Metal Film Resistors, 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
- Special tolerance and or TC matching available on request
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available

RoHS* COMPLIANT

Note

* Lead (Pb)-containing terminations are not RoHS-compliant. Exemptions may apply.

Vishay Dale Model CMF is also available as Military Qualified Styles RN and RL. See appropriate catalog or web page for the MIL-SPEC ratings/attributes. (Except for marking, the Industrial and Military versions are exactly the same. Depending upon stock, military marked parts may be supplied as industrial rated parts).

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	MAXIMUM WORKING VOLTAGE (1) V	RESISTANCE RANGE Ω								
			0.1 % to 1 %	0.1 % to 0.5 %	1 % to 5 %	1 %	2 %, 5 %	1 %	2 %, 5 %	1 %	2 %, 5 %
			25 ppm/°C	50 ppm/°C	50 ppm/°C	100 ppm/°C	100 ppm/°C	150 ppm/°C	150 ppm/°C	200 ppm/°C	200 ppm/°C
CMF50	CMF-50	200	10 to 2.5M	10 to 2.5M	10 to 2.5M	10 to 2.5M	10 to 2.5M	10 to 22M	10 to 22M	10 to 22M	10 to 22M
CMF55	CMF-55	250	10 to 2.5M	10 to 2.5M	10 to 5M	1 to 22.1M	1 to 22.1M	0.5 to 50M	0.5 to 50M	0.5 to 50M	0.1 to 50M
CMF60	CMF-60	500	10 to 2.5M	10 to 2.5M	10 to 10M	1 to 10M	1 to 10M	0.5 to 10M	0.5 to 10M	0.5 to 10M	0.1 to 10M
CMF65	CMF-65	500	10 to 2.5M	10 to 2.5M	10 to 10M	1 to 15M	1 to 15M	0.5 to 22M	0.5 to 22M	0.5 to 22M	0.1 to 22M
CMF70	CMF-70	500	10 to 2.5M	10 to 2.5M	10 to 10M	1 to 15M	1 to 15M	1 to 22M	1 to 22M	1 to 22M	1 to 22M
CMF07	CMF-07	250	-	-	-	-	5 to 5M	-	1 to 5M	-	1 to 5M
CMF20	CMF-20	500	-	-	-	-	5 to 10M	-	1 to 10M	-	1 to 10M

Note

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

MAXIMUM COMMERCIAL POWER RATING

WATTAGE (2)	MODEL						
	CMF50	CMF55	CMF60	CMF65	CMF70	CMF07	CMF20
At + 70 °C	0.25 W	0.5 W	1 W	1 W	1 W	0.5 W	1 W
At + 125 °C	0.125 W	0.25 W	0.5 W	0.75 W	0.75 W	-	-

Note

(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.

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CMF55301R00FKRE (preferred part numbering format)

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

GLOBAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMPERATURE COEFFICIENT (3)	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)	Blank = Standard (Dash Number) (Up to 3 digits) From **1 to 999** as applicable **70** = Color banded, 5 bands (≤ 1 %) **80** = Color banded, 4 bands (≥ 2 %) **88** = Hot solder dip

Historical Part Number example: CMF-553010FT-1 (will continue to be accepted)

CMF-55	3010	F	T-1	R36
HISTORICAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMP. COEFFICIENT	PACKAGING

Notes

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

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

For technical questions, contact: ff2aresistors@vishay.com

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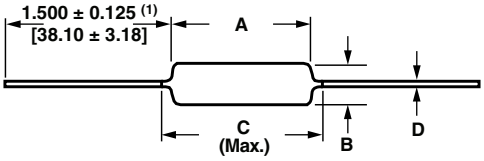
DIMENSIONS in inches (millimeters)



GLOBAL MODEL	A	B	C (Max.)	D
CMF50	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	0.240 ± 0.020 (4) (6.10 ± 0.51)	0.090 ± 0.008 (2.29 ± 0.20)	0.278 (7.06) (3)	0.025 ± 0.002 (0.64 ± 0.05)
CMF60	0.344 ± 0.031 (8.74 ± 0.79)	0.145 ± 0.015 (3.68 ± 0.38)	0.425 (10.80)	0.025 ± 0.002 (2) (0.64 ± 0.05)
CMF65	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	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)
CMF07	0.240 ± 0.020 (6.10 ± 0.51)	0.090 ± 0.008 (2.29 ± 0.20)	0.278 (7.06)	0.025 ± 0.002 (0.64 ± 0.05)
CMF20	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)

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) Available with 0.032" (0.813 mm) lead [CMF60..95]

(3) 0.290" (7.37 mm) for ± 0.25 % and ± 0.1 % resistance tolerances and values > 1 MΩ

(4) 0.260" ± 0.020" (6.60 mm ± 0.51 mm) for values > 5 MΩ

TECHNICAL SPECIFICATIONS								
PARAMETER	UNIT	CMF50	CMF55	CMF07	CMF60	CMF20	CMF65	CMF70
Maximum Working Voltage	V≅	≤ 200	≤ 250	≤ 250	≤ 500	≤ 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	450	450	750	750	900	900
Insulation Resistance	Ω	≥ 10^{11}						
Operating Temperature Range	°C	- 55 to + 175						
Terminal Strength (Pull Test)	lb	2	2	5	2	5	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	0.12	0.20	0.20	0.50	0.60	1.00	1.10

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

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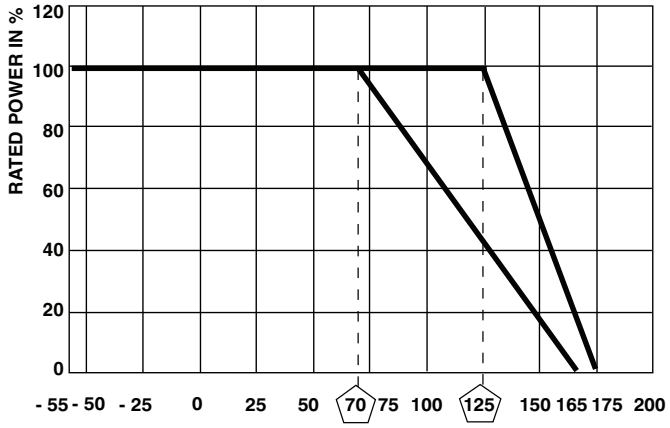
LOAD LIFE SHIFT DUE TO POWER AND DERATING (AT 70 °C AND AT + 125 °C)

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.

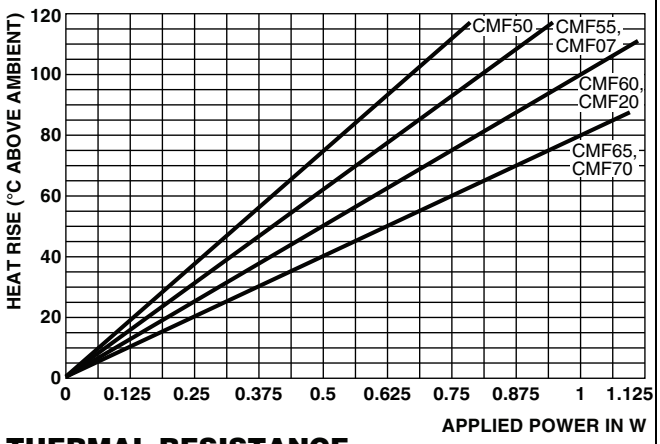
LOAD LIFE SHIFT VS. POWER RATING

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	1/20 W and 1/10 W	1/8 W	1/4 W	1/20 W	1/10 W	1/8 W
CMF55, CMF07	1/10 W and 1/8 W	1/4 W	1/2 W	1/10 W	1/8 W	1/4 W
CMF60, CMF20	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	1/4 W and 1/2 W	3/4 W	1 W	1/4 W	1/2 W	3/4 W
CMF70	1/4 W and 1/2 W	3/4 W	1 W	1/4 W	1/2 W	3/4 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 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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SPECIAL MODIFICATIONS

1. Terminals may be supplied in any commercial material with several type finishes.
2. Special pre-conditioning (power aging, temperature cycling, etc.) to customer specifications.
3. Non-helixed resistors can be supplied for critical high frequency applications.
4. Fusible, flameproof versions available.

MARKING

Temperature coefficient: T00 = 200 ppm, T0 = 150 ppm, T1 = 100 ppm, T2 = 50 ppm, T9 = 25 ppm

CMF50: (3 lines)

3.01	Value
K 1 %	Ohm, K or M sign and Tolerance
1208	4-digit date code

CMF55, CMF60, CMF65, CMF70: (4 lines)

CMF55	Style and size
49.9 kΩ	Value
1 % T2	Tolerance and TC
1208	4-digit date code

Note

- CMF07 and CMF20 parts are marked with color bands, either per MIL-PRF-22684 (with a wide white band) or using commercial color bands. CMFxx..70 and CMFxx..80 parts are marked using commercial color bands.

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	± 0.004 %	± 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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