Type MS Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275°C Maximum Temperature

With power ratings to 22 Watts and voltage ratings as high as 6,000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

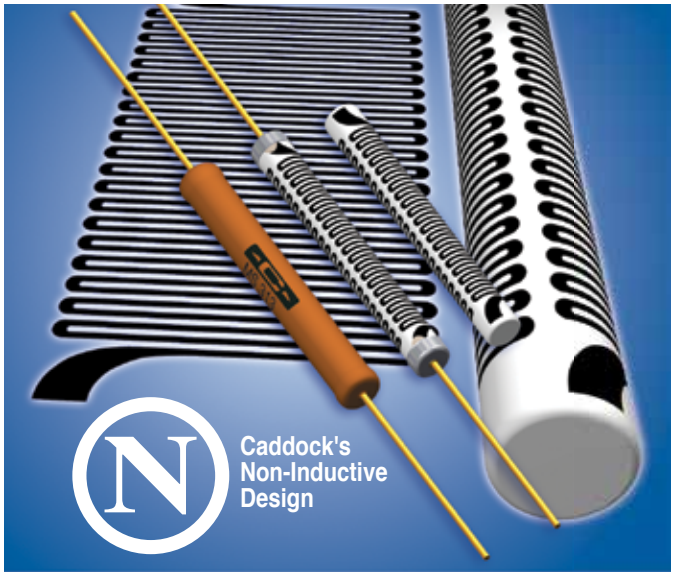
- Full power and voltage ratings, without derating:
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1,000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Caddock's Micronox® complex metal oxide resistance films. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for over 30 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core at temperatures above 1400°F (760°C). These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing a wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.



The Serpentine Pattern used in this patented product contain features which enhance high stability in High-Power Resistor applications.

Most models are manufactured with Caddock's Non-Inductive serpentine resistive pattern that provides for neighboring lines to carry current in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements.

Manufacturing Control

Type MS Resistors are produced under intensive manufacturing controls with processes which include power conditioning, overvoltage conditioning, and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials, to the supervision of manufacturing processes, all Caddock Type MS Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of Mil-I-45208 in many recent surveys as described on page 8.

Reliability Verification

Type MS resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration, and Humidity are verified on a periodic basis. Data from Type MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG, and MK represent an identical combination of materials - aluminum oxide substrate, Micronox® resistance film, and silicone insulating coating.

Certain products shown in this catalog are covered by one or more patents, there are also patents pending.

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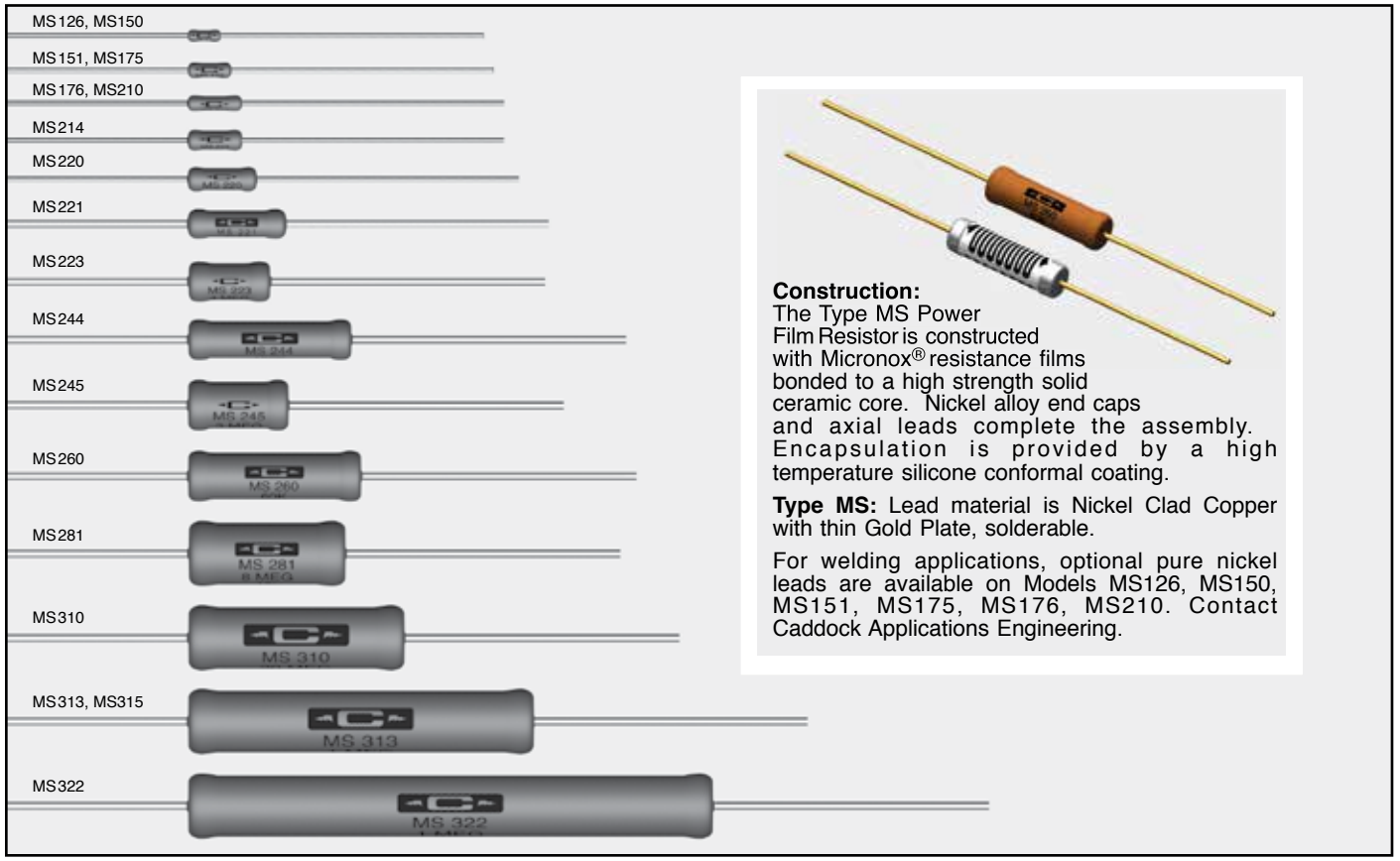
Type MS Power Film Resistors



Construction:
The Type MS Power Film Resistor is constructed with Micronox® resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and axial leads complete the assembly. Encapsulation is provided by a high temperature silicone conformal coating.

Type MS: Lead material is Nickel Clad Copper with thin Gold Plate, solderable.

For welding applications, optional pure nickel leads are available on Models MS126, MS150, MS151, MS175, MS176, MS210. Contact Caddock Applications Engineering.

Model No.	Wattage at +25°C	Wattage at +125°C	Max. Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions in inches and (millimeters) A	B	C
MS126	0.25	0.25	200	500	20 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
MS150	0.50	0.30	*	500	20 Ω	2 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
MS151	0.50	0.50	300	750	20 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MS175	0.75	0.45	*	750	20 Ω	2 K	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MS176	0.75	0.75	500	750	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MS210	1.0	0.60	*	750	45 Ω	3 K	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MS214	1.0	0.60	500	750	45 Ω	5 Meg	.313 ±.030 (7.95 ±.76)	.109 ±.025 (2.77 ±.64)	.025 ±.002 (.64 ±.05)
MS220	2.0	1.2	1,000	800	20 Ω	10 Meg	.400 ±.060 (10.16 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MS221	3.0	1.8	1,000	800	45 Ω	10 Meg	.575 ±.050 (14.61 ±1.27)	.165 ±.030 (4.19 ±.76)	.032 ±.002 (.81 ±.05)
MS223	3.0	1.8	800	1,000	20 Ω	4 Meg	.480 ±.060 (12.19 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)
MS244	4.0	2.4	2,000	1,000	45 Ω	15 Meg	.950 ±.060 (24.13 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)
MS245	4.0	2.4	800	1,000	20 Ω	6 Meg	.570 ±.060 (14.48 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)
MS260	6.0	3.6	2,000	1,000	45 Ω	15 Meg	.970 ±.060 (24.64 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)
MS281	8.0	4.8	2,000	1,000	45 Ω	8 Meg	.910 ±.060 (23.11 ±1.52)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)
MS310	10.0	6.0	4,500	1,000	45 Ω	20 Meg	1.250 ±.070 (31.75 ±1.78)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)
MS313	12.5	7.5	6,000	1,000	50 Ω	30 Meg	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)
MS315	15.0	9.0	*	1,000	50 Ω	1 Meg	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)
MS322	22.0	13.2	*	1,000	100 Ω	1.5 Meg	3.000 ±.090 (76.20 ±2.29)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)

* Limited by power rating.

Models with low inductance construction are in shaded areas.

Models with Caddock's Non-Inductive Resistance Pattern are in non-shaded areas.

Ordering Information:

MS220 -100K - 1%

- MS220 — Model Number:
- 100K — Resistor Value:
- 1% — Tolerance

Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: 50 ppm/°C. TC referenced to +25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

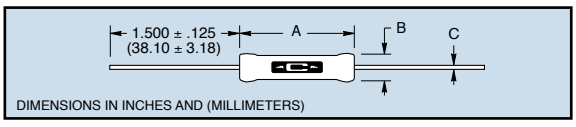
Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

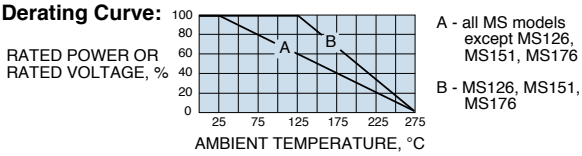
Load Life: 1,000 hours at rated power at +25°C or +125°C (see derating curve), not to exceed rated voltage, ΔR 0.5% max. or 0.5 ohm max., whichever is greater. Mounting method per Mil-R-39007, para. 4.7.2 "conditioning".

Maximum Operating Temperature: +275°C.

Encapsulation: High Temperature Silicone Conformal.



Derating Curve:



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