

## Metal Film Resistors, Industrial



### 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  $\pm 5\text{ppm/Volt}$
- Special tolerance and or TC matching available on request

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.)

STANDARD ELECTRICAL SPECIFICATIONS								
MODEL	LIMITING ELEMENT VOLTAGE MAX $V_{\cong}$	RESISTANCE RANGE $\Omega$ VS - BEST AVAILABLE TOLERANCE/TEMPERATURE COEFFICIENT						
		$\pm 2\%^{**}$ T-00	$\pm 1\%$ T-0	$\pm 2\%, 5\%$ T-0	$\pm 1\%$ T-1	$\pm 2\%, 5\%$ T-1	$\pm 1\%$ T-2	$\pm 0.1\%$ T-9
CMF-50	200 V	—	10 - 1M	—	10 - 1M	—	10 - 500k	10 - 500k
CMF-55	250 V	0.1 - 0.49	0.5 - 22.1M	—	1 - 22.1M	—	10 - 5M	10 - 2.5M
CMF-07	250 V	—	—	1 - 5M	—	5 - 5M	—	—
CMF-60	350 V	0.1 - 0.49	0.5 - 8M	—	1 - 8M	—	10 - 8M	10 - 2.5M
CMF-20	350 V	—	—	1 - 8M	—	5 - 8M	—	—
CMF-65	500 V	0.1 - 0.49	0.5 - 15M	—	1 - 15M	—	10 - 10M	10 - 2.5M
CMF-70	500 V	—	1 - 15M	—	1 - 15M	—	10 - 10M	10 - 2.5M

\*\*A 0.0005 $\Omega$  bridge error is allowed in resistance measurement. It has the greatest effect on values in this range and should be taken into account when verifying tolerance and Temperature Coefficient.

COMMERCIAL POWER RATING (See Performance Table)		
WATTAGE	@ + 70°C	@ + 125°C
1/20	CMF-50	CMF-50
1/10	CMF-50, -55	CMF-50, -55
1/8	CMF-50, -55, -60	CMF-50, -55, -60
1/4	CMF-55, -60, -65, -70, -07	CMF-55, -60, -65, -70
1/2	CMF-55, -60, -65, -70, -20	CMF-60, -65, -70
3/4	CMF-60, -65, -70	CMF-65, -70
1	CMF-65, -70	—

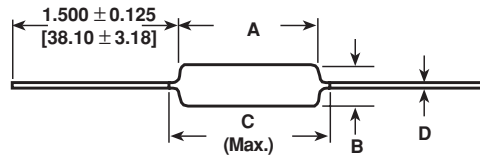
**Note:** The above table summarizes the more common combinations of power rating, case size and ambient operating temperature that prevail in various Industrial and Military resistor specifications. The "performance" table in ensuing pages qualifies the load life stability under these combinations

ORDERING INFORMATION			
CMF-55 MODEL	3010 RESISTANCE* VALUE	F TOLERANCE	T-1 TEMPERATURE*** COEFFICIENT
CMF-50 CMF-70 CMF-55 CMF-07 CMF-60 CMF-20 CMF-65	First three digits are significant. (Two for $\pm 2\%$ and $\pm 5\%$ tolerance.) Last digit specifies the number of zeros to follow.	B = $\pm 0.1\%$ C = $\pm 0.25\%$ D = $\pm 0.5\%$ F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$	T-00 = $\pm 200\text{ppm}/^\circ\text{C}$ T-0 = $\pm 150\text{ppm}/^\circ\text{C}$ T-1 = $\pm 100\text{ppm}/^\circ\text{C}$ T-2 = $\pm 50\text{ppm}/^\circ\text{C}$ T-9 = $\pm 25\text{ppm}/^\circ\text{C}$

\* Examples: R27 = 0.27 ohm, 49R9 = 49.9 ohm, 1000 = 100 ohm, 1001 = 1 kilohm, 1004 = 1 Megohm, R511 = 0.511 ohm.

\*\*\* Tolerances of  $\pm 0.5\%$  (D),  $\pm 0.25\%$  (C) and  $\pm 0.1\%$  (B) are available only in T-2 and T-9 temperature coefficients.

**DIMENSIONS** in inches [millimeters]



\*  $1.08 \pm 0.125$  [27.43 ± 3.18] IF TAPE AND REEL

MODEL	A	B	C (Max.)	D
CMF-50	$0.150 \pm 0.020$ [3.81 ± 0.51]	$0.065 \pm 0.015$ [1.65 ± 0.38]	0.187 [4.75]	$0.016 \pm 0.002$ [0.41 ± 0.05]
CMF-55	$0.240 \pm 0.020^{***}$ [6.10 ± 0.51]	$0.090 \pm 0.008$ [2.29 ± 0.20]	0.278 [7.06]**	$0.025 \pm 0.002$ [0.64 ± 0.05]
CMF-60	$0.344 \pm 0.031$ [8.74 ± 0.79]	$0.145 \pm 0.015$ [3.68 ± 0.38]	0.425 [10.80]	$0.025 \pm 0.002^*$ [0.64 ± 0.05]
CMF-65	$0.562 \pm 0.031$ [14.27 ± 0.79]	$0.180 \pm 0.015$ [4.57 ± 0.38]	0.687 [17.45]	$0.025 \pm 0.002^*$ [0.64 ± 0.05]
CMF-70	$0.562 \pm 0.031$ [14.27 ± 0.79]	$0.180 \pm 0.015$ [4.57 ± 0.38]	0.687 [17.45]	$0.032 \pm 0.002$ [0.81 ± 0.05]
CMF-07	$0.240 \pm 0.020$ [6.10 ± 0.51]	$0.090 \pm 0.008$ [2.29 ± 0.20]	0.278 [7.06]	$0.025 \pm 0.002$ [0.64 ± 0.05]
CMF-20	$0.375 \pm 0.040$ [9.53 ± 1.02]	$0.145 \pm 0.015$ [3.68 ± 0.38]	0.425 [10.80]	$0.032 \pm 0.002$ [0.81 ± 0.05]

\* Available with .032" [.813mm] lead.

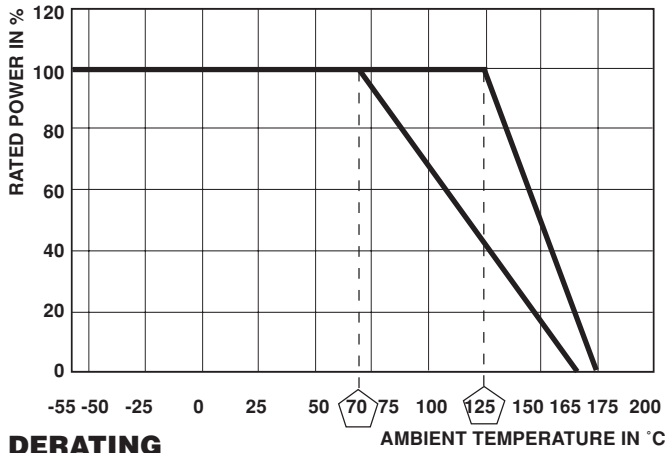
\*\* 290" [7.37mm] for ± 0.25% and ± 0.1% resistance tolerances and values > 1MΩ

\*\*\* .260" ± .020" [6.60mm ± .508mm] for values > 5 MΩ.

TECHNICAL SPECIFICATIONS								
PARAMETER	UNIT	CMF-50	CMF-55	CMF-07	CMF-60	CMF-20	CMF-65	CMF-70
Maximum Working Voltage	$V_{\cong}$	≤ 200	≤ 250	≤ 250	≤ 350	≤ 350	≤ 500	≤ 500
Insulation Voltage (1min)	$V_{eff}$	>500						
Voltage Coefficient	Max	± 5ppm/Volt (measured between 10% and full rated voltage)						
Dielectric Strength	VAC	450	450	450	750	750	900	900
Insulation Resistance	Ω				≥10 <sup>11</sup>			
Operating Temperature Range	°C	- 55 / + 175						
Terminal Strength (pull test)	lb	2	2	5	2	5	2	5
Noise	dB	0.10 microvolts/Volt over a decade of frequency, with low and intermediate resistance values typically below 0.5 microvolts/V						
Weight (max)	g	0.12	0.20	0.20	0.50	0.60	1.00	1.10



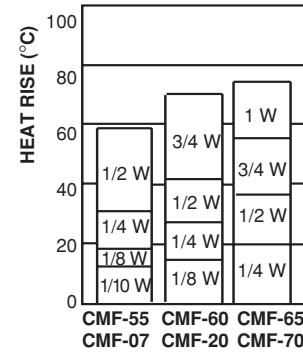
CMF resistors have an operating temperature range of - 55°C to + 175°C. They must be derated at high ambient temperatures according to the derating curve.



**DERATING**

The increase in resistor surface temperature due to the rated load is shown below.

Resistor surface temperature = heat rise plus ambient temperature.



**HEAT RISE**

### 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

— Value  
 — Decade and Tolerance  
 — Date code  
 (Alternate parts may be MIL marked)



TEMPERATURE COEFFICIENT CODES	
TEMPERATURE COEFFICIENT CODE	TEMPERATURE COEFFICIENT
T-00	0 ± 200ppm/°C
T-0	0 ± 150ppm/°C
T-1	0 ± 100ppm/°C
T-2	0 ± 50ppm/°C
T-9	0 ± 25ppm/°C

PERFORMANCE						
MODEL	POWER RATING					
	@ + 70°C			@ + 125°C		
CMF-50	1/10 Watt	1/8 Watt	-	1/20 Watt	1/10 Watt	1/8 Watt
CMF-55	1/8 Watt	1/4 Watt	1/2 Watt	1/10 Watt	1/8 Watt	1/4 Watt
CMF-60	1/4 Watt	1/2 Watt	3/4 Watt	1/8 Watt	1/4 Watt	1/2 Watt
CMF-65	1/2 Watt	3/4 Watt	1 Watt	1/4 Watt	1/2 Watt	3/4 Watt
CMF-70	1/2 Watt	3/4 Watt	1 Watt	1/4 Watt	1/2 Watt	3/4 Watt
CMF-07	-	1/4 Watt	-	-	-	-
CMF-20	-	1/2 Watt	-	-	-	-
TEST [Test methods - MIL-STD-202]	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	± 0.15%	± 0.5%	± 1.0%	± 0.15%	±0.5%	± 1.0%
Dielectric Withstanding Voltage	-	± 0.01%	-	-	±0.01%	-
Effect of Solder	-	± 0.03%	-	-	±0.03%	-