Metal Film Resistors, Axial, Non-Magnetic, Industrial, Precision

FEATURES

- Small size - conformal coated
- Flame retardant epoxy coating
- Controlled temperature coefficient
- Excellent high frequency characteristics
- Exceptionally low noise; typically 0.10 µV/V
- Low voltage coefficient to ± 5 ppm/V
- Utilizes non-magnetic brass or nickel silver end caps (as appropriate for value and tolerance)
- Tested using magnets to ensure parts are non-magnetic
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available

e3

RoHS* Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	MAXIMUM WORKING VOLTAGE (1) V	POWER RATING $P_{70\,°C}$ (2) W	POWER RATING $P_{125\,°C}$ (2) W	RESISTANCE RANGE Ω	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C
CMF50..143	CMF-50-143	200	0.25	0.125	10 to 2.5M	0.1, 0.25, 0.5, 1	25
					10 to 2.5M	0.1, 0.25, 0.5, 1, 2, 5	50
					10 to 2.5M	1, 2, 5	100
					10 to 22M	1, 2, 5	150, 200
CMF55..143	CMF-55-143	250	0.5	0.25	10 to 2.5M	0.1, 0.25, 0.5, 1	25
					10 to 2.5M	0.1, 0.25, 0.5	50
					10 to 5M	1, 2, 5	50
					1 to 22.1M	1, 2, 5	100
					0.5 to 50M	1, 2, 5	150
					0.5 to 50M	1	200
					0.1 to 50M	2, 5	200
CMF60..143	CMF-60-143	500	1	0.5	10 to 2.5M	0.1, 0.25, 0.5, 1	25
					10 to 2.5M	0.1, 0.25, 0.5	50
					10 to 10M	1, 2, 5	50
					1 to 10M	1, 2, 5	100
					0.5 to 10M	1, 2, 5	150
					0.5 to 10M	1	200
					0.1 to 10M	2, 5	200
CMF65..143	CMF-65-143	500	1.5	1	10 to 2.5M	0.1, 0.25, 0.5, 1	25
					10 to 2.5M	0.1, 0.25, 0.5	50
					10 to 10M	1, 2, 5	50
					1 to 15M	1, 2, 5	100
					0.5 to 22M	1, 2, 5	150
					0.5 to 22M	1	200
					0.1 to 22M	2, 5	200
CMF70..143	CMF-70-143	500	1.75	1.25	10 to 2.5M	0.1, 0.25, 0.5, 1	25
					10 to 2.5M	0.1, 0.25, 0.5	50
					10 to 10M	1, 2, 5	50
					1 to 15M	1, 2, 5	100
					1 to 22M	1, 2, 5	150, 200
CMF07..143	CMF-07-143	250	0.5	-	5 to 5M	2, 5	100
					1 to 5M	2, 5	150, 200
CMF20..143	CMF-20-143	500	1	-	5 to 10M	2, 5	100
					1 to 10M	2, 5	150, 200

Notes

(1) Continuous working voltage shall be $\sqrt{P \times R}$ or maximum working voltage, whichever is less

(2) See the load life shift due to power and derating table for a summary of the more common combinations of power rating, case size and ambient operating temperature that prevail in various industrial and military resistor specifications. The “performance” table quantifies the load life stability under these combinations.

For technical questions, contact: ff2aresistors@vishay.com

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GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CMF5510K000FKRE143 (preferred part numbering format)

C	M	F	5	5	1	0	K	0	0	0	F	K	R	E	1	4	3

GLOBAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMPERATURE COEFFICIENT (1)	PACKAGING	SPECIAL
(See Standard Electrical Specifications table)	**R** = Ω **K** = kΩ **M** = MΩ **R10000** = 0.1 Ω **680K00** = 680 kΩ **1M0000** = 1.0 MΩ	**B** = ± 0.1 % **C** = ± 0.25 % **D** = ± 0.5 % **F** = ± 1 % **G** = ± 2 % **J** = ± 5 %	**E** = 25 ppm **H** = 50 ppm **K** = 100 ppm **L** = 150 ppm **N** = 200 ppm	**EK** = lead (Pb)-free, bulk **EA** = lead (Pb)-free, T/R (full) **EB** = lead (Pb)-free, T/R (1000 pieces) **BF** = tin/lead, bulk **RE** = tin/lead, T/R (full) **R6** = tin/lead, T/R (1000 pieces)	**143** = non-magnetic

Historical Part Number Example: CMF-55-1431002FT-1 (will continue to be accepted)

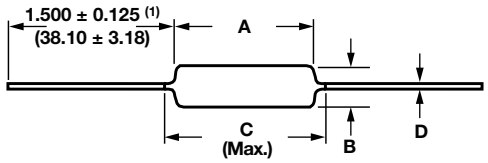
CMF-55-143	1002	F	T-1	R36
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMP. COEFFICIENT	PACKAGING

Notes

- For additional information on packaging, refer to the Through-Hole Resistor Packaging document (www.vishay.com/doc?31544).

(1) Tolerance of ± 0.5 % (D), ± 0.25 % (C), and ± 0.1 % (B) are available only in 50 ppm and 25 ppm temperature coefficients.

DIMENSIONS in inches (millimeters)



GLOBAL MODEL	A	B	C (Max.)	D
CMF07..143	0.240 ± 0.020 (6.10 ± 0.51)	0.090 ± 0.008 (2.29 ± 0.20)	0.290 (7.37)	0.025 ± 0.002 (0.64 ± 0.05)
CMF20..143	0.375 ± 0.040 (9.53 ± 1.02)	0.145 ± 0.015 (3.68 ± 0.38)	0.425 (10.80)	0.032 ± 0.002 (0.81 ± 0.05)
CMF50..143	0.150 ± 0.020 (3.81 ± 0.51)	0.065 ± 0.015 (1.65 ± 0.38)	0.187 (4.75)	0.016 ± 0.002 (0.41 ± 0.05)
CMF55..143	0.240 ± 0.020 (2) (6.10 ± 0.51)	0.090 ± 0.008 (2.29 ± 0.20)	0.290 (7.37)	0.025 ± 0.002 (0.64 ± 0.05)
CMF60..143	0.344 ± 0.031 (8.74 ± 0.79)	0.145 ± 0.015 (3.68 ± 0.38)	0.425 (10.80)	0.025 ± 0.002 (0.64 ± 0.05)
CMF65..143	0.562 ± 0.031 (14.27 ± 0.79)	0.180 ± 0.015 (4.57 ± 0.38)	0.687 (17.45)	0.025 ± 0.002 (0.64 ± 0.05)
CMF70..143	0.562 ± 0.031 (14.27 ± 0.79)	0.180 ± 0.015 (4.57 ± 0.38)	0.687 (17.45)	0.032 ± 0.002 (0.81 ± 0.05)

Notes

(1) Lead length for product in bulk pack. For product supplied in tape and reel, the actual lead length would be based on the body size, tape spacing and lead trim.

(2) 0.260" ± 0.020" (6.60 mm ± 0.51 mm) for values > 5 MΩ

TECHNICAL SPECIFICATIONS

PARAMETER	UNIT	CMF07..143	CMF20..143	CMF50..143	CMF55..143	CMF60..143	CMF65..143	CMF70..143
Maximum Working Voltage	V≅	≤ 250	≤ 500	≤ 200	≤ 250	≤ 500	≤ 500	≤ 500
Insulation Voltage (1 Min)	V_{eff}	> 500						
Voltage Coefficient (Max.)	ppm/V	± 5 (measured between 10 % and full rated voltage)						
Dielectric Strength	V_{AC}	450	750	450	450	750	900	900
Insulation Resistance	Ω	≥ 10^{11}						
Operating Temp. Range	°C	-55 to +175						
Terminal Strength (Pull Test)	lb	5	5	2	2	2	2	5
Noise	dB	0.10 µV/V over a decade of frequency, with low and intermediate resistance values typically below 0.05 µV/V						
Weight (Max.)	g	0.28	0.60	0.12	0.28	0.50	1.00	1.10

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TEMPERATURE COEFFICIENT CODES

GLOBAL TC CODE	HISTORICAL TC CODE	TEMPERATURE COEFFICIENT
E	T-9	25 ppm/°C
H	T-2	50 ppm/°C
K	T-1	100 ppm/°C
L	T-0	150 ppm/°C
N	T-00	200 ppm/°C

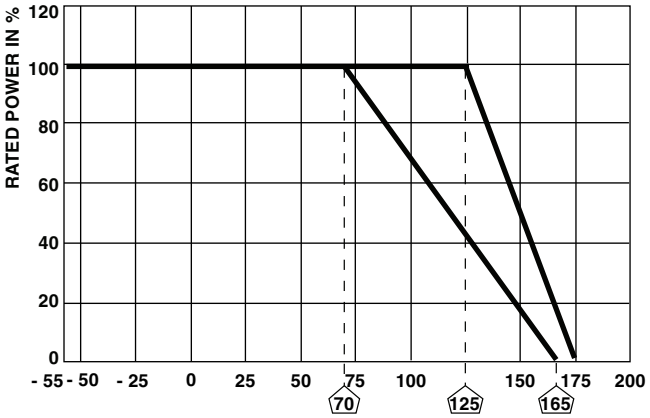
LOAD LIFE SHIFT DUE TO POWER AND DERATING (AT +70 °C AND AT +125 °C)

The power rating for the CMF parts is tied to the derating temperature, the heat rise of the parts, and the ΔR for the load life performance. When the tables/graphs below are used together they show that when the parts are run at their higher power ratings, the parts will run hotter, which has the potential of causing the resistance of the parts to shift more over the life of the part.

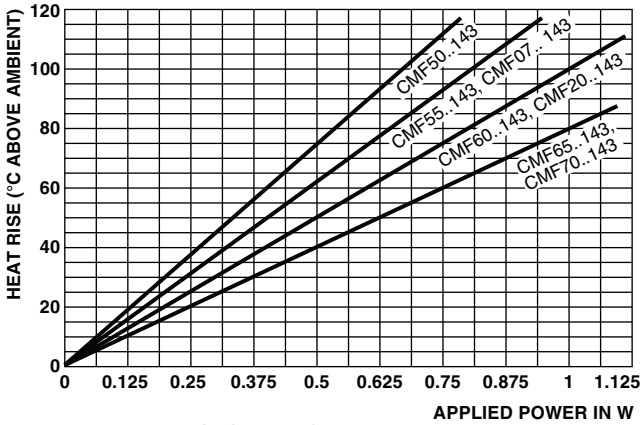
LOAD LIFE SHIFT VS. POWER RATING

LOAD LIFE	MAXIMUM ΔR (TYPICAL TEST LOTS)					
	± 0.15 %	± 0.5 %	± 1.0 %	± 0.15 %	± 0.5 %	± 1.0 %
MODEL	POWER RATING AT +70 °C			POWER RATING AT +125 °C		
CMF50..143	1/20 W and 1/10 W	1/8 W	1/4 W	1/20 W	1/10 W	1/8 W
CMF55..143, CMF07..143	1/10 W and 1/8 W	1/4 W	1/2 W	1/10 W	1/8 W	1/4 W
CMF60..143, CMF20..143	1/8 W and 1/4 W	1/2 W	3/4 W and 1 W	1/8 W	1/4 W	1/2 W
CMF65..143	1/4 W and 1/2 W	3/4 W	1 W and 1-1/2 W	1/4 W	1/2 W	3/4 W and 1 W
CMF70..143	1/4 W and 1/2 W	3/4 W	1 W and 1-3/4 W	1/4 W	1/2 W	3/4 W and 1-1/4 W

CMF resistors have an operating temperature range of -55 °C to +175 °C.
They must be derated at high ambient temperatures according to the derating curve.



DERATING



THERMAL RESISTANCE

Example:
When a CMF55..143 part is run at 1/8 W in a 70 °C ambient environment, the resistor will generate enough heat that the surface temperature of the part will reach about 19 °C over the ambient temperature, and over the life of the part this could cause the resistance value to shift up to ± 0.15 %.
If the same resistor was instead run at 1/4 W in a 70 °C environment, the element will heat up to about 30 °C over ambient, and over the life of the part the resistance value could shift roughly ± 0.5 %.
And if the resistor was run at it maximum power rating of 1/2 W in a 70 °C environment, it will heat up to about 58 °C over ambient, and you could see the resistance value shift roughly ± 1 % over the life of the part.

MATERIAL SPECIFICATIONS

Element	Vacuum-deposited nickel-chrome alloy	**Coating**	Flame retardant epoxy, formulated for superior moisture protection
Core	Fire-cleaned high purity ceramic	**Solderability**	Continuous satisfactory coverage when tested in accordance with MIL-R-10509

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MARKING

- Model
- Value
- Decade and tolerance
- Date code

PERFORMANCE

TEST (TEST METHODS - MIL-STD-202)	AT +70 °C	AT +125 °C
	MAXIMUM ΔR (TYPICAL TEST LOTS)	
Short Time Overload	± 0.05 %	± 0.05 %
Low Temperature Operation	± 0.05 %	± 0.05 %
Moisture Resistance	± 0.05 %	± 0.05 %
Shock	± 0.01 %	± 0.01 %
Vibration	± 0.04 %	± 0.04 %
Temperature Cycling	± 0.15 %	± 0.15 %
Load Life	Varies based on power rating used; see load life shift due to power and derating table	
Dielectric Withstanding Voltage	± 0.01 %	± 0.01 %
Effect of Solder	± 0.03 %	± 0.03 %

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