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# High Voltage Resistor Series


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## High Voltage Resistor Series

# Terminology & Glossary

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### Terminology & Glossary

#### Cermet

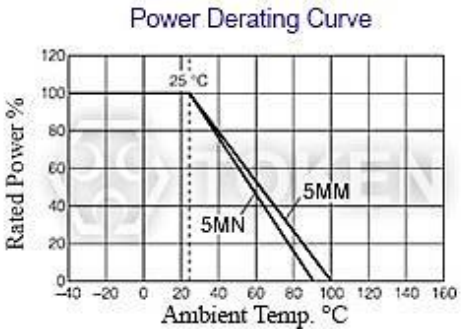
A cermet resistive element is made from a mixture of glass and metal oxides. The metal oxide is typically $RuO_2$ or an AgPt alloy. Applying cermet materials to a flat or cylindrical substrate, and then firing them at 850℃ produce thick Film resistors. In the electronic industry cermet material is typically called Thick Film paste or ink.

#### Critical Resistance Value

The maximum nominal resistance value at which the rated power can be applied continuously without exceeding the maximum working voltage is the critical resistance value. The rated voltage is equal to the maximum working voltage in the critical resistance value. If the circuit designs permits, the choice of a high Ohmic value resistor or divider network will eliminate this consideration.

#### Derating Curve

The curve that describes the relationship between the resistors' operating temperature and the maximum value of continuous power permitted at that temperature. If the circuit designs permits, the choice of a high ohmic value resistor or divider network will minimize this consideration and improve the resistor's performance because it will operate at lower power.




**Typical Derating Curve**

#### Maximum Working Voltage

The maximum voltage applied continuously to a resistor or a resistor element. The maximum value of the applicable voltage is the rated voltage at the critical resistance value or lower. If the circuit designs permits, the choice of a high ohmic value resistor or divider network will improve the resistor's performance because it will operate at lower power.

#### Noise

Resistive noise can have a devastating effect on low-level signals, charge amplifiers, high gain amplifiers, and other applications sensitive to noise. The best approach is to use resistor types with low or minimal noise in applications that are sensitive to noise. Because of their construction and manufacturing processes.

### Power Rating

Power ratings are based on physical size, allowable change in resistance over life, thermal conductivity of materials, insulating and resistive materials, and ambient operating conditions. For best results, employ the largest physical size resistors at the less than their maximum rated temperature and power. Never use them continuously at their maximum rating unless you are prepared to accept the maximum allowed life cycle changes. If the circuit designs permits, the choice of a high ohmic value resistor or divider network will minimize the power level and improve the resistor's performance as it is operating at a lower power level.

### Rated Power

Rated power is the maximum value of power (watts), which can be continuously applied to a resistor at a rated ambient temperature. The basic mathematical relationship is

**Equation: Power (watts) = (Current (Amps))$^2$ × Resistance (Ohms).**

If the circuit designs permits, the choice of a high ohmic value resistor or divider network will minimize the power level and improve the resistor's performance because it is operating at a lower power and temperature level.

### Rated Voltage

The maximum voltage applied continuously to a resistor at the rated ambient temperature. Rated voltage is calculated from the following formula, but it must not exceed the maximum working voltage.

**Equation: Rated Voltage (V) = (Rated Power (W) × Nominal Resistance Value (Ω))$^{1/2}$.**

High voltage resistors often are potted or operated in oil as the arc over voltage, in air, is approximately 10,000 volts per inch. Token's resistors feature higher voltage ratings due to their high square count and associated design characteristics.

### Resistor Tolerance

Resistor Tolerance is expressed as the deviation from nominal value in percent and is measured at 25 ℃ only with no appreciable load applied. A resistors value will also change with applied voltage (VCR) and temperature (TCR). For networks, absolute resistor tolerance refers to the overall tolerance of the network. Ratio tolerance refers to the relationship of each resistor to the others. It is often practical to specify tight ratio tolerances and loose absolute tolerances.

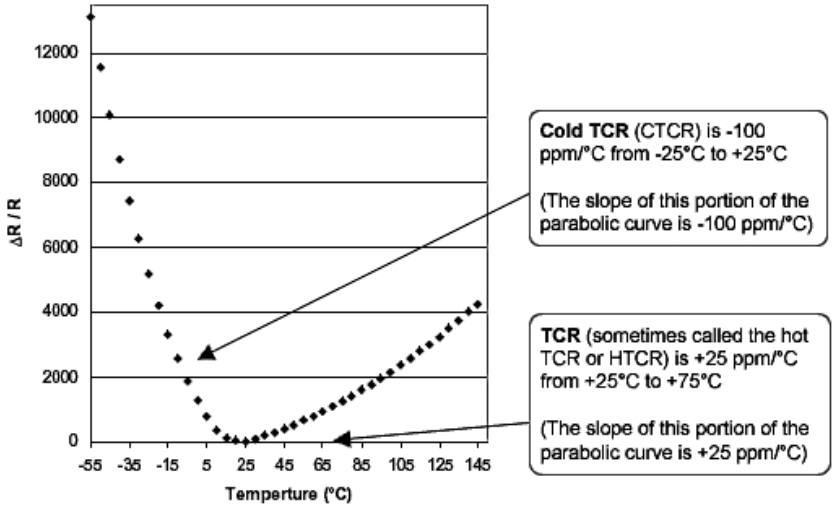
## Temperature Coefficient of Resistance (TCR)

The Temperature Coefficient of Resistance (TCR) is expressed as the change in resistance in ppm (0.0001%) with each degree of change in temperature Celsius (℃). For example, a resistor with a TCR of +100 ppm/℃ will change +0.1% total over a 10-degree change and +1% total over a 100-degree change.

The TCR value quoted on specification sheets is typically quoted as being referenced at +25℃ and is the +25℃ to +75℃ slope of the TCR curve. TCR is typically not linear, but parabolic with temperature, as illustrated by the accompanying fig-1. Often the circuit designer treats the TCR as being linear unless very accurate measurements are needed. MIL STD 202 Method 304 is often referenced as a standard for measuring TCR. The following formula expresses the rate of change in resistance value per 1℃ in a prescribed temperature range:

- TCR (ppm/℃) = $(R - R_o) / R_o \times 1 / (T - T_o) \times 10^6$
- R: Measured resistance (Ω) at T ℃; $R_o$: Measured resistance (Ω) at $T_o$ ℃
- T: Measured test temperature (℃); $T_o$: Measured test temperature (℃)

In the context of a resistor network, this TCR value is called the absolute TCR in that it defines the TRC of a specific resistor element.




**Typical Thick Film TCR (Temperature Coefficient of Resistance) Curve**

## Voltage Coefficient of Resistance (VCR)

The Voltage Coefficient is the change in resistance with applied voltage. This is entirely different and in addition to the effects of self-heating when power is applied. A resistor with a VCR of 100 ppm/V will change 0.1% over a 10 Volt change and 1% over a 100 Volt change. The rate of change in resistance value per 1 Volt in the prescribed voltage range is expressed by the following formula:

- VCR (ppm/V) = $(R_o - R) / R_o \times 1 / (V_o - V) \times 10^6$
- R: Measured resistance (Ω) at base voltage; V: Base voltage
- $R_o$: Measured resistance (Ω) at upper voltage; $V_o$: Upper voltage

# Ceramic Resistors (RMCA, RMCB)

## Product Introduction

### Non-Inductive Enhanced Performance for High Voltage Ignition Applications.

**Features :**

- Operating Temperature -40℃ ~ 155℃.
- Resistance Tolerance K(±10%), M(±20%).
- Typical resistance range 470 ohm ~ 100 Kohm.
- Replaces 1 and 2 watt carbon composition resistors.
- Suitable for noise suppressor of engine ignition system.
- High peak power, Reliable with non-disconnection failure.
- Rated Wattage up 5W, meets high energy density demands.

**Applications :**

- Inrush limiters
- R-C snubber circuits
- Vehicle ignition system
- High voltage power supplies

The RMCA, RMCB Series MELF type of fixed ceramic resistors from Token Electronics offers automotive designers a compact solution for applications involving high voltages, surges, high peak power, or high-energy pulses. They offer enhanced performance in R-C snubber circuits, high voltage power supplies, and inrush limiters.


Token's RMCA, RMCB series now offers the industry a direct replacement carbon composition resistor based on a bulk resistive element comprising carbon in ceramic filler. Due to the need for higher peak voltages, the RMCA, RMCB range is perfect for vehicle ignition system applications.

The RMCA, RMCB Voltage Resistors conform to RoHS compliant and lead free. For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact us, or link to Token official website "High Voltage Resistors" to get more information.

**Ceramic Composition Resistor Construction:**

- Bulk ceramic resistor that consists of a clay, alumina, and ceramic filler that has been blended and pressurized into a resistive core and then covered with a molded outer insulating core.

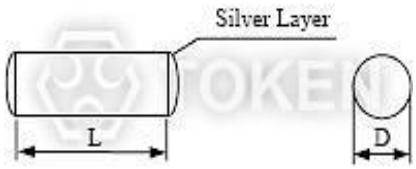
**Replacement Carbon-Composition Resistors:**

- Design requirements for custom sizes, surface mount, or special footprints can be met easily.
- In cases where several carbon-composition resistors have been used together in an array to achieve a particular rating, they have been replaced with a single bulk ceramic resistor, frequently at a lower installed cost.

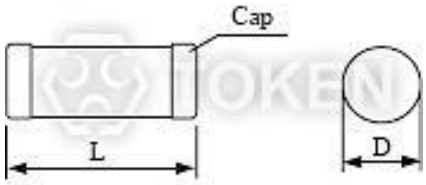
# General Specifications

## General Specifications (RMCA, RMCB) (Unit: mm)

| Model | Style | Rated Wattage | Dimensions (Unit: mm) | |
|---|---|---|---|---|
| | | | L | D |
| RMC | A | 1 | 7 ± 1.5 | 4.0 ± 0.4 |
| | | | 9 ± 1.5 | 4.0 ± 0.4 |
| | | | 10 ± 1.5 | 4.0 ± 0.4 |
| | B | | 11 ± 1.5 | 4.6 ± 0.5 |
| | A | 2 | 18 ± 1.5 | 4.0 ± 0.4 |
| | B | | 19 ± 1.5 | 4.6 ± 0.5 |
| | A | 3 | 24 ± 2.0 | 4.0 ± 0.4 |
| | B | | 25 ± 2.0 | 4.6 ± 0.5 |
| | A | 5 | 24 ± 2.0 | 7.0 ± 0.5 |
| | B | | 25 ± 2.0 | 7.6 ± 0.5 |




Ceramic Composition Resistor
(RMC-A) Dimensions




**Ceramic Composition Melf**
**(RMC-B) Dimensions**

# Electrical Characteristics

## Electrical Characteristics (RMCA, RMCB)

| Item | | RMCA, RMCB | | | |
|---|---|---|---|---|---|
| Power Rating at 25℃ (W) | | 1 | 2 | 3 | 5 |
| Operating Temp. Range (℃) | | -40~155 | | | |
| Resistance Tolerance | | K(±10%), M(±20%) | | | |
| Resistance Range (Ω) | | 470~33K | 1K~56K | 1K~100K | 470~33K |
| Max. Working Voltage (V) | | 300 | 350 | 400 | 500 |
| T.C.R (PPM/℃) | -40℃~25℃ | -750~3300 | -750~3300 | -750~3300 | -750~3300 |
| | 25℃~155℃ | -750~2600 | -750~2600 | -750~2600 | -750~2600 |
| Max. Pulse Voltage (KV) | | 8 | 15 | 20 | 25 |
| Moisture Resistance (%) | | 10 | 10 | 10 | 10 |

**Non-Inductive Performance:**

- Chemically inert and thermally stable, the resistors are inherently non-inductive because of their bulk ceramic construction, which allows energy and power to be uniformly distributed through the entire ceramic resistor body with no film or wire to fail.
- The bulk ceramic material also allows simple efficient resistor designs that enable the designer to minimize the resistor package size while providing the required performance and reliability.

# Order Codes

## Order Codes (RMCA, RMCB)

| RMC | 2W | a | 510R | | M | |
|---|---|---|---|---|---|---|
| Part Number | Rated Power (W) | Style | Resistance Value (Ω) | | Resistance Tolerance (%) | |
| RMC | 1W | a Style | 510R | 510Ω | K | ±10% |
| | 2W | b Style | 5K1 | 5.1KΩ | M | ±20% |
| | 3W | | 51K | 51KΩ | | |
| | 5W | | 68K | 68KΩ | | |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Metal Ceramic Resistor (RMCC)

## Product Introduction

### Metal Ceramic Resistor is The Way Allows Energy and Power to be Uniformly Distributed.

**Features :**

- Operating Temperature -40℃ ~ 155℃.
- Resistance Tolerance K(±10%), M(±20%).
- Typical resistance range 470 ohm ~ 100 Kohm.
- Replaces 1 and 2 watt carbon composition resistors.
- Suitable for noise suppressor of engine ignition system.
- High peak power, Reliable with non-disconnection failure.
- Rated Wattage up 5W, meets high energy density demands.

**Applications :**

- Radar, Motor Drives, Broadcast Transmitters,
- X-Ray, Lasers, Medical Defibrillators,
- Dynamic Braking, Soft-start/Current-limit,
- Snubber Circuits, Dummy Loads, Energy Research,
- RF Amplifiers, Semiconductor Process, Power Conditioning.


Following market demands, Token Electronics provided an extent of Bulk Ceramic Composition RMCA, RMCB Series to RMCC Series. The cap and lead assemblies are pressed onto the RMCC resistor core, finishing the resistor and providing rugged terminal attachment.

Token Surge Resistors - RMCC Series are primarily designed for high voltage, power charging/discharging circuits, surge energy applications and conform to the RoHS directive and Lead-free. For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact us, or link to Token official website "High Voltage Resistors" to get more information.

Bulk Ceramic Construction:

- Bulk metal ceramic resistors that consists of a clay, alumina, and ceramic filler that has been blended and pressurized into a resistive core and then covered with a molded outer insulating core.

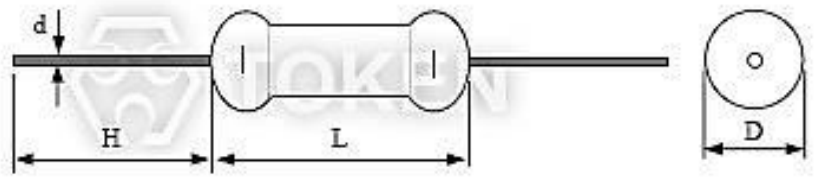
Replacement Carbon-Composition Resistors:

- Design requirements for custom sizes, surface mount, or special footprints can be met easily.
- In cases where several carbon-composition resistors have been used together in an array to achieve a particular rating, they have been replaced with a single bulk ceramic resistor, frequently at a lower installed cost.

# General Specifications

## General Specifications (RMCC)(Unit: mm)

| Model | Style | Rated Wattage | Dimensions (mm) | | | |
|---|---|---|---|---|---|---|
| | | | L | D | H | d |
| RMC | C | 1 | 11±1.5 | 4.8±0.5 | 25±2 | 0.8±0.05 |
| | C | 2 | 19±1.5 | 4.8±0.5 | 25±2 | 0.8±0.05 |
| | C | 3 | 25±2.0 | 4.8±0.5 | 25±2 | 0.8±0.05 |
| | C | 5 | 25±2.0 | 7.8±0.5 | 30±3 | 1.0±0.05 |




Bulk Ceramic Composition Resistors (RMCC) Dimensions

# Electrical Characteristics

## Electrical Characteristics (RMCA, RMCB)

| Item | | RMCC | | | |
|---|---|---|---|---|---|
| Power Rating at 25℃ (W) | | 1 | 2 | 3 | 5 |
| Operating Temp. Range (℃) | | -40~155 | | | |
| Resistance Tolerance | | K (±10%), M (±20%) | | | |
| Resistance Range (Ω) | | 470~33K | 1K~56K | 1K~100K | 470~33K |
| Max. Working Voltage (V) | | 300 | 350 | 400 | 500 |
| T.C.R (PPM/℃) | -40℃~25℃ | -750~3300 | -750~3300 | -750~3300 | -750~3300 |
| | 25℃~155℃ | -750~2600 | -750~2600 | -750~2600 | -750~2600 |
| Max. Pulse Voltage (KV) | | 8 | 15 | 20 | 25 |
| Moisture Resistance (%) | | 10 | 10 | 10 | 10 |

**Non-Inductive Performance:**

- Chemically inert and thermally stable, the resistors are inherently non-inductive because of their bulk ceramic construction, which allows energy and power to be uniformly distributed through the entire ceramic resistor body with no film or wire to fail.
- The bulk ceramic material also allows simple efficient resistor designs that enable the designer to minimize the resistor package size while providing the required performance and reliability.

# Order Codes

## Order Codes (RMCC)

| RMC | 2W | c | 51K | | K | |
|---|---|---|---|---|---|---|
| Part Number | Rated Power (W) | Style | Resistance Value (Ω) | | Resistance Tolerance (%) | |
| RMC | 1W | c Style | 510R | 510Ω | K | ±10% |
| | 2W | | 5K1 | 5.1KΩ | M | ±20% |
| | 3W | | 51K | 51KΩ | | |
| | 5W | | 68K | 68KΩ | | |

# General Information

### Cost Effective Complete Selection of High Voltage Components

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Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor. When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Ceramic Resistors (RMCD)

## Product Introduction

### Bulk Ceramic Tubular Resistor Offers Higher Energy Power Dissipation & Higher Voltage Withstand.

**Features :**

- Peak voltage up to 74 KV, Power (W) up to 100W.
- Typical resistance range 75 ohm ~ 1 Kohm.
- Resistance tolerance K(±10%).
- Inductance only 0.4μH max.
- Heavy load characteristics.

**Applications :**

- X-Ray, Lasers, Medical Defibrillators,
- Dynamic Braking, Soft-start/Current-limit,
- Radar, Motor Drives, Broadcast Transmitters,
- Snubber Circuits, Dummy Loads, Energy Research,
- RF Amplifiers, Semiconductor Process, Power Conditioning.

Power High Voltage Dividers and Resistors Type RMCD extend Token Electronic's advanced proprietary high voltage resistor technology to larger devices than have previously been available on the market.


The RMCD is the bulk non-inductive ceramic tubular resistor. Because of the larger volume of resistive material, these resistors are capable of handling significantly higher pulsed power than their wire wound or metal film counterparts, making them suitable for rapid energy dumping and high energy pulse work.

This RMCD offer higher average power dissipation while retaining the advantages of high surge energy, high voltage withstand, and non-inductance. It is especially useful in RF applications such as transmitters and modulators, where the tube configuration provides more effective convection cooling.

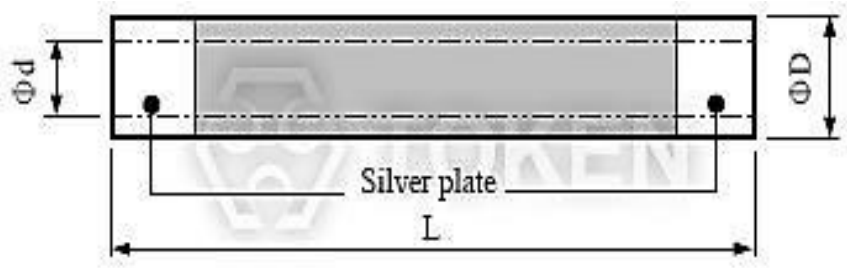
In addition, this RMCD HV resistor and divider provide high peak voltage and power energy combined with extremely high working voltage. These specifications can provide important improvements in performance in many types of advanced electronic systems, including TWT power supplies, radar systems, X-ray systems, analytical equipment and high resolution CRT displays.

Token will also produce devices outside these specifications to meet customer requirements, with comprehensive application engineering and design support available for customers worldwide. For complete information on quantity price and delivery, please contact our Sales Office, or link to Token official website "High Voltage Resistors" to get more information.

# General Specifications

## General Specifications (RMCD) (Unit: mm)

| Type | Dimensions (Unit: mm) | | | Resistance (Ω) | Tolerance (%) | Energy (KJ) | Peak Voltage (KV) | Power (W) |
|---|---|---|---|---|---|---|---|---|
| | L±3.0 | ΦD±2.0 | Φd±2.0 | | | | | |
| **RMCD-100** | 305 | 25.4 | 15.5 | 75~1K | ±10 | 30 | 75 | 100 |
| **RMCD-90** | 250 | 25.4 | 15.5 | | | 25 | 60 | 90 |
| **RMCD-70** | 200 | 25.4 | 15.5 | | | 20 | 45 | 70 |
| **RMCD-50** | 150 | 25.4 | 15.5 | | | 15 | 30 | 50 |
| **RMCD-35** | 100 | 25.4 | 15.5 | | | 10 | 15 | 35 |




Tubular High Voltage Resistors (RMCD) Dimensions

# Electrical Characteristics

## Electrical Characteristics (RMCD)

| Type | Power Rating | Temperature Coefficient | Resistivity | Specific Heat | Inductance | Density | Max. Operating Temperature |
|---|---|---|---|---|---|---|---|
| **RMCD** | 35 ~ 100W | -500 ~-1500PPM/℃ | 5~80Ω·cm | 2J/cm$^3$·℃ | 0.4μH max | 2.25g/cm$^3$ | 220℃ max |

# Order Codes

## Order Codes (RMCD)

| RMCD | 100W | 100R | | K | | S | B | |
|---|---|---|---|---|---|---|---|---|
| Part Number | Rated Power (W) | Resistance Value (Ω) | | Resistance Tolerance (%) | | Silver plate terminal | Color | |
| RMCD | 35W | 82R | 82Ω | K | ±10% | | B | black |
| | 50W | 100R | 100Ω | | | | | |
| | 70W | 470R | 470Ω | | | | | |
| | 90W | 820R | 820Ω | | | | | |
| | 100W | 1K | 1KΩ | | | | | |

# General Information

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### Application Notes

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- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Frequency Resistor (RY31A)

## Product Introduction

### A Perfect Choice for High Frequency RF Circuit Designs

**Features :**
- Special Oxide Film technology
- Speciality product for RF applications
- Low-inductance non-helical trimmed product
- Lead (Pb)-free and RoHS compliant

**Applications :**
- Telecommunication equipment
- Industrial electronics


RY31A specialty MELF Non-Inductive Resistors combines the advanced pulse load capability and the suitability for RF applications in a single component.

They are the perfect choice in RF high frequency circuit designs where the parasitic inductance of regular, helical trimmed resistors cannot be accepted, but where also pulse energies apply. Typical applications are in the fields of telecommunication equipment and industrial electronics.

RY31A - High Frequency Metal Oxide Film Resistor, with the inner and outer surfaces coated with a special glass, features higher thermal resistance and larger electric power capacity for the compact volume. Unlike conventional wire wound type, the volumetric resistance will provide superior stability versus frequency and excellent durability against transient voltage. RY31A is suitable for the application with large current as well as high frequency circuit.

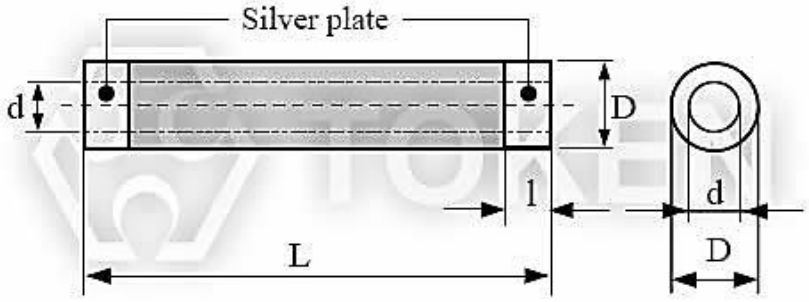
In very low resistance values, between 1.0 and 100 ohm, these are available in rated wattage 10W, 25W, 50W, 100W, and 150W packages.

The High-Frequency RY31A Series is RoHS compliant and lead free. For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact our Sales Office, or link to Token official website "High Voltage Resistors" to get more information.

# Electrical Characteristics

## Electrical Characteristics (RY31A)

| Rated power (W) | T.C.R (PPM/℃) | Resistance range (Ω) | Tolerance (%) | Pulse test voltage (KV) | Ambient Temp.(70℃ Full Power) | D max. (mm) | L max. (mm) | d max. (mm) | l max. (mm) |
|---|---|---|---|---|---|---|---|---|---|
| **10** | (+20℃ ~+125℃) ±400 | 50 | ±5(J) ±10(K) | 3.2 | -55℃~ +125℃ | Φ 15.1 | 77 | Φ 10.7 | 5±0.5 |
| | | 75 | | 4 | | | | | |
| **25** | | 50 | | 5 | | Φ 25.1 | 121 | Φ17.9 | 10±1 |
| | | 70 | | 6.5 | | | | | |
| **50** | | 50 | | 7.5 | | | 162 | | |
| | | 75 | | 8.7 | | | | | |
| **100** | | 50 | | 11 | | Φ 35.1 | 202 | Φ23.1 | 12±1 |
| | | 75 | | 12.5 | | | | | |
| **150** | | 50 | | 12.5 | | | 302 | | 20+2 20-1 |
| | | 75 | | 12.5 | | | | | |




RF Non-Inductive (RY31A) Dimensions

- **Note: Request resistance within 1~100Ω, please contact Token Sales.**
- **The resistors with the standard resistance values as showed as above. will be supplied with a shorter delivery.**

# Order Codes

## Order Codes (RY31A)

| RY31A | 10W | 50R | | K | |
|---|---|---|---|---|---|
| Part Number | Rated Power (W) | Resistance Value (Ω) | | Resistance Tolerance (%) | |
| RY31A | 10W | 51R | 51Ω | J | ±5% |
| | 25W | 56R | 56Ω | K | ±10% |
| | 50W | 62R | 62Ω | | |
| | 100W | 68R | 68Ω | | |
| | 150W | 75R | 75Ω | | |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Hermetic Resistor (RH1)

## Product Introduction

### Hermetic Resistors Lead to a High Ohmic Resistance Values.

**Features :**

- High Resistance Range $1\times10^{7}$~$1\times10^{12}$(Ω).
- Resistance Tolerance (J±5%) (K±10%).
- Glass vacuum sealed hermetic resistors.
- Stability temperature and voltage.
- Metal Glaze resistive elements.

**Applications :**

- Ultra-High Vacuum Applications.
- Surge Protection and Voltage Divider.
- Mains Protection and Discharge Path Resistor.
- Current Pulse Limiters and Pulse Load Equipments.
- Micro Current Circuit Measurement, Medical Instrumentation.


Token Hi-Meg Hermetically Sealed Resistors are designed for use in electrometer circuits where a high order of performance is required an extended period of time under adverse environmental conditions.

The RH1 metal glaze resistor is disclosed as being encapsulated in a glass tube, the enclosure being hermetically sealed to conductive caps mounted on the resistor ends. The metal glaze film of the resistance path of the resistor is protected from thermal damage during heat sealing by spacing the resistance path from the conductive caps and providing an electrical path there between in the form of an extended termination.

By being vacuum sealed in a glass envelope with its resistance glaze glass characteristic, these high resistance resistors are suitable for ultra-high vacuum applications, micro current circuit measurement, and pulse load equipment.

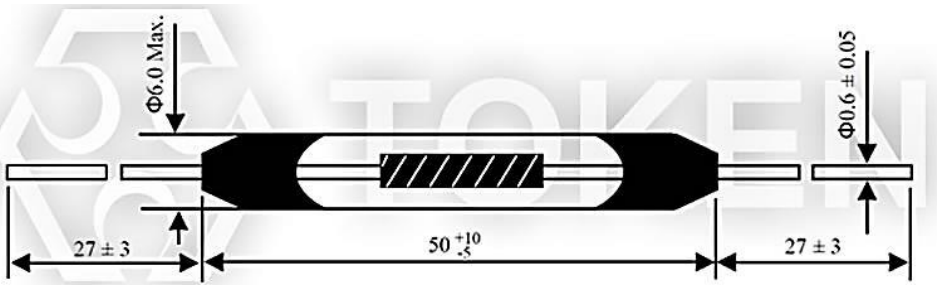
These RH1 Series features a high degree of stability and accuracy, and operate at this high performance level for long-term stability.

For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact us, or link to Token official website "High Voltage Resistors" to get more information.

# Dimensions & Specification

## Dimensions & Specification (RH1) (Unit: mm)

| | |
|---|---|
| **Resistance Range** | $1\times10^{7}$~$1\times10^{12}$(Ω) |
| **Resistance Tolerance** | (J±5%) (K±10%) |
| **Operating Temperature** | -55 ~ +125 |
| **Temperature Coefficient** | ±500PPM/ (-55~+125℃) |
| **Damp Heat** | ΔR ≤ ± (5%R+0.1Ω) |
| **Working Voltage** | 1000V |
| **Rated Power** | 1/2 W |




Hermetic High Resistance High-Megohm Resistors (RH1) Dimensions (Unit: mm)

# Cleaning & Handling

## Cleaning & Handling (RH1)

**Hermetic High-Megohm Resistor Cleaning & Handling:**

- It should be handled by the leads, unless gloves are worn.
- If cleaning should become necessary, use isopropyl alcohol and lightly wipe dry with lint free tissues.
- These glass encapsulated (hermetic) resistors with high resistance value is required extraordinary cleanliness.
- Fingerprints on the surface of the resistor will attract contaminants and moisture, which will cause a parallel resistance path, reducing the resistance value of the device.

# Order Codes

## Order Codes (RH1)

| RH1 | 1T | | J | |
|---|---|---|---|---|
| Part Number | Resistance Value (Ω) | | Resistance Tolerance (%) | |
| RH1 | 1T | 1TΩ | J | ±5% |
| | 10T | 10TΩ | K | ±10% |
| | 100T | 100TΩ | | |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Surge Resistor (RI80)

## Product Introduction

### Serpentine Pattern Design Achieves High Power Voltage Resistors (RI80).

**Features :**

- Rated Wattage from 1W to 300W.
- Max Working Voltage from 10KV to 35KV.
- Resistance Tolerance G( ±2%), J(±5%), K(±10%).
- Temperature Coefficient: 200 ppm/℃ to 400 ppm/℃.
- High Resistance Range from 1 Megohm to 1,000 Megohms.

**Applications :**

- Impulse voltage generators,
- Arc furnace damping, Energy research,
- Pulse modulators, Radar Pulse-forming networks,
- Capacitor crowbar circuits, High voltage snubber circuits,
- X-ray/imaging equipment, and EMI/lightning supression.


The tubular RI80 high voltage precision resistors were specifically designed for general purpose high voltage systems in industrial. The RI80 uses Token's proprietary thick film Metal Glaze resistive element and Serpentine Pattern Design which provides ideal cost efficient, stability, precision and high voltage characteristics for a wide range of measurement, voltage divider circuits, and control functions in high voltage power electronics applications.

Token RI80 Precision Voltage Resistors are able to absorb large amounts of energy at high voltage while remaining non-inductive and heavy load characteristics. The RI80 conforms to the RoHS directives and Lead-free. Customed design and tighter tolerances are available on request.

By utilizing specific ceramic core materials with optimum processing, Token are able to control, very tightly in manufacturing, the important ultra-stable performance parameters in operating temperatures from -55℃ to +70℃.

(RI80) can handle up to 35KV voltage. This unique process is offered in specific resistance values in a wide variety of sizes and terminations. The extraordinary operating stability of the Type RI80 resistors will improve the performance of your high voltage system.

The RI80 Precision Voltage Series is for customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact our sales, or link to Token official website "High Voltage Resistors" to get more information.

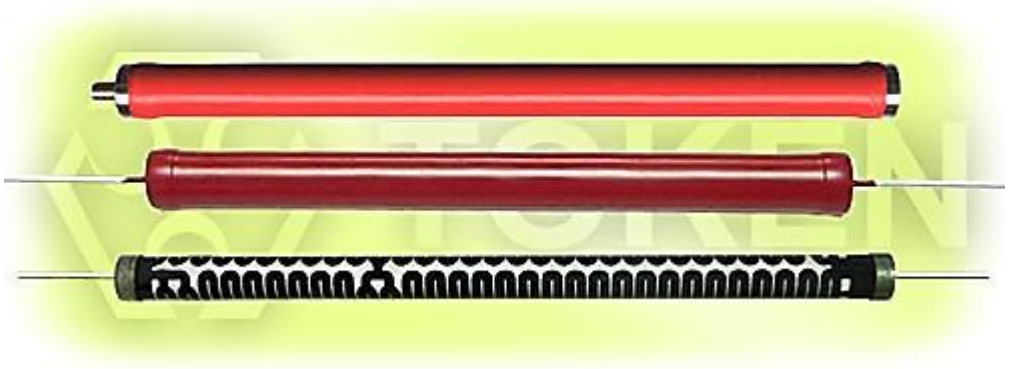
# General Specifications

## General Specifications (RI80) (Unit: mm)

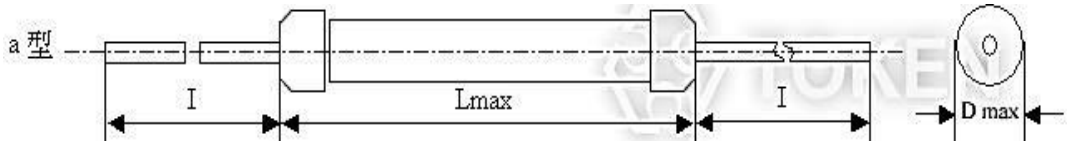
| Part Number | Rated Wattage (W) | Style | Dimensions (Unit: mm) | | | | Resistance Range (M Ω) | Temp Coefficient (10-6/℃) | Max Working Voltage (KV) | Operating Temp (℃) | Resistance tolerance (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lmax | Dmax | I | D | | | | | |
| **RI80-1** | 1 | a | 30±2 | 9±1 | 30±3 | 0.7 | 10-1000 | ≤200 | 10 | -55℃ ~ +70℃ | G( ±2%) J(±5%) K(±10%) |
| **RI80-2** | 2 | a | 50±2 | 9±1 | 30±3 | 0.7 | 10-1000 | ≤200 | 15 | | |
| **RI80-3** | 3 | a | 65±2 | 9±1 | 30±3 | 0.7 | 10-1000 | ≤200 | 15 | | |
| **RI80-5** | 5 | a | 100±2 | 9±1 | 30±3 | 1 | 10-1000 | ≤300 | 25 | | |
| **RI80-10** | 10 | b | 147±2 | 11±1 | 6 | M4 | 10-1000 | ≤300 | 30 | | |
| **RI80-20** | 20 | c | 116±2 | 17±1 | | | 10-100 | ≤400 | 30 | | |
| **RI80-25** | 25 | c | 116±2 | 19±1 | | | 10-100 | ≤400 | 30 | | |
| **RI80-30** | 30 | c | 116±2 | 19±1 | | | 10-100 | ≤400 | 30 | | |
| **RI80-50** | 50 | c | 116±2 | 21±1 | | | 10-100 | ≤400 | 30 | | |
| **RI80-80** | 80 | c | 130±2 | 27±1 | | | 10-51 | ≤400 | 30 | | |
| **RI80-100** | 100 | c | 160±2 | 27±1 | | | 10-51 | ≤400 | 35 | | |
| **RI80-150** | 150 | c | 210±2 | 27±1 | | | 10-51 | ≤400 | 35 | | |
| **RI80-200** | 200 | c | 260±2 | 27±1 | | | 10-51 | ≤400 | 35 | | |
| **RI80-300** | 300 | c | 310±2 | 33±1 | | | 1-51 | ≤400 | 35 | | |

# Construction & Dimensions

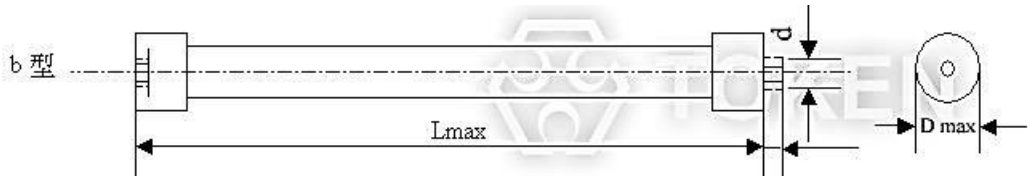
## High Voltage Resistors (RI80)



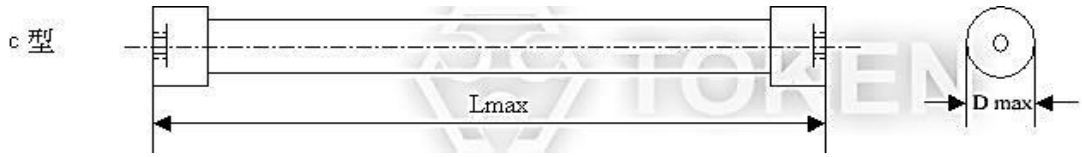
Metal Glaze Serpentine Pattern Impulse Resistors (RI80)




A style Tubular (RI80) - Dimensions (Unit: mm)




B style Tubular (RI80) - Dimensions (Unit: mm)




C style Tubular (RI80) - Dimensions (Unit: mm)

**Remark:**

- Rated continuous Working Voltage (RCWV) shall be determined from RCWV = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$ (Ω)
- When RCWV ≥ Max. Working Voltage listed above, RCWV = Max. Working Voltage.

# Advance Technique

## Advance Technique of Non-Inductive & Serpentine Pattern (RI80)

**Non-Inductive Performance:**

- RI80 Non-Inductive Design which uses a serpentine resistive pattern that offers for zigzagging lines to carry current in opposite directions, thereby achieving maximum neutralization of flux fields over the entire length of the resistor.
- This efficient non-inductive construction without derating of any performance advantages is ideal for applications where high frequency is required.

**Serpentine Pattern Screen Printing Design:**

- Type High Voltage RI80 Precision Resistors combine Token's Non-Inductive serpentine pattern, high thru-put screen printed silicone coating.
- The alignment of the gap in the serpentine resistor pattern with the gap in the coating pattern provides a complete encapsulation of the resistor element.
- The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.

# Order Codes

## High Voltage Resistors (RI80)

| RI80 | 1W | a | 51M | | G | |
|---|---|---|---|---|---|---|
| Part Number | Rated Power (W) | Style | Resistance Value (Ω) | | Resistance Tolerance (%) | |
| RI80 | 1W | a Style | 5M1 | 5.1MΩ | G | ±2% |
| | 2W | b Style | 51M | 51MΩ | J | ±5% |
| | 3W | c Style | 510M | 510MΩ | K | ±10% |
| | 5W | | | | | |
| | 10W | | | | | |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Resistors (RI82)

## Product Introduction

### An Excellent Solution for The High Voltage Trend in Power Impulse Products.

**Features :**

- Rated Wattage from 0.1W to 30W
- Max Working Voltage from 2KV to 30KV.
- Designs built from customer supplied schematics
- Tough epoxy-based coating and high voltage stability
- Temperature Coefficient: 200 ppm/℃ to 300 ppm/℃.
- Resistance Range from 10 Megohm to 100K Megohms (100 Gegaohms).
- Resistance Tolerance F(±1%), G(±2%), J(±5%), K(±10%), and M(±20%).
- Stable cermet resistive element bonded to a high-purity alumina substrate.

**Applications :**

- X-ray/imaging equipment, Impulse voltage generators,
- Capacitor crowbar circuits, High voltage snubber circuits, Arc furnace damping,
- Pulse modulators, Radar Pulse-forming networks, Energy research, and EMI/lightning supression.
- Applications include power supplies, transformers and any application requiring operation within an environment where high voltages are used.

The High Voltage RI82 Precision Series provides an excellent solution for design engineers looking for a compact product with high-voltage capabilities to enable them to design within the voltage trend for power impulse products.


The RI82 resistors use Token's proprietary thick film Metal Glaze resistive element and Serpentine Pattern Design which provides ideal cost efficient, stability, precision, non-Inductive, and high voltage characteristics for a wide range of measurement, voltage divider circuits, and control functions in high voltage power electronics applications.

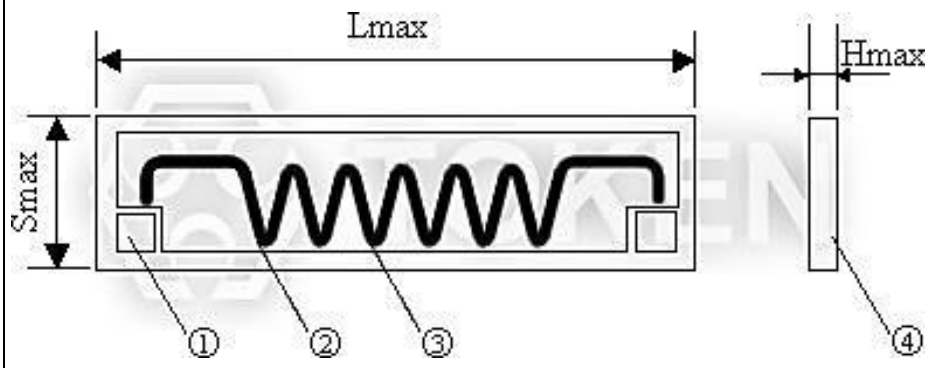
By utilizing specific 96 % pure alumina materials with optimum processing, Token are able to control, very tightly in manufacturing, the important ultra-stable performance tolerance F(±1%), G(±2%), J(±5%), K(±10%), and M(±20%). Voltage handles up to 30 KV. This unique process is offered in specific resistance values in a wide variety of sizes and terminations. The extraordinary operating stability of the Type RI82 resistors will improve the performance of your high voltage system in precision.

The Precision RI82 High Voltage Series is RoHS compliant and lead free. For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact us, or link to Token official website "High Voltage Resistors" to get more information.

# Chip General Specifications

## Chip Type General Specifications (Unit: mm) (RI82)

| Part Number | Rated Wattage (W) | Style | Dimensions (Unit: mm) | | | | | Resistance Range (MΩ) | Temp Coefficient (10-6/ ℃) | Resistance Tolerance | Max Working Voltage (KV) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L Max | S Max | H Max | I | D Max | | | | |
| **RI82-2** | 2 | a | 33 | 8 | 0.8 | | | 10-1000 | ≤200 | J(±5%) K(±10%) M(±20%) | 15 |
| **RI82-2** | 2 | a | 25 | 10 | 0.8 | | | | | | |




① Silver Palladium Pole
② Resistent Film
③ Insulation Coating
④ 96%A1023 Ceramic Base

A Style Dimensions - High Voltage Chip Resistor (RI82)

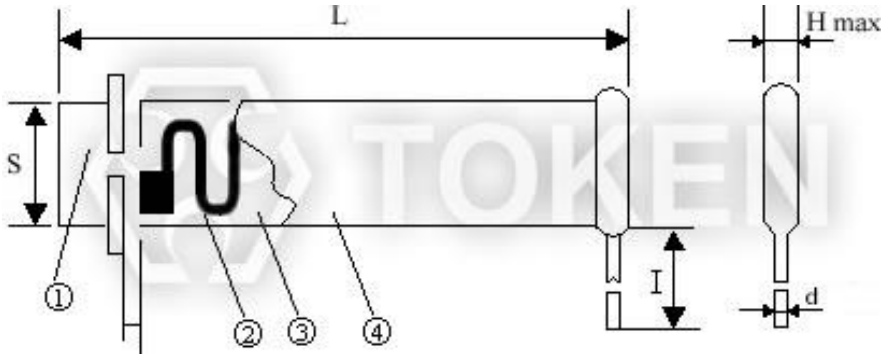
**Remark:**

- **Rated continuous Working Voltage (RCWV) shall be determined from RCWV = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$ (Ω)**
- **When RCWV ≥ Max. Working Voltage listed above, RCWV = Max. Working Voltage.**

# DIP General Specifications

## Dip Type General Specification (Unit: mm) (RI82)

| Part Number | Rated Wattage (w) | Dimensions (Unit: mm) | | | | | Resistance Range (MΩ) | Temp Coefficient (10-6/℃) | Max Working Voltage(KV) | Resistance Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L±2 | S±2 | HMax | I | d±0.1 | | | | |
| **RI82-0.125** | 0.125 | 8 | 3.5 | 2.5 | 20.0Min | 0.56 | 100-4.7K | ≤200 | 4 | F(±1%) G(±2%) J(±5%) K(±10%) M(±20%) |
| **RI82-0.125** | 0.125 | 10 | 5 | 2.5 | 24.0Min | 0.56 | 100-10K | ≤200 | 4 | |
| **RI82-0.25S** | 0.25S | 10 | 5 | 2.5 | 20.0Min | 0.56 | 10-1000 | ≤200 | 4 | |
| **RI82-0.25** | 0.25 | 22 | 4 | 2.5 | 20.0Min | 0.56 | 100-10K | ≤200 | 4 | |
| **RI82-0.25** | 0.25 | 25 | 5 | 2.5 | 20.0Min | 0.56 | 100-10K | ≤200 | 10 | |
| **RI82-0.5** | 0.5 | 35 | 5 | 2.5 | 24.0Max | 0.56 | 100-10K | ≤200 | 15 | |
| **RI82-0.5** | 0.5 | 41 | 5 | 2.5 | 42.0Max | 0.56 | 100-1KK | ≤200 | 4 | |
| **RI82-1** | 1 | 25 | 10 | 2.5 | 30.0Max | 0.56 | 100-10K | ≤200 | 15 | |
| **RI82-1** | 1 | 30 | 8 | 2.5 | 30.0Max | 0.56 | 100-10K | ≤200 | 15 | |
| **RI82-1** | 1 | 33 | 8 | 2.5 | 35.0Max | 0.56 | 100-10K | ≤200 | 15 | |
| **RI82-1** | 1 | 38 | 10 | 3 | 45.0Max | 0.80 | 10-1000 | ≤200 | 20 | |
| **RI82-2** | 2 | 38 | 10 | 3 | 40.0Max | 0.80 | 100-10K | ≤200 | 20 | |
| **RI82-2** | 2 | 45 | 10 | 3 | 45.0Max | 0.80 | 100-10K | ≤200 | 20 | |
| **RI82-3** | 3 | 50 | 10 | 3 | 45.0Max | 0.80 | 100-10K | ≤200 | 20 | |
| **RI82-3** | 3 | 30 | 15 | 3 | 35.0Max | 0.80 | 100-10K | ≤200 | 25 | |
| **RI82-3** | 3 | 60 | 10 | 3 | 55.0Max | 0.80 | 100-100K | ≤300 | 25 | |
| **RI82-5** | 5 | 80 | 20 | 4 | 60.0Max | 0.80 | 100-200 | ≤300 | 25 | |
| **RI82-10** | 10 | 97 | 23 | 4 | 80.0Max | 0.80 | 100-200 | ≤300 | 30 | |
| **RI82-20** | 20 | 100 | 35 | 4 | 80.0Max | 1 | 100-200 | ≤300 | 30 | |
| **RI82-30** | 30 | 100 | 48 | 4 | 80.0Max | 1 | 100-200 | ≤300 | 30 | |




① Silver Palladium Pole
② Resistent Film
③ 96%A1023 Ceramic Base
④ b style: Insulate Dielectric Glass;
c style: High Temperature Silicone Resin

B & C Style Dimensions - High Voltage Dip Type (RI82)

**Remark:**

- **Rated Continus Working Voltage (RCWW) shall be determined from RCWW = $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$ (Ω) or Max.Working Voltage listed above , whichever two.**

# Advance Technique

## Advance Technique of Non-Inductive & Serpentine Pattern (RI82)

**Non-Inductive Performance:**

- Token's RI82 Non-Inductive Design which uses a serpentine resistive pattern that offers for zigzagging lines to carry current in opposite directions, thereby neutralizing maximum of flux fields over the entire length of the resistor.
- This efficient non-inductive construction retains performance advantages and heavy load characteristics which is ideal for high frequency applications.

**Serpentine Pattern Screen Printing Design:**

- Type RI82 High Voltage Impulse Resistors combine Token's Non-Inductive serpentine pattern, high thru-put screen printed silicone coating.
- The alignment of the gap in the serpentine resistor pattern with the gap in the coating pattern provides a complete encapsulation of the resistor element.
- The lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.

# Order Codes

## Order Codes (RI82)

| RI82 | 0.125W | c | 47M | | K | |
|---|---|---|---|---|---|---|
| Part Number | Rated Power (W) | Style | Resistance Value (Ω) | | Resistance Tolerance (%) | |
| RI82 | 0.125W | a Style | 4M7 | 4.7MΩ | F | ±1% |
| | 0.25W | b Style | 47M | 47MΩ | G | ±2% |
| | 0.5W | c Style | 47M5 | 47.5MΩ | J | ±5% |
| | 1W | | 470M | 470MΩ | K | ±10% |
| | | | | | M | ±20% |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Power Resistors (RI85)

## Product Introduction

### Token High Voltage Resistors (RI85) Break Through 800 Wattage in High Power Applications.

Features :

- Max Working Voltage from 50KV to 100KV.
- Temperature Coefficient ≤ 100 ppm/℃.
- Resistance Range from 100KΩ to 1TeraΩ.
- Resistance Tolerance K(±10%), M(±20%).
- Rated Wattage from 200W to 800W.

Applications :

- X-ray/imaging equipment,
- EMI/lightning supression, Energy research,
- Pulse modulators, Radar Pulse-forming networks,
- Impulse voltage generators, Arc furnace damping,
- Capacitor crowbar circuits, High voltage snubber circuits.


Token Electronics RI85 series has been developed to provide design engineers with high quality, high power, and high voltage dividers for use in sophisticated system.

The RI85 resistors use Token's proprietary thick film metal glaze resistive element and Serpentine Pattern Design which provides ideal cost efficient, stability, high power and high voltage characteristics for a wide range of measurement, voltage divider circuits, and control functions in high voltage power electronics applications.

Token RI85 Voltage Power Resistors are able to absorb large amounts of energy at high voltage while remaining non-inductive and heavy load characteristics. RI85 Resistors conform to the RoHS directives and Lead-free. Customed design, low TCR, resistance values, and tighter tolerances are available on request.

The RI85 non-inductive metal glazed resistors are manufactured on proceeding of tube designed with tab terminal, thick-film printing, firing and laser trimming.

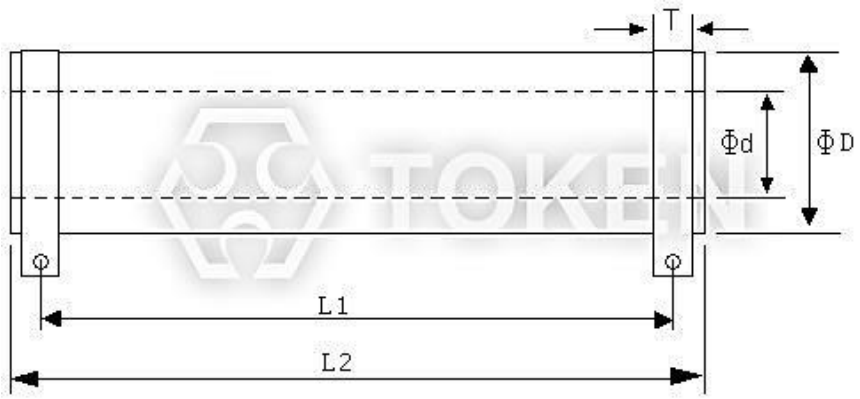
By utilizing specific ceramic core materials with optimum processing, Token are able to control, very tightly in manufacturing, the important ultra-stable performance parameters TCR less than 100 ppm/℃. Voltage handles up to 100 KV and Wattage available 200W to 800W. This unique process is also offered in specific resistance values in a wide variety of sizes and terminations. The extraordinary operating stability of the Type RI85 resistors will improve the performance of your high voltage system.

The RI85 Power Voltage Series is RoHS compliant and lead free. For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact us, or link to Token official website "High Voltage Resistors" to get more information.

# Dimensions & Specification

## Dimensions & Specification (RI85) (Unit: mm)

| Type | Power Rating | Resistance Value (Ω) | Resistance Tolerance | Temperature Coefficient (PPM/℃) | Dimensions (Unit: mm) | | | | | Max working voltage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ΦD±2 | Φd±2 | L1±5 | L2±5 | T±1 | |
| **RI85** | 200W | 100K~100G | 10% (K) 20% (M) | ≤100 | 28 | 15 | 185 | 200 | 10.5 | 50KV |
| **RI85** | 500W | 100K~500G | | ≤100 | 34 | 20 | 205 | 220 | 15 | 50KV |
| **RI85** | 800W | 100K~1T | | ≤100 | 55 | 40 | 205 | 220 | 15 | 100KV |

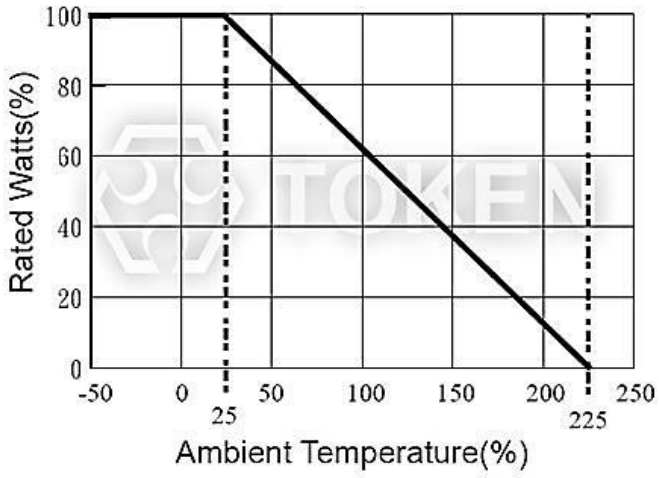



Tubular High Voltage Ceramic Resistors (RI85) Dimensions

- **Remark: Rated Continuous Working Voltage (RCWV) shall be determined from RCWV = square root (power rating × resistance value) or Max Working Voltage listed above, whichever less.**

# Derating Curve

## Power Derating Curve (RI85)




**(RI85) Power Derating Curve**

# Performance Specifications

## Performance Specifications (RI85)

| Test Item | Test Methods | Characteristics |
|---|---|---|
| **Moisture resistance** | MIL Std. 202, method 106 (IEC68-2-3) | ΔR/R≤±0.1% typ., 0.25% Max. |
| **Insulation resistance** | 500V 25℃ 75% relative humidity | 10GΩ Min. |
| **Dielectric strength** | 25℃ 75% relative humidity | 1000V Min. |
| **Overload** | 1.5×Pnom. 5 sec (do not exceed max. voltage) | ΔR/R≤±0.1% typ., 0.25% Max. |
| **Thermal shock** | MIL Std. 202, method 107 Cond. C (IEC68-2-14) | ΔR/R≤±0.1% typ., 0.2% Max. |
| **Load life** | 1000h at rated power (IEC115-1) | ΔR/R≤±0.1% typ., 0.25% Max. |

# Advance Technique

## The Advantages of Non-Inductance & Serpentine Pattern - (RI85)

**Non-Inductive Performance:**

- RI85 Non-Inductive Design which uses a serpentine resistive pattern that offers for zigzagging lines to carry current in opposite directions, thereby achieving maximum neutralization of flux fields over the entire length of the resistor.
- This efficient non-inductive construction without derating of any performance advantages is ideal for applications where high frequency is required.

**Serpentine Pattern Screen Printing Design:**

- The RI85 High Voltage Power Resistor combines Token's Non-Inductive serpentine pattern, high thru-put screen printed silicone coating.
- The alignment of the gap in the serpentine resistor pattern with the gap in the coating pattern provides a complete encapsulation of the resistor element.
- The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.

# Order Codes

## High Voltage Resistors (RI85)

| RI85 | 200W | 1M | K |
|---|---|---|---|
| Product Type. | Rated Power.(W) | Resistance Value. (Ω) | Resistance Tolerance. |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# High Voltage Network Dividers (NTK)

## Product Introduction

### Token High Voltage Resistor Network Dividers can be customized to order.

**Specifications :**

- Resistance Range: 1KΩ ~ 10GΩ.
- Resistance Tolerance: ±1% ~ ±30%.
- Thick film on Aluminum > 96% Al2O3.
- High Voltage Withstanding: Up to 30 ~ 50KV.
- Low VCR: 1ppm / 5ppm / 10ppm upon request.
- Temperature Range: -55℃ ~ +125℃ (higher temp. upon request).
- Low TCR Available: 250 ppm/℃. (ppm/℃ or tighter upon request).

**Features :**

- Flat style, Low Resistor Noise.
- Non Inductive Design.
- Divider Design upon Request.
- Pb-free Production: Meet RoHS.
- Different Coating Available: Glass / Epoxy resin / Silicon.
- Solderable Leads (Tin coated copper leads): Type Φ0.5 (Φ0.6 / Φ0.8 upon request).


RoHS-compliant resistor network, high-value high-voltage resistors and potential dividers in a wide variety of configurations are now available from Token Electronics as custom versions of its standard ranges of resistive products.

This advanced film resistor technology provides the performance characteristics required by the precision input signal circuits of both bench-type and laboratory digital instruments. In addition to requiring less board space, these compact voltage network dividers deliver higher performance than selected discrete resistor sets and thin-film dividers.

Manufactured using advance thick-film technology from existing tooling ensures fast turnaround of samples prior to low to medium volume in-house production. These custom dividers are ideal for high performance voltage division applications in medical equipment, laboratory equipment, analytical instruments, etc. The custom high voltage network divider can be supplied in various packages and packaging materials including glass, epoxy resin, silicon options.

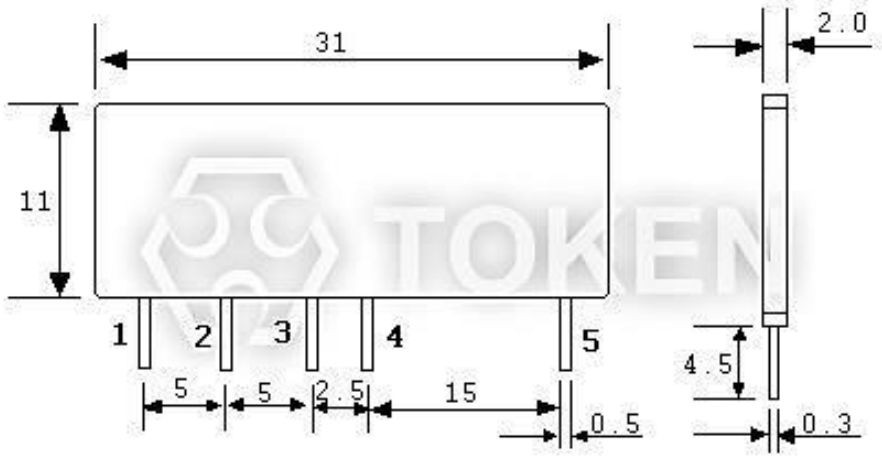
By applying this technology to the low-profile, single-in-line package configuration, the Type (NTK) Custom SIP Resistor Networks are available with a combination of features. Which include: Low TCR 250 ppm/℃ (100 ppm/℃ or tighter upon request), operating temperature range -55℃ ~ +125℃ (higher temperature upon request), flat style, non-inductive, low noise, and also custom divider design.

For complete information on quantity price and delivery, please contact our Sales Office, or link to Token official website "High Voltage Resistors" to get more information.

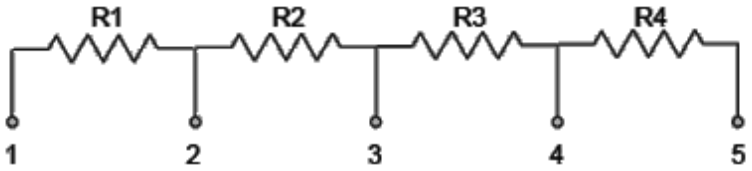
# NTK-A Electrical Parameters

## Electrical Parameters (NTK-A)

| Type | PIN | Resistance Value (Ω) | | Resistance Tolerance | Pressure parameters | Rated Power (W) |
|---|---|---|---|---|---|---|
| NTK-A | 1~2 | R1 | 30M | K (±10%) | 4KV Min. | 0.6W Min. |
| | 2~3 | R2 | 30M | K (±10%) | 4KV Min. | 0.6W Min. |
| | 3~4 | R3 | 1M | J (±5%) | 500V Min. | 0.3W Min. |
| | 4~5 | R4 | 800M | K (±10%) | 10KV Min. | 1W Min. |



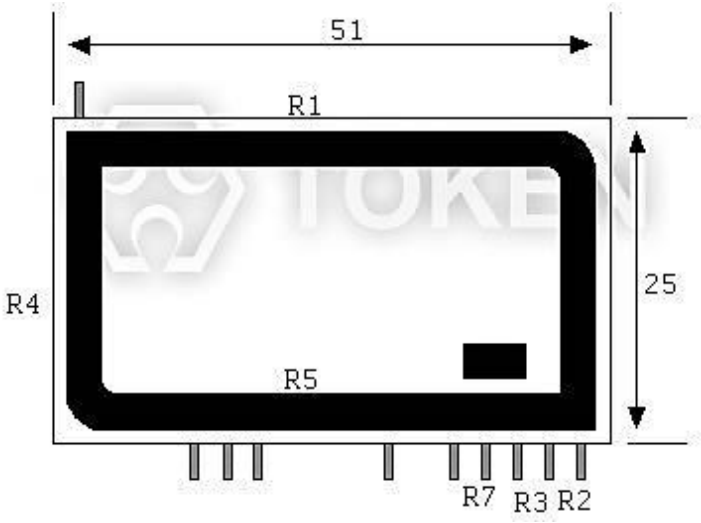

High Voltage Divider Network (NTK-A) Series Dimensions



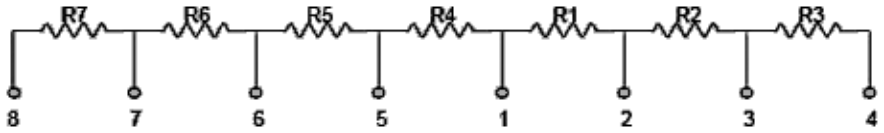
# NTK-B Electrical Parameters

## Electrical Parameters (NTK-B)

| Type | Serial Number | Resistance Value (Ω) | Rated Power | Resistance Tolerance | Temperature Coefficient | Operating Voltage |
|---|---|---|---|---|---|---|
| NTK-B | R1 | 52M | 5W | ±5% | ±250PPM/℃ | 8500V |
| | R2 | 10K | - | | | - |
| | R3 | 10K | - | | | - |
| | R4 | 16M2 | 4W | | | 4200V |
| | R5 | 17M3 | 3W | | | 4400V |
| | R6 | 3M3 | 1W | | | 800V |
| | R7 | 8K | - | | | - |




High Voltage Divider Network (NTK-B) Series Dimensions



# Thick Film Planar Dividers, High Voltage Resistors (HI83)

## Product Introduction

### Token electronic printing technology to achieve a superior precision, thick film planar high voltage dividers.

**Features :**

- High precision, Non-Inductance design.
- High voltage, Wide range of resistance.
- Custom design services. RoHS compliant.

**Applications :**

- Pulse Modulator, Radar Pulse Forming Network.
- X-ray/Imaging Equipment, and EMI lightning suppression.
- Capacitor Arc Suppression Circuit, High Voltage Buffer Circuit.
- Impulse Voltage Generator. Electric Arc Furnace Damping, Energy Research.

Through-hole (HI83) thick film planar divider, high voltage resistor series is a new generation of Token Electronic Technology Co., Ltd. Taking advantage of high-quality ruthenium oxide resistance material to 96% alumina planar ceramic matrix, dividers (HI83) features good thermal conductivity, small size, and high reliability. Custom dividers available with leadwire terminals or with leadless conductive pads.


The planar thick film divider resistor (HI83) provides stable performance over a wide range of resistance values with a voltage rating up to 35KV. The maximum resistance ratio is 1000: 1 (ratio greater than 1000: 1, such as 2000: 1, 4000: 1, and 5000: 1 is available on request) with a minimum resistance ratio of 40: 1.

Low temperature coefficient can be used for high stability circuit applications. Space-saving planar packages provide an alternative to traditional high-voltage resistors. (HI83) is mainly used in precision instruments, drive circuits, power supplies, transformers, high voltage power equipment, and any need to operate in high voltage electrical appliances and other fields.

The main structure of the planar thick film voltage divider (HI83): The terminal connecting conductor and the ruthenium oxide resistive material were printed on the surface of the 96% alumina substrate in a non-inductive pattern. Then apply the screen printing protection, after connect the terminals. Phosphor bronze solder is welded to the lead frame terminal and is immersed in SnAgCu to meet the following IEC weldability requirements.

Thick film (HI83) voltage dividers are RoHS compliant and 100% lead free. For conventional parameters, specifications outside the parameters, or technical requirements, please contact Token, or link to Token official website "High Voltage Resistors" to get more information.

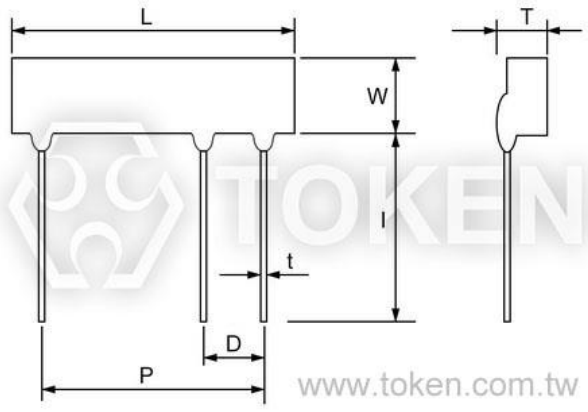
# General Specifications

## Composition Structure (HI83)

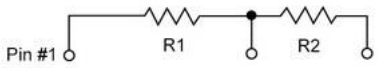

| | |
|---|---|
| Membrane Material (a) | Ruthenium Paste |
| Base Material (b) | 95% Aluminum Oxide, $Al_2O_3$ |
| Encapsulating Material (c) | High Temperature Silicone Resin |

## Dimension Specifications (Unit: mm) (HI83)

| Part Number | Power Rating (W) | Max. Working Voltage (KV) | L ±0.5 mm | W ±0.5 mm | D ±0.5 mm | I ±1 mm | T ±0.5 mm | t ±0.05 mm |
|---|---|---|---|---|---|---|---|---|
| **HI83-04** | 1/4W | 10 | 25 | 5 | 4 | 20 | 2 | 0.6 |
| **HI83-02** | 1/2W | 15 | 35 | 5 | 5 | 20 | 2 | 0.6 |
| **HI83-10** | 1W | 15 | 38 | 8 | 6 | 20 | 2 | 0.6 |
| **HI83-20** | 2W | 20 | 45 | 10 | 6 | 20 | 2 | 0.6 |
| **HI83-30** | 3W | 25 | 60 | 10 | 8 | 40 | 3.5 | 1 |
| **HI83-50** | 5W | 30 | 80 | 20 | 10 | 40 | 3.5 | 1 |




**Divider Dimension Specifications (Unit: mm) - (HI83)**



# Electrical Characteristics

## Technical Characteristics - (HI83)

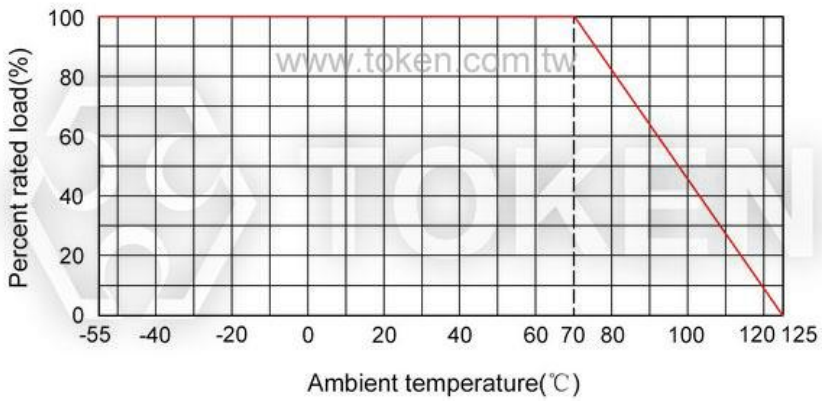
| Part Number | HI83-04 | HI83-02 | HI83-10 | HI83-20 | HI83-30 | HI83-50 |
|---|---|---|---|---|---|---|
| Power rating at 70℃ (W) | 1/4W | 1/2W | 1W | 2W | 3W | 5W |
| Limiting element voltage in air dc or ac pk (KV) | 6KV | 10KV | 15KV | 15KV | 20KV | 25KV |
| Resistance value (Ω) | 10K–1G | 50K–1G | 100K–1G | 100K–1G | 100K–1G | 100K–1G |
| Resistance tolerance (%) | 1, 5 | | | | | |
| Ratio tolerance (%) | 0.25, 0.5, 1 | | | | | |
| TCR (20℃ to 70℃) (ppm/℃) | 50, 100 | | | | | |
| Tracking TCR (20℃ to 70℃) (ppm/℃) | 25, 50 | | | | | |
| Standard values | E24 preferred for (R1 + R2) and R2 | | | | | |
| Ambient temperature range (℃) | -55 to +125 | | | | | |
| Insulation resistance at 500V (Ω) | >10G | | | | | |
| Dielectric strength of insulation (V) | >1000 | | | | | |

# Environmental Characteristics

## Environmental characteristics - (HI83)

| Test Items | Condition | Spec. |
|---|---|---|
| Resistance Temp. Coeff. | -55℃ ~ 125℃ | ±200 ~ ±300 ppm/℃ |
| Overload | 1.5 times of rated voltage, 15 min (do not exceed max. voltage) | ΔR ≤ ±( 1%R + 0.05Ω ) |
| Load Life | 96 hours at rated power | ΔR ≤ ±( 1%R + 0.1%Ω ) |

## Derating Curve



# Serpentine Pattern

## Advance Technique of Non-Inductive & Serpentine Pattern (HI83)

**Non-Inductive Performance:**

- HI83 Non-Inductive Design which uses a serpentine resistive pattern that offers for zigzagging lines to carry current in opposite directions, thereby achieving maximum neutralization of flux fields over the entire length of the resistor.
- This efficient non-inductive construction without derating of any performance advantages is ideal for applications where high frequency is required.

**Serpentine Pattern Screen Printing Design:**

- Type High Voltage HI83 Precision Resistors combine Token's Non-Inductive serpentine pattern, high thru-put screen printed silicone coating.
- The alignment of the gap in the serpentine resistor pattern with the gap in the coating pattern provides a complete encapsulation of the resistor element.
- The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.

# Application Notes

## High Voltage Divider Application Notes (HI83)

- Due to the high voltage that may occur between the terminals and any adjacent metal parts, the voltage divider should be installed at a sufficient distance from other conductors.
- For some ultra-high voltage applications, it is necessary to immerse the component in oil or SF6 gas or place it in a void-free silicone compound to reduce surface tracking or corona. The printed protection is right for these applications.
- The planar voltage divider consists of high value R1 and low value R2. The voltage division ratio of the divider is specified by Ratio R2: (R1 + R2).

# Order Codes

## Order Codes (HI83)

Example:
HI83-20 for a voltage ratio of 1:1000, with R1 = 99.9 megohms and R2 = 100 kilohms (total R1 + R2 = 100 megohms) at 50ppm/℃ absolute and 25ppm/℃ tracking TCR, 1% absolute and 0.5% ratio tolerance.

| HI83 | 20 | C2C3 | 100M | 100K | FD |
|---|---|---|---|---|---|

| Part Number |
|---|
| HI83 |

| Size | |
|---|---|
| 04 | 1/4W |
| 02 | 1/2W |
| 10 | 1W |
| 20 | 20W |
| 30 | 30W |
| 50 | 5W |

| TCR (ppm/℃) | |
|---|---|
| C1C2 | 100ppm absolute and 50ppm tracking |
| C1C3 | 100ppm absolute and 25ppm tracking |
| C2C3 | 50ppm absolute and 25ppm tracking |

| R1 + R2 (Ω) | |
|---|---|
| 100M | 99MΩ + 1MΩ |
| 100M | 99.9MΩ + 100KΩ |
| 150M | 148.5MΩ + 1.5MΩ |

| R2 (Ω) | |
|---|---|
| 1M | 1MΩ |
| 100K | 100KΩ |
| 1M5 | 1.5MΩ |

| Resistance Tolerance (%) | |
|---|---|
| JF | 5% absolute and 1% ratio |
| FD | 1% absolute and 0.5% ratio |
| FC | 1% absolute and 0.25% ratio |

## Order Codes (HI80P) High-Power High Voltage Resistor

| HI80P | 20 | a | 1G | F |
|---|---|---|---|---|

| Part Number |
|---|
| HI80P |

| Rated Power (W) | |
|---|---|
| 20 | 20W |
| 30 | 30W |
| 150 | 150W |
| 300 | 300W |

| Type |
|---|
| a |
| b |
| c |

| Resistance Value (Ω) | |
|---|---|
| 10 | 10Ω |
| 1K1 | 1.1KΩ |
| 110K | 110KΩ |
| 1M1 | 1.1MΩ |
| 110M | 110MΩ |
| 10G | 10GΩ |

| Resistance Tolerance (%) | |
|---|---|
| D | ±0.5% |
| F | ±1% |
| J | ±5% |
| K | ±10% |

## Order Codes (HI80T) Ultra-Precision High Voltage Resistor

| HI80T | 32 | 500M | B |
|---|---|---|---|

| Part Number |
|---|
| HI80T |

| Rated Power (W) | |
|---|---|
| 20 | 0.8W |
| 32 | 1.2W |
| 52 | 2W |
| 154 | 6W |

| Resistance Value (Ω) | |
|---|---|
| 10 | 10Ω |
| 1K1 | 1.1KΩ |
| 110K | 110KΩ |
| 1M1 | 1.1MΩ |
| 500M | 500MΩ |

| Resistance Tolerance (%) | |
|---|---|
| B | ±0.1% |
| D | ±0.5% |
| F | ±1% |

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# Precision High-Megohm High-Value Chip Resistors (HM)

## Product Introduction

### Token (HM) non-magnetic chip resistor providing high resistance value and high-temperature application performance.

**Features :**

- Non-magnetic.
- Non-standard values available.
- Low temperature and voltage dependency.
- Contact areas PtAg for glueing and soldering.
- Untrimmed for higher working voltage up to 6000V.

**Packaging :**

- Halogen-free, compiant to RoHS directive 2002/95/EC.
- Bilk in plastic bags or tubes - MOQ 100 pieces.
- Blister tape IEC60286-3 - MOQ 1000 pieces. Reel diameter 180mm or 330mm.


Token non-magnetic SMD resistor (HM) series, applied to the field of medical high magnetic fields, such as electronic circuits located in magnetic resonance (MRI) and computed tomography (CT), or in the extreme environment of oil and gas industries, such as downhole instruments for oil wells, or flight control in aerospace applications.

(HM) SMD Resistor series its junction area does not contain nickel, they are made of metal alloy PtAg, can be used as thick film slurry, suitable for roll coating or impregnation process to the packaging chipset parts area. The standard SMD soldering process can also be used in the bonding process of silver conductive epoxy resins. The bonding technology of conductive epoxy resin is mainly used in the case of welding technology can not be applied, such as the temperature sensitive component which is affected by the high welding temperature, or the semiconductor without cladding on the same board. PtAg terminals are suitable for high temperature welding applications, which can be higher than the 155℃ of typical soldering.

Similarly, (HM) chip resistors do not contain organic materials, no tin or tin lead layer, and resistance and conductive layer at 850℃ high-temperature sintering, so the resistor chip will not have a substantial change, and has a stable electrical characteristics. The terminal material also affects the VCR (the voltage coefficient of the resistor), which is an important characteristic of the high-voltage resistor, and lower VCR is also designed for the Token of the non-magnetic SMD resistor.

Token non-magnetic thick flim chip resistor (HM) series, it consists of two main categories: (HMM) Precision High Value Chips and (HMS) Conventional Precision Megohm Chips. Sizes are 0402, 0603, 0805, 1206, 1210, 2512, and 4020 available. Resistance range from 100KΩ to the highest value 10TΩ. Operating voltage can reach 6000V. Precision tolerance has 0.25%/0.5%/1%/2%/5%/10%/20%/30% alternative. The temperature coefficient is low to 25ppm/℃. The voltage factor VCR can be specified within the range, from low to 25ppm/v.

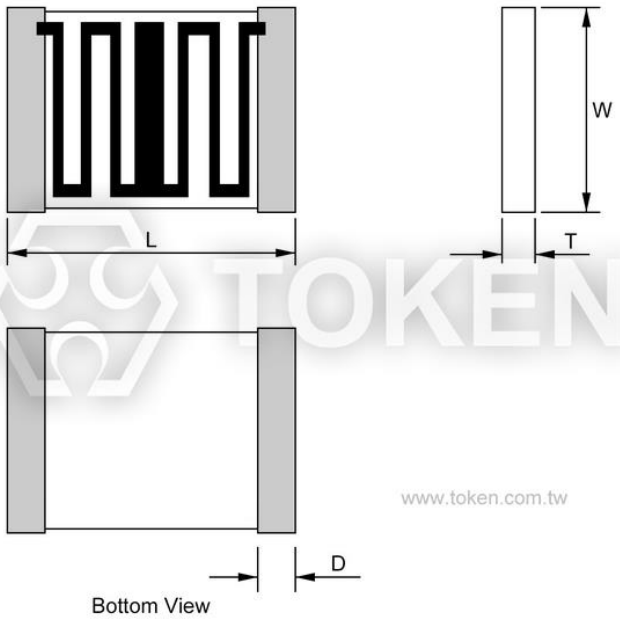
(HM) chips compliant with RoHS and lead-free standards. Provide more competitive prices and fast delivery services. For technical requirements and special applications outside the specification, please contact the business representative of the Token Electronics, or link to Token official website "High Voltage Resistors" to get more information.

# Dimensions

## Precision Non-magnetic Chip Dimensions (Unit: mm)

| (HMM) Precision High Value Chip Resistors | | | | |
|---|---|---|---|---|
| **Part Number** | **L (mm)** | **W (mm)** | **T (mm)** | **D (mm)** |
| **HMM-0805** | $2.00^{+0.15/-0.05}$ | $1.25^{+0.15/-0.05}$ | $0.40^{+0.15/-0.05}$ | $0.30^{+0.20/-0.10}$ |
| **HMM-1206** | $3.20^{+0.15/-0.05}$ | $1.50^{+0.20/-0.05}$ | $0.40^{+0.15/-0.05}$ | $0.30^{+0.20/-0.10}$ |
| **HMM-1210** | $3.20^{+0.15/-0.05}$ | $2.50^{+0.20/-0.05}$ | $0.50^{+0.15/-0.05}$ | $0.80^{\pm0.20}$ |
| **HMM-2010** | $5.10^{+0.15/-0.05}$ | $2.50^{+0.20/-0.05}$ | $0.60^{+0.20/-0.10}$ | $1.20^{\pm0.20}$ |
| **HMM-2512** | $6.30^{+0.15/-0.05}$ | $3.50^{+0.20/-0.05}$ | $0.60^{+0.15/-0.05}$ | $0.90^{\pm0.20}$ |
| **HMM-4020** | $10.20^{+0.20/-0.05}$ | $5.10^{+0.20/-0.05}$ | $0.60^{+0.20/-0.10}$ | $0.90^{\pm0.20}$ |
| **Note: L = Length, H = Width, T = Thickness, D = width of wrap around。** | | | | |

| (HMS) Conventional Precision Megohm Chip Resistors | | | | |
|---|---|---|---|---|
| **Part Number** | **L (mm)** | **W (mm)** | **T (mm)** | **D (mm)** |
| **HMS-0402** | $1.04^{\pm0.05}$ | $0.50^{\pm0.05}$ | $0.30^{\pm0.05}$ | $0.10^{+0.10/-0.05}$ |
| **HMS-0603** | $1.50^{+0.15/-0.05}$ | $0.80^{+0.15/-0.05}$ | $0.40^{+0.15/-0.05}$ | $0.20^{+0.20/-0.10}$ |
| **HMS-0805** | $2.00^{+0.15/-0.05}$ | $1.25^{+0.15/-0.05}$ | $0.40^{+0.15/-0.05}$ | $0.30^{+0.20/-0.10}$ |
| **HMS-1206** | $3.20^{+0.15/-0.05}$ | $1.50^{+0.20/-0.05}$ | $0.40^{+0.15/-0.05}$ | $0.30^{+0.20/-0.10}$ |
| **HMS-1210** | $3.20^{+0.15/-0.05}$ | $2.50^{+0.20/-0.05}$ | $0.50^{+0.15/-0.05}$ | $0.80^{\pm0.20}$ |
| **HMS-2512** | $6.30^{+0.15/-0.05}$ | $3.50^{+0.20/-0.05}$ | $0.60^{+0.15/-0.05}$ | $0.90^{\pm0.20}$ |
| **HMS-4020** | $10.20^{+0.15/-0.05}$ | $5.10^{+0.20/-0.05}$ | $0.60^{+0.15/-0.05}$ | $0.90^{\pm0.20}$ |
| **Note: L = Length, H = Width, T = Thickness, D = width of wrap around。** | | | | |




Precision Non-magnetic Chip Dimensions (Unit: mm)

# HMM Electrical characteristics

## Technical Characteristics - (HMM)

| Part Number | Power Rating $P_{70}$(mW) | Working Voltage (V) | | Resistance Range (Ω) | Tolerance (%) | TCR[2] (ppm/℃) | VCR[3] (ppm/V) |
|---|---|---|---|---|---|---|---|
| | | trimmed | untrimmed | | | | |
| **HMM-0805** | 125 | 200 | 600 | 100K - 100M | 0.5/1/5/10 | TC25/50/100 | <50ppm/V |
| | | | | >100M - 1G | 2/5/10/20 | TC50/100/250 | <250ppm/V |
| | | | | >1G - 10G | 5/10/20 | TC100/250 | <500ppm/V |
| | | | | >10G - 100G | 10/20/30 | TC1000/2000 | <1000ppm/V |
| | | | | >100G - 1T | - | - | - |
| | | | | >1T - 10T | - | - | - |
| **HMM-1206** | 250 | 600 | 1000 | 100K - 100M | 0.5/1/2/5/10 | TC25/50/100 | <50ppm/V |
| | | | | >100M - 1G | 2/5/10/20 | TC50/100/250 | <100ppm/V |
| | | | | >1G - 10G | 5/10/20 | TC100/250 | <250ppm/V |
| | | | | >10G - 100G | 10/20/30 | TC500/1000 | <1000ppm/V |
| | | | | >100G - 1T | 10/20/30 | TC1000/2000 | <2000ppm/V |
| | | | | >1T - 10T | - | - | - |
| **HMM-1210** | 350 | 1000 | 1200 | 100K - 100M | 0.5/1/2/5/10 | TC25/50/100 | <25ppm/V |
| | | | | >100M - 1G | 1/2/5/10/20 | TC25/50/100 | <50ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC50/100 | <100ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC500/1000 | <500ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC500/1000 | <1000ppm/V |
| | | | | >1T - 10T | - | - | - |
| **HMM-2010** | 500 | 1500 | 2000 | 100K - 100M | 0.5/1/2/5/10 | TC25/50/100 | <25ppm/V |
| | | | | >100M - 1G | 1/2/5/10/20 | TC25/50/100 | <50ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC50/100 | <100ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC250/500 | <500ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC500/1000 | <1000ppm/V |
| | | | | >1T - 10T | - | - | - |
| **HMM-2512** | 1000[1] | 2000 | 3000 | 100K - 100M | 0.5/1/2/5/10 | TC25/50/100 | <10ppm/V |
| | | | | >100M - 1G | 1/2/5/10/20 | TC25/50/100 | <25ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC500/100 | <100ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC250/500 | <250ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC500/1000 | <500ppm/V |
| | | | | >1T - 10T | 10/20/30 | TCR VCR | on request |
| **HMM-4020** | 1500[1] | 4000 | 6000 | 100K - 100M | 0.25/.../10 | TC25/50/100 | <10ppm/V |
| | | | | >100M - 1G | 0.5/.../20 | TC25/50/100 | <10ppm/V |
| | | | | >1G - 10G | 1/2/5/10/20 | TC25/50/100 | <25ppm/V |
| | | | | >10G - 100G | 2/5/10/20/30 | TC250/500 | <100ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC500/1000 | <250ppm/V |
| | | | | >1T - 10T | 10/20/30 | TCR VCR | on request |

**Note:**

- **[1] At continuous power dissipation the dimensions of solder-pads have to secure sufficient heat-conduction.**
- **[2] TCR 25/50: Temperature range +25℃ ~ +85℃ ; [3] VCR: Typical values.**
- **Lower values of tolerance, TCR and VCR on request and agreement.**

## Environmental Characteristic

| | | | |
|---|---|---|---|
| **Temperature range** | -55℃ ~ +155℃ | | |
| **Climatic category acc. to IEC 60068** | 55/155/56 | | |
| **Max. soldering temperature acc. IEC60068 T2-20, Ta Meth.1**[4] | 235℃ 5s | | |
| **Max. soldering temperature acc. IEC60068 T2-20, Tb Meth.1A** | 260℃ 10s | | |
| **Long term stability** | <1G | <10G | ≥10G |
| **Storage 125℃/1000h** | <0.5% | <1% | <2% |
| **Load life 70℃/1000h** | <0.25% | <0.5% | <1% |

**Note:**

- [4] **Up to 6 months after shipment resp, at storage in Nitrogen.**
- **Data not specified according CECC 40401-802.**

# HMS Electrical characteristics

## Technical Characteristics - (HMS)

| Part Number | Power Rating $P_{70}$(mW) | Working Voltage (V) | | Resistance Range (Ω) | Tolerance (%) | TCR[2] (ppm/℃) | VCR[3] (ppm/V) |
|---|---|---|---|---|---|---|---|
| | | trimmed | untrimmed | | | | |
| **HMS-0402** | 50 | 30 | 90 | 1M - 100M | 5/10/20 | TC100/250 | <500ppm/V |
| | | | | >100M - 500M | 5/10/20 | TC250/500 | <1000ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC250/500 | <1000ppm/V |
| | | | | >1G - 10G | 10/20/30 | TC1000/2000 | <2000ppm/V |
| | | | | >10G - 100G | - | - | - |
| | | | | >100G - 1T | - | - | - |
| **HMS-0603** | 75 | 75 | 200 | 1M - 100M | 1/5/10/20 | TC100/250 | <250ppm/V |
| | | | | >100M - 500M | 2/5/10/20 | TC100/250 | <250ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC250/500 | <500ppm/V |
| | | | | >1G - 10G | 5/10/20/30 | TC500/1000 | <2000ppm/V |
| | | | | >10G - 100G | 10/20/30 | TC1000/2000 | <5000ppm/V |
| | | | | >100G - 1T | - | - | - |
| **HMS-0805** | 125 | 100 | 300 | 1M - 100M | 1/5/10/20 | TC50/100 | <100ppm/V |
| | | | | >100M - 500M | 2/5/10/20 | TC100/250 | <250ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC250/500 | <250ppm/V |
| | | | | >1G - 10G | 5/10/20 | TC500/1000 | <1000ppm/V |
| | | | | >10G - 100G | 10/20/30 | TC1000/2000 | <2000ppm/V |
| | | | | >100G - 1T | 10/20/30 | TC3000 | <5000ppm/V |
| **HMS-1206** | 250 | 200 | 600 | 1M - 100M | 1/5/10/20 | TC25/50/100 | <100ppm/V |
| | | | | >100M - 500M | 2/5/10/20 | TC50/100/250 | <100ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC100/250 | <250ppm/V |
| | | | | >1G - 10G | 5/10/20 | TC500/1000 | <1000ppm/V |
| | | | | >10G - 100G | 10/20/30 | TC1000/2000 | <2000ppm/V |
| | | | | >100G - 1T | 10/20/30 | TC3000 | <5000ppm/V |
| **HMS-1210** | 350 | 300 | 900 | 1M - 100M | 1/5/10/20 | TC25/50/100 | <50ppm/V |
| | | | | >100M - 500M | 2/5/10/20 | TC50/100/250 | <100ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC100/250 | <100ppm/V |
| | | | | >1G - 10G | 5/10/20 | TC250/500 | <500ppm/V |
| | | | | >10G - 100G | 5/10/20 | TC500/1000 | <1000ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC1000/2000 | <2000ppm/V |
| **HMS-2512** | 1000[1] | 1000 | 2000 | 1M - 100M | 1/.../20 | TC25/50/100 | <10ppm/V |
| | | | | >100M - 500M | 1/5/10/20 | TC25/50/100 | <25ppm/V |
| | | | | >500M - 1G | 1/5/10/20 | TC100/250 | <25ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC250/500 | <100ppm/V |
| | | | | >10G - 100G | 5/10/20 | TC250/500 | <250ppm/V |
| | | | | >100G - 1T | 5/10/20 | TC500/1000 | <500ppm/V |
| **HMS-4020** | 1500[1] | 4000 | 6000 | 1M - 100M | 1/.../10 | TC25/50/100 | <5ppm/V |
| | | | | >100M - 500M | 0.5/1/5/10/20 | TC25/50/100 | <10ppm/V |
| | | | | >500M - 1G | 1/5/10/20 | TC25/50/100 | <10ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC50/100 | <25ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC100/250 | <100ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC250/500 | <250ppm/V |

**Note:**

- [1] At continuous power dissipation the dimensions of solder-pads have to secure sufficient heat-conduction.
- [2] TCR 25/50: Temperature range +25℃ ~+85℃； [3] VCR mesdured between 10V and 100V.
- Lower values of tolerance, TCR and VCR on request and agreement.

## Environmental Characteristic

| | | | |
|---|---|---|---|
| **Temperature range** | -55℃ ~ +155℃ | | |
| **Climatic category acc. to IEC 60068** | 55/155/56 | | |
| **Max. soldering temperature acc. IEC60068 T2-20, Ta Meth.1**[4] | 235℃ 5s | | |
| **Max. soldering temperature acc. IEC60068 T2-20, Tb Meth.1A** | 260℃ 10s | | |
| **Long term stability** | <1G | <10G | ≥10G |
| **Storage 125℃/1000h** | <1% | <2% | <5% |
| **Load life 70℃/1000h** | <0.5% | <1% | <2% |

**Note:**

- [4] **Up to 6 months after shipment resp, at storage in Nitrogen.**
- **Data not specified according CECC 40401-802.**

# Order Codes

## Order Codes (HMM) - Precision High Value Chip Resistors

| HMM | 0805 | 1G | M | E |
|---|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | | TCR (ppm/℃) | |
|---|---|---|---|---|---|---|---|---|
| HMM | 0805 | 125mW | 1M1 | 1.1MΩ | C | ±0.25% | C | ±25ppm/℃ |
| | 1206 | 250mW | 110M | 110MΩ | D | ±0.5% | D | ±50ppm/℃ |
| | 1210 | 350mW | 1G5 | 1.5GΩ | F | ±1% | E | ±100ppm/℃ |
| | 2010 | 500mW | 10G | 10GΩ | G | ±2% | L | ±250ppm/℃ |
| | 2512 | 1000mW | 1T | 1TΩ | J | ±5% | I | ±500ppm/℃ |
| | 4020 | 1500mW | 10T | 10TΩ | K | ±10% | R | ±1000ppm/℃ |
| | | | | | M | ±20% | S | ±2000ppm/℃ |
| | | | | | N | ±30% | | |

## Order Codes (HMS) - Conventional Precision Megohm Chip Resistors

| HMS | 0402 | 1G | M | E |
|---|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | | TCR (ppm/℃) | |
|---|---|---|---|---|---|---|---|---|
| HMS | 0402 | 50mW | 1M1 | 1.1MΩ | D | ±0.5% | C | ±25ppm/℃ |
| | 0603 | 75mW | 110M | 110MΩ | F | ±1% | D | ±50ppm/℃ |
| | 0805 | 125mW | 1G5 | 1.5GΩ | G | ±2% | E | ±100ppm/℃ |
| | 1206 | 250mW | 10G | 10GΩ | J | ±5% | L | ±250ppm/℃ |
| | 1210 | 350mW | 1T | 1TΩ | K | ±10% | I | ±500ppm/℃ |
| | 2512 | 1000mW | | | M | ±20% | R | ±1000ppm/℃ |
| | 4020 | 1500mW | | | N | ±30% | S | ±2000ppm/℃ |
| | | | | | | | T | ±3000ppm/℃ |

- **Note: If no requirements for TCR, measuring voltage and taping are given, the standard value (highest value in table) will be supplied, measuring voltage of 10V is used and packaging is bulk.**

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# Ultra-Precision High-Power High-Voltage Resistors (HI80)

## Product Introduction

**New ruthenium material, extended ultra-precision high-power high-voltage resistors (HI80) breakthrough 300W, precision narrowed to 0.1%.**

**Features :**

- Thick film sensorless design.
- Wide range of resistance.
- Bottom temperature coefficient and high precision.
- Resistance to humidity, heat and electricity.
- Long term performance, stable and reliable.

**Applications :**

- Impulse voltage generators,
- Arc furnace damping, Energy research,
- Pulse modulators, Radar Pulse-forming networks,
- Capacitor crowbar circuits, High voltage snubber circuits,
- X-ray/imaging equipment, and EMI/lightning supression.


Token electronic ultra-precision high-power high-voltage resistor (HI80) family series take advantage of new ultra-fine ruthenium material, 95% aluminum oxide ceramic rods, and thick film non-inductive Serpentine Pattern Design. Precision can be narrowed to ±0.1%, and power breakthrough 300W. (HI80) featuring heat-resistant, humidity-resistant, resisting electrical pulse, and stable and reliable long-term performance, is specifically designed for general purpose industrial high voltage system applications.

(HI80) family of high-voltage resistors includes conventional high-voltage resistors (HI80D), conventional miniaturized high-voltage resistors (HI80DS), high-power high-voltage resistors (HI80P), and ultra-precision high-voltage resistors (HI80T).

Conventional high voltage resistors (HI80D) have a wide resistance range of 200Ω ~ 10GΩ, rated power 2.5W ~ 20W, accuracy tolerance F (± 1%), J (± 5%), K (± 10%), the lowest temperature coefficient down to 50ppm on request, and the standard temperature coefficient of 100ppm.

(HI80DS) All-film conventional miniature high-voltage resistor relative to (hi80d), with small size, higher power 3W ~ 30W, withstand higher voltage, and none-inductance. The temperature coefficient of the lowest can reach 50ppm (25℃ ~105℃), the standard temperature coefficient of 100ppm. Precision Tolerances F (±1%), J (±5%), K (±10%).

High power high voltage resistors (HI80P) have high rated power 20W ~ 300W, resistance range 1Ω ~ 1GΩ, precision tolerance D (± 0.5%), F (± 1%), J (± 5%), K (± 10% ), The temperature coefficient of up to 25ppm (on request), the standard temperature coefficient of 50ppm.

Ultra-precision high-voltage resistor (HI80T) characters 15ppm temperature coefficient, the standard temperature coefficient is 25ppm, the precision tolerance has B (± 0.1%), D (± 0.5%), F (± 1%), the resistance range 1Ω ~ 500MΩ, and the rated power 0.8W ~ 6W to choose from.

Token (HI80) Voltage Resistor series is able to absorb large amounts of energy at high voltage while remaining non-inductive and heavy load characteristics. The HI80 conforms to the RoHS directives and Lead-free. Customed design, and tighter tolerances are available on request. For customed designs, tighter tolerances, non-standard technical requirements, or custom special applications, please contact our sales for more information or link to Token official website "High Voltage Resistors" to get more information.

# HI80D Spec.

## Conventional High Voltage Resistor Construction (HI80D)


| | |
|---|---|
| Membrane Material (a) | Ruthenium Paste |
| Base Material (b) | 95% Aluminum Oxide, $Al_2O_3$ |
| Encapsulating Material (c) | High Temperature Silicone Resin |

## Specifications & Painted Dimensions (Unit: mm) (HI80D)

| Part Number | Rated power (W) Ambient temperature (75℃) | Max. continuous Oper. Volt (KV) | Resistance range (Ω) | | Dimensions (mm) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | L ±0.5mm | E ±3mm | D ±0.5mm | d ±0.1mm |
| **HI80D-15** | 0.5 | 3.0 | 200 | 1G | 15 | 30 | 5.0 | 0.8 |
| **HI80D-20** | 2.5 | 4.8 | 200 | 1G | 20 | 28 | 8.0 | 1.0 |
| **HI80D-26** | 3.7 | 6.4 | 250 | 1G | 27 | 28 | 8.0 | 1.0 |
| **HI80D-32** | 4.5 | 8.0 | 300 | 1.5G | 33 | 28 | 8.0 | 1.0 |
| **HI80D-39** | 5.2 | 12.8 | 400 | 1.5G | 39 | 28 | 8.0 | 1.0 |
| **HI80D-52** | 7.5 | 16 | 500 | 2.5G | 52 | 28 | 8.0 | 1.0 |
| **HI80D-78** | 11 | 24 | 900 | 4G | 78 | 28 | 8.0 | 1.0 |
| **HI80D-103** | 12 | 32 | 1K2 | 6G | 103 | 28 | 8.0 | 1.0 |
| **HI80D-124** | 15 | 40 | 1K5 | 8G | 124 | 28 | 8.0 | 1.0 |
| **HI80D-154** | 20 | 45 | 2K | 10G | 154 | 28 | 8.0 | 1.0 |


Conventional High Voltage Resistor Painted Dimensions (Unit: mm) - (HI80D)

# HI80DS Spec.

## Conventional Miniature High Voltage Resistor Construction (HI80DS)


| | |
|---|---|
| Membrane Material (a) | Ruthenium Paste |
| Base Material (b) | 95% Aluminum Oxide, $Al_2O_3$ |
| Encapsulating Material (c) | High Temperature Silicone Resin |

## Conventional Miniature Specifications & Painted Dimensions (Unit: mm) (HI80DS)

| Part Number | Rated power (W) Ambient temperature (75℃) | Max. continuous Oper. Volt (KV) | Resistance range (Ω) | | Dimensions (mm) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Min. | Max. | L ±0.5mm | E ±3mm | D ±0.5mm | d ±0.1mm |
| **HI80DS-20** | 3 | 4.8 | 200 | 1G | 20.2 | 30 | 8.2 | 1.0 |
| **HI80DS-26** | 5 | 6.4 | 250 | 1G | 26.9 | 30 | 8.2 | 1.0 |
| **HI80DS-32** | 7 | 8.0 | 300 | 1.5G | 33.0 | 30 | 8.2 | 1.0 |
| **HI80DS-39** | 9 | 12.8 | 400 | 1.5G | 39.5 | 30 | 8.2 | 1.0 |
| **HI80DS-52** | 10 | 16 | 500 | 2.5G | 52.1 | 30 | 8.2 | 1.0 |
| **HI80DS-78** | 15 | 24 | 900 | 4G | 77.7 | 30 | 8.2 | 1.0 |
| **HI80DS-103** | 20 | 32 | 1K2 | 6G | 102.9 | 30 | 8.2 | 1.0 |
| **HI80DS-124** | 25 | 40 | 1K5 | 8G | 123.7 | 30 | 8.2 | 1.0 |
| **HI80DS-154** | 30 | 45 | 2K | 10G | 153.7 | 30 | 8.2 | 1.0 |


Conventional Miniature Specifications & Painted Dimensions (Unit: mm) - (HI80DS)

# HI80T Spec.

## Conventional High Voltage Resistor Construction (HI80D)


| | |
|---|---|
| **Membrane Material (a)** | Ruthenium Paste |
| **Base Material (b)** | 95% Aluminum Oxide, $Al_2O_3$ |
| **Encapsulating Material (c)** | High Temperature Silicone Resin |

## Ultra-Precision High Voltage Resistor Specifications (HI80T)

| Part Number | Rated power (W) | Max. continuous Oper. Volt (KV) | Resistance range (Ω) | L ±0.5mm | E ±3mm | D ±0.5mm | d ±0.1mm |
|---|---|---|---|---|---|---|---|
| **HI80T-20** | 0.8 | 3 | 1 ~ 500M | 20 | 30 | 8 | 1 |
| **HI80T-26** | 1.0 | 4 | 1 ~ 500M | 27 | 30 | 8 | 1 |
| **HI80T-32** | 1.2 | 5 | 1 ~ 500M | 33 | 30 | 8 | 1 |
| **HI80T-39** | 1.5 | 6 | 1 ~ 500M | 39 | 30 | 8 | 1 |
| **HI80T-52** | 2 | 10 | 1 ~ 500M | 52 | 30 | 8 | 1 |
| **HI80T-78** | 3 | 15 | 1 ~ 500M | 78 | 30 | 8 | 1 |
| **HI80T-103** | 4 | 20 | 1 ~ 500M | 103 | 30 | 8 | 1 |
| **HI80T-124** | 5 | 25 | 1 ~ 500M | 124 | 30 | 8 | 1 |
| **HI80T-154** | 6 | 30 | 1 ~ 500M | 154 | 30 | 8 | 1 |


Ultra-Precision High Voltage Resistor Unpainted Dimensions (Unit: mm) - (HI80T)

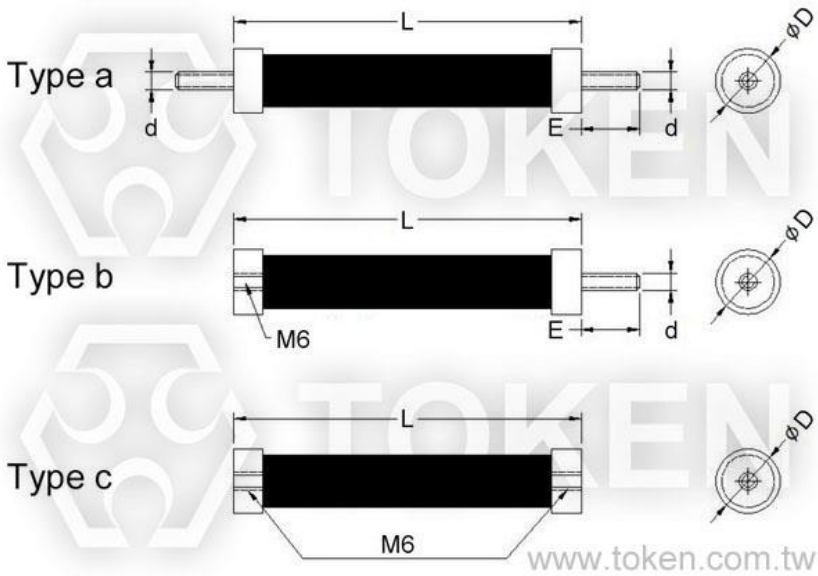
# HI80P Specifications

## High-Power High Voltage Resistor Construction (Unit: mm) (HI80P)


| | |
|---|---|
| Membrane Material (a) | **Ruthenium Paste** |
| Base Material (b) | **95% Aluminum Oxide, $Al_2O_3$** |
| Encapsulating Material (c) | **High Temperature Silicone Resin** |
| Cap (d) | **Nickel Plating Copper** |

## High-Power High Voltage Resistor Specifications (Unit: mm) (HI80P)

| Part Number | Rated power (W) | Max. continuous Oper. Volt (KV) | Resistance range (Ω) | L ±1mm | E ±1mm | D ±0.5mm | d ±0.01mm |
|---|---|---|---|---|---|---|---|
| **HI80P-20** | 20 | 30 | 1 ~ 1G | 116 | 10 | 17 | M6 |
| **HI80P-30** | 30 | 30 | 1 ~ 1G | 116 | 10 | 19 | M6 |
| **HI80P-50** | 50 | 30 | 1 ~ 1G | 116 | 10 | 21 | M6 |
| **HI80P-80** | 80 | 30 | 1 ~ 1G | 130 | 10 | 28 | M6 |
| **HI80P-100** | 100 | 35 | 1 ~ 1G | 160 | 10 | 28 | M6 |
| **HI80P-150** | 150 | 60 | 1 ~ 1G | 210 | 10 | 28 | M6 |
| **HI80P-200** | 200 | 60 | 1 ~ 1G | 260 | 10 | 28 | M6 |
| **HI80P-300** | 300 | 80 | 1 ~ 1G | 310 | 10 | 33 | M6 |




**High-Power High Voltage Resistor Dimensions (Unit: mm) - (HI80P)**

# Environmental Characteristics

## Technical Characteristics - (HI80)

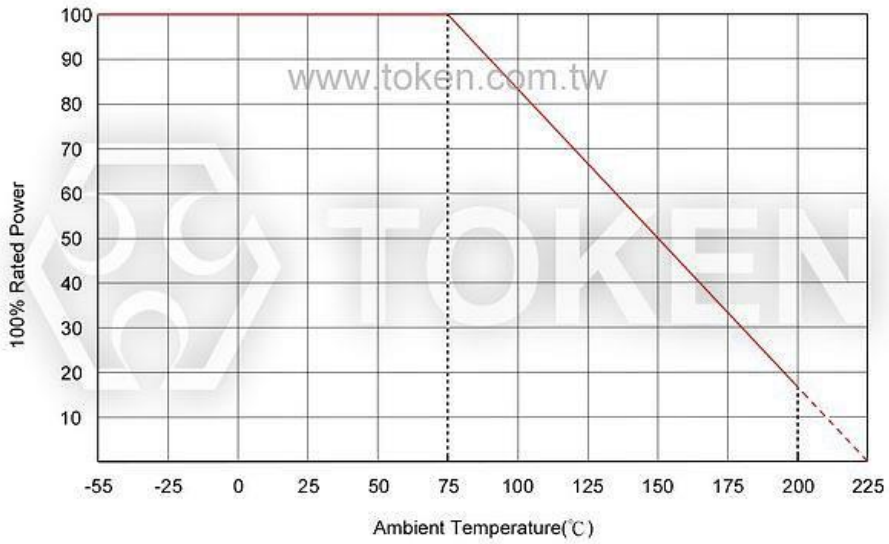
| Part Number | Resistance range (Ω) | Tolerance (%) | TCR @25℃ (-55℃ ~ +105℃) | Insulation withstand voltage | Insulation resistance | Operating temp. range |
|---|---|---|---|---|---|---|
| **HI80D** | 200 ~ 10G | ±1% ~ ±10% | ±100ppm/℃, (±50ppm/℃ on request) | 1000VDC | ≥ 10GΩ | -55℃ ~ +225℃ |
| **HI80DS** | 200 ~ 10G | ±5% ~ ±10% | ±100ppm/℃, (±50ppm/℃ on request) | | | |
| **HI80T** | 1 ~ 500M | ±0.1% ~ ±1% | ±25ppm/℃, (±15ppm/℃ on request) | | | |
| **HI80P** | 1 ~ 1G | ±0.5% ~ ±10% | ±50ppm/℃, (±25ppm/℃ on request) | | | |

## Environmental Characteristics - (HI80)

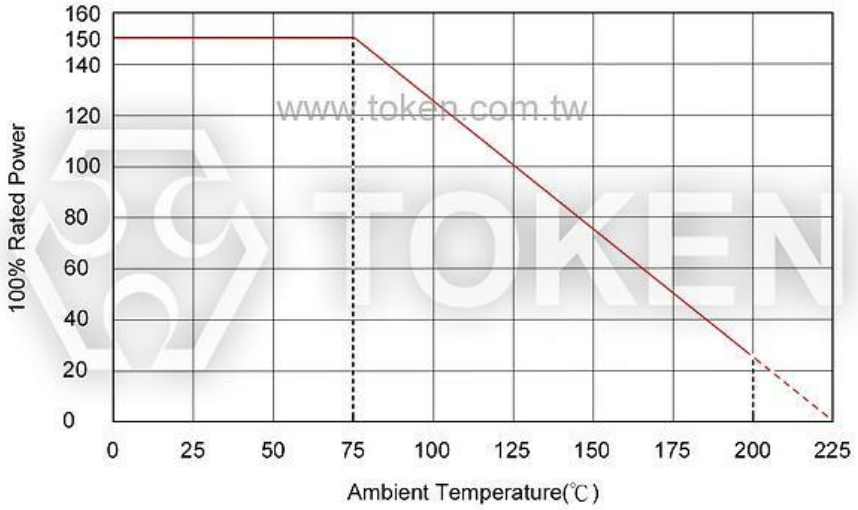
| Inspection item | Inspection method | Performance requirement |
|---|---|---|
| **Overload** | 5 times the rated power, but not more than 1.5 times the maximum continuous operating voltage, 5 seconds | $\Delta R \leq \pm(0.2\%R + 0.01\Omega)$ |
| **Load life** | 1000 hours under rated power | $\Delta R \leq \pm(0.5\%R + 0.01\Omega)$ |
| **Steady-state damp heat** | 40℃, RH ≥ 95%, 240h | $\Delta R \leq \pm(0.4\%R + 0.01\Omega)$ |
| **Temperature shock** | -65℃ ~ 155℃, 5 cycle | $\Delta R \leq \pm(0.2\%R + 0.01\Omega)$ |

# Power Derating Curve

## Power Derating Curve - (HI80)




## Power Derating Curve - (HI80DS)



# Serpentine Pattern

## Advance Technique of Non-Inductive & Serpentine Pattern (HI80)

### Non-Inductive Performance:

- HI80 Non-Inductive Design which uses a serpentine resistive pattern that offers for zigzagging lines to carry current in opposite directions, thereby achieving maximum neutralization of flux fields over the entire length of the resistor.
- This efficient non-inductive construction without derating of any performance advantages is ideal for applications where high frequency is required.

### Serpentine Pattern Screen Printing Design:

- Type High Voltage HI80 Precision Resistors combine Token's Non-Inductive serpentine pattern, high thru-put screen printed silicone coating.
- The alignment of the gap in the serpentine resistor pattern with the gap in the coating pattern provides a complete encapsulation of the resistor element.
- The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.

# Order Codes

## Order Codes (HI80D) Conventional High Voltage Resistor

| HI80D | 39 | 1G | F |
|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | |
|---|---|---|---|---|---|---|
| HI80D | 20 | 2.5W | 1K1 | 1.1KΩ | F | ±1% |
| | 26 | 3.7W | 110K | 110KΩ | J | ±5% |
| | 39 | 5.2W | 1M1 | 1.1MΩ | K | ±10% |
| | 103 | 12W | 110M | 110MΩ | | |
| | 154 | 20W | 1G5 | 1.5GΩ | | |
| | | | 10G | 10GΩ | | |

- Note: TCR 100ppm/℃, (±50ppm/℃ on request).

## Order Codes (HI80DS) Conventional Miniature high voltage resistors

| HI80DS | 124 | 1G | F |
|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | |
|---|---|---|---|---|---|---|
| HI80DS | 20 | 3W | 1K1 | 1.1KΩ | J | ±5% |
| | 32 | 7W | 110K | 110KΩ | K | ±10% |
| | 78 | 15W | 1M1 | 1.1MΩ | | |
| | 103 | 20W | 110M | 110MΩ | | |
| | 154 | 30W | 1G5 | 1.5GΩ | | |
| | | | 10G | 10GΩ | | |

- Note: TCR 100ppm/℃, (±50ppm/℃ on request).

## Order Codes (HI80T) Ultra-Precision High Voltage Resistor

| HI80T | 32 | 500M | B |
|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | |
|---|---|---|---|---|---|---|
| HI80T | 20 | 0.8W | 10 | 10Ω | B | ±0.1% |
| | 32 | 1.2W | 1K1 | 1.1KΩ | D | ±0.5% |
| | 52 | 2W | 110K | 110KΩ | F | ±1% |
| | 154 | 6W | 1M1 | 1.1MΩ | | |
| | | | 500M | 500MΩ | | |

- Note: TCR ±25ppm/℃, (±15ppm/℃ on request).

## Order Codes (HI80P) High-Power High Voltage Resistor

| HI80P | 20 | a | 1G | F |
|---|---|---|---|---|

| Part Number | Rated Power (W) | | Type | Resistance Value (Ω) | | Resistance Tolerance (%) | |
|---|---|---|---|---|---|---|---|
| HI80P | 20 | 20W | a | 10 | 10Ω | D | ±0.5% |
| | 30 | 30W | b | 1K1 | 1.1KΩ | F | ±1% |
| | 150 | 150W | c | 110K | 110KΩ | J | ±5% |
| | 300 | 300W | | 1M1 | 1.1MΩ | K | ±10% |
| | | | | 110M | 110MΩ | | |
| | | | | 10G | 10GΩ | | |

- **Note: TCR ±50ppm/℃, (±25ppm/℃ on request).**

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# Ultra-Precision High Voltage Film Resistors (HI82)

## Product Introduction

### Up to 10TΩ, (HI82) sets a new standard for high value, ultra-stable precision high voltage resistors.

**(HI82) Family Members:**

- (HI82D) Precision High-Voltage High-Value Resistor series, resistance range from 1mΩ to 10TΩ, precision tolerance from 30% to 0.25%, rated power has 1w/1.2w/3w selectable.
- (HI82H) Conventional Precision High-Voltage High Resistance Resistor series, various precision tolerance 1%/2%/5%/10%/20%/30%/50% available, four kinds of rated power 0.5w/0.7/1w/2w selectable, resistance from 1MΩ to 1TΩ.
- (HI82T) High Power Voltage Resistor series, maximum operating voltage up to 35KV, 30W high rated power to 0.125W, resistance range from 1Ω to 500MΩ, tolerance range 0.5% to 5%.

**Features :**

- High voltage thick film precision technology resistor.
- Resistance up to 10TΩ. Low TCR, low VCR.
- Radial leads, variable lead spacing by bending.
- Climatic protection by silicone coating

**Applications :**

- Impulse voltage generators,
- Arc furnace damping, Energy research,
- Pulse modulators, Radar Pulse-forming networks,
- Capacitor crowbar circuits, High voltage snubber circuits,


The high performance high-voltage applications require the use of high voltage resistors in applications with long-term stability and good temperature coefficient. Token Electronics has introduced ultra-stable high-precision HI82 high voltage resistors to meet these needs.

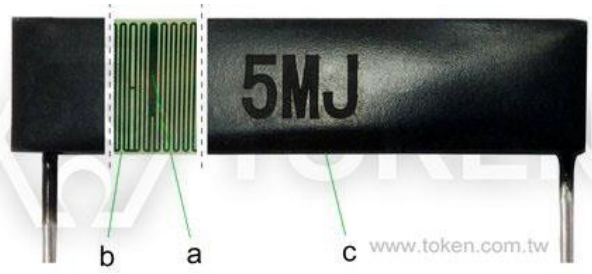
Token's unique precision full film and serpentine transfer pattern (serpentine patterns design), using a specifical high speed fine-line thick film dispensing system, developed a series of high voltage application resistor components with excellent performance.Especially in smaller sizes and higher resistance-value components.

Through the use of alloy ruthenium paste material, and 95% high aluminum planar ceramic chip, Token can control the manufacture of very precise precision and stabilize the performance parameters of important high-voltage operating temperature range. (HI82) thick film resistor combined with close tracking design, with low current noise, linear current voltage, low TCR, high temperature durability, wide resistance range, long-term stability, and low-cost advantages.

Token HI82 ultra-precision high-voltage resistors conform with RoHS and lead-free standards and provide more competitive prices and fast delivery service. For technical specifications and special applications, please contact your Token's sales representative, or link to Token official website "High Voltage Resistors" to get more information.

# Dimensions

## Composition Structure (HI82)



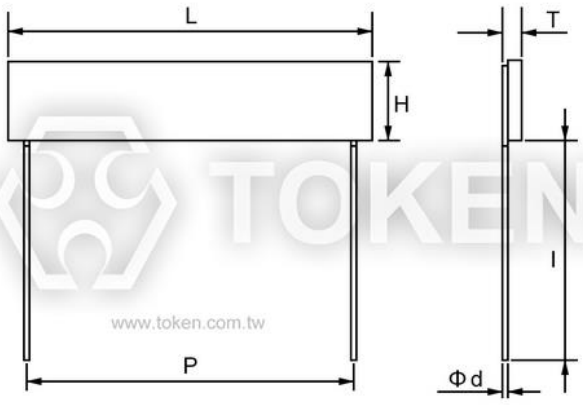

| | |
|---|---|
| **Membrane Material (a)** | Ruthenium Paste |
| **Base Material (b)** | 95% Aluminum Oxide, $Al_2O_3$ |
| **Encapsulating Material (c)** | High Temperature Silicone Resin |

## Ultra-precision high value voltage Resistor Dimensions (Unit: mm)

| HI82D Ultra-precision high-voltage high-value resistor | | | | | | |
|---|---|---|---|---|---|---|
| Part Number | L ±1mm | H ±1mm | T ±0.5mm | P ±2mm | I ±3mm | d ±0.1mm |
| HI82D-1W | 30.0 | 6.0 | 1.4 | 27.5 | 20 | 0.4 |
| HI82D-1BW | 40.0 | 6.0 | 1.4 | 37.8 | 20 | 0.4 |
| HI82D-3W | 50.0 | 12.5 | 1.4 | 47.8 | 20 | 0.4 |
| Note: L = Length, H = Width, T = Thickness, I = Length of steel wire, d = Wire diameter。<br>P = Standard lead spacing ( Other spacing possible by bending )。 | | | | | | |

| HI82H Conventional precision high-voltage high-resistance resistor | | | | | | |
|---|---|---|---|---|---|---|
| Part Number | L ±1mm | H ±1mm | T ±0.5mm | P ±2mm | I ±3mm | d ±0.1mm |
| HI82H-05W | 3.2 | 2.5 | 0.9 | 2.0 | 20 | 0.4 |
| HI82H-07W | 3.8 | 5.0 | 1.0 | 2.5 | 20 | 0.4 |
| HI82H-1W | 6.3 | 3.5 | 1.0 | 5.5 | 20 | 0.4 |
| HI82H-2W | 10.2 | 5.1 | 1.0 | 9.5 | 20 | 0.4 |
| Note: L = Length, H = Width, T = Thickness, I = Length of steel wire, d = Wire diameter。<br>P = Standard lead spacing ( Other spacing possible by bending )。 | | | | | | |

| HI82T High-power voltage resistor | | | | | | |
|---|---|---|---|---|---|---|
| Part Number | L ± 1mm | H ± 1mm | T ± 0.5mm | P ± 2mm | I ± 3mm | d ± 0.1mm |
| HI82T-0125W | 8 | 3.5 | 2 | 5.7 | 10 | 0.6 |
| HI82T-025W | 10 | 5 | 2 | 7.7 | 10 | 0.6 |
| HI82T-04W | 25 | 5 | 2 | 22.5 | 20 | 0.6 |
| HI82T-05W | 35 | 5 | 2 | 32 | 20 | 0.6 |
| HI82T-1W | 30 | 8 | 2 | 27 | 20 | 0.6 |
| HI82T-2SW | 25 | 10 | 2 | 22 | 20 | 0.6 |
| HI82T-2NW | 22 | 18 | 2 | 19 | 20 | 0.6 |
| HI82T-2BW | 45 | 10 | 3 | 41.5 | 20 | 0.8 |
| HI82T-3W | 60 | 10 | 3 | 56.5 | 20 | 0.8 |
| HI82T-5W | 80 | 20 | 4 | 76.5 | 40 | 1.0 |
| HI82T-10W | 97 | 23 | 4 | 93.5 | 40 | 1.0 |
| HI82T-20W | 100 | 35 | 4 | 96.5 | 40 | 1.0 |
| HI82T-30W | 100 | 48 | 4 | 96.5 | 40 | 1.0 |
| Note: L = Length, H = Width, T = Thickness, I = Length of steel wire, d = Wire diameter。<br>P = Standard lead spacing ( Other spacing possible by bending )。 | | | | | | |




Ultra-precision high value voltage Resistor Dimensions (Unit: mm)

# HI82D Electrical Charcs.

## Technical Characteristics - (HI82D)

| Part Number | Power Rating $P_{70}$(W) | Working Voltage Max. (V) | Resistance Range (Ω) | Tolerance (%) | TCR[1] (ppm/℃) | VCR[2] (ppm/V) |
|---|---|---|---|---|---|---|
| **HI82D-1W** | 1.0 | 10KV | 1M - 100M | 0.25/0.5/5/10 | 25/50/100 | 2ppm/V |
| | | | 100M - 1G | 1/2/5/10/20 | 50/100/250 | 5ppm/V |
| | | | 1G - 100G | 5/10/20/30 | 250/500 | 20ppm/V |
| | | | 100G - 1T | 5/10/20/30 | 500/1000 | 100ppm/V |
| **HI82D-1BW** | 1.2 | 20KV | 1M - 100M | 0.25/0.5/5/10 | 25/50/100 | 1ppm/V |
| | | | 100M - 1G | 1/2/5/10/20 | 50/100/250 | 2ppm/V |
| | | | 1G - 100G | 5/10/20/30 | 250/500 | 10ppm/V |
| | | | 100G - 1T | 5/10/20/30 | 500/1000 | 50ppm/V |
| **HI82D-3W** | 3.0 | 30KV | 1M - 100M | 0.25/0.5/5/10 | 25/50/100 | 1ppm/V |
| | | | 100M - 1G | 1/2/5/10/20 | 25/50/100 | 1ppm/V |
| | | | 1G - 100G | 5/10/20/30 | 100/250 | 5ppm/V |
| | | | 100G - 1T | 5/10/20/30 | 250/500 | 25ppm/V |
| | | | 1T - 10T | 10/20/30 | 500/1000 | 100ppm/V |

**Note:**

- **[1] TCR 25/50: Temperature range +25℃ ~+85℃ ; [2] The voltage coefficient is measured between 10V and 100V.**
- **Operating Voltage = $\sqrt{(P * R)}$ , or Max. Operating Voltage listed in above table whichever is lower.**
- **Optional specifications on request.**

## Environmental Characteristic

| | | |
|---|---|---|
| **Continuous operating voltage** | V = $\sqrt{(P * R)}$ , or Max. Operating Voltage listed in above table whichever is lower. | |
| **Measuring voltage** | Standard measuring voltage is 10V (50V for values >1G).<br>Different voltages on request. | |
| **TCR ppm/℃** | Temperature range +25℃ ~+125℃ | |
| | TCR25/50 | |
| | Values above 1G: +25℃ ~+85℃. | |
| **Operating temp. range** | -55℃ ~+125℃ | |
| **Climatic category to EN 60068-1** | 55/125/56 | |
| **Humidity-/contact protection** | Lacquer coating. Resistant to most solvents. Isopropyl alcohol recommended for cleaning;<br>Do not use acetone or methylene choloride. Avoid mechanical stress to coating. | |
| **Stability: Storage 125℃/1000Hrs** | ≤10G | >10G |
| | <1% | <2% |
| **Stability at Max. voltage/1000Hrs** | ≤10G | >10G |
| | <1% | <2% |

# HI82H Electrical Charcs.

## Technical Characteristics - (HI82H)

| Part Number | Power Rating $P_{70}$(W) | Working Voltage Max. (V) | | Resistance Range (Ω) | Tolerance (%) | TCR[1] (ppm/℃) | VCR[2] (ppm/V) |
|---|---|---|---|---|---|---|---|
| | | trimmed | untrimmed | | | | |
| **HI82H-05W** | 0.5 | 300 | 1000 | 1M - 100M | 1/2/5/10 | TC25/50/100 | <50ppm/V |
| | | | | >100M - 500M | 2/5/10/20 | TC50/100/250 | <100ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC100/250 | <100ppm/V |
| | | | | >1G - 10G | 5/10/20/30 | TC250/500 | <500ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC500/1000 | <1000ppm/V |
| | | | | >100G - 1T | - | - | - |
| **HI82H-07W** | 0.7 | 300 | 500 | 1M - 100M | 2/5/10 | TC50/100 | <50ppm/V |
| | | | | >100M - 500M | 5/10/20 | TC100/250 | <100ppm/V |
| | | | | >500M - 1G | 5/10/20 | TC100/250 | <100ppm/V |
| | | | | >1G - 10G | 10/20/30 | TC250/500 | <500ppm/V |
| | | | | >10G - 100G | 10/20/30 | TC500/1000 | <1000ppm/V |
| | | | | >100G - 1T | - | - | - |
| **HI82H-1W** | 1.0 | 1200 | 2500 | 1M - 100M | 1/.../10 | TC25/50/100 | <10ppm/V |
| | | | | >100M - 500M | 1/2/5/10/20 | TC25/50/100 | <25ppm/V |
| | | | | >500M - 1G | 1/2/5/10/20 | TC100/250 | <25ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC100/250 | <100ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC250/500 | <250ppm/V |
| | | | | >100G - 1T | 10/20/30/50 | TC500/1000 | <500ppm/V |
| **HI82H-2W** | 2.0 | 4000 | 6000 | 1M - 100M | 1/.../10 | TC25/50/100 | <5ppm/V |
| | | | | >100M - 500M | 1/2/5/10/20 | TC25/50/100 | <10ppm/V |
| | | | | >500M - 1G | 1/2/5/10/20 | TC25/50/100 | <10ppm/V |
| | | | | >1G - 10G | 2/5/10/20 | TC50/100 | <25ppm/V |
| | | | | >10G - 100G | 5/10/20/30 | TC100/250 | <100ppm/V |
| | | | | >100G - 1T | 5/10/20/30 | TC250/500 | <250ppm/V |

**Note:**

- **[1] TCR 25/50: Temperature range +25℃ ~+85℃； [2] The voltage coefficient is measured between 10V and 100V.**
- **Operating Voltage = $\sqrt{(P * R)}$ , or Max. Operating Voltage listed in above table whichever is lower.**
- **Optional specifications on request.**

## Environmental Characteristic

| | | | |
|---|---|---|---|
| **Continuous Operating Voltage** | V = $\sqrt{(P * R)}$ , or Max. Operating Voltage listed in above table whichever is lower. | | |
| **Measuring Voltage** | Standard measuring voltage is 10V (50V for values >1G).<br>Different voltages on request. | | |
| **TCR ppm/℃** | Temperature range +25℃ ~+125℃ | | |
| | TCR25/50 | | |
| | Values above 1G: +25℃ ~+85℃. | | |
| **Operating Temperature Range** | -55℃ ~+125℃ | | |
| **Climatic Category to EN 60068-1** | 55/125/56 | | |
| **Humidity-/Contact Protection** | Lacquer coating. Resistant to most solvents. Isopropyl alcohol recommended for cleaning;<br>Do not use acetone or methylene choloride. Avoid mechanical stress to coating. | | |
| **Stability: Storage 125℃/1000Hrs.** | ≤1G | ≤10G | >10G |
| | <1% | <2% | <5% |
| **Stability at Max. voltage/1000Hrs.** | ≤1G | ≤10G | >10G |
| | <0.5% | <1% | <2% |

# HI82T Electrical Charcs.

## Technical Characteristics - (HI82T)

| Part Number | Power Rating $P_{75}$(W) | Working Voltage Max. (V) | Resistance Range (Ω) | Tolerance (%) | TCR |
|---|---|---|---|---|---|
| **HI82T-0125W** | 1/8W | 2KV | 1 ~ 500M | ±0.5% ~ ±5% | ±100ppm/℃ |
| **HI82T-025W** | 1/4W | 4KV | 1 ~ 500M | | |
| **HI82T-04W** | 2/5W | 10KV | 1 ~ 500M | | |
| **HI82T-05W** | 1/2W | 15KV | 1 ~ 500M | | |
| **HI82T-1W** | 1W | 15KV | 1 ~ 500M | | |
| **HI82T-2SW** | 2W | 20KV | 1 ~ 500M | | |
| **HI82T-2NW** | 2W | 20KV | 1 ~ 500M | | |
| **HI82T-2BW** | 2W | 20KV | 1 ~ 500M | | |
| **HI82T-3W** | 3W | 25KV | 1 ~ 500M | | |
| **HI82T-5W** | 5W | 30KV | 1 ~ 500M | | |
| **HI82T-10W** | 10W | 35KV | 1 ~ 500M | | |
| **HI82T-20W** | 20W | 35KV | 1 ~ 500M | | |
| **HI82T-30W** | 30W | 35KV | 1 ~ 500M | | |

**Note :**

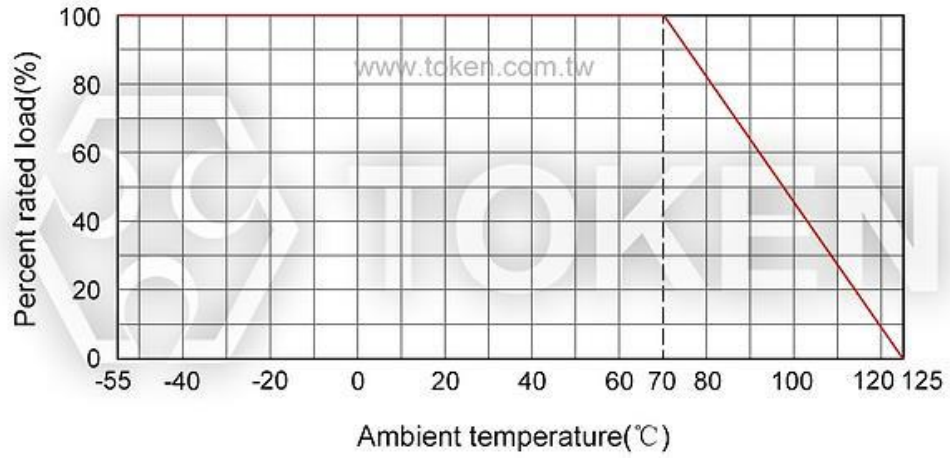
- **TCR @25℃ (25℃ ~+105℃). TCR ±15ppm/℃ on request.**
- **Operating Voltage = $\sqrt{(P * R)}$ , or Max. Operating Voltage listed in above table whichever is lower.**
- **Optional specifications on request.**

## Environmental Characteristic

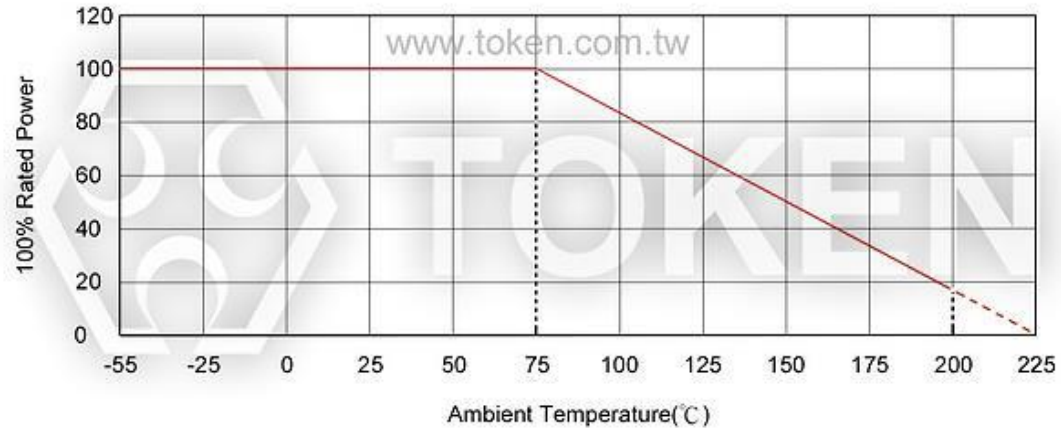
| | | | |
|---|---|---|---|
| **Continuous Operating Voltage** | V = $\sqrt{(P * R)}$, or Max. Operating Voltage listed in above table whichever is lower. | | |
| **Measuring Voltage** | Standard measuring voltage is 10V (50V for values >1G).<br>Different voltages on request. | | |
| **TCR ppm/℃** | Temperature range +25℃~+105℃ | | |
| | TCR 25/50 | | |
| | Values above 1G: +25℃~+105℃. | | |
| **Operating Temperature Range** | -55℃ ~ +225℃ | | |
| **Climatic Category to EN 60068-1** | 55/125/56 | | |
| **Insulation withstand voltage** | 1000VDC | | |
| **Insulation resistance** | ≥ 10GΩ | | |
| **Humidity-/Contact Protection** | Lacquer coating. Resistant to most solvents. Isopropyl alcohol recommended for cleaning;<br>Do not use acetone or methylene choloride. Avoid mechanical stress to coating. | | |
| **Stability: Storage 125℃/1000Hrs.** | ≤1G | ≤10G | >10G |
| | <1% | <2% | <5% |
| **Stability at Max. voltage/1000Hrs.** | ≤1G | ≤10G | >10G |
| | <0.5% | <1% | <2% |

# Power Derating Curve

## Power Derating Curve - (HI82D & HI82H)




## Power Derating Curve - (HI82T)



# Advance Technique

## Advance Technique of Non-Inductive & Serpentine Pattern (HI82)

### Non-Inductive Performance:

- HI82 Non-Inductive Design which uses a serpentine resistive pattern that offers for zigzagging lines to carry current in opposite directions, thereby achieving maximum neutralization of flux fields over the entire length of the resistor.
- This efficient non-inductive construction without derating of any performance advantages is ideal for applications where high frequency is required.

### Serpentine Pattern Screen Printing Design:

- Type High Voltage HI82 Precision Resistors combine Token's Non-Inductive serpentine pattern, high thru-put screen printed silicone coating.
- The alignment of the gap in the serpentine resistor pattern with the gap in the coating pattern provides a complete encapsulation of the resistor element.
- The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.

# Order Codes

## Order Codes (HI82D) - Ultra-Precision High-Voltage High Value Resistors

| HI82D | 1W | 1G | F | E |
|---|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | | TCR (ppm/℃) | |
|---|---|---|---|---|---|---|---|---|
| HI82D | 1W | 1.0W | 1M1 | 1.1MΩ | C | ±0.25% | C | ±25ppm/℃ |
| | 1BW | 1.2W | 110M | 110MΩ | D | ±0.5% | D | ±50ppm/℃ |
| | 3W | 3.0W | 1G5 | 1.5GΩ | F | ±1% | E | ±100ppm/℃ |
| | | | 10G | 10GΩ | J | ±5% | L | ±250ppm/℃ |
| | | | | | K | ±10% | I | ±500ppm/℃ |
| | | | | | M | ±20% | R | ±1000ppm/℃ |
| | | | | | N | ±30% | | |

## Order Codes (HI82H) - Conventional Precision High-Voltage High-Resistance Resistors

| HI82H | 2W | 1G | F | E |
|---|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | | TCR (ppm/℃) | |
|---|---|---|---|---|---|---|---|---|
| HI82H | 05W | 0.5W | 1M1 | 1.1MΩ | F | ±1% | C | ±25ppm/℃ |
| | 07W | 0.7W | 110M | 110MΩ | G | ±2% | D | ±50ppm/℃ |
| | 1W | 1.0W | 1G5 | 1.5GΩ | J | ±5% | E | ±100ppm/℃ |
| | 2W | 2.0W | 10G | 10GΩ | K | ±10% | L | ±250ppm/℃ |
| | | | 1T | 1TΩ | M | ±20% | I | ±500ppm/℃ |
| | | | | | N | ±30% | R | ±1000ppm/℃ |

## Order Codes (HI82T) - High-Power Voltage Resistors

| HI82T | 30W | 500M | F | E |
|---|---|---|---|---|

| Part Number | Rated Power (W) | | Resistance Value (Ω) | | Resistance Tolerance (%) | | TCR (ppm/℃) | |
|---|---|---|---|---|---|---|---|---|
| HI82T | 0125W | 1/8W | 10 | 10Ω | D | ±0.5% | E | ±100ppm/℃ |
| | 04W | 2/5W | 1M1 | 1.1MΩ | F | ±1% | C5 | ±15ppm/℃ on request |
| | 2BW | 2W | 110M | 110MΩ | J | ±5% | | |
| | 10W | 10W | 500M | 500MΩ | | | | |
| | 30W | 30W | | | | | | |

- **Note: If no requirements for TCR, (HI82D), (HI82H) and (HI82T) measuring voltage and taping are given, the standard value(highest value in table) will be supplied, measuring voltage of 10V.**

# General Information

### Cost Effective Complete Selection of High Voltage Components

Token high voltage series can be specified for use in industrial and general purpose high voltage systems, as well as a complete selection of high resistance, Hi-Meg, high-voltage, high frequency, and bulk ceramic resistors for higher average power dissipation. These High Resistance, High Frequency, High Resistance resistors combine the proven performance of Token resistance system with new cost efficient design elements and high voltage applications.

Detailed specifications, both mechanical and electrical, please contact our sales representative for more information.

### High Voltage Applications

Resistors produced from Serpentine Pattern Screen Printing Design or bulk ceramic materials have displayed several key advantages in demanding high-voltage situations, including both continuous-wave and pulse applications. These include radar and broadcast transmitters, x-ray systems, defibrillators, lasers, and high-voltage semiconductor process equipment applications, where resistors must handle peak voltage anywhere from 8KV to 75KV.

Typical applications include current limit in capacitor charge/discharge, crowbar, and tube-arc circuits. In these uses, bulk ceramic resistors provide low inductance, high average power per unit size, stability at high voltage, and durability at extreme peak-power levels. Film resistors typically cannot withstand high-voltage pulse applications.

### RF/Digital Loads and High-Frequency Applications

Token Non-Inductive Voltage Resistors are used extensively for high-frequency RF loads in broadcast and communication equipment because of their non-inductive characteristics. They provide excellent non-inductive power-handling capacity at frequencies up to the gigahertz range, with no sacrifice in power dissipation.

Film resistors may provide the needed non-inductive characteristics required by such RF applications, but they have size limitations and present reliability problems due to potential film burnout. This is especially true in advanced digital applications such as digital radio and TV transmitters involving pulses at high frequencies.

### Application Notes

- Due to the high voltage which can appear between the end cap and any adjacent metal part, resistors should be mounted at an adequate distance from other conductors.
- An appropriate number of resistors may be screwed together as a stick to provide an assembly which will be capable to withstanding any desired voltage, providing no individual resistor is subject to a greater stress or power dissipation than is recommended in its data sheet, and that appropriate anticorona devices are fitted.
- The axial termination should not be bent closer than twice the diameter of the terminal wire from the body of the resistor.
  When resistors are required to be potted, the preferred encapsulant is a silicone compound.

### Oil Immersion

For some high voltage applications it is required to immerse the components in oil or gas to reduce the effects of corona and surface tracking. A special lacquer protected version of the resistor is available, suitable for immersion in transformer oil or SF6.

# Carbon Composition Resistors (CCR)

## Product Introduction

### High pulse withstanding carbon composition resistors handle big peaks and pulses.

**Features :**

- Low inductance
- Solid rod carbon composition
- Power rating 1/4W and 2W
- Resistance range 1.8Ω ~ 22KΩ
- Resistance tolerance J(±5%), K(±10%) and M(±20%)
- High pulse withstanding and high energy capability
- Products with Pb-free Terminations and RoHS compliant

**Applications :**

- Strobe Lighting
- High Power Lighting
- Medical defibrillators
- Welding, Automotive
- Inrush Current Limiting
- High Voltage Power Supplies
- Protection (e.g. Discharge Circuits, Surge Protection)


The high pulse withstanding capability of the CCR series of carbon composition resistors from Token Electronics offers designers a compact solution for applications involving high voltages and high-energy pulses.

Though, many resistor manufacturers claim to offer carbon composition replacements. However, these wire wound or thick film alternatives do not fully match the pulse performance and low inductance of carbon composition.

Token's CCR series now offers the industry a carbon composition resistor made up of a solid rod of conductive composite material, the chemical composition of which is altered to produce different resistance values.

The main advantage of carbon composition is their pulse handling capability. This is due to the fact that the entire rod conducts and so the thermal mass is far higher, which results in a higher energy capability. Due to the need for higher peak voltages, the CCR range is perfect for vehicle ignition system applications, medical monitoring equipment and as output resistors in defibrillators.

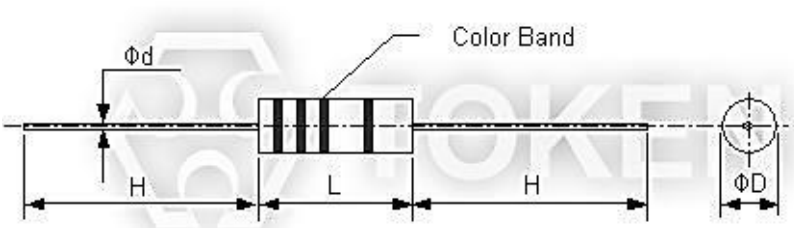
The standard carbon composition CCR resistor offers a power rating of 1/4W, 1/2W, 1W and 2W at 25 ℃ and is made up of a solid rod of conductive composition material, which can be altered to produce different resistance values. With a typical resistance range of 1.8Ω ~ 22KΩ, resistance tolerance is J(±5%), K(±10%) and M(±20%). Resistors with 5%, 10% and 20% tolerance have four bands indicating value and tolerance in accordance with IEC62.

Our custom solutions are designed to address your need for technical and economic success in a timely manner. Contact us with your specific needs. For more information, please link to Token official website "High Voltage Resistors".

# Dimensions

## Dimensions (Unit: mm) (CCR)

| Type | Power Rating | L | | Φ D | H | Φ d |
|---|---|---|---|---|---|---|
| CCR | 1/4W | 6.3 | +1.0<br>-1.0 | 2.3±0.3 | 27±2 | 0.60±0.02 |
| CCR | 1/2W | 9.5 | +0.5<br>-1.5 | 3.5±0.3 | 27±2 | 0.70±0.02 |
| CCR | 1W | 15 | +1.5<br>-0.5 | 6.0±0.3 | 28±2 | 0.80±0.02 |
| CCR | 2W | 18 | +0.5<br>-1.5 | 8.0±0.3 | 27±2 | 1.00±0.02 |




Carbon Composition (CCR) Dimensions (Unit: mm)

# Ratings Specifications

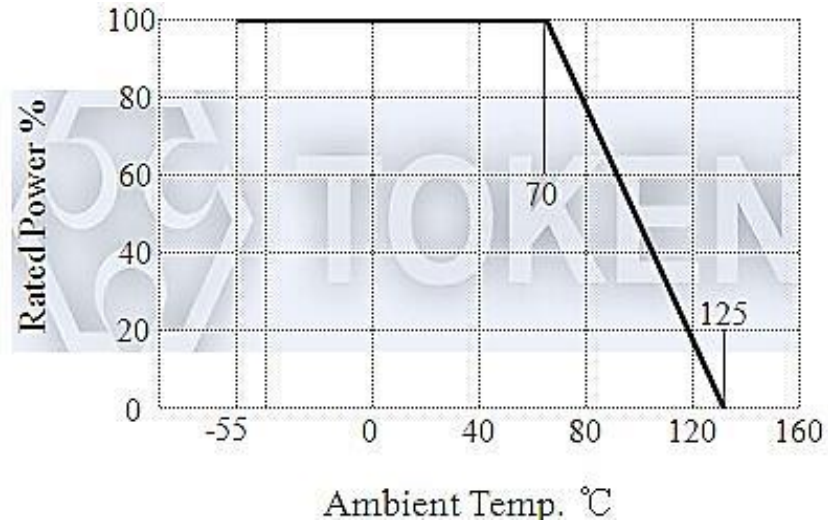
## Ratings Specifications (CCR)

| Type | Power Rating | Resistance Range | Tolerance E12,E24 | Max Working voltage | Max overload Voltage | Rated Ambient Temp. | Operating Temp. Range |
|---|---|---|---|---|---|---|---|
| CCR | 1/4W | 2.2Ω ~ 12MΩ | J(±5%)<br>K±10%<br>M±20% | 250V | 400V | +70℃ | -55℃ ~ +125℃ |
| CCR | 1/2W | 2.2Ω ~ 22MΩ | | 350V | 700V | +70℃ | -55℃ ~ +125℃ |
| CCR | 1W | 2.2Ω ~ 22KΩ | | 500V | 1000V | +70℃ | -55℃ ~ +125℃ |
| CCR | 2W | 1.8Ω ~ 10KΩ | | 500V | 1000V | +70℃ | -55℃ ~ +125℃ |

- Rated Voltage = $\sqrt{\text{Power Rating} * \text{Resistance Value}}$ or Max. Working voltage, whichever is lower.

# Derating Curve

## Derating Curve (CCR)




**(CCR) Derating Curve**

# Performance

## Performance (CCR)

| Description | | Performance Requirements | | | Test Method |
|---|---|---|---|---|---|
| **Resistance Temperature Coefficient** | | Resistance Range | Maximum Resistance Value Change % | | Test Temperature<br>+20℃ /-40℃ /+20℃ /+100℃ /+20℃ |
| | | | -40~+20℃ | +20~+100℃ | |
| | | <1KΩ | ±6.5% | ±5.0% | |
| | | 1.1KΩ ~10KΩ | ±10% | ±6.0% | |
| | | 11KΩ ~100KΩ | ±13% | ±7.5% | |
| | | 11KΩ ~1MΩ | ±15% | ±10% | |
| | | 1.1MΩ ~10MΩ | ±20% | ±15% | |
| | | >11MΩ | ±25% | ±20% | |
| **Short-time Overload** | | Δ R≤±2.5% | | | Rate Voltage*2.5 or maximum overload voltage (the lower)5sec. |
| **With Standing Voltage** | | No flashover or breakdown | | | 2times maximum working voltage 1 minute |
| **Terminal Strength** | Pulled | ΔR≤±2% No visible damage | | | Load 10N 10s |
| | Winded | | | | Load 10N 4*90° |
| | Twisted | | | | 3*360° in opposite direction |
| **Resistance to vibration** | | No visible damage | | | 10~50Hz 3 direction 2 hours each |
| **Solder-heat Resistance** | | ΔR≤±5% Marks legible, no visible damage | | | 350℃ 4mm from the body,3 seconds |
| **Solderability** | | At least 95% if the dipping surface must be covered by new solder, no flaws gathered. | | | 235℃ 2mm from the body,2 seconds |
| **Temperature Cycle** | | ΔR≤±2%<br>No visible damage | | | -40℃(30min.)/85℃(30min.)5 cycles |
| **Humidity** | | ΔR≤±10% No visible damage | | | 40℃ 95% RH 240 hours |
| **Load Life** | | ΔR≤±10%<br>No visible damage, marks legible | | | Rated voltage or maximum working voltage, 1.5 hours on, 0.5 hours off, 40℃ 1000 hours |

# Order Codes

## Order Codes (CCR)

| CCR | 1/2W | 120R | K | P |
|---|---|---|---|---|
| Part Number: CCR | Rated Power (W) | Resistance Value (Ω): 2R2 = 2.2Ω; 120R = 120Ω; 1M2 = 1.2MΩ; 22M = 22MΩ | Resistance Tolerance (%): J = ±5%; K = ±10%; M = ±20% | Package: P = Bulk |

# General Information

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