | 0.8 | 0.1-400Ω |
| KNP 5W | 5W | 6.0 | 17.0 | 27 | 0.8 | 0.1-1K |
| KNP 7W | 7W | 6.0 | 24.0 | 27 | 0.8 | 0.1-1K |
| KNP 8W | 8W | 8.0 | 40.0 | 27 | 0.8 | 0.1-1K |
| KNP 10W | 10W | 8.0 | 53.0 | 27 | 0.8 | 0.1-2K |

# High Voltage Fixed Resistors (RV Series)

## 高電壓固定電阻器（RV系列）

### FEATURES

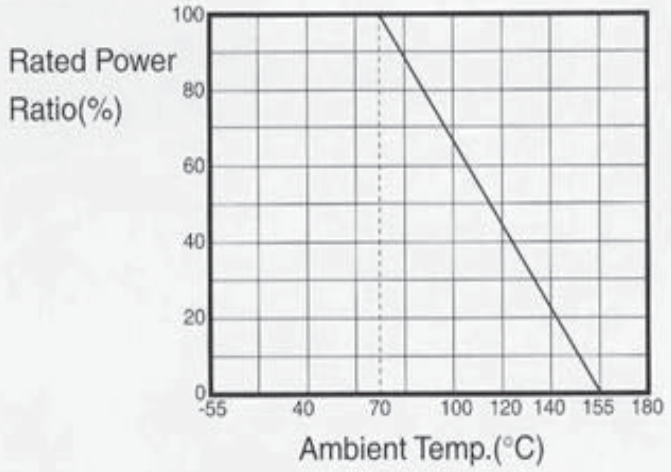
- Formed by a metal glaze printed onto highly $Al_2O_3$ concentrated ceramic rods.
- Excellent heat resistance due to its special non-flammable coating.
- Will not ignite during overload.
- Able to withstand high voltage surge.



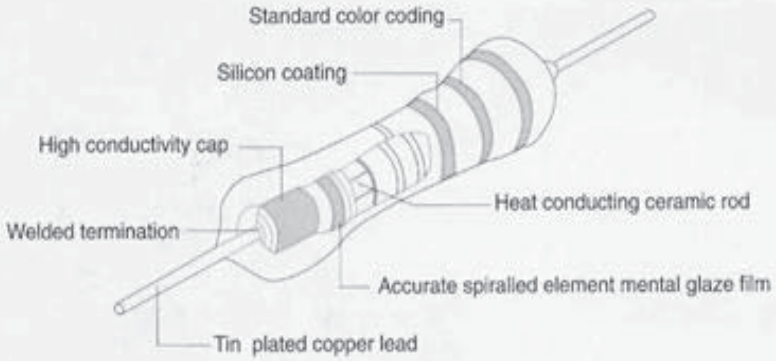
### CHARACTERISTIC PERFORMANCE

| Description | Requirements | Test Method MIL-R-10509 MIL-STD-202F |
|---|---|---|
| Nominal Resistance | E24 Series | |
| Operating Temp. Range | -55°C ~ +155°C | |
| Resistance Value | Within Specified Tolerance | Method 303 |
| Resistance Temp. Coefficient (PPM/°C) | T.C.R: E: Within ±200PPM/°C | Method 304 |
| Short-time Overload | Within ± (1% + 0.05Ω) No major visible damage | MIL-R-10509 |
| Insulation Resistance | At least 1000MΩ | Method 302 |
| Withstanding Voltage | No flashover, scorching or insulation breakdown | Method 301 |
| Resistance to Vibration | Within ± (0.5% + 0.05Ω) No major visible damage | Method 204 |
| Solder-heat Resistance | Within ± (1% + 0.05Ω) No major visible damage | Method 210 |
| Temperature Cycle | Within ± (1.5% + 0.05Ω) No major visible damage | Method 102 |
| Load Life in Moisture | Within ± (3% + 0.05Ω) No major visible damage | Method 106 |
| Load Life | Within ± (3% + 0.05Ω) No major visible damage | Method 108 |

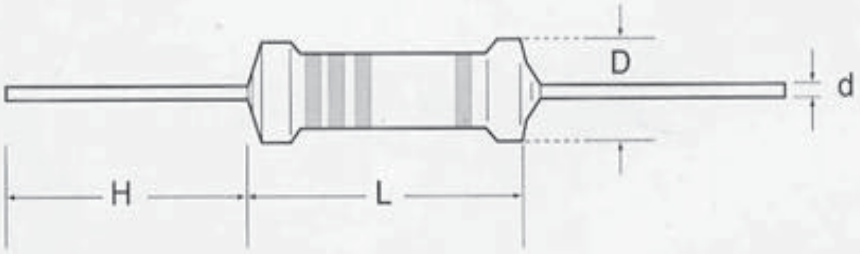
## DERATING CURVE




## STRUCTURE & MATERIAL




## DIMENSIONS



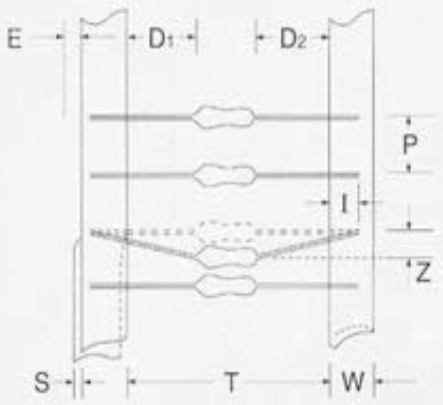

| Style | Dimensions (mm) | | | | Max. Working V. | Max. Overload V. | Resistance Range ±5% (J) |
|---|---|---|---|---|---|---|---|
| | L | D | d | H (Min) | | | |
| RV 1/4W | 6.5±0.5 | 2.3±0.5 | 0.55±0.05 | 26 | 500V | 1000V | 100K~33MΩ |
| RV 1/2WS | 6.5±0.5 | 2.3±0.5 | 0.55±0.05 | 26 | 1000V | 2000V | 100K~33MΩ |
| RV 1/2W | 9.5±0.5 | 3.0±0.5 | 0.65±0.05 | 26 | 1000V | 2000V | 100K~33MΩ |

• Note: "WS" represents small size.

# Taping Dimensions
## 帶裝尺寸

Unit: mm

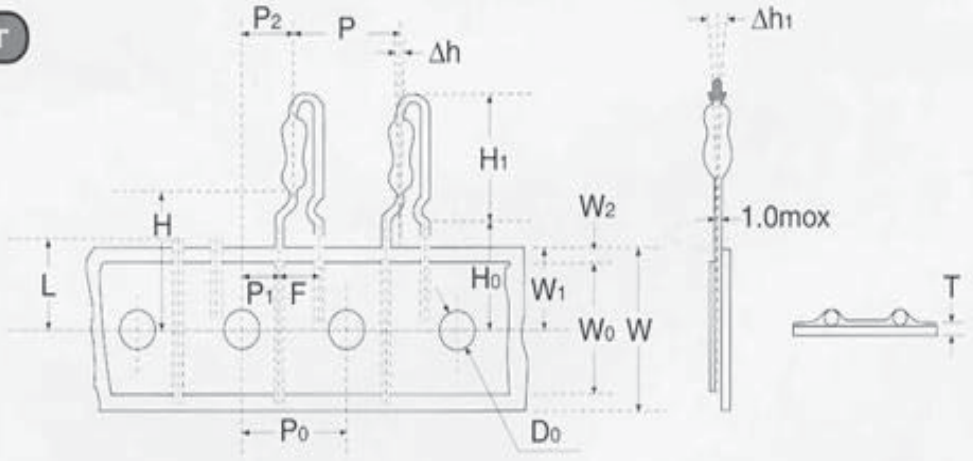
### AXIAL-LEAD TAPING




| Watt | Type | T | P ±0.5 | W ±0.5 | D1–D2 Max. | E Max. | Z Max. | S Max. | I Min. |
|---|---|---|---|---|---|---|---|---|---|
| 1/8W<br>1/6W | T-26 | 26+1.5 −0 | 5 | 6 | 0.8 | 0 | 1.2 | 0.8 | 3.2 |
| 1/8W | T-52 | 52±1.5 | 5 | 6 | 0.8 | 0 | 1.2 | 0.8 | 3.2 |
| 1/4W | T-26 | 26+1.5 −0 | 5 | 6 | 1.0 | 0 | 1.2 | 0.8 | 3.2<br>3.2 |
| 1/4W | T-52 | 52±1.5 | 5 | 6 | 1.0 | 0 | 1.2 | 0.8 | 3.2 |
| 1/2W | T-26 | 26+1.5 −0 | 5 | 6 | 1.2 | 0 | 1.2 | 0.8 | 3.2<br>3.2 |
| 1/2W | T-52 | 52±1.5 | 5 | 6 | 1.2 | 0 | 1.2 | 0.8 | 3.2 |
| 1W | T-73 | 73±1.5 | 5 | 6 | 1.4 | 0 | 1.2 | 0.8 | 3.2 |
| 2W | T-73 | 73±1.5 | 10 | 6 | 1.4 | 0 | 1.2 | 0.8 | 3.2 |

| Style | T26 | T52 | T73 | PN | Style | T26 | T52 | T73 | PN |
|---|---|---|---|---|---|---|---|---|---|
| CR 1/8W | • | • | | | MF 1/4WS | • | • | | |
| CR 1/6W | • | • | | | MF 1/4W | • | • | | • |
| CR 1/4WS | • | • | | | MF 1/2WS | • | • | | • |
| CR 1/4W | • | • | | • | MF 1/2W | | • | | |
| CR 1/2WS | • | • | | • | MF 1W | | | • | |
| CR 1/2W | | • | | | RSF 1W | | | • | |
| CR 1W | | | • | | RSF 2W | | | • | |
| CR 2W | | | • | | RSS 1WS | | | • | |
| MF 1/8W | • | • | | | RSS 2WS | | | • | |
| MF 1/6W | • | • | | | RSS 3WS | | | • | |

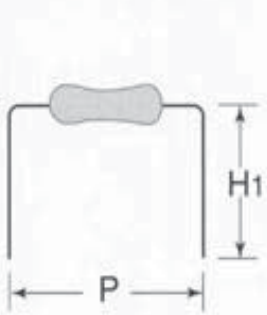
### PANA-SERT



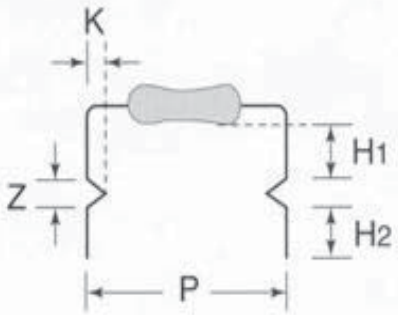

| Dimensions (mm) | | | | | |
|---|---|---|---|---|---|
| P | 12.7±1.0 | Δh 1 | 0±0.5 | H0 | 16.0±0.5 |
| P0 | 12.7±0.3 | W | 18.0-0.5/+1.0 | H1 | 12.0 max. |
| P1 | 3.85±0.7 | W0 | 12.5 min. | D0 | 4.0±0.3 |
| P2 | 6.35±1.0 | W1 | 9.0±0.5 | t | 0.7±0.2 |
| F | 5.0±0.5 | W2 | 2.75 max. | L | 11.0 max. |
| Δh | 0±2.0 | H | 20.0±0.5 | | |

# Formed Dimension

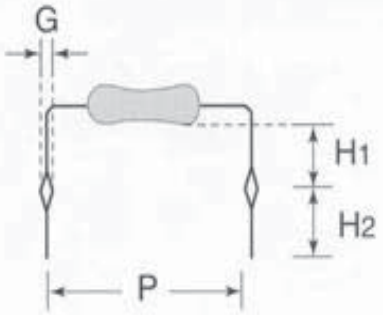
## 加工成型尺寸



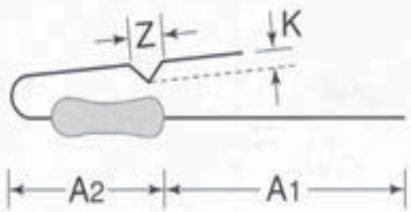

PU TYPE



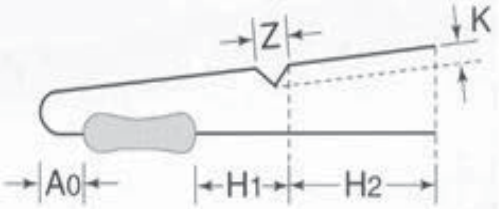

PUK TYPE




PUG TYPE




PF TYPE




PFK TYPE

Unit: mm

| Watt | Type | P ±0.5 | H1 ±1 | H2 ±1 | A0 ±0.5 | A1 Min. | A2 Max. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1/4W | PU | 10 | 10 | — | — | — | — | |
| 1/4W | PF | — | — | — | — | 27 | 11 | |
| 1/2W | PUG | 15 | 4.5 | 4.5 | — | — | — | |
| 1W | PUG | 15 | 7 | 5 | — | — | — | |
| 1W | PUK | 15 | 5 | 5 | — | — | — | |
| 1W | PFK | — | 5 | 5 | 3 | — | — | |
| 2W | PUG | 20 | 10 | 5 | — | — | — | |
| 2W | PUK | 20 | 5 | 5 | — | — | — | |
| 2W | PFK | — | 5 | 5 | 3 | — | — | |

- Remark: Z=3±1; K=2±0.5; G=1.25~1.45.
- The measurement of "P" is from lead center to lead center.
- Formed dimensions can be accepted as per customer's request.

# Packing Specifications
## 包裝規格

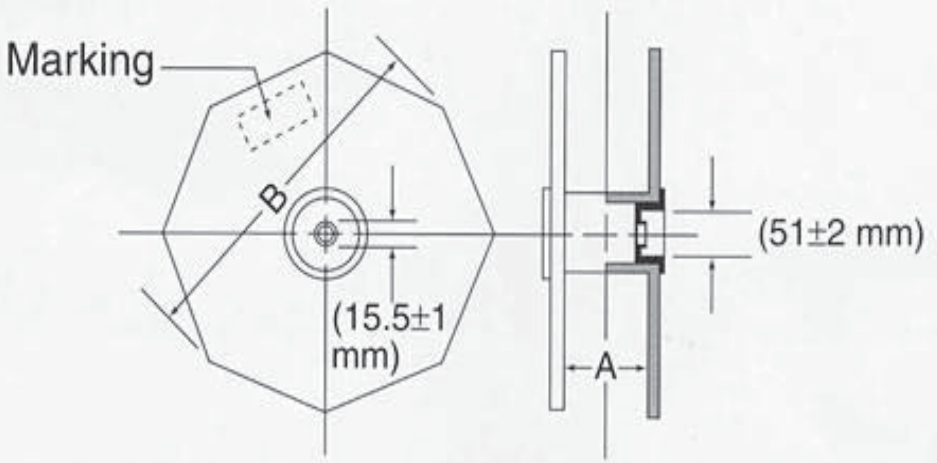
### BULK PACKING

| Style | PCS. Per PE bag | PCS. Per box | Dimension (mm) | | |
|---|---|---|---|---|---|
| | | | L | W | H |
| 1/8W,1/6W, 1/4WS | 500 | 10,000 | 200±2 | 138±2 | 85±2 |
| 1/4W, 1/2WS | 500 | 10,000 | 230±2 | 165±2 | 78±2 |
| 1/2W, 1WS | 500 | 5,000 | 285±2 | 170±2 | 87±2 |
| 1W, 2WS | 100 | 1,000 | 200±2 | 138±2 | 85±2 |
| 2W, 3WS | 100 | 1,000 | 200±2 | 138±2 | 85±2 |

### AMMO PACKING

| Style | PCS Per box | Dimension (mm) | | |
|---|---|---|---|---|
| | | L | W | H |
| 1/8W | 5,000 | 255±2 | 83±2 | 75±2 |
| 1/4W | 5,000 | 255±2 | 83±2 | 106±2 |
| 1/2W | 1,000 | 255±2 | 75±2 | 52±2 |
| 1W | 1,000 | 270±2 | 96±2 | 96±2 |
| 2W | 1,000 | 270±2 | 96±2 | 96±2 |

### REEL PACKING



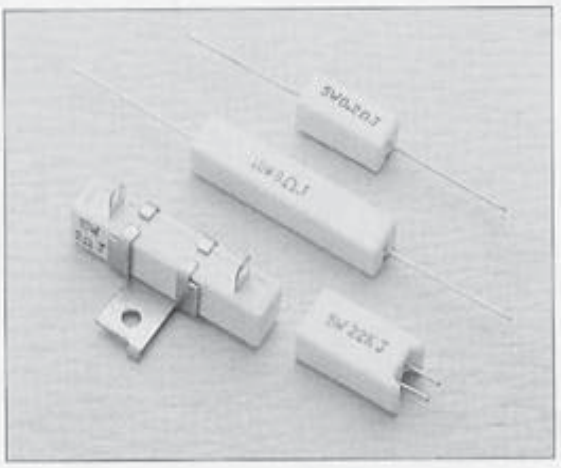

| Style | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | Across Flanges | Across Points | Resistor Spacing | Tape Spacing | Quantity |
| | A | B | P | T | Per Reel |
| 1/8W | 75 MAX | 310 MAX | 5±0.4 | 52±2 | 5,000 |
| 1/4W | 75 MAX | 310 MAX | 5±0.4 | 52±2 | 5,000 |
| 1/2W | 75 MAX | 310 MAX | 5±0.4 | 52±2 | 2,500 |
| 1W | 95 MAX | 310 MAX | 5±0.4 | 73±2 | 2,000 |
| 2W | 95 MAX | 310 MAX | 10±0.4 | 73±2 | 1,000 |

# Cement Type Resistors (LRW Series)

## 水泥型電阻器（LRW系列）

### FEATURES

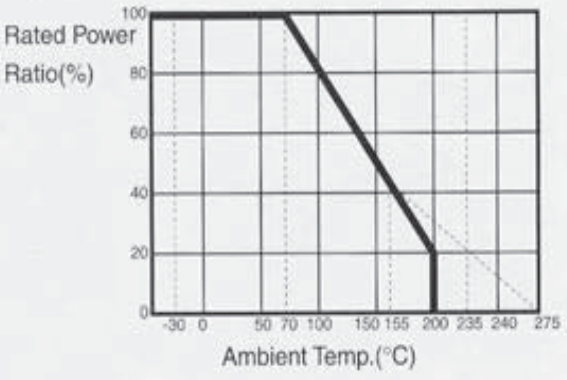
- Has a non-flammable material that will not ignite during overload.
- Complete insulation makes it suitable for P.C. board mounting.
- Precise resistance value with high stability.
- Super heat dissipation, small linear temperature coefficient.
- Low noise.
- For high resistance value, the winding core is replaced by Metal Oxide Film cutting core.



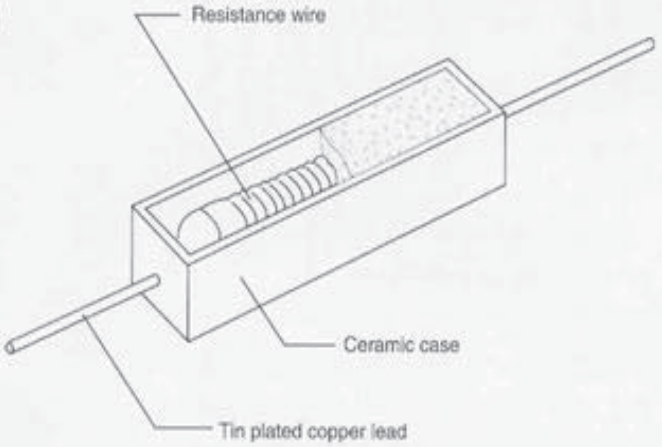
### CHARACTERISTIC PERFORMANCE

| Description | Requirements | | Test Method MIL-R-10509 MIL-STD-202F |
|---|---|---|---|
| Resistance Temp. Coefficient | -30°C ~ 155°C | ±300 PPM/°C | Method 304 |
| Short time Overload | 10 times of rated wattage for 5 Sec. | ±(2%+0.05Ω) | MIL-R-10509 |
| Voltage Durability | 1000V AC 1 Min. | ±(0.5%+0.05Ω) | |
| Insulation Resistance | 500V | 500MΩ | Method 302 |
| Temp. Cycle | -30°C ~ 85°C 5 Cycles | ±(1%+0.05Ω) | Method 102 |
| Load Life | 70°C on-off cycle 1000hrs. | ±(5%+0.05Ω) | Method 108 |
| Moisture-proof Load Life | 40°C 95% RH on-off cycle 500 hrs. | ±(3%+0.05Ω) | Method 106 |
| Flame Resistance | 6 times of rated wattage for 5 min. | Not flammable | |

### DERATING CURVE



## STRUCTURE & MATERIAL



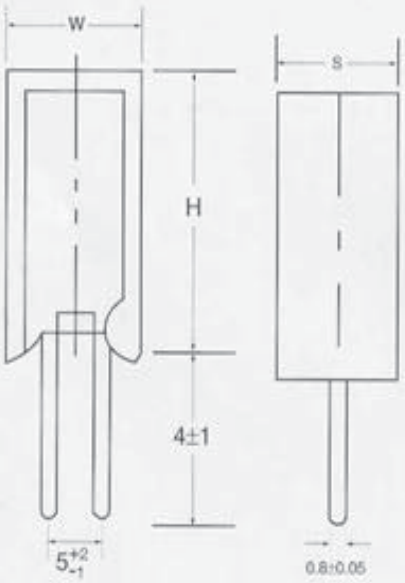

## DIMENSIONS

### SQP

| Style | Dimensions (mm) | | | | Max. | Resistance Range | |
|---|---|---|---|---|---|---|---|
| SQP | L±1 | W±1 | H±1 | d±0.05 | Working V. | RW | RSF |
| 2W | 18.0 | 7.0 | 7.0 | 0.8 | 15V | 0.1-80Ω | 120-20KΩ |
| 3W | 22.0 | 8.0 | 8.0 | 0.8 | 350V | 0.1-100Ω | 150-33KΩ |
| 5W | 22.0 | 10 | 9.0 | 0.8 | 350V | 0.1-220Ω | 200-50KΩ |
| 7W | 35.0 | 10 | 9.0 | 0.8 | 500V | 0.1-470Ω | 500-50KΩ |
| 10W | 48.0 | 10 | 9.0 | 0.8 | 750V | 0.1-680Ω | 1K-50KΩ |
| 15W | 48.0 | 12.5 | 11.5 | 0.8 | 1000V | 0.5-820Ω | 1K-150KΩ |
| 20W | 60.0 | 14.5 | 13.5 | 0.8 | 1000V | 0.5-1KΩ | 1K-150KΩ |

• Note: "RW"=Wirewound Resistor; "RSF"=Metal Oxide Film Resistor

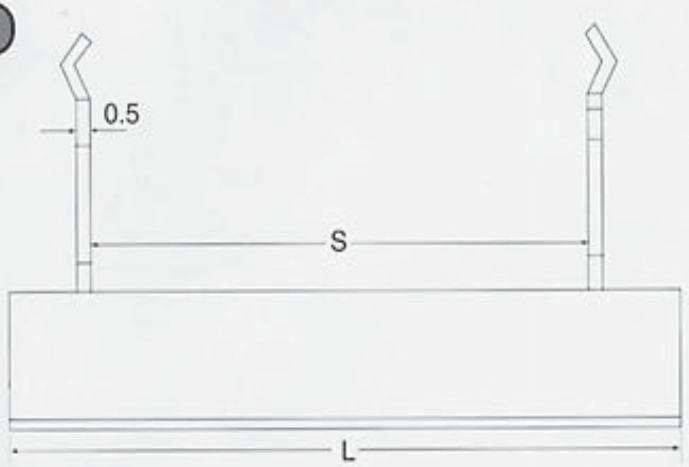
### SQM

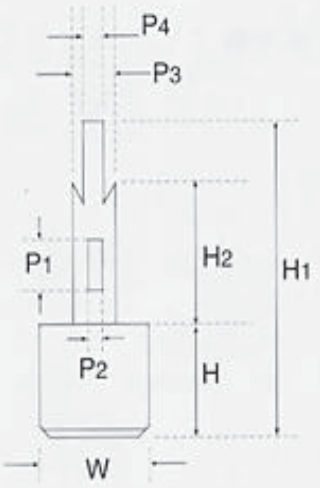



| Style | Dimension (mm) | | | Resistance Range | |
|---|---|---|---|---|---|
| SQM | H±1.5 | W±1 | S±1 | RW | RSF |
| 5W | 25.0 | 12.5 | 9.0 | 0.1-68Ω | 200-50KΩ |
| 7W | 39.0 | 12.5 | 9.0 | 0.1-470Ω | 500-47KΩ |
| 10W | 51.0 | 12.5 | 9.0 | 0.1-680Ω | 1K-47KΩ |

• Note: "RW"=Wirewound Resistor; "RSF"=Metal Oxide Film Resistor

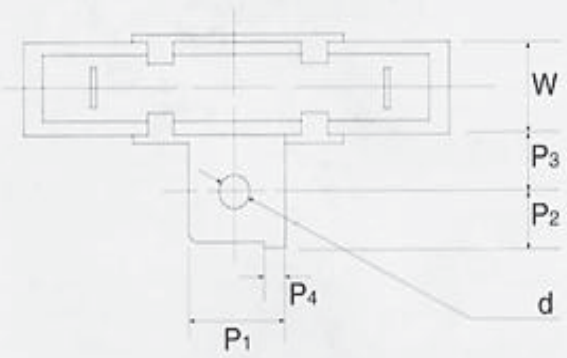
## SQZ

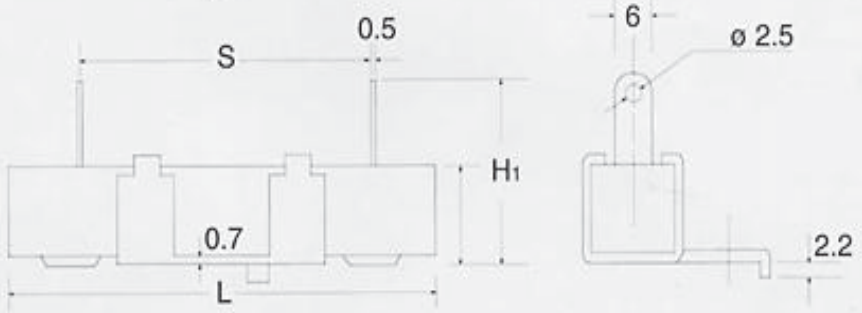



| Style | Power Rating | Dimension (mm) | | | | | | | | | | Resistance Range | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L±1.5 | H±1 | W±1.5 | S±1 | H1±1.5 | H2±1.5 | P1±1 | P2±1 | P3±1 | P4±1 | RW | RSF |
| SQZ-5 | 5W | 25.0 | 9.0 | 10.0 | 15.0 | 25.0 | 10.5 | 4.0 | 2.0 | 5.0 | 1.6 | 0.1-150Ω | 151-50KΩ |
| SQZ-7 | 7W | 35.0 | 9.0 | 10.0 | 20.5 | 25.0 | 10.5 | 4.0 | 2.0 | 5.0 | 1.6 | 0.1-470Ω | 451-50KΩ |
| SQZ-10 | 10W | 48.0 | 9.0 | 10.0 | 32.0 | 25.0 | 10.5 | 4.0 | 2.0 | 7.0 | 1.6 | 0.2-680Ω | 471-50KΩ |
| SQZ-15 | 15W | 48.0 | 11.5 | 12.5 | 32.0 | 34.5 | 15.0 | 7.0 | 6.0 | 10.0 | 3.0 | 0.5-820Ω | 601-150KΩ |
| SQZ-20 | 20W | 63.0 | 11.5 | 12.5 | 45.0 | 34.5 | 15.0 | 7.0 | 6.0 | 10.0 | 3.0 | 1-1KΩ | 1.1K-150 KΩ |

## SQH



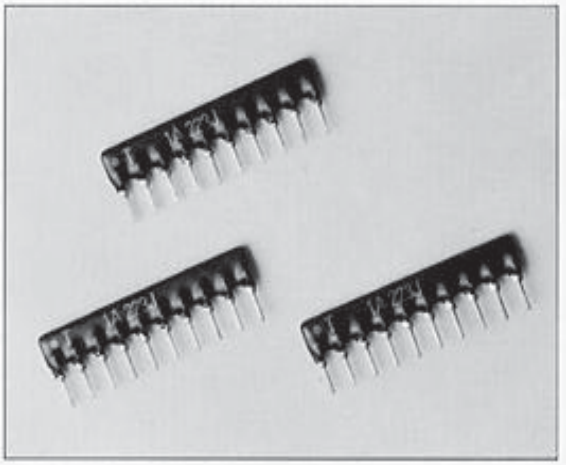

| Style | Power Rating | Dimension (mm) | | | | | | | | | | Resistance Range | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L±1.5 | H±1 | W±1.5 | S±1 | H1±1.5 | P1±1 | P2±1 | P3±1 | P4±1 | d | RW | RSF |
| SQH-10 | 10W | 48.0 | 10.0 | 10.0 | 32.0 | 18.0 | 12.0 | 6.0 | 8.0 | 3.0 | 4.0 | 0.5-600Ω | 601-50KΩ |
| SQH-15 | 15W | 48.0 | 12.0 | 12.5 | 32.0 | 21.0 | 12.0 | 6.0 | 8.0 | 3.0 | 4.0 | 1-820Ω | 601-150K |
| SQH-20 | 20W | 63.0 | 12.0 | 12.5 | 45.0 | 21.0 | 12.0 | 6.0 | 8.0 | 3.0 | 4.0 | 1-1KΩ | 1.1K-150K |
| SQH-30 | 30W | 75.0 | 19.0 | 19.0 | 56.0 | 32.0 | 12.0 | 6.0 | 8.0 | 3.0 | 4.0 | 1-2KΩ | |
| SQH-40 | 40W | 90.0 | 19.0 | 19.0 | 70.0 | 32.0 | 12.0 | 6.0 | 8.0 | 3.0 | 4.0 | 1-2KΩ | |

# Thick Film Resistor Networks (RA Series)

## 厚膜排列電阻器（RA系列）

### FEATURES

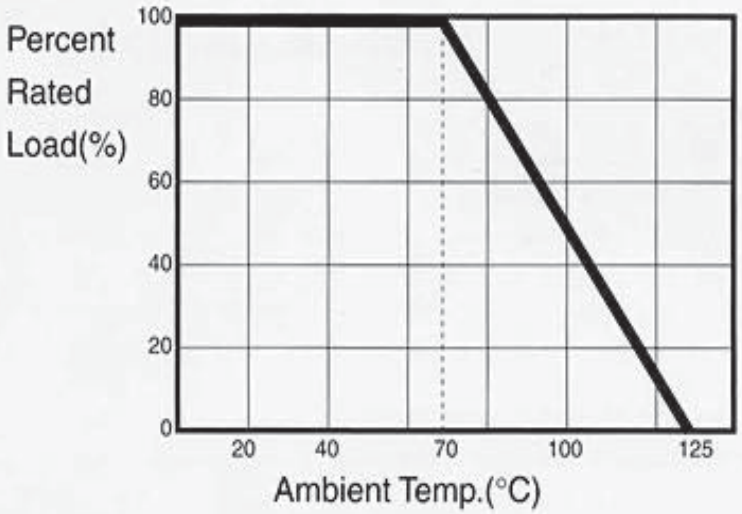
- Formed from metal glaze elements screened on ceramic substrates with strong clip construction terminals.
- Small in size with high precise, single line, packaging.
- Able to meet the need for increasing the density of circuit assembling.
- Extremely stable, accurate, and reliable.



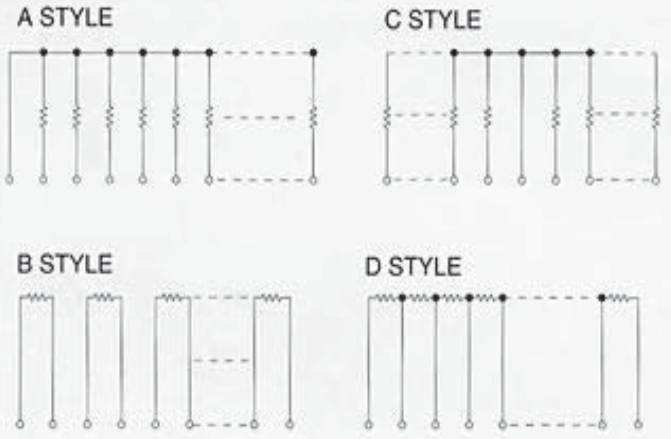
### CHARACTERISTIC PERFORMANCE

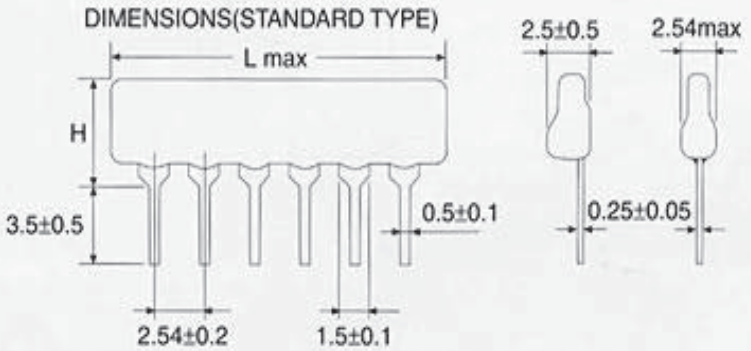
| Description | Requirements | Test Method (JIS C 5202) |
|---|---|---|
| Resistance Value | Within specified tolerance | Section 5.1 |
| Resistance Temp. Coefficient | ±250 PPM/°C | Section 5.2<br>Test temperature 20/ -15/ -40/20/60/100°C |
| Short-time overload | ± (1% + 0.05Ω) | Section 5.5-A<br>2.5 times rated voltage for 5 seconds |
| Dielectric withstanding | No insulation break down | Section 5.7-E (metal ball)<br>Test voltage: 500V<br>Duration: 1 minute |
| Terminal Strength | ± (1% + 0.05Ω)<br>No end cap shall loosen and<br>No lead wire shall break | Pull: Section 6.1- (1), 1kg, 10 seconds<br>Bend: Section 6.1- (4), 90 deg., 2 times each direction. |
| Solder-heat Resistance | ± (1% + 0.05Ω)<br>No mechanical damage | Section 6.4<br>260°C, 5 seconds |
| Solderability | New solder shall cover at least 95% | Section 6.5<br>235°C, 5 seconds |
| Temperature Cycling | ± (1% + 0.05Ω)<br>No mechanical damage | Section 7.4<br>-40/ + 85°C, 5 cycles |
| Moisture-resistance Cycling | ± (3% + 0.1Ω)<br>No mechanical damage | 40 cycles of -10°C, 2 hours<br>and + 70°C, 90% RH, 2 hours |
| Load Life in Moisture | ± (5% + 0.1Ω) | Section 7.9<br>Rated voltage with the cycle of 1.5 hours-on and 0.5 hours-off for 1,000 hours at 40°C, 95% RH |
| Load Life | ± (5% + 0.1Ω) | Section 7.10<br>Rated voltage with the cycle of 1.5 hours-on and 0.5 hours off for 1,000 hours at 70°C |

## DERATING CURVE




## STANDARD INTERNAL CIRCUITS




## DIMENSIONS

| MIL | Style | Power Rating | Dimensions (mm) | | | | Max. Working V. | Max. Overload V. | Resistance Range G(±2%) J (±5%) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Elements | Pin Number | L Max. | H. | | | |
| RA1/8 | A.C.D. | 0.125W | 3-11 | 4-12 | Pin Number x 2.54+0.25 | 5.08 Max. | 100V. | 150V. | 22-1MΩ E24 Series |
| | B | | 2-6 | | | | | | |
| RA1/4 | A.C.D. | 0.25W | 3-13 | 4-12 | Pin Number x 2.54+0.25 | 7.0 Max. | 200V. | 300V. | |
| | B | | 2-7 | | | | | | |

# Thick Filmk Chip Resistors CR 02, 03, 05, 06, 20, 25

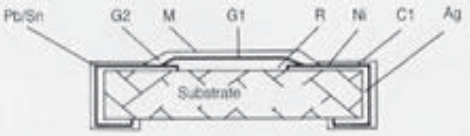
## 晶片電阻器（CR 02, 03, 05, 06, 20, 25系列）

## FEATURES

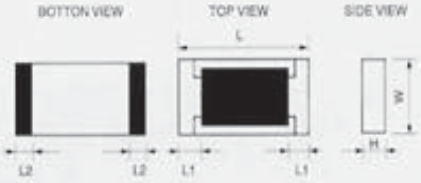
1. A series of resistors and jumper chips from 0402 to 2512 for using in a wide variety of circuits.
2. Highly stability metal-glaze is used for the electrodes together with a glass coating improves resistance to mechanical stress.
3. Packaging -bulk, bulk cassette and taped. P roduct is suitable for high-speed surface mount machines.

## DIMENSIONS AND STRUCTURE

Chip Resistors: CR 02, 03, 05, 06, 20, 25
Low-Ohmic Resistors: CR 03,05, 06,20,25




Substrate:$Al_2O_3$
C1(Conductor):Ag/Pd
R(Resistors):$RuO_2$
G1(1st Protective Coating): Glass
G2(2nd Protective Coating): Glass
M(Marking):Glass
Ag (Terminal Conductor): Ag
Ni (Middle Electrode): Ni
Pb/Sn (Outer Electrode): Pb/Sn,Sn




Unit: mm

| STYLE | Type | L | W | H | L1 | L2 |
|---|---|---|---|---|---|---|
| CR02 | 0402 | 1.0± 0.05 | 0.5± 0.05 | 0.35± 0.05 | 0.2± 0.1 | 0.25 $^{+0.15}_{-0.10}$ |
| CR03 | 0603 | 1.6± 0.1 | 0.8 $^{+0.15}_{-0.10}$ | 0.45± 0.10 | 0.3± 0.2 | 0.3± 0.2 |
| CR05 | 0805 | 2.05± 0.1 | 1.25± 0.15 | 0.55± 0.10 | 0.4± 0.2 | 0.40± 0.2 |
| CR06 | 1206 | 3.15± 0.15 | 1.6± 0.15 | 0.55± 0.10 | 0.5± 0.25 | 0.50± 0.2 |
| CR20 | 2010 | 5.0± 0.15 | 2.5± 0.15 | 0.55± 0.10 | 0.6± 0.25 | 0.6± 0.25 |
| CR25 | 2512 | 6.4± 0.15 | 3.2± 0.15 | 0.55± 0.10 | 0.6± 0.25 | 0.6± 0.25 |

## RATINGS

| Size | Rate Power At 70℃ (w) | Rate Current of Jumper (A) | Maximum Working Voltage (Vw) | Maximum Overload Voltage (Vo) | Temperature Coefficient of Resistance (ppm/℃) | | Combination of Resistance Range and Tolerance F(±1%) E96 series E24 series | Combination of Resistance Range and Tolerance J(±5%) E24 series | Operating Temperature Range (℃) |
|---|---|---|---|---|---|---|---|---|---|
| 0402 | 1/16 | 1 | 50 | 100 | ±100 | 10Ω~1M | 100Ω~560K | 10Ω~1MΩ | -55~+125 |
| | | | | | ±200 | 1Ω~9.1Ω >1M | | | |
| 0603 | 1/10 | | 50 | 100 | ±100 | 10Ω~1M | 1Ω~1MΩ | 1Ω~10MΩ | |
| | | | | | ±200 | 1Ω~9.1Ω >1M | | | |
| 0805 | 1/8 | 2 | 150 | 300 | ±100 | 10Ω~1M | 1Ω~1MΩ | 1Ω~22MΩ | |
| | | | | | ±200 | 1Ω~9.1Ω >1M | | | |
| 1206 | 1/4 | | 200 | 400 | ±100 | 10Ω~1M | 1Ω~1MΩ | 1Ω~22MΩ | |
| | | | | | ±200 | 1Ω~9.1Ω >1M | | | |
| 2010 | 3/4 | | | | ±100 | 10Ω~1M | 1Ω~1MΩ | 1Ω~22MΩ | |
| | | | | | ±200 | 1Ω~9.1Ω >1M | | | |
| 2512 | 1 | | | | ±100 | 10Ω~1M | 1Ω~1MΩ | 1Ω~22MΩ | |
| | | | | | ±200 | 1Ω~9.1Ω >1M | | | |

*Above 10M ohm up to 39M ohm is specially available.

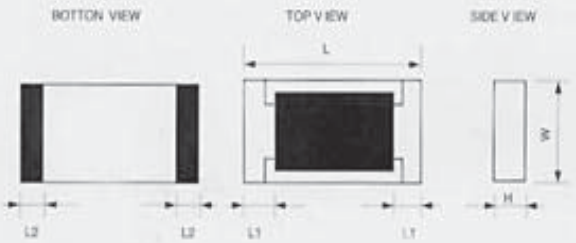
# Thick Film Low-Ohmic Chip Resistors CR 03, 05, 06, 20, 25

## 晶片電阻器/低阻值（CR 03, 05, 06, 20, 25系列）

## FEATURES

1. Most suitable as resistors for current detection in power source circuits, motor circuits. etc.

## DIMENSIONS




Unit: mm

| STYLE | Type | L | W | H | L1 | L2 |
|---|---|---|---|---|---|---|
| CR03 | 0603 | 1.6± 0.1 | $0.8^{+0.15}_{-0.10}$ | 0.45± 0.10 | 0.3± 0.2 | 0.3± 0.2 |
| CR05 | 0805 | 2.05± 0.1 | 1.25± 0.15 | 0.55± 0.10 | 0.4± 0.2 | 0.4± 0.2 |
| CR06 | 1206 | 3.15± 0.15 | 1.6± 0.15 | 0.55± 0.10 | 0.5± 0.25 | 0.5± 0.2 |
| CR20 | 2010 | 5.0. ± 0.15 | 2.5± 0.15 | 0.55± 0.10 | 0.6± 0.25 | 0.6± 0.25 |
| CR25 | 2512 | 6.4± 0.15 | 3.2± 0.15 | 0.55± 0.10 | 0.6± 0.25 | 0.6± 0.25 |

## RATINGS

| Type | Rated Power At 70 ℃ (w) | Temperature Coefficient of Resistance (ppm/ ℃) | Resistance Range | Resistance Tolerance | Qperating Temperature Range ( ℃ ) |
|---|---|---|---|---|---|
| 0603 | 1/10 | ±250 | 0.5Ω~1 Ω | F(± 1%), J(± 5%) | -55~+125 |
| | | ±500 | 0.1Ω~0.5 Ω | J(± 5%) | |
| 0805 | 1/8 | ±250 | 0.1Ω~1 Ω | F(± 1%), J(± 5%) | |
| | | ±500 | 0.02Ω~0.1 Ω | J(± 5%) | |
| 1206 | 1/4 | ±250 | 0.1Ω~1 Ω | F(± 1%), J(± 5%) | |
| | | ±500 | 0.02Ω~0.1 Ω | J(± 5%) | |
| 2010 | 3/4 | ±250 | 0.1Ω~1 Ω | F(± 1%), J(± 5%) | |
| | | ±500 | 0.02Ω~0.1 Ω | J(± 5%) | |
| 2512 | 1 | ±250 | 0.1Ω~1 Ω | F(± 1%), J(± 5%) | |
| | | ±500 | 0.02Ω~0.1 Ω | J(± 5%) | |

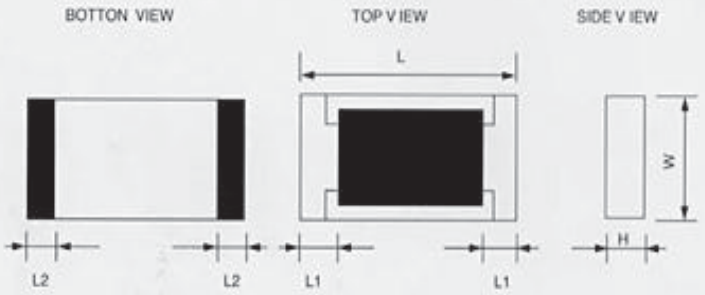
# High Precision Chip Resistors
# CR 02, 03, 05, 06, 20, 25

## 高精密度晶片電阻器（CR 02, 03, 05, 06, 20, 25系列）

## FEATURES

1. Most suitable as resistors for current detection in power source circuits, motor circuits. etc.

## DIMENSIONS




Unit: mm

| STYLE | Type | L | W | H | L1 | L2 |
|---|---|---|---|---|---|---|
| CR02 | 0402 | 1.0± 0.05 | 0.5± 0.05 | 0.35± 0.05 | 0.2± 0.1 | $0.25^{+0.15}_{-0.10}$ |
| CR03 | 0603 | 1.6± 0.1 | $0.8^{+0.15}_{-0.10}$ | 0.45± 0.10 | 0.3± 0.2 | 0.3± 0.2 |
| CR05 | 0805 | 2.05± 0.1 | 1.25± 0.15 | 0.55± 0.10 | 0.4± 0.2 | 0.4± 0.2 |
| CR06 | 1206 | 3.15± 0.15 | 1.6± 0.15 | 0.55± 0.10 | 0.5± 0.25 | 0.5± 0.2 |
| CR20 | 2010 | 5.0. ± 0.15 | 2.5± 0.15 | 0.55± 0.10 | 0.6± 0.25 | 0.6± 0.25 |
| CR25 | 2512 | 6.4± 0.15 | 3.2± 0.15 | 0.55± 0.10 | 0.6± 0.25 | 0.6± 0.25 |

## RATINGS

| Type | Rated Power At 70 ℃ (w) | Maximum Working Voltage (Vw) | Maximum Overload Voltage (Vo) | Temperature Coefficient of Resistance (ppm/ ℃) | Resistance Range | | | Operating Temperature Range (℃ |
|---|---|---|---|---|---|---|---|---|
| | | | | | ±0.5% | ±0.25% | ±0.1% | |
| 0402 | 1/16 | 50 | 100 | ±100 | 100Ω~ 1MΩ | --- | --- | -55~+125 |
| 0603 | 1/10 | 50 | 100 | ±100 | 100Ω~1M Ω | | | |
| 0805 | 1/8 | 150 | 300 | ±100 | | | | |
| 1206 | 1/4 | 200 | 400 | ±100 | | | | |
| 2010 | 3/4 | 200 | 400 | ±100 | | | | |
| 2512 | 1/4 | 200 | 400 | ±100 | | | | |

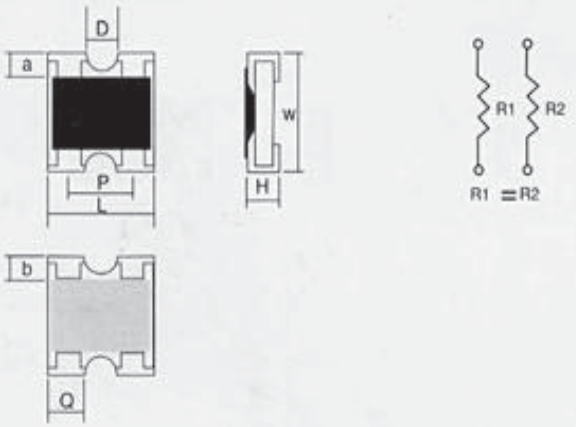
# Thick Film Chip Resistor Array RB02 (0402SIZE/2-ELEMENTS)

## 晶片排列電阻器/二元素（RB02系列）

## FEATURES

1. High density SMD packaging gives higher productivity and reduced assembly costs.
2. Suitable for flow and reflow soldering.
3. Suitable for automatic surface mount.

## DIMENSIONS AND STRUCTURE




Unit: mm

| STYLE | TYPE | Terminal | L | W | H | Q | a | b | p | D |
|---|---|---|---|---|---|---|---|---|---|---|
| RB 02 | 022R | Convex | 1.0±0.1 | 1.0±0.1 | 0.35±0.1 | 0.25±0.15 | 0.2±0.15 | 0.25±0.15 | 0.65±0.15 | 0.3±0.1 |

## RATINGS

| TYPE | Rated Power At 70℃ (w) | Maximum Working Voltage (Vw) | Maximum Overload Voltage (Vo) | Temperature Coefficient of Resistance (ppm/℃) | Resistance Range | Resistance Tolerance | Opera ting Tempe rature Range (℃) |
|---|---|---|---|---|---|---|---|
| 022R | 1/16 | 50 | 100 | ±200 | 10Ω~1MΩ | J(±5%) F(±1%) | -55~+125 |

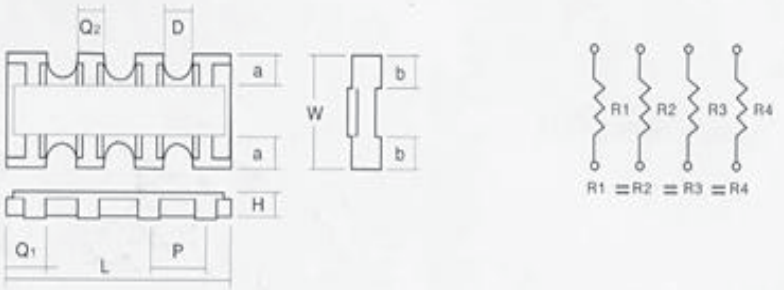
# Thick Film Chip Resistor Array
# RA02 (0402SIZE/4-ELEMENTS)
# RA03 (0603SIZE/4-ELEMENTS)

## 晶片排列電阻器/四元素（RA02, 03系列）

## FEATURES

1. High density SMD packaging gives higher productivity and reduced assembly costs.
2. Suitable for flow and reflow soldering.
3. Suitable for automatic surface mount.

## DIMENSIONS AND STRUCTURE




Unit: mm

| STYLE | TYPE | Terminal | L | W | H | $Q_1$ | a | b | p | $Q_2$ | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RA 02 | 024R | Convex | 2.0±0.1 | 1.0±0.1 | 0.45±0.1 | 0.3±0.1 | 0.2±0.1 | 0.3±0.1 | 0.5±0.1 | 0.2±0.1 | 0.2±0.1 |
| RA 03 | 034R | Convex | 3.2±0.15 | 1.6±0.2 | 0.6±0.1 | 0.65±0.15 | 0.3±0.15 | 0.3±0.15 | 0.8±0.1 | 0.45±0.1 | 0.38±0.1 |

## RATINGS

| TYPE | Rated Power At 70℃ (w) | Maximum Working Voltage (Vw) | Maximum Overload Voltage (Vo) | Temperature Coefficient of Resistance (ppm/℃) | Resistance Range | Resistance Tolerance | Operating Temperature Range (℃) |
|---|---|---|---|---|---|---|---|
| 024R | 1/16 | 50 | 100 | ±200 | 10Ω~1MΩ | J(±5%) F(±1%) | -55~+125 |
| 034R | 1/16 | 50 | 100 | ±200 | 10Ω~1MΩ | J(±5%) F(±1%) | |

# Thick Film Chip Resistor Array RC02 (0402SIZE/8-ELEMENTS)

## 晶片排列電阻器/八元素（RC02系列）

### FEATURES

1. This product is highly suitable for the purpose of pull-up and pull-down.
2. It is easy to handle because of no specified direction for mounting due to the symmetrical placement of common terminal.

### DIMENSIONS

Unit: mm

| STYLE | TYPE | L | W | H | D | Q1 | Q2 | a | b | p |
|---|---|---|---|---|---|---|---|---|---|---|
| RC 02 | 028R | 4.0±0.2 | 1.6±0.15 | 0.45±0.1 | 0.2±0.1 | 0.4±0.2 | 0.3±0.1 | 0.3±0.2 | 0.3±0.2 | 0.5±0.2 |

### RATINGS

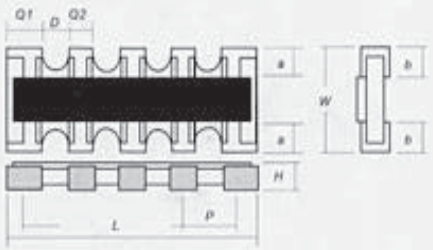
| TYPE | Rated Power At 70℃ (w) | Maximum Working Voltage (Vw) | Maximum Working Voltage (Vo) | Temperature Coefficient of Resistance (ppm/℃) | Resistance Range E12 series | Resistance Tolerance | Operating Temperature Range (℃) |
|---|---|---|---|---|---|---|---|
| 028R | 1/16 | 50 | 100 | ±200 | 10Ω~1MΩ | J(±5%) | -55~+125 |

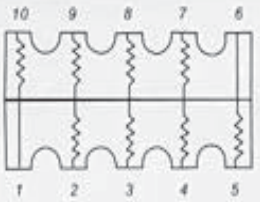
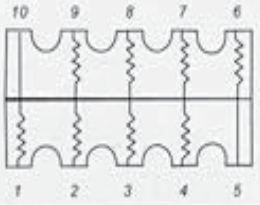
# Thick Film Chip Resistor Network
# RN02 (0402 SIZE/ELEMENTS 10P8R)
## 晶片排列電阻器/10P8R（RN02系列）

## FEATURES

1. This product is highly suitable for the purpose of pull-up and pull-down.
2. It is easy to handle because of no specified direction for mounting due to the symmetrical placement of common terminal.

## DIMENSIONS




| Type | Circute diagram |
|---|---|
| S |  |
| R |  |



Unit: mm

| STYLE | TYPE | L | W | H | D | Q1 | Q2 | a | b | p |
|---|---|---|---|---|---|---|---|---|---|---|
| RN 02 | 028R | 3.2± 0.2 | 1.6± 0.2 | 0.5± 0.1 | 0.32± 0.1 | 0.53± 0.1 | 0.32± 0.1 | 0.3± 0.2 | 0.3± 0.2 | 0.64± 0.1 |

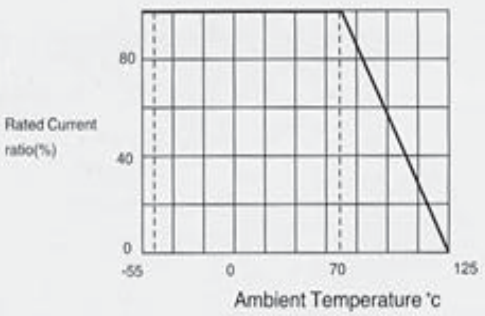
## RATINGS

| TYPE | Rated Power At 70℃ (w) | Maximum Working Voltage (Vw) | Maximum Overload Voltage (Vo) | Temperatur e Coefficie nt of Resistanc e (ppm/℃) | Resistance Range E12 series | Resistance Tolerance | Opera ting Tempe rature Range (℃) |
|---|---|---|---|---|---|---|---|
| 028R | 1/32 | 25 | 50 | ±200 | 10Ω～1MΩ | J(±5%) | -55～+125 |

# Characteristics Reference

## DERATING CURVE

The power that the resistor can dissipate depends on the operating temperature. For operation at ambient temperature in excess 70℃.The load should be derated in accordance with figure of Derating Curve.




## PERFORMANCE CHARACTERISTIC

| Item | Condition of test | Performance of requirement | |
|---|---|---|---|
| | | CHIP Resistor | Jumper |
| DC Resistance | JIS C 5202 5.1/IEC 115-1 4.5 | Within specified tolerance | <50m Ω |
| Temperature Coefficient of Resistance | JIS C 5202 5.2/IEC 115-1 4.8.4.2<br>$T.C.R. = \frac{R-R_0}{R_0(t-t_0)} \times 10^6 (ppm/℃)$<br>$t_0$=+25 ℃,t=Testtemperature (-55 ℃~125 ℃)<br>$R_0$=Resistance at 25℃,R=Resistance at test temp. | See Ratings Table | --- |
| Short-time Overload | JIS C 5202 5.5/IEC 115-1 4.13<br>Apply 2.5 times of rated voltage but not exceeding the maximum overload voltage for 5 seconds. | 5%,△R/R±(2.0%+0.1 Ω)max.<br>1%,△R/R±(1.0%+0.05 Ω)max.<br>No visible damage | <50m Ω |
| Bending Strength | JIS C 5202 6.1<br>Mount the specimen on a 90mm glass epoxy resin PCB(FR4), Bending once for 10secs.<br>>2mm for 2512,2010<br>>3mm for 1206,0805,0603,0402 | △R/R±(1.0%+0.05 Ω)<br>No visible damage | <50m Ω |
| Resistance to Soldering heat | JIS C 5202 6.4/IEC 115-1 4.18<br>Immerse the specimen in the solder pot at 260 ±5℃ for 10 ±1seconds. | 5%,△R/R±(1.0%+0.05 Ω)max.<br>1%,△R/R±(0.5%+0.05 Ω)max.<br>No visible damage | <50m Ω |
| Solderability | JIS C 5202 6.5/IEC 115-1 4.17<br>Dipping the specimen in the solder pot at 235 ±5℃ for 2±1seconds. | At least 95%of the terminal surface must be covered by new solder. | As left |
| Temperature Cycle | JIS C 5202 7.4/IEC 115-1 4.19<br>In sequence, at room temperature,-55 ℃/30min., 25℃/2min.+125 ℃/30min., 25 ℃/2min. as a cycle, perform 5 cycles. | 5%,△R/R±(1.0%+0.05 Ω)max.<br>1%,△R/R±(0.5%+0.05 Ω)max.<br>No visible damage | <50m Ω |
| Load Life in Humidity | JIS C 5202 7.9/IEC 115-1 4.24.2<br>Apply the rated voltage of 1.5 hours"ON"and 0.5 hour "OFF"cycle at 40±2℃ and 90~95%RH for 1000+48/-0 hours. | 5%,△R/R±(3.0%+0.1 Ω)max.<br>1%,△R/R±(1.0%+0.05 Ω)max.<br>No visible damage | <100m Ω |
| Load Life | JIS C 5202 7.10/IEC 115-1 4.25.1<br>Apply the rated voltage of 1.5 hours"ON"and 0.5 hour "OFF"cycle at 70±2℃ 7 for 1000+48/-0 hours. | 5%,△R/R±(3.0%+0.1 Ω)max.<br>1%,△R/R±(1.0%+0.05 Ω)max.<br>No visible damage | <100m Ω |
| Insulation Resistance | JIS C 5202 5.6<br>Place the specimen the jig and apply a maximun working DC voltage for one minute. | 1000M Ω minimum | As left |
| Voltage Proof | JIS C 5202 5.7<br>Place the specimen the jig and apply a maximun working AC voltage for one minute. | No abnormalities such as flashover or Breakdown on appearance. | As left |

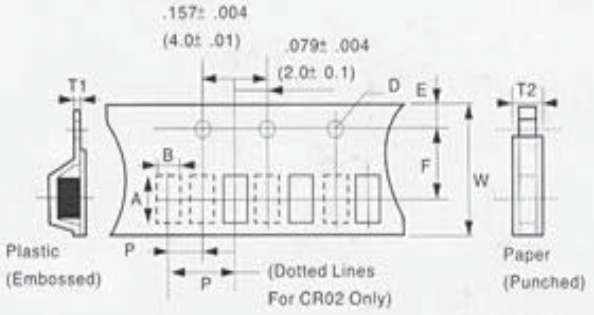
# Thick Film Chip Resistor Packing

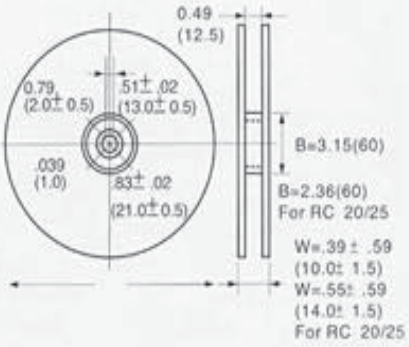
## 包裝規格

### PACKING METHODS

| Packing / Style | Paper Taping Reel(R) | | | Embossed Taping Reel(K) |
|---|---|---|---|---|
| | 7"(178mm) | 10"(254mm) | 13"(330mm) | |
| CR02/RB02 | 10,000 | 20,000 | 40,000 | 7"(178mm) |
| CR03/RC02 | 5,000 | 10,000 | 20,000 | — |
| CR05 | | | | |
| CR06/RA03/RN02 | 5,000 | 10,000 | 20,000 | — |
| CR20 | — | — | — | 4,000 |
| CR25 | — | — | — | 4,000 |

### DIMENSIONS




Unit: inch/(mm)

| Dimension | A | B | W | E | F | T1 | T2 | P | D |
|---|---|---|---|---|---|---|---|---|---|
| CR02 | 0.045± 0.008 (1.15± 0.2) | 0.026± 0.008 (0.65± 0.2) | 0.315± 0.008 (8.0± 0.2) | 0.069± 0.004 (1.75± 0.1) | 0.138± 0.002 (3.5± 0.05) | -------- | 0.018± 0.004 (0.45± 0.1) | 0.79± 0.004 (2.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| CR03 | 0.075± 0.008 (1.9± 0.2) | 0.043± 0.008 (1.1± 0.2) | 0.315± 0.008 (8.0± 0.2) | 0.069± 0.004 (1.75± 0.1) | 0.138± 0.002 (3.5± 0.05) | -------- | 0.024± 0.004 (0.6± 0.1) | 0.157± 0.004 (4.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| CR05 | 0.092± 0.008 (2.35± 0.2) | 0.065± 0.008 (1.6± 0.2) | 0.315± 0.008 (8.0± 0.2) | 0.069± 0.004 (1.75± 0.1) | 0.138± 0.002 (3.5± 0.05) | -------- | 0.030± 0.004 (0.75± 0.1) | 0.157± 0.004 (4.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| CR06 RA03 RN02 | 0.138± 0.008 (3.5± 0.2) | 0.075± 0.008 (1.9± 0.2) | 0.315± 0.008 (8.0± 0.2) | 0.069± 0.004 (1.75± 0.1) | 0.138± 0.002 (3.5± 0.05) | -------- | 0.30± 0.004 (0.75± 0.1) | 0.157± 0.004 (4.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| CR20 | 0.22± 0.008 (5.4± 0.2) | 0.11± 0.008 (2.8± 0.2) | 0.472± 0.004 (12.0± 0.1) | 0.069± 0.004 (1.75± 0.1) | 0.217± 0.002 (5.5± 0.05) | 0.008± 0.002 (0.2± 0.05) | -------- | 0.157± 0.004 (4.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| CR25 | 0.264± 0.008 (6.7± 0.2) | 0.142± 0.008 (3.4± 0.2) | 0.472± 0.004 (12.0± 0.1) | 0.069± 0.004 (1.75± 0.1) | 0.217± 0.002 (5.5± 0.05) | 0.008± 0.002 (0.2± 0.05) | -------- | 1.57± 0.004 (4.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| RB02 | 0.045± 0.008 (1.15± 0.2) | 0.045± 0.08 (1.15± 0.2) | 0.315± 0.008 (8.0± 0.2) | 0.069± 0.004 (1.75± 0.1) | 0.318± 0.002 (3.5± 0.05) | -------- | 0.018± 0.004 (0.45± 0.1) | 0.79± 0.004 (2.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |
| RC02 | 0.169± 0.008 (4.3± 0.2) | 0.075± 0.008 (1.9± 0.2) | 0.472± 0.008 (12.0± 0.2) | 0.069± 0.004 (1.75± 0.1) | 0.217± 0.002 (5.5± 0.05) | -------- | 0.033± 0.004 (0.8± 0.1) | 0.157± 0.004 (4.0± 0.1) | 0.059± 0.004 (1.5± 0.1) |

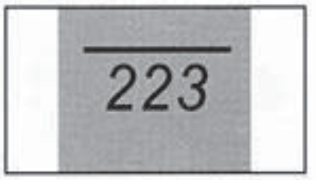
# Thick Film Chip Resistor Marking

## 電阻值標示

±2%, ±5%marking
0603(CR 03)　0805(CR 05)
1206(CR 06)　2010(CR 20)
2512(CR 25)　ARRAY(RA03,RA02,RC02,RN02)
Ex:683　68000Ω　68kΩ

± 0.1%,± 0.25%,± 0.5%,± 1% marking
0805(CR 05)　1206(CR 06)
2010(CR20)　2512(CR25)
ARRAY(RA03,RN02)
Ex:1780=178Ω

±0.1%, ±0.25%, ±0.5%, ±1% marking
0603(CR 03)
Ex:10C　12.4kΩ




0603 ±0.1%, ±0.25%, ±0.5%, ±1% marking
Just for E24series-22,27,30,33,36,39,43,51,
56,62,68,82,91,

No marking
0402(CR 02)
ARRAY(RB02)

---

- ±2%, ± 5% tolerance: 3 digits, first two digits are significant figure. Last digit indicates the resistance decade.

- ±0.1%, ±0.25%, ±0.5%, ±1% tolerance: 4 digits, first three digits are significant figure. Forth digits is the number of zeros. Letter R is decimal point.

- 0603±1%: 22,27,30,33,36,39,43,51,56,62,68,82,91,Series Resistance marking, except for a upper line upon the digits.

- 0603±1%:EIA E-96 marking
  E-192 Series, refer to the 0603 E-192 RESISTANCE CODE table.
  (Upon request)

- 0402,RB02: no marking.

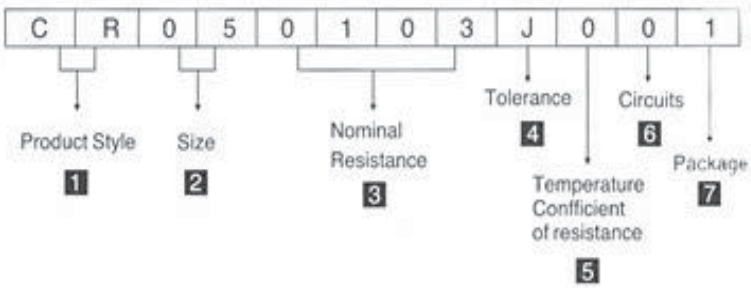
- Remarks: a. Zero ohm jumper. Resistance≦50mΩ
  b. Marked "000" for the products.

# Thick Film Chip Resiseors Ording Code

## ORDERING CODE

## 晶片電阻訂購方法

Example:




| 1 Product Style | |
|---|---|
| Code | Type |
| CR | Single Chip |
| RA | Chip Array-4R |
| RB | Chip Array-2R |
| RC | Chip Array-8R |
| RN | Chip Network |

| 2 Size | | |
|---|---|---|
| | Code | Size |
| CR | 02 | 0402 |
| | 03 | 0603 |
| | 05 | 0805 |
| | 06 | 1206 |
| | 20 | 2010 |
| | 25 | 2512 |
| RA | 03 | 034R |
| | 02 | 024R |
| RB | 02 | 022R |
| RC | 02 | 028R(16P8R) |
| RN | 02 | 028R(10P8R) |

| 3 Nominal Resistance | |
|---|---|
| E24 Series2%,5%<br>Eg.0473=47K Ω | 3Digits |
| E96 Series0.1%,<br>0.25%,0.5%,1%<br>Eg.71K5=71.5K Ω | 4Digits |
| Zero Ohm Jumper | 000 |

| 4 Resistance Tolerance | |
|---|---|
| Code | Resistance Tolerance |
| B | ± 0.1% |
| C | ± 0.25% |
| D | ± 0.5% |
| F | ± 1.0% |
| G | ± 2.0% |
| J | ± 5.0% |
| K | ± 10.0% |

| 5 Temperature Coefficient Of Resistance | |
|---|---|
| Code | Temperature Coefficient Of Resistance |
| 0 | ±100ppm / ℃ |
| 1 | ±25ppm / ℃ |
| 2 | ±50ppm / ℃ |
| 3 | ±200ppm / ℃ |
| 4 | ±250ppm / ℃ |
| 5 | ±400ppm / ℃ |
| 6 | ±500ppm / ℃ |
| 7 | ±1500ppm / ℃ |

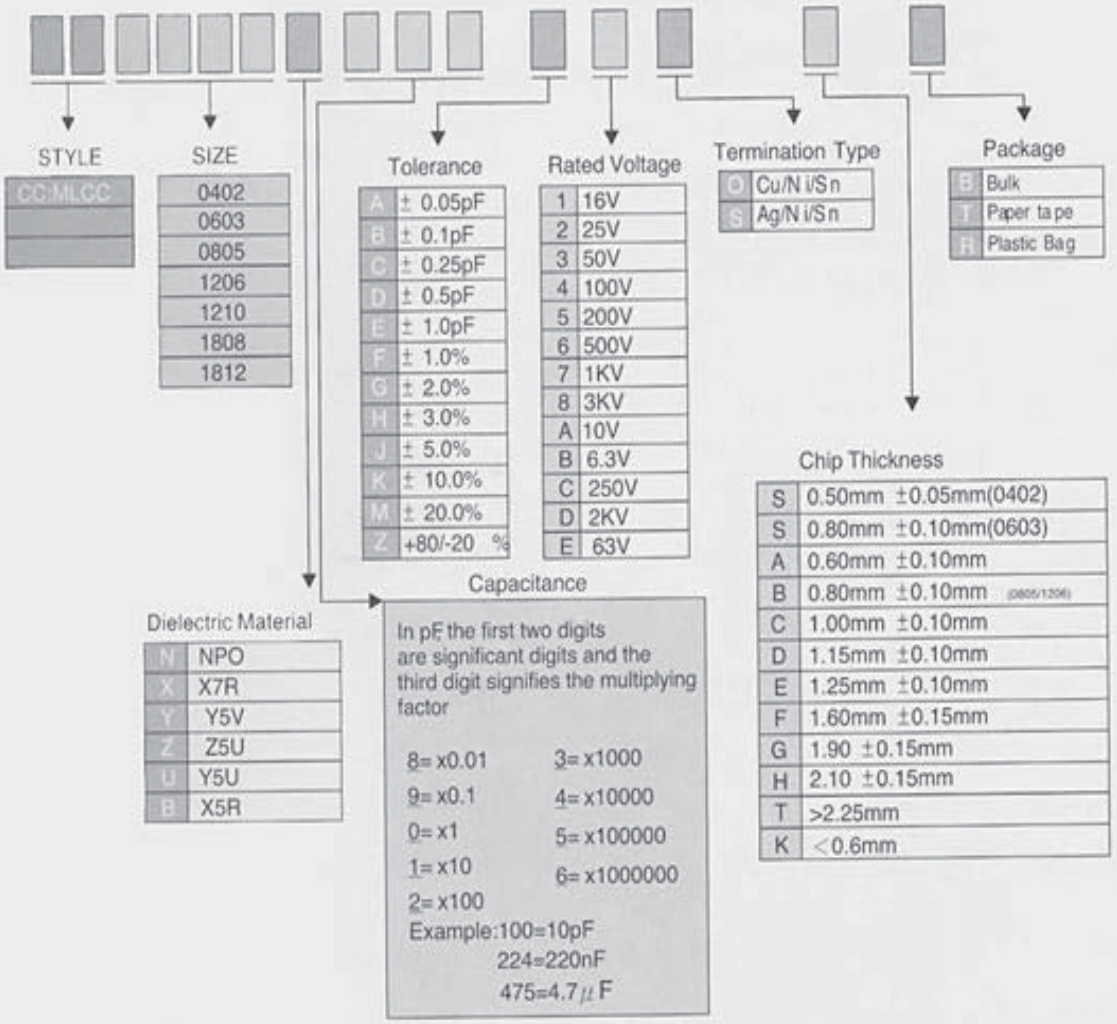
| 6 Circuits | |
|---|---|
| Code | Circuits |
| 0 | NA |
| 1 | 028R(10P8R)R type |
| 2 | 028R(10P8R)S type |

| 7 Package | |
|---|---|
| Code | Package |
| 1 | 5K Paper Taping |
| 2 | 10K Paper Taping |
| 3 | 20K Paper Taping |
| 4 | 4K Emboss Taping |
| 5 | Bulk |
| A | 5K BOX |
| B | 10K BOX |
| C | 25K BOX |
| D | 50K BOX |

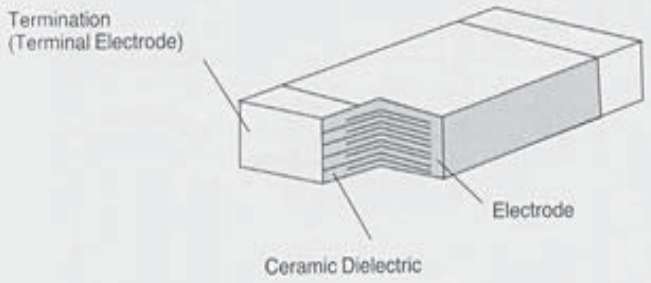
# Multilayer Ceramic Chip Capacitors

## ORDERING CODE

晶片電容訂購方法




## CHIP CAPACITOR STRUCTURE



# Size Dimension

## 尺寸規格

### SIZE DIMENSION

| Size | Code | Thickness |
|---|---|---|
| 0402 | S | 0.50mm ±0.05mm |
| 0603 | S | 0.80mm ±0.10mm |
| 0805/1206 | A | 0.60mm ±0.10mm |
| 0805/1206 | B | 0.80mm ±0.10mm |
| 0805/1206/1210 | C | 1.00mm ±0.10mm |
| 0805/1206/1210/1812 | D | 1.15mm ±0.10mm |
| 0805/1206/1210 /1812 | E | 1.25mm ±0.10mm |
| 1206/1210/1808/1812 | F | 1.60mm ±0.15mm |
| 1210/1812 | G | 1.90 mm ± 0.15mm |
| 1210/1812 | H | 2.10mm ±0.15mm |
| 1210/1812 | T | >2.25mm |
| 0805/1206 | K | <0.6mm |

| Size | Length Inch (mm) | Width Inch (mm) | Size | Length Inch (mm) | Width Inch (mm) |
|---|---|---|---|---|---|
| 0402 | 0.04 ±0.002 (1.0 ±0.05) | 0.02 ±0.002 (0.5 ±0.05) | 1210 | 0.126 ±0.006 (3.2 ±0.15) | 0.098 ±0.006 (2.5 ±0.15) |
| 0603 | 0.063 ±0.004 (1.6 ±0.1) | 0.032 ±0.003 (0.8 ±0.1) | 1808 | 0.177 ±0.010 (4.5 ±0.25) | 0.079 ±0.006 (2.0 ±0.15) |
| 0805 | 0.079 ±0.006 (2.0 ±0.15) | 0.049 ±0.006 (1.25 ±0.15) | 1812 | 0.177 ±0.010 (4.5 ±0.25) | 0.126 ±0.006 (3.2 ±0.15) |
| 1206 | 0.126 ±0.006 (3.2 ±0.15) | 0.063 ±0.006 (1.6 ±0.15) | | | |

# Capacitance Range

## 電容範圍

(pf)

| NP0 | | | | | |
|---|---|---|---|---|---|
| | 50V | 100V | 500V | 1KV | 2KV/3KV |
| 0402 | 0.47~330 | | | | |
| 0603 | 0.47~2200 | 10~680 | | | |
| 0805 | 4.7~10,000 | 10~2,700 | | | |
| 1206 | 10~33,000 | 10~6,800 | | | |
| 1210 | 1,000~33,000 | 8,200~10,000 | | | |
| 1808 | | | | 5~1,000 | 10~120 |
| 1812 | | | 2,200~3,300 | 100~1,500 | 10~220 |

(pf)

| X7R | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 10V | 16V | 25V | 50V | 100V | 200/250V | 500V |
| 0402 | 100~47,000 | 100~47,000 | 100~22,000 | 100~6,800 | | | |
| 0603 | 100~220,000 | 100~220,000 | 100~150,000 | 100~100,000 | | | |
| 0805 | 150~1,000,000 | 150~1,000,000 | 150~470,000 | 150~330,000 | 150~27,000 | 150~6,800 | |
| 1206 | 220~4,700,000 | 220~3,300,000 | 220~2,200,000 | 220~470,000 | 220~100,000 | 680~47,000 | 470~2,200 |
| 1210 | | | 1,000~470,000 | 1,000~220,000 | 47,000~150,000 | 22,000~47,000 | 3,300~6,800 |
| 1808 | | | | | 2,700~68,000 | 2,700~68,000 | 2,700~68,000 |
| 1812 | | | | 100,000~470,000 | 100,000~330,000 | 47,000~100,000 | 10,000~15,000 |

(pf)

| Y5V | | | | |
|---|---|---|---|---|
| | 10V | 16V | 25V | 50V |
| 0402 | 2,200~470,000 | 2,200~100,000 | 2,200~22,000 | 2,200~15,000 |
| 0603 | 10,000~2,200,000 | 10,000~1,000,000 | 10,000~470,000 | 10,000~220,000 |
| 0805 | 10,000~10,000,000 | 10,000~4,700,000 | 10,000~2,200,000 | 10,000~1,000,000 |
| 1206 | 33,000~22,000,000 | 33,000~10,000,000 | 33,000~4,700,000 | 33,000~2,200,000 |
| 1210 | 100,000~22,000,000 | 100,000~10,000,000 | 100,000~4,700,000 | 100,000~2,200,000 |

(pf)

| X5R | | |
|---|---|---|
| | 6.3V | 10V |
| 0402 | 68,000~100,000 | 68,000~100,000 |
| 0603 | 33,000~1,000,000 | 33,000~1,000,000 |
| 0805 | 33,000~10,000,000 | 33,000~3,300,000 |
| 1206 | 33,000~10,000,000 | 33,000~3,300,000 |

# Capacitance Range

## EIA Standard Code for Capacitance Classification

Example: In E3 series the standard capacitance values are $1.0x10^{n}$pF, $2.2x10^{n}$pF and $4.7x10^{n}$pF

| E3 SERIES | E6 SERIES | E12 SERIES | E24 SERIES | |
|---|---|---|---|---|
| 1.0 | 1.0 | 1.0 | 1.0 | 1.1 |
| | | 1.2 | 1.2 | 1.3 |
| | 1.5 | 1.5 | 1.5 | 1.6 |
| | | 1.8 | 1.8 | 2.0 |
| 2.2 | 2.2 | 2.2 | 2.2 | 2.4 |
| | | 2.7 | 2.7 | 3.0 |
| | 3.3 | 3.3 | 3.3 | 3.6 |
| | | 3.9 | 3.9 | 4.3 |
| 4.7 | 4.7 | 4.7 | 4.7 | 5.1 |
| | | 5.6 | 5.6 | 6.2 |
| | 6.8 | 6.8 | 6.8 | 7.5 |
| | | 8.2 | 8.2 | 9.1 |

NPO: E12 series (standard)
E24 series (option)
X5R / X7R: E6 series (standard)
E12 series (option)
Z5U / Y5V: E3 series (standard)
E6 series (option)

## Ceramic Dielectric EIA Definition

Example: A capacitor with X7R code has 15% capacitance variation among -55 ℃~125 ℃, which is refered to the initial value at 25 ℃.

EIA CODE

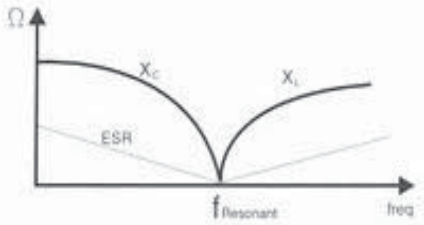
Percentage Capacitance V ariation Among Temperature Range

| RS198 Temperature Range Code | | Capacitance Variation |
|---|---|---|
| | D | ± 3.3% |
| X7 -55 ℃ to +125 ℃ | E | ± 4.7 % |
| X5 -55 ℃ to +85 ℃ | F | ± 7.5 % |
| Y5 -30 ℃ to +85 ℃ | P | ± 10 % |
| Z5 +10 ℃ to +85 ℃ | R | ± 15 % |
| | T | +22%, -33% |
| | U | +22%, -56% |
| | V | +22%, -82% |

# The Essence of Capacitor

## 晶片電容電氣特性

### FREQUENCY RESPONSE MODEL FROM A CAPACITOR

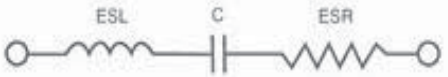



Resonant Frequency, $f = \frac{1}{2L\pi\sqrt{C}}$

$|Z| = \sqrt{ESR^2 + (Xc - XL)^2}$

$XC = \frac{-1}{2f\pi C}$

$X_L = 2\pi fL$

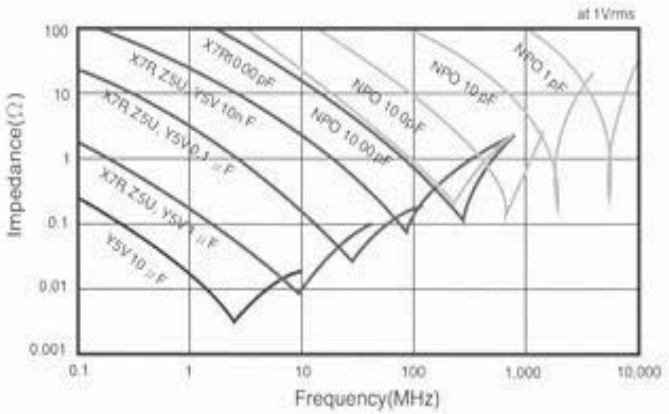



$C = \frac{0.224KA}{T}$

When 1) Working frequency = SRF of a capacitor
$X_C - X_L = O$, $|Z| =$ ESR
2) Working frequency < SRF
|Z| dominated by $X_C$
3) Working frequency > SRF
|Z| dominated by $X_L$

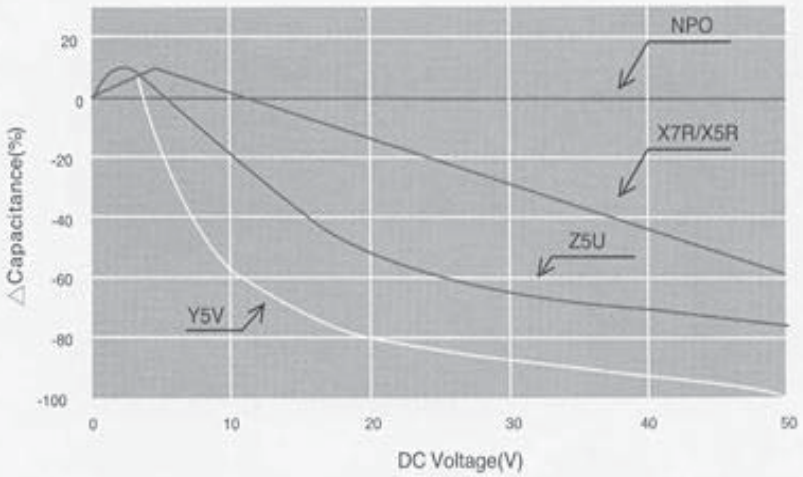
C = capacitance (Farads)
K = Dielectric constant
A = Area in square inches
T = Thickness of dielectric

0.224 = conversion constant
0.0884 for metric system, cm

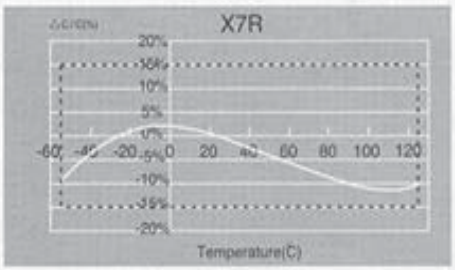


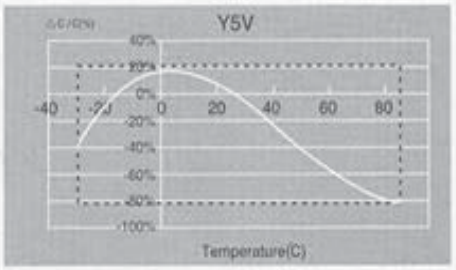

Typical NPO, X7R, Z5U, Y5V Frequency Response

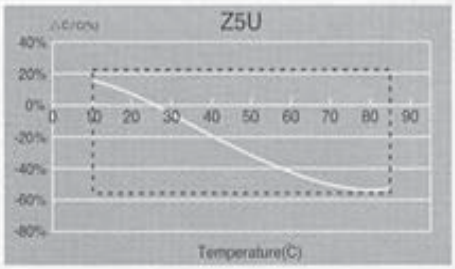
For temperature compensation : 1MH z
Rated at 50V , X7R , Z5U, Y5V 1Vrms/for high dielectric constant. 1KH z, 1Vrms

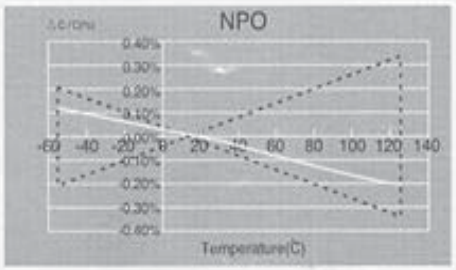


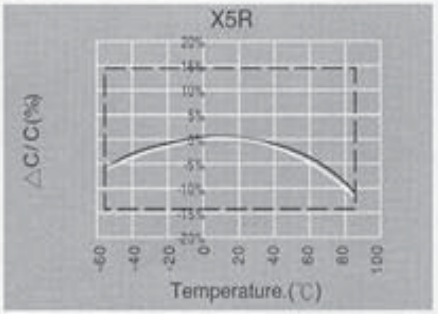

Typical NPO , X7R ,X5R, Z5U , Y5V DC bias vs. Capacitance



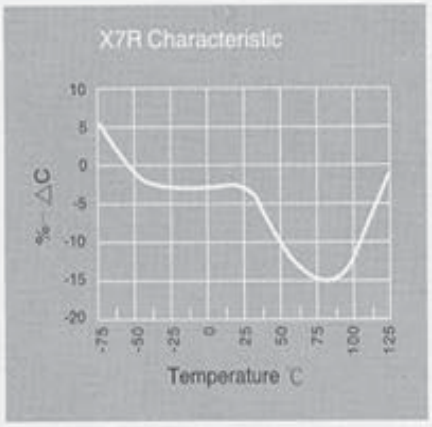



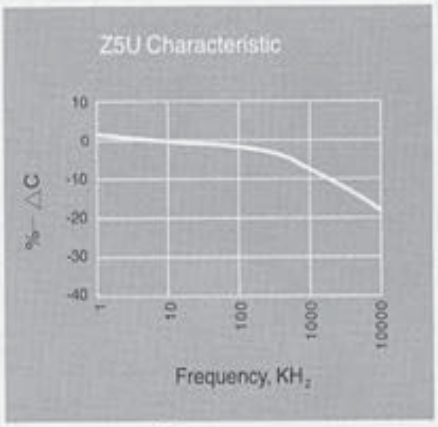

Temperatur

Typical X7R, X5R, Z5U, Y5V, NPO Capacitance Change vs.Temperature

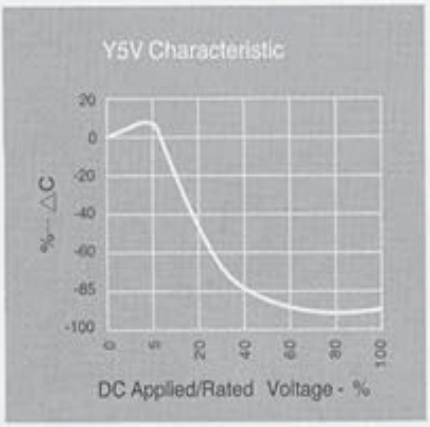
## THE DRIVEN FACTORS TO A CAPACITOR




Temperature



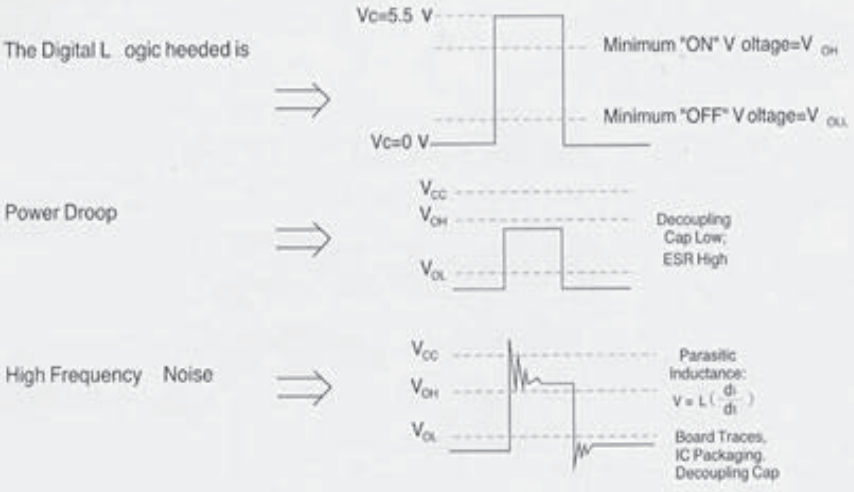

Frequency




Voltage

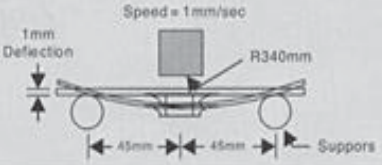
Note: To ensure total suitability at design stage, above factors are considered as a combination of design criterion and must to review them as a whole. If fails, the characteristic of a capacitor may not work properly for a long run.

## SIGNAL EFFECTS



# IEC/EIA Test Criteria

## IEC/EIA測試規格

| Test item | Test conditions | Specifications |
|---|---|---|
| Operating Temperature | | NPO : -55℃~+125℃<br>X7R : -55℃~+125℃<br>X5R :-55℃~ +85℃<br>Y5V : -30℃~+85 ℃<br>Z5U:+10 ℃~+85 ℃ |
| Capacitance | NPO : ≦1000pF,F=1MH z,V=1.0 ±0.2Vrms<br>>1000pF,F=1KH z,V=1.0 ±0.2Vrms<br>X7R/X5R : F=1KH z,V=1.0 ±0.2Vrms<br>Z5U : F=1KH z,V=1.0 ±0.2Vrms<br>Y5V: F=1KH z, V=1.0 ±0.2Vrms | Within specified tolerance |
| Dissipation Factor | same condition as Capacitance | NPO : Cap. ≧30pF,Q ≧1000<br>Cap. ≦30pF,Q ≧400+20C<br>X7R/X5R : RateVoltage ≧25V : ≦2.5%<br>Rate Voltage 16V : ≦3.5%<br>Rate Voltage 10V : ≦5.0%<br>Rate Voltage 6.3V : ≦7.0%<br>Y5V/Z5U : Rate Voltage ≦10V : ≦12.5%<br>Rate Voltage 16V : ≦9%<br>Rate Voltage 25V : ≦7%<br>Rate Voltage ≧50V : ≦5% |
| Withstanding Voltage | Applying 2.5times of the rated voltage and less then 5 secs.The charge and discharge current is within 50mA. | No mechanicial breakdown |
| Insulation Resistance | Applying the rated voltage for 1 minute. | More then either 100G Ω or 500M Ω μF ,whichever value is smaller. |
| Bending Strength | Bending 1mm at a rate of 1mm/s radius jig. 340 mm.<br>  | No visual damage<br>NPO : △C/C : ±0.5%or<br>±0.5pF max whichever is larger<br>X7R/X5R: △C/C : ±10%<br>Y5V/Z5U : △C/C : ±20% |
| Resistance to soldering heat | 260 ±5℃ for 10 ±0.5S in a Statics solder bath.<br><br>Measurement to be made after keeping at room temp. for 24 ±2hrs of class Ⅰ part; for 48 ±2hrs of class Ⅱ part. | △C/C : NPO: ±2.5% or 0.25pF max.<br>X7R/X5R ±7.5%<br>Y5V/Z5U : ±20%<br><br>Q(D.F);I.R;Withstanding Voltage:<br>Tomeet initial requirement.<br>No remarkable damage |
| Solderability | Soldering temperature :235 ±5℃<br>Immersion time : 2±1sec. | At least 95% of the termination on each end of the ceramic chip should be covered with new solder . |
| Temperature cycle | Perform the five cycles according to the four heat treatments listed in the following table.<br><br>Measurement to be made after keeping at room temp. for 24 ±2hrs of class Ⅰ part; for 48 ±2hrs of class Ⅱ part. | △C/C :NPO : ±2.5% or 0.25pF max.<br>X7R/X5R :±7.5%<br>Y5V/Z5U : ±20%<br><br>Q(D.F);I.R;Withstanding Voltage:<br>Tomeet initial requirement.<br>No remarkable damage |

| Step | Temperature | 時間 |
|---|---|---|
| 1 | Min. operating temp. ± 3℃ | 30± 3min |
| 2 | 25± 2℃ | 2~3min |
| 3 | Min. operating temp. ± 3℃ | 30± 3min |
| 4 | 25± 2℃ | 2~3min |

# IEC/EIA Test Criteria

## IEC/EIA測試規格

### Capacitance temperature characteristics

Test conditions:

Temperature compensating type using the capacitance measured in step 3 as a reference. Then cycling the temperature sequentially from step 1 to 5.

| Step | Temperature (℃) |
|---|---|
| 1 | 25±2 |
| 2 | Min. Operating temp. ±3 |
| 3 | 25±2 |
| 4 | Max. operating temp ±3 |
| 5 | 25±2 |

Specifications:

| Char. | temp.(℃) | △C/C(%) |
|---|---|---|
| NPO | -55~+125 | ±30PPM/℃ |
| X7R | -55~+125 | ±15% |
| X5R | -55~+85 | ±15% |
| Y5V | -30~+85 | +22%~-82% |
| Z5U | +10~+85 | +22%~-56% |

### Endurance

Test conditions:

Apply 200% of the rated voltage for 1000+24/-0 hours at the maximum operating temperature ±3℃

Measurement to be made after keeping at room temp. for 24 ±2hrs of class Ⅰ part; for 48 ±2hrs of class Ⅱ part.

Specifications:

△C/C :NPO : ±3% or±0.3pF max .
X7R/X5R : ±12.5%
Y5V/Z5U : ±30%

Q for NPO : Cap. ≧30pF,Q ≧350
10pF≦Cap.≦30pF,Q≧275+5/2 C
Cap. ≦10pF,Q ≧200+10C

D.F : X7R/X5R :
Rate Voltage ≧50V : ≦3.5%
Rate Voltage 25V,16V : ≦5.0%
Rate Voltage 10V,6.3V : ≦7.5%
Y5V/Z5U :
Rate Voltage ≧25V : ≦7.5%
Rate Voltage 16V : ≦10%(＜1 μF)
Rate Voltage 16V : ≦12.5%(≧1 μF)
Rate Voltage ≦10V : ≦15%
I.R : morethen 1000M Ω or 50 ΩF whichever is smaller
No remarkable damage

### Damp heat

Test conditions:

Apply the rated voltage for 1000 +24/-0 hours at 40 ±2℃ and 90 to 95% RH.

Measurement to be made after keeping at room temp. for 24 ±2hrs of class Ⅰ part; for 48 ±2hrs of class Ⅱ part.

Specifications:

△C/C :NPO :±7.5% or ±0.75pF max .
X7R/X5R : ±12.5%
Y5V/Z5U : ±30%

Q for NPO :Cap. ≧30pF,Q ≧200
Cap ≦30pF,Q ≧100+10/3 C

D.F : X7R/X5R :
Rate Voltage ≧50V : ≦3.5%
Rate Voltage 25V,16V : ≦5.0%
Rate Voltage 10V,6.3V : ≦7.5%
Y5V/Z5U :
Rate Voltage ≧25V : ≦7.5%
Rate Voltage 16V : ≦10%(＜1 μF)
Rate Voltage 16V : ≦12.5%(≧1 μF)
Rate Voltage ≦10V : ≦15%
I.R :more then 1000M Ω or 50 ΩF whichever is smaller
No remarkable damage

### Adhesion

Test conditions:

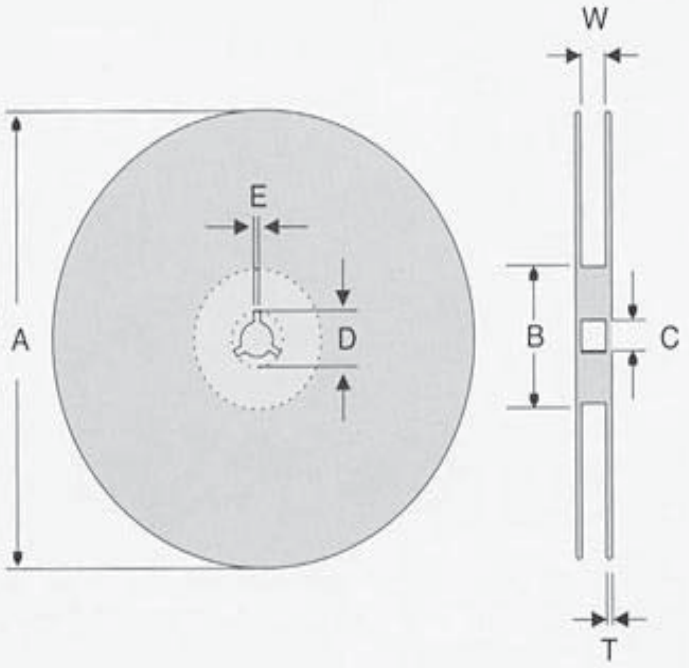
Solder the capacitor as deflection Then apply a 10N force in parallel with the test jig for 10 ±1 sec.

Specifications:

No removal of the terminations or other defects shall occur.

# EIA Reel Dimension

## 捲裝規格




| | Tape Size | A Max. | B Min. | C | D Min. | E Min. | W | T Max. |
|---|---|---|---|---|---|---|---|---|
| 13"Reel | 8mm | 330 ± 2 (12.992± 0.08) | 60 (2.362) | 13.0 ± 0.5 (0.512 ± 0.02) | 20.2 (0.795) | 1.5 (0.059) | 9± 0.5 (0.354 ± 0.02) | 2.5 (0.1) |
| | 12mm | | | | | | 13± 0.5 (0.512 ± 0.02) | |
| 7"Reel | 8mm | 178 ± 1 (7.008 ± 0.04) | 50 (1.969) | 13.0 ± 0.5 (0.512 ± 0.02) | 20.2 (0.795) | 1.5 (0.059) | 9± 0.5 (0.354 ± 0.02) | 2.5 (0.1) |
| | 12mm | | | | | | 13± 0.5 (0.512 ± 0.02) | |

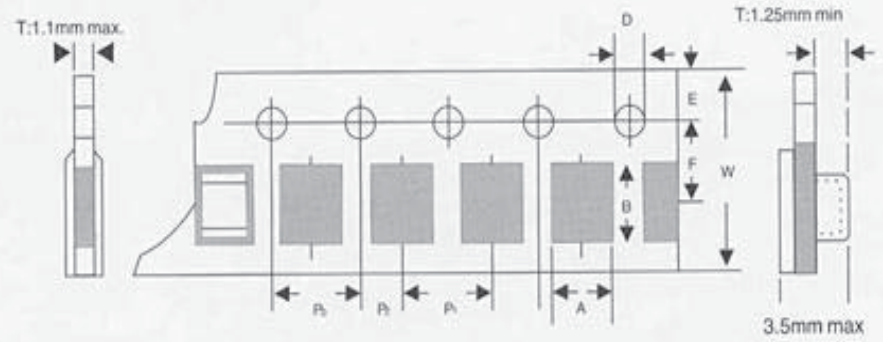
**STANDARD**

| Size | 7 "Reel | | 13" Reel | | Tape Width |
|---|---|---|---|---|---|
| | Paper | Plastic | Paper | Plastic | |
| 0402 | 10,000 | | 50,000 | | 8mm |
| 0603 | 4,000 | | 15,000 | | |
| 0805 | 4,000 | 3,000 | 10,000 | 10,000 | |
| 1206 | 4,000 | 3,000 | 10,000 | 10,000 | |
| 1210 | | 3,000 | | | 12mm |
| 1808 | | 2,000<br>3,000 | | | |
| 1812 | | 500<br>1,000 | | | |

# EIA Reel Dimension

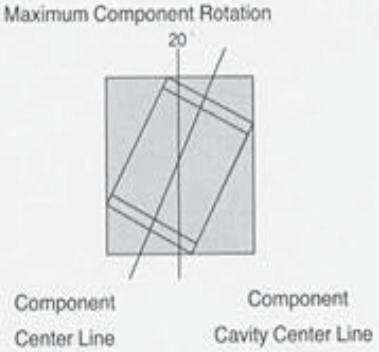
Paper Tape:

Plastic Tape:




| | 0402 | 0603 | 0805 | 1206 | 1210 | 1808 | 1812 |
|---|---|---|---|---|---|---|---|
| A | 0.62± 0.05 (.024± .002) | 1.1± 0.2 (.043± .008) | 1.5± 0.2 (.059± .008) | 1.9± 0.2 (.075± .008) | 2.8± 0.2 (.110± .008) | 2.3± 0.2 (.091± .008) | 3.5± 0.2 (.138± .008) |
| B | 1.15± 0.1 (.045± .004) | 1.9± 0.2 (.075± .008) | 2.3± 0.2 (.091± .008) | 3.5± 0.2 (.138± .008) | 3.5± 0.2 (.138± .008) | 4.9± 0.2 (.193± .008) | 4.9± 0.2 (.193± .008) |
| D | 1.5± 0.1 (.059± .004) | 1.5± 0.1 (.059± .004) | 1.5± 0.1 (.059± .008) | 1.5± 0.1 (.059± .004) | 1.5± 0.1 (.059± .004) | 1.5± 0.1 (.059± .004) | 1.5± 0.1 (.059± .004) |
| E | 1.75± 0.1 (.069± .004) | 1.75± 0.1 (.069± .004) | 1.75± 0.1 (.069± .004) | 1.75± 0.1 (.069± .004) | 1.75± 0.1 (.069± .004) | 1.75± 0.1 (.069± .004) | 1.75± 0.1 (.069± .004) |
| F | 3.5± 0.1 (.138± .004) | 3.5± 0.1 (.138± .004) | 3.5± 0.1 (.138± .004) | 3.5± 0.1 (.138± .004) | 3.5± 0.1 (.138± .004) | 5.5± 0.1 (.217± .004) | 5.5± 0.1 (.217± .004) |
| P0 | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) |
| P1 | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) | 4.0± 0.1 (.157± .004) |
| P2 | 2.0± 0.05 (.079± .002) | 2.0± 0.05 (.079± .002) | 2.0± 0.05 (.79± .02) | 2.0± 0.05 (.079± .002) | 2.0± 0.05 (.079± .002) | 2.0± 0.05 (.079± .002) | 2.0± 0.05 (.079± .002) |
| W | 8.0± 0.3 (.315± .012) | 8.0± 0.3 (.315± .012) | 8.0± 0.3 (.315± .012) | 8.0± 0.3 (.315± .012) | 8.0± 0.3 (.315± .012) | 12.0± 0.2 (.472± .008) | 12.0± 0.2 (.472± .008) |

## COMPONENT ROTATION

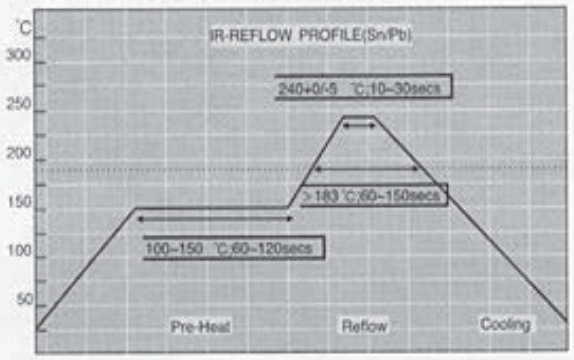


# Soldering Recommendation

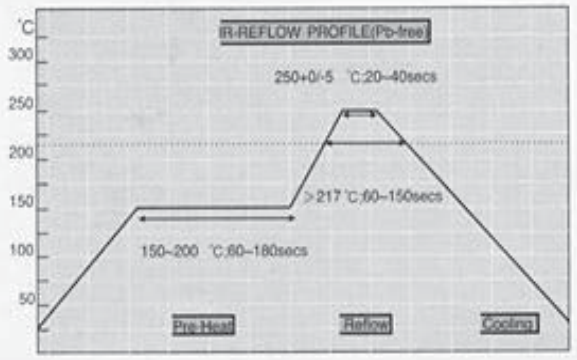
## 浸焊條件

### Typical Soldering Profile

(1) COMPOSTAR's REFLOW PROFILE FOR Sn/Pb:

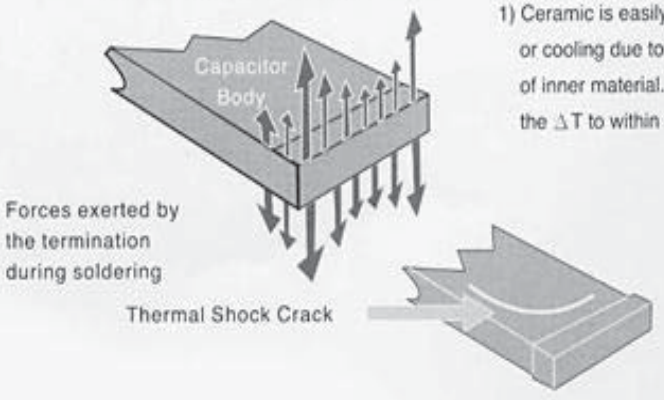



COMPOSTAR's REFLOW PROFILE FOR LEAD FREE:




### Thermal Shock

**Thermal ShockCracks**

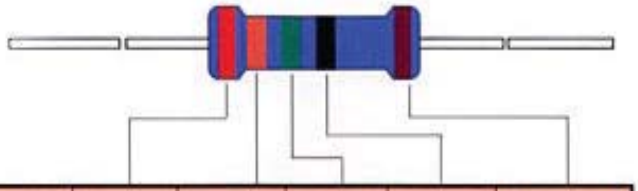



1) Ceramic is easily damaged from rapid heat-up or cooling due to its thermal expansion of varieties of inner material. It is highly recommended to limit the ΔT to within 100℃ when possible.

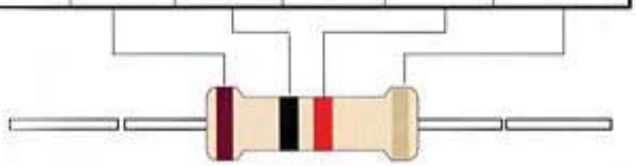
# Color Indication of Rating and Standard Values and Symbols

## 5-BAND-CODE

For TOL: 0.1%, 0.25%, 0.5%, 1%



| Color | 1st Band | 2nd Band | 3rd Band | Multiplier | Tolerance |
|---|---|---|---|---|---|
| Black | 0 | 0 | 0 | $10^0$ | |
| Brown | 1 | 1 | 1 | $10^1$ | F (±1%) |
| Red | 2 | 2 | 2 | $10^2$ | G (±2%) |
| Orange | 3 | 3 | 3 | $10^3$ | |
| Yellow | 4 | 4 | 4 | $10^4$ | |
| Green | 5 | 5 | 5 | $10^5$ | D (±0.5%) |
| Blue | 6 | 6 | 6 | $10^6$ | C (±0.25%) |
| Violet | 7 | 7 | 7 | $10^7$ | B (±0.1%) |
| Gray | 8 | 8 | 8 | | |
| White | 9 | 9 | 9 | | |
| Gold | | | | $10^{-1}$ | J (±5%) |
| Silver | | | | $10^{-2}$ | K (±10%) |
| Blank | | | | | M (±20%) |



## 4-BAND-CODE

For TOL: 2%, 5%, 10%

## Temperature Coefficient

Unit: ppm/°c

| Symbol | T | E | C | K | J | L | D |
|---|---|---|---|---|---|---|---|
| T.C.R. | ±10 | ±25 | ±50 | ±100 | ±150 | ±200 | +200<br>-500 |

## Resistance Tolerance

Unit: %

| Symbol | B | C | D | F | G | J | K | M |
|---|---|---|---|---|---|---|---|---|
| Resistance Tolerance | ±0.1 | ±0.25 | ±0.5 | ±1 | ±2 | ±5 | ±10 | ±20 |

| ±2% ±5% | ±1% | | ±0.5% |
|---|---|---|---|
| E24 | E48 | E96 | E192 |
| 100 | 100 | 100 | 100 |
| | | | 101 |
| | | 102 | 102 |
| | | | 104 |
| | 105 | 105 | 105 |
| | | | 106 |
| | | 107 | 107 |
| | | | 109 |
| 110 | 110 | 110 | 110 |
| | | | 111 |
| | | 113 | 113 |
| | | | 114 |
| | 115 | 115 | 115 |
| | | | 117 |
| | | 118 | 118 |
| 120 | | | 120 |
| | 121 | 121 | 121 |
| | | | 123 |
| | | 124 | 124 |
| | | | 126 |
| | 127 | 127 | 127 |
| | | | 129 |
| 130 | | 130 | 130 |
| | | | 132 |
| | 133 | 133 | 133 |
| | | | 135 |
| | | 137 | 137 |
| | | | 138 |
| | 140 | 140 | 140 |
| | | | 142 |
| | | 143 | 143 |
| | | | 145 |
| | 147 | 147 | 147 |
| | | | 149 |
| 150 | | 150 | 150 |
| | | | 152 |
| | 154 | 154 | 154 |
| | | | 156 |
| | | 158 | 158 |
| 160 | | | 160 |
| | 162 | 162 | 162 |
| | | | 164 |
| | | 165 | 165 |
| | | | 167 |
| | 169 | 169 | 169 |
| | | | 172 |
| | | 174 | 174 |
| | | | 176 |
| | 178 | 178 | 178 |
| 180 | | | 180 |
| | | 182 | 182 |
| | | | 184 |
| | 187 | 187 | 187 |
| | | | 189 |
| | | 191 | 191 |
| | | | 193 |
| | 196 | 196 | 196 |
| | | | 198 |
| 200 | | 200 | 200 |
| | | | 203 |
| | 205 | 205 | 205 |
| | | | 208 |
| | | 210 | 210 |
| | | | 213 |
| | 215 | 215 | 215 |
| | | | 218 |
| 220 | | | 221 |
| | | 221 | 223 |
| | 226 | 226 | 226 |
| | | | 229 |
| | | 232 | 232 |
| | | | 234 |
| | 237 | 237 | 237 |
| 240 | | | 240 |
| | | 243 | 243 |
| | | | 246 |
| | 249 | 249 | 249 |
| | | | 252 |
| | | 255 | 255 |
| | | | 258 |
| | 261 | 261 | 261 |
| | | | 264 |
| | | 267 | 267 |
| 270 | | | 271 |
| | 274 | 274 | 274 |
| | | | 277 |
| | | 280 | 280 |
| | | | 284 |
| | 287 | 287 | 287 |
| | | | 291 |
| | | 294 | 294 |
| | | | 298 |
| 300 | | | 301 |
| | 301 | 301 | 301 |
| | | | 305 |
| | | 309 | 309 |
| | | | 312 |
| | 316 | 316 | 316 |
| | | | 320 |
| | | 324 | 324 |
| | | | 328 |

| ±2% ±5% | ±1% | | ±0.5% |
|---|---|---|---|
| E24 | E48 | E96 | E192 |
| 330 | | | |
| | 332 | 332 | 332 |
| | | | 336 |
| | | 340 | 340 |
| | | | 344 |
| | 348 | 348 | 348 |
| | | | 352 |
| | | 357 | 357 |
| 360 | | | |
| | | | 361 |
| | 365 | 365 | 365 |
| | | | 370 |
| | | 374 | 374 |
| | | | 379 |
| | 383 | 383 | 383 |
| | | | 388 |
| 390 | | | |
| | | 392 | 392 |
| | | | 397 |
| | 402 | 402 | 402 |
| | | | 407 |
| | | 412 | 412 |
| | | | 417 |
| | 422 | 422 | 422 |
| | | | 427 |
| 430 | | | |
| | | 432 | 432 |
| | | | 437 |
| | 442 | 442 | 442 |
| | | | 448 |
| | | 453 | 453 |
| | | | 459 |
| | 464 | 464 | 464 |
| 470 | | | 470 |
| | | 475 | 475 |
| | | | 481 |
| | 487 | 487 | 487 |
| | | | 493 |
| | | 499 | 499 |
| | | | 505 |
| 510 | | | |
| | 511 | 511 | 511 |
| | | | 517 |
| | | 523 | 523 |
| | | | 530 |
| | 536 | 536 | 536 |
| | | | 542 |
| | | 549 | 549 |
| | | | 556 |
| 560 | | | |
| | 562 | 562 | 562 |
| | | | 569 |
| | | 576 | 576 |
| | | | 583 |
| | 590 | 590 | 590 |
| | | | 597 |
| | | 604 | 604 |
| | | | 612 |
| | 619 | 619 | 619 |
| 620 | | | |
| | | | 626 |
| | | 634 | 634 |
| | | | 642 |
| | 649 | 649 | 649 |
| | | | 657 |
| | | 665 | 665 |
| | | | 673 |
| 680 | | | |
| | 681 | 681 | 681 |
| | | | 690 |
| | | 698 | 698 |
| | | | 706 |
| | 715 | 715 | 715 |
| | | | 723 |
| | | 732 | 732 |
| | | | 741 |
| 750 | 750 | 750 | 750 |
| | | | 759 |
| | | 768 | 768 |
| | | | 777 |
| | 787 | 787 | 787 |
| | | | 796 |
| | | 806 | 806 |
| | | | 816 |
| 820 | | | |
| | 825 | 825 | 825 |
| | | | 835 |
| | | 845 | 845 |
| | | | 856 |
| | 866 | 866 | 866 |
| | | | 876 |
| | | 887 | 887 |
| | | | 898 |
| | 909 | 909 | 909 |
| 910 | | | |
| | | | 920 |
| | | 931 | 931 |
| | | | 942 |
| | 953 | 953 | 953 |
| | | | 965 |
| | | 976 | 976 |
| | | | 988 |

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