Type MS Power Film Resistors

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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:

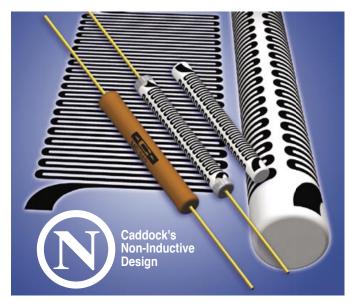
- Full power and voltage ratings, without derating:
- for non-inductive performance.
- for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
 Tests demonstrate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

Micronox® Resistance Films

Type MS performance begins with Caddock's Micronox® 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.

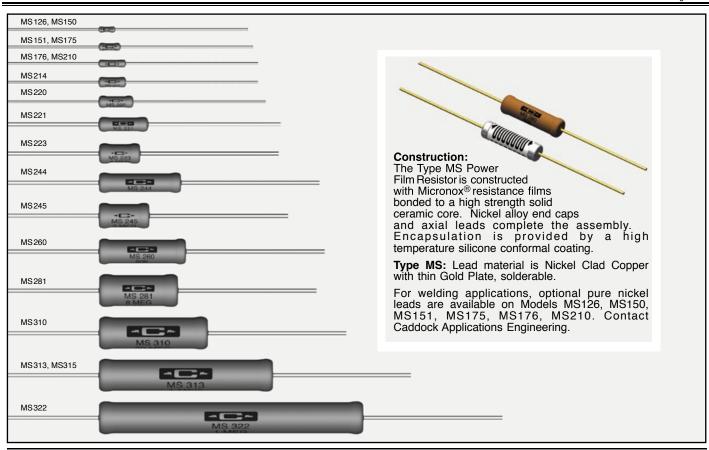
Certain products shown in this catalog are covered by one or more patents, there are also patents pending.

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Riverside, California 92507-2364 Phone: (951) 788-1700 Fax: (951) 369-1151



Watt- age at +25°C	Watt- age at +125°C	Max. Voltage	Dielect. Strength	Resistance		Dimensions in inches and (millimeters)		
				Min.	Max.	Α	В	С
0.25	0.25	200	500	20 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
0.50	0.30	*	500	20 Ω	2 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
0.50	0.50	300	750	20 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
0.75	0.45	*	750	20 Ω	2 K	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
0.75	0.75	500	750	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
1.0	0.60	*	750	45 Ω	зк	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
1.0	0.60	500	750	45 Ω	5 Meg	.313 ±.030 (7.95 ±.76)	.109 ±.025 (2.77 ±.64)	.025 ±.002 (.64 ±.05)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
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)
	age at +25°C 0.25 0.25 0.50 0.50 0.75 1.0 1.0 2.0 3.0 4.0 4.0 6.0 8.0 10.0 12.5 15.0	age at +25°C age at +125°C 0.25 0.25 0.50 0.30 0.75 0.45 0.75 0.75 1.0 0.60 2.0 1.2 3.0 1.8 4.0 2.4 4.0 2.4 6.0 3.6 8.0 4.8 10.0 6.0 12.5 7.5 15.0 9.0	age at +125°C voltage +125°C voltag	age at +25°C +125°C voltage winds strength Strength 0.25 0.25 200 500 0.50 0.30 * 500 0.50 0.50 300 750 0.75 0.45 * 750 1.0 0.60 * 750 1.0 0.60 500 750 2.0 1.2 1,000 800 3.0 1.8 1,000 800 3.0 1.8 800 1,000 4.0 2.4 2,000 1,000 6.0 3.6 2,000 1,000 8.0 4.8 2,000 1,000 10.0 6.0 4,500 1,000 12.5 7.5 6,000 1,000	age at $+25^{\circ}$ C	age at +25°C +125°C voltage Strength voltage Min. Max. 0.25 0.25 200 500 20 Ω 1 Meg 0.50 0.30 * 500 20 Ω 2 K 0.50 0.50 300 750 20 Ω 2 Ke 0.75 0.45 * 750 20 Ω 2 Ke 0.75 0.75 500 750 45 Ω 5 Meg 1.0 0.60 * 750 45 Ω 5 Meg 2.0 1.2 1,000 800 20 Ω 10 Meg 3.0 1.8 1,000 800 20 Ω 10 Meg 3.0 1.8 800 1,000 20 Ω 4 Meg 4.0 2.4 2,000 1,000 45 Ω 15 Meg 4.0 2.4 800 1,000 20 Ω 6 Meg 6.0 3.6 2,000 1,000 45 Ω 15 Meg 8.0 4.8 2,000 1,000	age at +125°C +125°C violage strength Min. Max. A 0.25 0.25 200 500 20 Ω 1 Meg (4.78±51) .188±020 (4.78±51) 0.50 0.30 ★ 500 20 Ω 2 K (4.78±51) .250±020 (6.35±51) 0.50 0.50 300 750 20 Ω 2 Meg (6.35±51) .250±020 (6.35±51) 0.75 0.45 ★ 750 20 Ω 2 K (6.35±51) .250±020 (6.35±51) 0.75 0.75 500 750 45 Ω 5 Meg (7.95±51) .313±020 (7.95±51) 1.0 0.60 ★ 750 45 Ω 5 Meg (7.95±51) .313±020 (7.95±51) 1.0 0.60 500 750 45 Ω 5 Meg (7.95±61) .759±61 1.0 0.60 500 750 45 Ω 5 Meg (7.95±76) .759±76 2.0 1.2 1,000 800 20 Ω 10 Meg (10.16±1.52) .757±5±60 3.0 1.8 1,000 800 45 Ω 10 Meg (12.19±1.52) <t< td=""><td>age at +25°C +125°C wids. (voltage) Min. (voltage) Max. (voltage) A B 0.25 0.25 200 500 20 Ω 1 Meg (4.78 ± 51) (1.78 ± 38) (1.78 ±</td></t<>	age at +25°C +125°C wids. (voltage) Min. (voltage) Max. (voltage) A B 0.25 0.25 200 500 20 Ω 1 Meg (4.78 ± 51) (1.78 ± 38) (1.78 ±

* 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%

Model Number: ______ Resistor Value: _____

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.

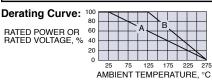
Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Load Life: 1,000 hours at rated power at $+25^{\circ}$ C or $+125^{\circ}$ C (see derating curve), not to exceed rated voltage, Δ R 0.5% max. or 0.5 ohm max., whichever is greater.

Maximum Operating Temperature: +275°C.

Encapsulation: High Temperature Silicone Conformal.





A - all MS models except MS126, MS151, MS176

B - MS126, MS151, MS176

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MS315-124-1% MS220-100K-1% MS223-110-1% MS322-500-1% MS310-25K-1% MS176-1MEG-0.1% MS244-5.00M-1% MS220-499K-1% MS223-41.7K-1% MS210-1.00K-1% MS244-500K-1% MS223-499K-1% MS221-20K-1% MS151-2.00K-1% MS176-300K-1% MS281-27K-1% ms210-100-1% MS220-390-1% MS315-1.00M-1% MS151-124-1% MS310-100-1% MS310-300-1% MS223-442-1% MS151-3.16K-1% MS220-100-1% MS221-510R-1% MS310-10K-1% MS220-78.7-1% MS310-500K-1% MS260-680K-5% MS310-10.0K-5% MS260-680K-2% MS221-1.00M-1% MS313-30.0M-5% MS223-383K-1% MS210-45.0-1% MS151-200K-1% MS221-250-1% MS176-5.11K-1% MS313-200K-1% MS244-1.00M-1% MS310-20.0M-1% MS220-6.8K-1% MS220-1K-1% MS310-1.89M-1% MS315-100-1%