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Power Resistor Series

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Power Resistor Series

Heat Sink Mountable Resistor Application Guide

Heat Sink Mountable Resistor Application Guide

Application Guide for Heat Sink Mountable Power Film Resistors

Understanding Temperature and Power Rating

The maximum power rating of TO-style power film resistor is specified with the case temperature (TC) at 25℃. This is the same method proven and established by the power semiconductor industry. Case temperature is the temperature measured at the center of the resistor mounting surface which is in contact with the heat sink, while the resistor is under electrical load. Case temperature is different from the molded body temperature, the tab temperature, the lead temperature, or the ambient temperature (as shown in Figure 1).

Using case temperature we can determine the temperature of the resistor film (TJ). This is crucial factor since early device failures are usually traced to excessive temperatures of the resistor film. Excessive film temperatures will cause a drift of the resistance value or reduced component life. Proper thermal design followed by temperature measurements to verify the design, and consistent mounting procedures will avoid these problems.

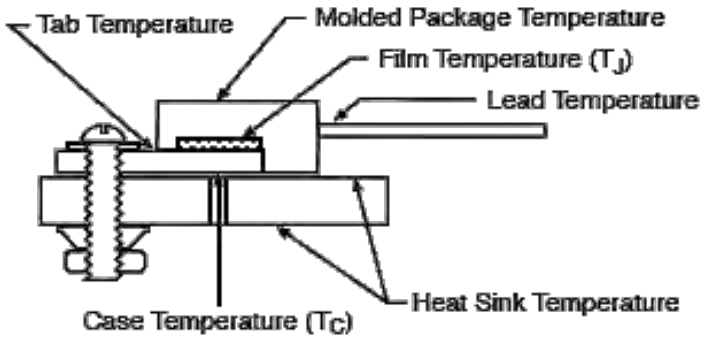


Figure 1 - **Understanding Temperature and Power Rating**

Assembly of Thermal Material

Due to variations in the mating surfaces between the resistor package and the heat sink air voids are created. These voids will substantially degrade the performance of TO-Style device. Thus, it is important to use a thermal interface material to fill these air voids. Several materials are available to reduce thermal resistance between the resistor and heat sink surface.

- **Thermal grease** is a combination of thermally conductive particles combined with a fluid forming a grease-like consistency. The fluid has typically been a silicone oil, however there are now very good "non-silicone" thermal greases. Thermal grease has been used for many years and typically has among the lowest thermal resistances of all thermal materials available.
- **Thermal pads**, an alternative to thermal grease, are available from a number of manufacturers. These thermally conductive pads are available in sheet form or in pre-cut shapes designed for various standard packages such as the TO-220 and TO-247. Thermal pads are spongy materials and require uniform pressure and firm to perform properly.

Selection of Hardware Assembly

Proper hardware is an extremely important consideration in a good thermal design. The hardware must maintain firm even pressure on the device, through thermal cycling, without deforming the heat sink or the device.

- Spring Clips are preferred by many designers in place of screw assembly for attaching Token TO-Style Power Resistors to the heat sink. These spring clips are available from several manufacturers which offers a number of standard springs and heat sinks specifically designed for clip mounting TO-220 and TO-247 packages. Spring clips offer many benefits for ease of assembly, but their biggest advantage is the consistent application of optimum force over the center of the power resistor (as shown in Figure 2).
- Screw Mounting - Belleville or Conical Washers used with a screw are an effective method for attachment to a heat sink. A Belleville washer is a conical spring washer designed to maintain constant pressure over a wide range of deflection. The washers withstand long-term temperature cycling without variation in pressure. Figure 3 shows some typical hardware configurations for screw mounting a TO-Style package to a heat sink. Flat washers, star washers, and most split lock washers should not be used in place of Belleville washers since they do not provide a constant mounting pressure and may cause damage to the resistor.

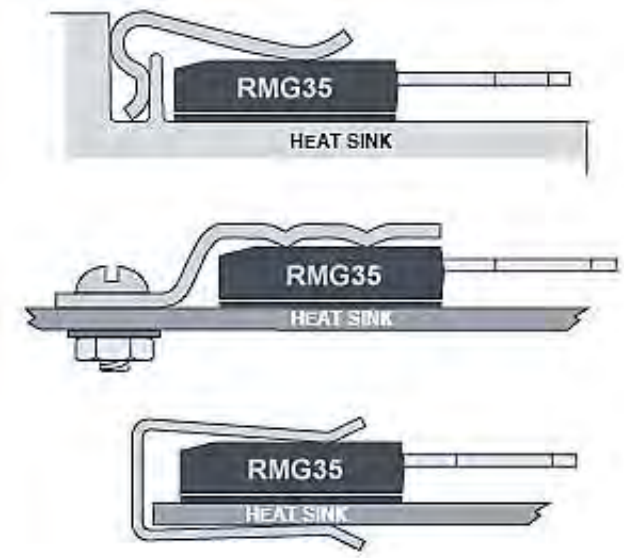


Figure 2 - Spring Clips Mounting Technigques

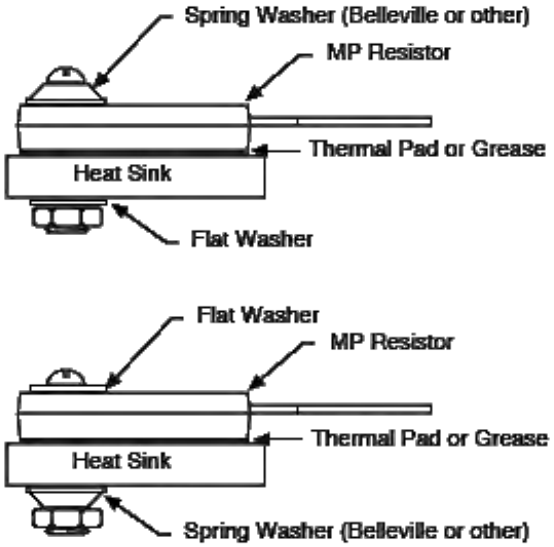


Figure 3 - Screw and Washer Mounting Techniques

Assembly Considerations

- Avoid using this TO-Style family of power resistors for SMT assembly.
- Plastic mounting hardware that softens or creeps at high operating temperatures must be avoided.
- Never let the head of the screw contact the resistor. Use a flat washer or conical washer to evenly distribute the force.
- Avoid sheet metal screws which have a tendency to roll up the edges of the hole and create damaging burrs on the heat sink.
- Rivets are not recommended. With rivets it is difficult to maintain consistent pressure and they can easily damage plastic packages.
- Do not over-torque. If the screw is too tight, the package may crack or have a tendency to bow up at the end farthest from the screw (lead end). Pneumatic tools are not recommended.

TO-220 Heat Sink Resistors (RMG20)

Product Introduction

Token power resistor TO-220 package deliver thermal efficiency.

Features :

- Molded Case for Protection and Easy to Mount.
- 20 Watt at 25℃ Case Temperature Heat Sink Mounted.
- Isolated Case, Non Inductive, TO-220 Style Power Package.

Applications :

- VHF Amplifiers, Snubber Circuits,
- Voltage Regulation,
- Load Resistor for Pulse Generators,
- High Speed Switching Power Supplies.

Providing design engineers with superior heat dissipation in a standard industry-recognized package, Token Electronics has introduced a TO220-style power resistor using a highly reliable, economical copper power film.
The RMG20 Series, designed by Token, are rugged resistors feature non-inductive performance and low thermal resistance, making them ideal for a variety of industrial applications such as power supplies, industrial controls and automotive, where cost effective performance and reliability are paramount.

The non-noble copper ink construction of the RMG20 Series resistor makes it an efficient alternative to other thick film leaded power resistors while maintaining the excellent thermal conductivity and heat dissipation necessary for demanding power applications.

With low resistance values at higher power ratings, Token's proprietary resistor element ensures design engineers the highest quality non-inductive performance in an efficient package.

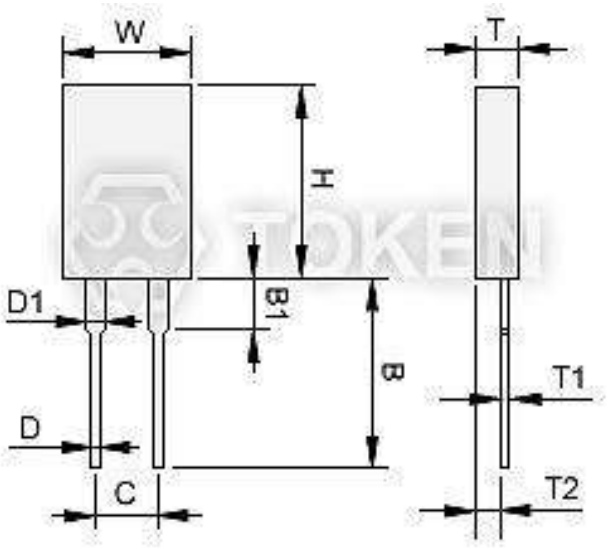
Operating temperatures range from -65℃ to +150℃.

Constructed with proprietary power-film copper conductors and alloy resistors on an alumina ceramic substrate, the RMG20 Series resistor features low thermal impedance for high power dissipation.
Contact us with your specific needs. Please link to Token official website "Power Resistors" for more information.

Dimensions

Dimensions (Unit: mm) (RMG20) TO220

Type	W	H	T	T1	T2	B	B1	C	D	D1
RMG20	10.15 ~ 10.67	16.00 ~ 16.52	2.92 ~ 3.44	0.40 ~ 0.60	1.52 ~ 2.04	11.43 ~ 13.97	2.54 ~ 4.06	4.82 ~ 5.34	0.66 ~ 0.86	1.14 ~ 1.40



TO220 Power Resistors (RMG20)
Dimensions (Unit: mm)

Specifications

Electrical Characteristics Specifications (RMG20) TO220

Resistance Range	Resistance Tolerance	TCR(PPM/℃)
0.05Ω~1Ω	±5.00% ±10.0%	-
2Ω~5Ω	±1.00% ±5.00% ±10.0%	±200
5Ω~10Ω	±1.00% ±5.00% ±10.0%	±100 ±200
11Ω~10KΩ	±0.50% ±1.00% ±5.00% ±10.0%	±50 ±100 ±200

- Operating Voltage:350V Max. Dielectric Strength: 1800VAC. Insulation Resistance: 10GΩmin.
- Working Temperature Range:-65℃ to +150℃. Resistance Value < 1Ω is Available

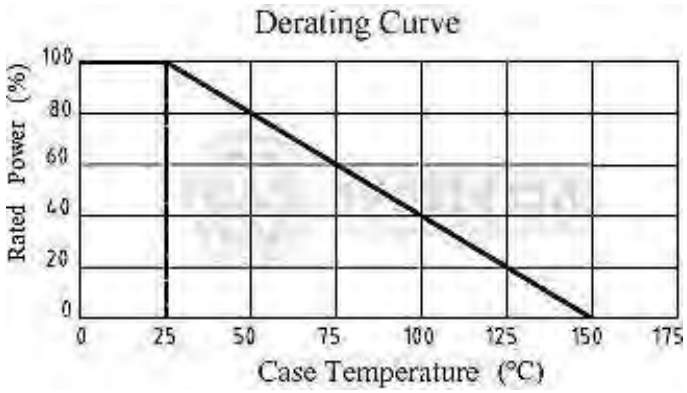
Characteristics

Environmental Characteristics (RMG20) TO220

Test Item	Specification	Test Method
Temperature Coefficient of Resistance	10Ω and above, ±50ppm/℃ 1Ω and 10Ω, (±100ppm)/℃	Referenced to 25℃, ΔR taken at +105℃
Short Time Overload	Δ R±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
Load Life	Δ R±1.0%	MIL-R-39009, 2,000 hours at rated power.
Humidity (Steady State)	Δ R±0.5%	MIL-STD-202F, Method 103B 40℃, 90~95%RH, RCWV 1.5hours ON, 0.5hours OFF. Total 1000~1048 hours.
Thermal Shock	Δ R±0.3%	MIL-STD-202, Method 107G. -65℃~150℃,100 cycle
Terminal Strength	Δ R±0.2%	MIL-STD-202, Method 211, Cond.A(Pull Test) 2.4N.
Vibration, High Frequency	Δ R±0.2%	MIL-STD-202, Method 204, Cond.D.

- **Lead Material: Tinned Copper. Without a Heat Sink, when in Free Air at 25℃, the RMG20 is Rated for 2.25W.**
- **The Case Temperature Measurement Must be Made with a Thermocouple Contacting the Center of the Component Mounted on the Designed Heat Sink.**
- **Thermal Grease Should be Applied Properly.**

Derating Curve



(RMG20) Power Derating Curve

Order Codes

Order Codes (RMG20) TO220

RMG	20	J	P	D	10R
Part Number	Power Rating (W)	Resistance Tolerance (%)	Package	TCR (PPM/℃)	Resistance (Ω)

Resistance Tolerance (%)	
D	±0.5%
F	±1%
G	±2%
J	±5%
K	±10%

Package	
T	Tube
P	Bulk

TCR (PPM/℃)	
D	±50PPM/℃
E	±100PPM/℃
F	±200PPM/℃
-	No specified

Resistance (Ω)	
0R1	0.1Ω
10R	10Ω
1K	1KΩ
10K	10KΩ

General Information

Compact TO-Style Resistors are Low Cost

Token Electronics TO-Style power film heat sink mountable resistors, TO-220 and TO-247 Style Packages, are designed for intermediate power applications and combines performance with an economical price.

TO-220 Power Resistors, TO-247 Power Resistors RMG series are ultra-precision and high power resistors encapsulated in the TO-220, TO-247 style power package. Power resistors are manufactured in 20W, 30W, 35W, 50W and 100W. Resistance element is electrically insulated from metal heat sink mounting tab. When properly mounted Token's RMG** TO220/TO247 packaged power resistors provide up to 50/100 watts of steady state power. These very low inductance resistors are ideal for many industrial applications: power supplies, power controls and inrush/bleeder resistors.

Non-Inductive Design for High Frequency Applications

Token's TO-Style Series satisfy demanding applications for accurate and stable power resistors housed in the convenient TO-Style case. The resistance element is isolated from the mounting tab by an alumina ceramic layer, providing very low thermal resistance and ensuring high insulation resistance between terminals and tab.

These isolated resistor element are constructed and packaged in a high temperature plastic case with a single screw metal tab for easy mounting to the heat sink. The non-inductive design makes these products especially useful in high frequency and high speed pulse applications.

Pulse-Loading Applications as Snubber or Bleeder Resistors

Token's TO-Style resistors are designed for use in pulse-loading applications, as bleeder or snubber resistors in switching power supplies, industrial power drives, medical, test equipment, high power equipment such as uninterruptible power supplies (UPS), and other power distribution and power conversion applications.

The Power Film Resistors use an optimized process of Token's thick film technology on an alumina substrate to achieve tolerances as low as ± 0.5 %, and up to ± 10 %. The Non-Inductive design and resistance values as low as 0.05 ohms are also ideal for current sensing applications.

TO-220 Snubber Power Film Bleeder Resistors (RMG30)

Product Introduction

TO-220 Power Resistors take on transistor outlines.

Features :

- Isolated Case, Non Inductive, TO-220 Style Power Package.
- Single Screw Mounting to Heat Sink, Molded Case for Protection and Easy to Mount.
- 30 Watt at 25℃ Case Temperature Heat Sink Mounted.

Applications :

- Gate Resistors in Power Supplies, Terminal Resistance in RF Power Amplifiers.
- UPS, Snubbers, Voltage Regulation, Low Energy
- Pulse Loading, Load and Dumping Resistors in CRT Monitors.

A wide range of TO-style power film resistors that are designed for use in power electronic circuits such as snubber, current limiting, bleeder, current sensing and other power resistor applications, is available from Token Components.

Their compact heat sink-mountable construction ensures that they are ideal for high-power-density applications, and the non-inductive form allows these TO-style resistors to operate at up to 30 Watt at 25℃ case temperature.

RMG30 Series values as low as 0.05Ω make them particularly suited for current sensing applications with Pb-free Terminations Meet RoHS Requirements.

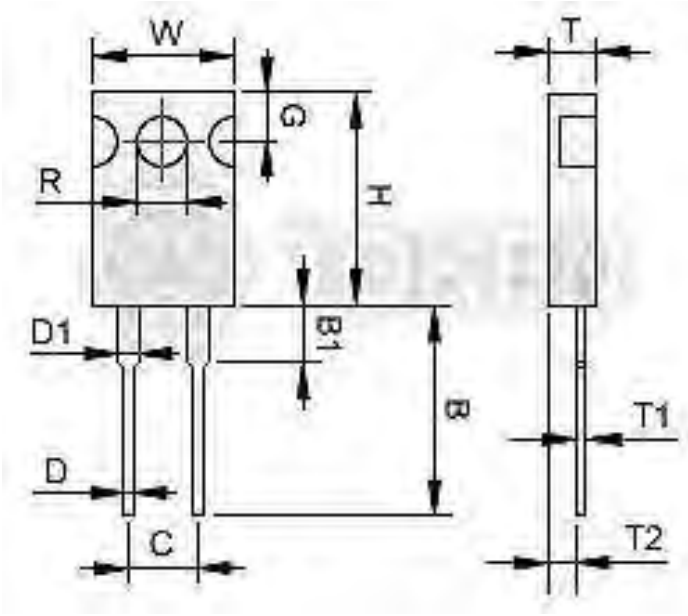
The resistance range of these resistors is from 0.05Ω to 10KΩ and tolerances are standard at 1% for most resistance values, although 5% tolerances are available.

Many standard values are available from Token. Contact us with your specific needs. Please link to Token official website "Power Resistors" for more information.

Dimensions

Dimensions (Unit: mm) (RMG30) TO220

Type	W	H	T	T1	T2	B	B1	C	D	D1	G	R
RMG30	10.15 ~ 10.67	16.00 ~ 16.52	2.92 ~ 3.44	0.40 ~ 0.60	1.52 ~ 2.04	11.43 ~ 13.97	2.54 ~ 4.06	4.82 ~ 5.34	0.66 ~ 0.86	1.14 ~ 1.40	2.92 ~ 3.44	3.08 ~ 3.28



TO-220 Style Resistor (RMG30)
Dimensions (Unit: mm)

Specifications

Electrical Characteristics Specifications (RMG30) TO220

Resistance Range	Resistance Tolerance	TCR(PPM/℃)
0.05Ω~1Ω	±5.00% ±10.0%	-
2Ω~5Ω	±1.00% ±5.00% ±10.0%	±200
5Ω~10Ω	±1.00% ±5.00% ±10.0%	±100 ±200
11Ω~10KΩ	±0.50% ±1.00% ±5.00% ±10.0%	±50 ±100 ±200

- Operating Voltage:350V Max. Dielectric Strength: 1800VAC. Insulation Resistance: 10GΩmin.
- Working Temperature Range:-65℃ to +150℃. Resistance Value < 1Ω is Available

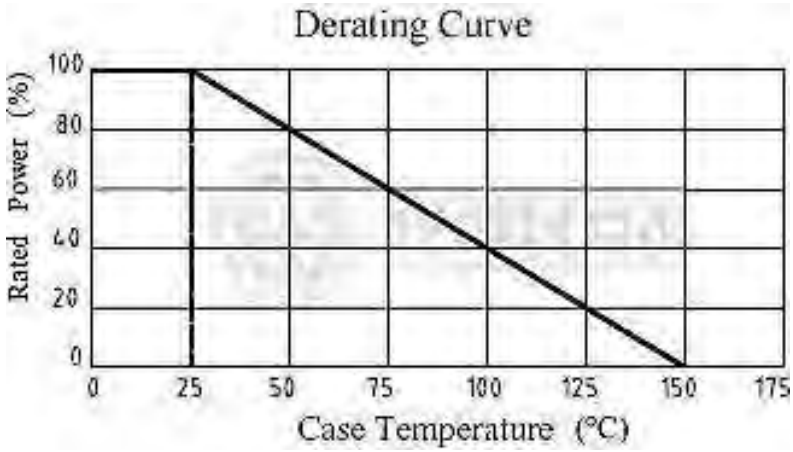
Characteristics

Environmental Characteristics (RMG30) TO220

Test Item	Specification	Test Method
Temperature Coefficient of Resistance	10Ω and above, ±50ppm/℃ 1Ω and 10Ω, (±100ppm)/℃	Referenced to 25℃, ΔR taken at +105℃
Short Time Overload	Δ R±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
Load Life	Δ R±1.0%	MIL-R-39009, 2,000 hours at rated power.
Humidity (Steady State)	Δ R±0.5%	MIL-STD-202F, Method 103B 40℃, 90~95%RH, RCWV 1.5hours ON, 0.5hours OFF. total 1000~1048 hours.
Thermal Shock	Δ R±0.3%	MIL-STD-202, Method 107G. -65℃~150℃,100 cycle
Terminal Strength	Δ R±0.2%	MIL-STD-202, Method 211, Cond.A(Pull Test) 2.4N.
Vibration, High Frequency	Δ R±0.2%	MIL-STD-202, Method 204, Cond.D.

- **Lead Material: Tinned Copper. Maximum Torque: 0.9 Nm.**
- **Without Heat Sink, When in Free Air at 25℃, the RMG30 is rated for 2.25W.**
- **The Case Temperature is to be used for the Definition of the Applied Power Limit.**
- **The Case Temperature Measurement Must be Made with a Thermocouple Contacting the Center of the Component Mounted on the Designed Heat Sink.**
- **Thermal Grease Should be Applied Properly.**

Derating Curve



(RMG30) Power Derating Curve

Order Codes

Order Codes (RMG30) TO220

RMG	30	J	P	D	10R
Part Number	Power Rating (W)	Resistance Tolerance (%)	Package	TCR (PPM/℃)	Resistance (Ω)

Resistance Tolerance (%)	
D	±0.5%
F	±1%
G	±2%
J	±5%
K	±10%

Package	
T	Tube
P	Bulk

TCR (PPM/℃)	
D	±50PPM/℃
E	±100PPM/℃
F	±200PPM/℃
-	No specified

Resistance (Ω)	
0R1	0.1Ω
10R	10Ω
1K	1KΩ
10K	10KΩ

General Information

Compact TO-Style Resistors are Low Cost

Token Electronics TO-Style power film heat sink mountable resistors, TO-220 and TO-247 Style Packages, are designed for intermediate power applications and combines performance with an economical price.

TO-220 Power Resistors, TO-247 Power Resistors RMG series are ultra-precision and high power resistors encapsulated in the TO-220, TO-247 style power package. Power resistors are manufactured in 20W, 30W, 35W, 50W and 100W. Resistance element is electrically insulated from metal heat sink mounting tab. When properly mounted Token's RMG** TO220/TO247 packaged power resistors provide up to 50/100 watts of steady state power. These very low inductance resistors are ideal for many industrial applications: power supplies, power controls and inrush/bleeder resistors.

Non-Inductive Design for High Frequency Applications

Token's TO-Style Series satisfy demanding applications for accurate and stable power resistors housed in the convenient TO-Style case. The resistance element is isolated from the mounting tab by an alumina ceramic layer, providing very low thermal resistance and ensuring high insulation resistance between terminals and tab.

These isolated resistor element are constructed and packaged in a high temperature plastic case with a single screw metal tab for easy mounting to the heat sink. The non-inductive design makes these products especially useful in high frequency and high speed pulse applications.

Pulse-Loading Applications as Snubber or Bleeder Resistors

Token's TO-Style resistors are designed for use in pulse-loading applications, as bleeder or snubber resistors in switching power supplies, industrial power drives, medical, test equipment, high power equipment such as uninterruptible power supplies (UPS), and other power distribution and power conversion applications.

The Power Film Resistors use an optimized process of Token's thick film technology on an alumina substrate to achieve tolerances as low as ± 0.5 %, and up to ± 10 %. The Non-Inductive design and resistance values as low as 0.05 ohms are also ideal for current sensing applications.

TO-220 Power Resistors (RMG35)

Product Introduction

TO220 High Power Resistors boast superior thermal performance.

Features :

- Single Screw Mounting to Heat Sink.
- Molded Case for Protection and Easy to Mount.
- 35 Watt at 25℃ Case Temperature Heat Sink Mounted.
- TO-220 Style Power Package, Isolated Case, Non-Inductive.
- Low Thermal Resistance to Heat Sink at Rth < 4.28℃/W.

Applications :

- RF Power Amplifier.
- Switching Power Supplies.
- Low Energy Pulse Loading.
- Automated Machine Controller.
- UPS, Snubbers Circuits, Voltage Regulation.

Giving power electronics design engineers a comprehensive range of high-wattage surface mount and through-hole resistors designed to provide superior thermal performance in densely populated power supply circuits, Token Electronics has released a series of non-inductive power resistors with power ratings 35W, in popular transistor-style packages (TO-220).

The RMG35 resistors are designed to provide complete thermal flow from the resistive element to the integral metal flange of the TO-style packages, giving design engineers the ability to specify them for high-wattage power electronics circuits that can experience elevated temperatures during operation.

The devices are all rated for operation from -65℃ to +150℃.

Their superior thermal performance and extreme power ratings make the RMG35 Series resistors ideal for switch-mode power supply circuits, motor control and drive circuits, automotive electronics, industrial power equipment and UPS systems. In addition, their non-inductance exhibit excellent high frequency characteristics for use in high frequency industrial RF power sources, RF linear amplifiers, termination resistor of RF circuit etc.

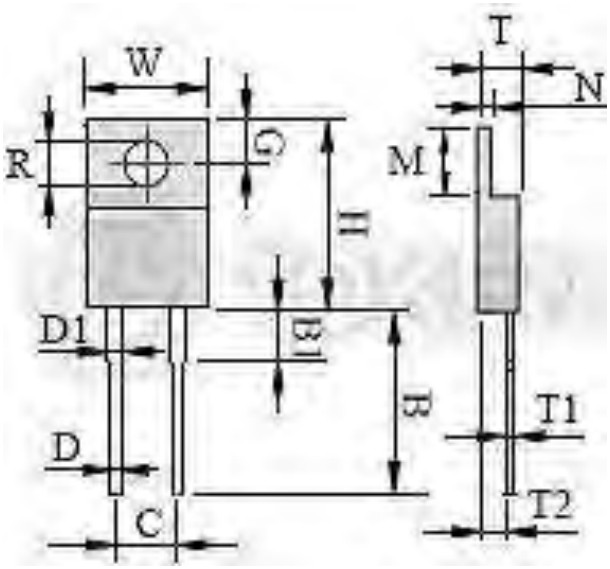
The RMG35 Series resistors feature thermally enhanced two-leaded industry standard packages designed for mounting directly to a heat-sink. Token Electronics will also produce devices outside these specifications to meet customer requirements, with comprehensive application engineering and design support available for customers worldwide.

All RMG35 Series devices are RoHS-compliant, and compatible with high temperature soldering processes normally employed for lead free solders. Contact us with your specific needs. Please link to Token official website "Power Resistors" for more information.

Dimensions

Dimensions (Unit: mm) (RMG35) TO220

Type	W	H	T	T1	T2	B	B1	C	D	D1	G	R	M	N
RMG35	9.91 ~ 10.41	14.50 ~ 15.00	4.06 ~ 4.82	0.55 ~ 0.70	2.05 ~ 2.52	12.70 ~ 14.70	4.00	4.83 ~ 5.33	0.70 ~ 0.86	1.17 ~ 1.37	2.85 ~ 3.05	3.55 ~ 3.75	5.85 ~ 6.35	1.20 ~ 1.40



TO-220 Style Resistors (RMG35)
Dimensions (Unit: mm)

Specifications

Electrical Characteristics Specifications (RMG35) TO220

Resistance Range	Resistance Tolerance	TCR(PPM/℃)
0.05Ω~1Ω	±5.00% ±10.0%	-
>0.1Ω~1Ω	±1.00% ±5.00% ±10.0%	-
>1Ω~3Ω	±1.00% ±5.00% ±10.0%	±300
>3Ω~10KΩ	±1.00% ±5.00% ±10.0%	±100 ±200
>10Ω~10KΩ	±0.50% ±1.00% ±5.00% ±10.0%	±50 ±100 ±200

- Operating Voltage:350V Max. Dielectric Strength: 1800VAC. Insulation Resistance: 10GΩmin.
- Working Temperature Range:-65℃ to +150℃. Resistance Value < 1Ω is Available

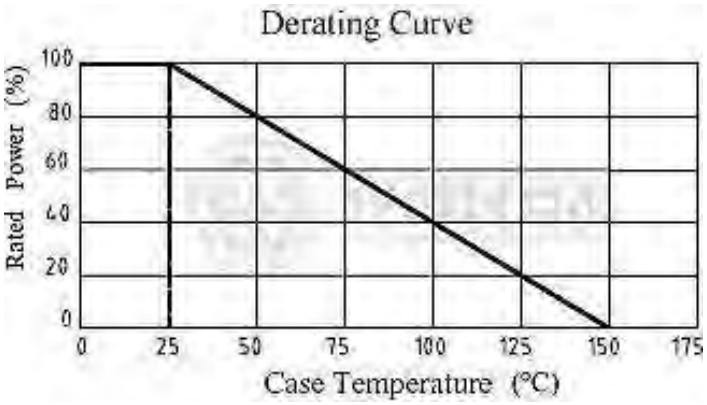
Characteristics

Environmental Characteristics (RMG35) TO220

Test Item	Specification	Test Method
Temperature Coefficient of Resistance	10Ω and above, ±50ppm/℃ 1Ω and 10Ω, (±100ppm)/℃	Referenced to 25℃, ΔR taken at +105℃
Short Time Overload	Δ R±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
Load Life	Δ R±1.0%	MIL-R-39009, 2,000 hours at rated power.
Humidity (Steady State)	Δ R±0.5%	MIL-STD-202F, Method 103B 40℃, 90~95%RH, RCWV 1.5hours ON, 0.5hours OFF. Total 1000~1048 hours.
Thermal Shock	Δ R±0.3%	MIL-STD-202, Method 107G. -65℃~150℃,100 cycle
Terminal Strength	Δ R±0.2%	MIL-STD-202, Method 211, Cond.A(Pull Test) 2.4N.
Vibration, High Frequency	Δ R±0.2%	MIL-STD-202, Method 204, Cond.D.

- **Lead Material: Tinned Copper. Without a Heat Sink, when in Free Air at 25℃, the RMG20 is Rated for 2.25W.**
- **The Case Temperature Measurement Must be Made with a Thermocouple Contacting the Center of the Component Mounted on the Designed Heat Sink.**
- **Thermal Grease Should be Applied Properly.**

Derating Curve



(RMG35) Power Derating Curve

Order Codes

Order Codes (RMG35) TO220

RMG	35	J	P	D	10R
Part Number	Power Rating (W)	Resistance Tolerance (%)	Package	TCR (PPM/℃)	Resistance (Ω)

Resistance Tolerance (%)	
D	±0.5%
F	±1%
G	±2%
J	±5%
K	±10%

Package	
T	Tube
P	Bulk

TCR (PPM/℃)	
D	±50PPM/℃
E	±100PPM/℃
F	±200PPM/℃
-	No specified

Resistance (Ω)	
0R1	0.1Ω
10R	10Ω
1K	1KΩ
10K	10KΩ

General Information

Compact TO-Style Resistors are Low Cost

Token Electronics TO-Style power film heat sink mountable resistors, TO-220 and TO-247 Style Packages, are designed for intermediate power applications and combines performance with an economical price.

TO-220 Power Resistors, TO-247 Power Resistors RMG series are ultra-precision and high power resistors encapsulated in the TO-220, TO-247 style power package. Power resistors are manufactured in 20W, 30W, 35W, 50W and 100W. Resistance element is electrically insulated from metal heat sink mounting tab. When properly mounted Token's RMG** TO220/TO247 packaged power resistors provide up to 50/100 watts of steady state power. These very low inductance resistors are ideal for many industrial applications: power supplies, power controls and inrush/bleeder resistors.

Non-Inductive Design for High Frequency Applications

Token's TO-Style Series satisfy demanding applications for accurate and stable power resistors housed in the convenient TO-Style case. The resistance element is isolated from the mounting tab by an alumina ceramic layer, providing very low thermal resistance and ensuring high insulation resistance between terminals and tab.

These isolated resistor element are constructed and packaged in a high temperature plastic case with a single screw metal tab for easy mounting to the heat sink. The non-inductive design makes these products especially useful in high frequency and high speed pulse applications.

Pulse-Loading Applications as Snubber or Bleeder Resistors

Token's TO-Style resistors are designed for use in pulse-loading applications, as bleeder or snubber resistors in switching power supplies, industrial power drives, medical, test equipment, high power equipment such as uninterruptible power supplies (UPS), and other power distribution and power conversion applications.

The Power Film Resistors use an optimized process of Token's thick film technology on an alumina substrate to achieve tolerances as low as ± 0.5 %, and up to ± 10 %. The Non-Inductive design and resistance values as low as 0.05 ohms are also ideal for current sensing applications.

TO-220 Low-Profile Power Resistors (RMG50)

Product Introduction

Token's low profile TO-220 heat sinkable resistor keeps its cool.

Features :

- Electrically Isolated Case.
- TO-220 Style Power Package.
- Low ohm value, non-inductance design
- Molded Case for Protection and Easy to Mount.
- 50 Watt at 25℃ Case Temperature Heat Sink Mounted.

Applications :

- UPS.
- Voltage Regulation.
- Pulsing applications.
- Switching Power Supplies.
- Non-inductive design for high frequency.

Providing design engineers with an open screened substrate device for applications requiring superior thermal performance, Token Electronics has developed a non-moulded power resistor rated up to 50W.

Designated the RMG50 Series, the resistor is housed in a TO-220 opened screened substrate package, and features an insulated tapered venturi bonded to the substrate for maximum heat dissipation. The design of the RMG50 Series resistor allows for three methods of heat dissipation, resulting in exceptional power handling characteristics.

The chimney-shaped tapered venturi is attached to the ceramic substrate and convection forces hot air up the 'neck' of the chimney and away from the resistor face of the component.

The power resistor utilizes all three methods of heat dissipation, including conduction through the heat-sink tab, radiation from the resistor surface, and convection through the venturi element. Typical applications for the RMG50 resistor include higher wattage switch-mode power supply circuits, motor control and drive circuits, inverters and industrial power equipment.

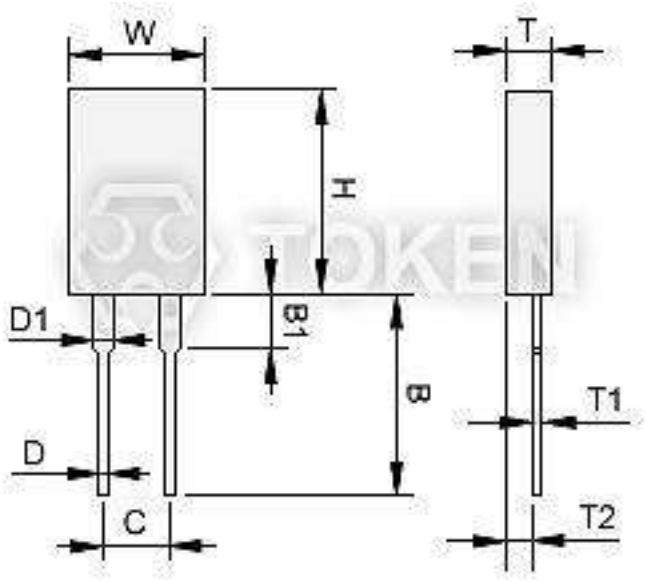
Resistance ranges from 0.05Ω to 10KΩ, with tolerances of ±0.50% and ±10% and operating temperature range is -65℃ to +150℃. The RMG50 Series TO-220 provides customers requiring more wattage in a smaller package with an excellent alternative.

Token Electronics will also produce devices outside these specifications to meet customer requirements, with comprehensive application engineering and design support available for customers worldwide. Contact us with your specific needs. Please link to Token official website "Power Resistors" for more information.

Dimensions

Dimensions (Unit: mm) (RMG50) TO220

Type	W	H	T	T1	T2	B	B1	C	D	D1
RMG50	10.15 ~ 10.67	16.00 ~ 16.52	2.92 ~ 3.44	0.40 ~ 0.60	1.52 ~ 2.04	11.43 ~ 13.97	2.54 ~ 4.06	4.82 ~ 5.34	0.66 ~ 0.86	1.14 ~ 1.40



TO220 Heat Sinkable Resistors (RMG50)
Dimensions (Unit: mm)

Specifications

Electrical Characteristics Specifications (RMG50) TO220

Resistance Range	Resistance Tolerance	TCR(PPM/℃)
0.05Ω~1Ω	±5.00% ±10.0%	-
2Ω~5Ω	±1.00% ±5.00% ±10.0%	±200
5Ω~10Ω	±1.00% ±5.00% ±10.0%	±100 ±200
11Ω~10KΩ	±0.50% ±1.00% ±5.00% ±10.0%	±50 ±100 ±200

- Operating Voltage:350V Max. Dielectric Strength: 1800VAC. Insulation Resistance: 10GΩmin.
- Working Temperature Range:-65℃ to +150℃. Resistance Value < 1Ω is Available

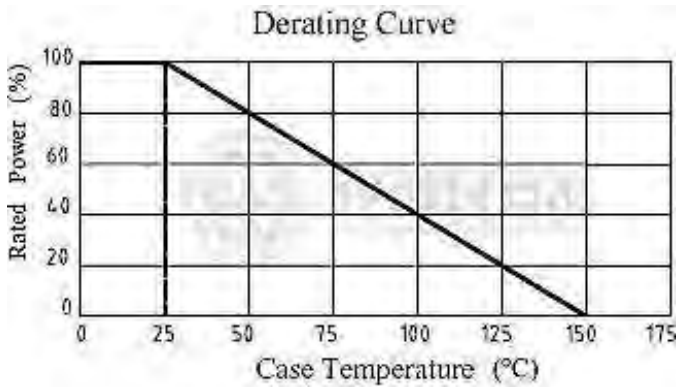
Characteristics

Environmental Characteristics (RMG50) TO220

Test Item	Specification	Test Method
Temperature Coefficient of Resistance	10Ω and above, ±50ppm/℃ 1Ω and 10Ω, (±100ppm)/℃	Referenced to 25℃, ΔR taken at +105℃
Short Time Overload	Δ R±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
Load Life	Δ R±1.0%	MIL-R-39009, 2,000 hours at rated power.
Humidity (Steady State)	Δ R±0.5%	MIL-STD-202F, Method 103B 40℃, 90~95%RH, RCWV 1.5hours ON, 0.5hours OFF. Total 1000~1048 hours.
Thermal Shock	Δ R±0.3%	MIL-STD-202, Method 107G. -65℃~150℃,100 cycle
Terminal Strength	Δ R±0.2%	MIL-STD-202, Method 211, Cond.A(Pull Test) 2.4N.
Vibration, High Frequency	Δ R±0.2%	MIL-STD-202, Method 204, Cond.D.

- **Lead Material: Tinned Copper. Maximum Torque: 0.9 Nm.**
- **Without a Heat Sink, When in Free Air at 25℃, the RMG50 is rated for 3W.**
- **The Case Temperature is to be used for the Definition of the Applied Power Limit.**
- **The Case Temperature Measurement Must be Made with a Thermocouple Contacting the Center of the Component Mounted on the Designed Heat Sink.**
- **Thermal Grease Should be Applied Properly.**

Derating Curve



(RMG50) Power Derating Curve

Order Codes

Order Codes (RMG50) TO220

RMG	50	J	P	D	10R
Part Number	Power Rating (W)	Resistance Tolerance (%)	Package	TCR (PPM/℃)	Resistance (Ω)

Resistance Tolerance (%)	
D	±0.5%
F	±1%
G	±2%
J	±5%
K	±10%

Package	
T	Tube
P	Bulk

TCR (PPM/℃)	
D	±50PPM/℃
E	±100PPM/℃
F	±200PPM/℃
-	No specified

Resistance (Ω)	
0R1	0.1Ω
10R	10Ω
1K	1KΩ
10K	10KΩ

General Information

Compact TO-Style Resistors are Low Cost

Token Electronics TO-Style power film heat sink mountable resistors, TO-220 and TO-247 Style Packages, are designed for intermediate power applications and combines performance with an economical price.

TO-220 Power Resistors, TO-247 Power Resistors RMG series are ultra-precision and high power resistors encapsulated in the TO-220, TO-247 style power package. Power resistors are manufactured in 20W, 30W, 35W, 50W and 100W. Resistance element is electrically insulated from metal heat sink mounting tab. When properly mounted Token's RMG** TO220/TO247 packaged power resistors provide up to 50/100 watts of steady state power. These very low inductance resistors are ideal for many industrial applications: power supplies, power controls and inrush/bleeder resistors.

Non-Inductive Design for High Frequency Applications

Token's TO-Style Series satisfy demanding applications for accurate and stable power resistors housed in the convenient TO-Style case. The resistance element is isolated from the mounting tab by an alumina ceramic layer, providing very low thermal resistance and ensuring high insulation resistance between terminals and tab.

These isolated resistor element are constructed and packaged in a high temperature plastic case with a single screw metal tab for easy mounting to the heat sink. The non-inductive design makes these products especially useful in high frequency and high speed pulse applications.

Pulse-Loading Applications as Snubber or Bleeder Resistors

Token's TO-Style resistors are designed for use in pulse-loading applications, as bleeder or snubber resistors in switching power supplies, industrial power drives, medical, test equipment, high power equipment such as uninterruptible power supplies (UPS), and other power distribution and power conversion applications.

The Power Film Resistors use an optimized process of Token's thick film technology on an alumina substrate to achieve tolerances as low as ± 0.5 %, and up to ± 10 %. The Non-Inductive design and resistance values as low as 0.05 ohms are also ideal for current sensing applications.

TO-247 Power Pulse-loading Resistors (RMG100)

Product Introduction

TO-247 Power Resistors handle high-speed pulses.

Features :

- TO-247 Style Power Package.
- Single M3 Screw Mounting to Heat Sink.
- Molded Case for Protection and Easy to Mount.
- Non-Inductive Design, Electrically Isolated Case.
- 100 Watts at 25℃ Case Temperature Heat Sink Mounted.

Applications :

- Low Energy Pulse Loading.
- Gate Resistors in Power Supplies.
- UPS, Snubbers, Voltage Regulation.
- Terminal Resistance in RF Power Amplifiers.
- Load and Dumping Resistors in CRT Monitors.

Providing design engineers with a high-power resistive device in a stable transistor style package, Token Electronics RMG100 Series TO-247 power resistors are available in 100W.

The resistors are specified for applications that require accuracy and stability. The RMG100 Series resistors are designed with an alumina ceramic layer that separates the resistance element and mounting tab.

This construction provides very low thermal resistance while ensuring high insulation resistance between the terminals and the metal back plate. As a result, the resistors feature a very low inductance, making them ideal for high frequency and high-speed pulse applications.

Additional applications for the RMG100 Series TO-247 resistors include automation test equipment, high frequency snubber and pulse handling circuits, motor control and drive circuits, switch mode power supplies, load resistors, automotive electronics, industrial power equipment, UPS systems and industrial computers.

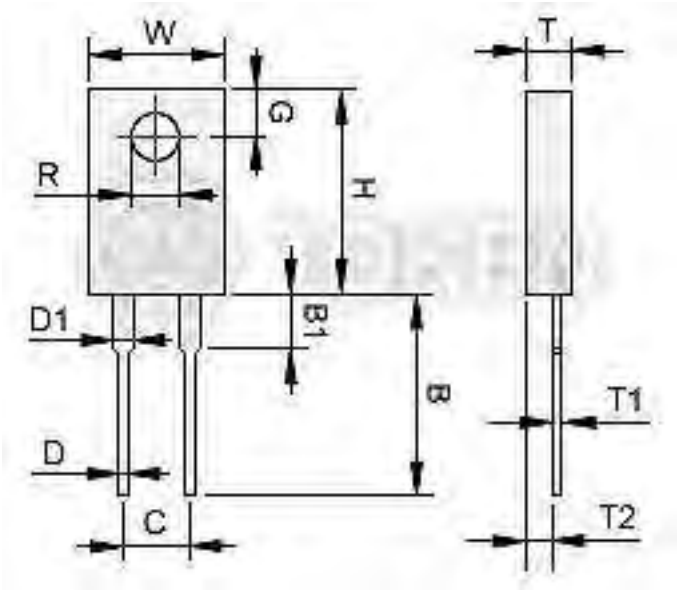
RMG100 Series 100W resistors feature a resistance range of 0.1Ω to 10KΩ and operating temperature range is -65℃ to +175℃.

Token will also produce devices outside these specifications to meet customer requirements. The RMG100 Series power resistors are RoHS-compliant with Pb-free Terminations. Contact us with your specific needs. Please link to Token official website "Power Resistors" for more information.

Dimensions

Dimensions (Unit: mm) (RMG100) TO247

Type	W	H	T	T1	T2	B	B1	C	D	D1	G	R
RMG100	15.49 ~ 16.01	20.44 ~ 20.96	4.69 ~ 5.21	0.55 ~ 1.07	2.15 ~ 2.67	13.21 ~ 15.75	2.03 ~ 3.55	9.90 ~ 10.42	1.42 ~ 1.62	3.45 ~ 3.81	5.07 ~ 5.59	3.53 ~ 3.73



Pulse Loading TO-247 Power Resistor
RMG100 Dimensions (Unit: mm)

Specifications

Electrical Characteristics Specifications (RMG100) TO247

Resistance Range	Resistance Tolerance	TCR(PPM/℃)
0.1Ω~1Ω	±5% ±10%	-
>1Ω~3Ω	±1%	±300
>3Ω~10Ω	±1% ±5% ±10%	±100 ±200
>10Ω~10KΩ	±1% ±5% ±10%	±50 ±100 ±200

- Operating Voltage: 350V Max. Dielectric Strength: 1800V AC
- Insulation Resistance: 10GΩ min. Working Temperature Range: -65℃ to +175℃

Characteristics

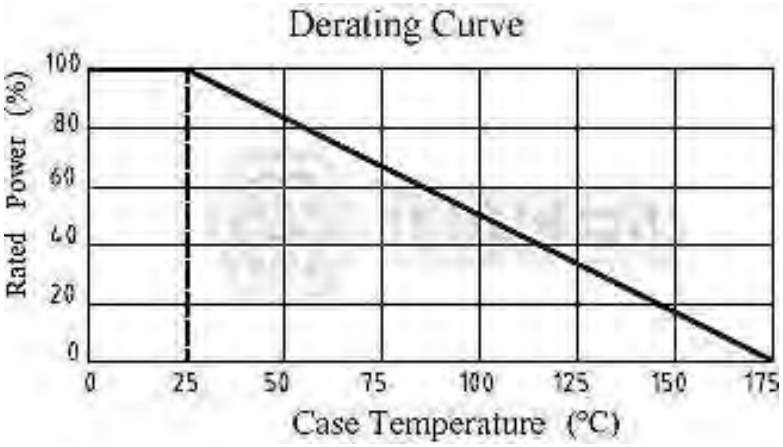
Environmental Characteristics (RMG100) TO247

Test Item	Specification	Test Method
Temperature Coefficient of Resistance	As spec.	Referenced to 25℃, ΔR taken at +105℃
Short Time Overload	ΔR±0.5%	1.5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
Dielectric strength	ΔR±0.15%	MIL-STD-202F Method 301(1800V AC, 60s)
Load Life	ΔR±1.0%	MIL-PRF-39009D, 4.8.13 Rated power, 2,000 hours.
Moisture resistance	ΔR±0.5%	-10℃~+65℃, RH>90%, cycle 240 hours.
Thermal Shock	ΔR±0.5%	MIL-STD-202, Method 107G. -65℃~150℃,100 cycle
Terminal Strength	ΔR±0.2%	MIL-STD-202F, Method 211, Cond. A (Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.42%	MIL-STD-202F, Method 204, Cond.D
Solderability	90% min coverage	MIL-STD-202F Method 208H 245℃±5℃, 3±0.5 (sec)

- **Lead Material: Tinned Copper. Thermal Grease Should be Applied Properly.**
- **When in Free Air at 25℃, the RMG100 is Rated for 3.5W.**
- **The Case Temperature is to be used for the Definition of the Applied Power Limit.**
- **The Case Temperature Measurement Must be Made with a Thermocouple Contacting the Center of the Component Mounted on the Designed Heat Sink.**

Derating Curve

Power Derating Curve (RMG100) TO247



TO-247 (RMG100) Power Derating Curve

Order Codes

Order Codes (RMG100) TO247

RMG	100	J	P	D	10R
Part Number	Power Rating (W)	Resistance Tolerance (%)	Package	TCR (PPM/℃)	Resistance (Ω)

Resistance Tolerance (%)	
D	±0.5%
F	±1%
G	±2%
J	±5%
K	±10%

Package	
T	Tube
P	Bulk

TCR (PPM/℃)	
D	±50PPM/℃
E	±100PPM/℃
F	±200PPM/℃
G	±300PPM/℃
-	No specified

Resistance (Ω)	
0R1	0.1Ω
10R	10Ω
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