

Metal Film Resistors, Axial, Industrial, Precision



FEATURES

- Small size - conformal coated
- Flame retardant epoxy coating
- Controlled temperature coefficient
- Excellent high frequency characteristics
- Exceptionally low noise; typically 0.10 $\mu\text{V/V}$
- 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


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

Vishay Dale Model CMF is also available as Military Qualified Styles RN and RL. See Vishay Dale's CMF (Military RN and RL) datasheet (www.vishay.com/doc?31027) for the MIL-SPEC ratings / attributes. (Except for marking, the Industrial and Military versions are exactly the same).

STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	HISTORICAL MODEL	MAXIMUM WORKING VOLTAGE ⁽¹⁾ V	POWER RATING $P_{70^{\circ}\text{C}}$ ⁽²⁾ W	POWER RATING $P_{125^{\circ}\text{C}}$ ⁽²⁾ W	RESISTANCE RANGE Ω	TOLERANCE $\pm \%$	TEMPERATURE COEFFICIENT $\pm \text{ppm}/^{\circ}\text{C}$
CMF50	CMF-50	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	CMF-55	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	300
					0.2 to 50M	2, 5	200
CMF60	CMF-60	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	300
					0.2 to 50M	2, 5	200
CMF65	CMF-65	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	300
					0.2 to 50M	2, 5	200
CMF70	CMF-70	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	CMF-07	250	0.5	-	5 to 5M	2, 5	100
					1 to 5M	2, 5	150, 200
CMF20	CMF-20	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

GLOBAL PART NUMBER INFORMATION

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

GLOBAL MODEL	RESISTANCE VALUE	TOLERANCE CODE	TEMPERATURE COEFFICIENT ⁽¹⁾	PACKAGING	SPECIAL
(See Standard Electrical Specifications table)	R = Ω K = k Ω M = M Ω R10000 = 0.1 Ω 680K00 = 680 k Ω 1M0000 = 1.0 M Ω	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 M = 300 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	TEMPERATURE COEFFICIENT	PACKAGING

Notes

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

⁽¹⁾ Tolerances 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
CMF50	0.150 $\pm$ 0.020 (3.81 $\pm$ 0.51)	0.065 $\pm$ 0.015 (1.65 $\pm$ 0.38)	0.187 (4.75)	0.016 $\pm$ 0.002 ⁽²⁾ (0.41 $\pm$ 0.05)
CMF55	0.240 $\pm$ 0.020 ⁽³⁾ (6.10 $\pm$ 0.51)	0.090 $\pm$ 0.008 (2.29 $\pm$ 0.20)	0.290 (7.37)	0.025 $\pm$ 0.002 (0.64 $\pm$ 0.05)
CMF60	0.344 $\pm$ 0.031 (8.74 $\pm$ 0.79)	0.145 $\pm$ 0.015 (3.68 $\pm$ 0.38)	0.425 (10.80)	0.025 $\pm$ 0.002 ⁽⁴⁾ (0.64 $\pm$ 0.05)
CMF65	0.562 $\pm$ 0.031 (14.27 $\pm$ 0.79)	0.180 $\pm$ 0.015 (4.57 $\pm$ 0.38)	0.687 (17.45)	0.025 $\pm$ 0.002 (0.64 $\pm$ 0.05)
CMF70	0.562 $\pm$ 0.031 (14.27 $\pm$ 0.79)	0.180 $\pm$ 0.015 (4.57 $\pm$ 0.38)	0.687 (17.45)	0.032 $\pm$ 0.002 (0.81 $\pm$ 0.05)
CMF07	0.240 $\pm$ 0.020 (6.10 $\pm$ 0.51)	0.090 $\pm$ 0.008 (2.29 $\pm$ 0.20)	0.290 (7.37)	0.025 $\pm$ 0.002 (0.64 $\pm$ 0.05)
CMF20	0.375 $\pm$ 0.040 (9.53 $\pm$ 1.02)	0.145 $\pm$ 0.015 (3.68 $\pm$ 0.38)	0.425 (10.80)	0.032 $\pm$ 0.002 (0.81 $\pm$ 0.05)

Notes

- 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.
- Available with 0.020" (0.51 mm) lead [CMF50..38]
- 0.260" $\pm$ 0.020" (6.60 mm $\pm$ 0.51 mm) for values > 5 M Ω
- Available with 0.032" (0.813 mm) lead [CMF60..95]

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	$\geq 10^{11}$						
Operating Temperature Range	$^{\circ}\text{C}$	-55 to $+175$						
Terminal Strength (Pull Test)	lb	2	2	5	2	5	2	5
Noise	dB	0.10 $\mu\text{V/V}$ over a decade of frequency, with low and intermediate resistance values typically below 0.05 $\mu\text{V/V}$						
Weight (Max.)	g	0.12	0.28	0.28	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
M	M	300 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)					
	$\pm 0.15\%$	$\pm 0.5\%$	$\pm 1.0\%$	$\pm 0.15\%$	$\pm 0.5\%$	$\pm 1.0\%$
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 and 1-1/2 W	1/4 W	1/2 W	3/4 W and 1 W
CMF70	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.

**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 $\pm 0.15\%$.

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 $\pm 0.5\%$.

And if the resistor was run at its 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 $\pm 1\%$ 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

**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, M = 300 ppm

CMF50: (3 lines)

CMF55, CMF60, CMF65, CMF70: (5 lines)

3.01	Value	DALE	Manufacturer's name
K 1 %	Ohm, K or M sign and Tolerance	CMF55	Style and size
1208	4-digit date code	49.9 k Ω	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	± 0.04 %	± 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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CMF5010R000FKBF	CMF5027R400FKRE	CMF5561K900FKBF	CMF55R50000FLBF	CMF55715R00DHR6
CMF5015K000FKR6	CMF504K6400FKRE2	CMF501K0000FHBF	CMF551M6200FKBF	CMF502K2100FKRE
CMF554K0200DHR6	CMF65113R00FKBF	CMF551M8200FKBF	CMF558R2500FKBF	CMF55100R00FKBF
CMF551R5000FKBF	CMF5522M100FKBF	CMF55620K00JKBF	CMF554M7000FKBF	CMF55825R00FKBF
CMF5511M500GKR6	CMF50470R00FKRE	CMF6033K200FKR6	CMF5021K500FKRE2	CMF55200K00FKBF
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CMF554M0200FHBF	CMF55475R00FKBF	CMF55221R00DHR6	CMF654R0000FKR6	CMF504R7500FKRE
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CMF501M0000FKBF	CMF551K9600FKBF	CMF551M3300FHBF	CMF5060K400FHBF	CMF551K5000BHBF
CMF55232K00DHR6	CMF552R0000FKBF	CMF551R0000FKBF	CMF6010M000FHBF112	CMF5517K800BHR6
CMF55200R00BHBF	CMF55100K00FKBF	CMF559K7600DHR6	CMF559K2000BER6	CMF557K5000DHR6
CMF556M1900FKBF	CMF551R0000FKR6	CMF5510M000FKR6	CMF601R0000FKBF	CMF554K9900DHR6
CMF6075K000FKR6	CMF552M1500FKBF	CMF556M4900FKBF	CMF551K7000BHR6	CMF55130R00DHR6
CMF55243K00BEBF	CMF602R4300FLBF	CMF50750K00FKBF	CMF558K6600BHR6	CMF55226K00FHBF