






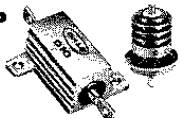



Precision General Purpose
Dale 1973 Film Resistor Index

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DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPEC.	EQUIV. MIL. TYPES*		CONDENSED SPECIFICATIONS	PAGE
			DALE	MIL.		
MF MIL-R-10509 	Epoxy-molded metal film resistor designed to meet a variety of military and commercial applications; combines high stability with low noise and offers exceptional moisture protection.	MIL-R-10509F (Char. C, D and E)	MF50 MF-1/10 MF-1/8 MF-1/4 MFS-1/2 MF-3/4 MF-1 MF-2	RN-50 RN-55 RN-60 RN-65 RN-70 None RN-75 RN-80	Power: 1/20, 1/10, 1/8, 1/4, 1/2, 3/4, 1 and 2 watt sizes Resistance Range: 10Ω to 10 Meg., depending on size and T.C. Resistance Tolerance: .1%, .25%, .5%, 1% T.C.: ±25, ±50, ±100, ±150 PPM standard	58
CMF MIL-R-10509 	Designed to meet a variety of military and commercial applications. Epoxy roll coated. Flame retardant coating.	MIL-R-10509	CMF-55 CMF-60 CMF-65	RN-55 RN-60 RN-65	Power: 1/10, 1/8, 1/4 watt sizes Resistance Range: 10Ω to 2 Meg., depending on size and T.C. Resistance Tolerance: .1%, .25%, .5%, 1% T.C.: ±25, ±35, ±50, ±100, ±150, ±200 PPM standard	60
CMF MIL-R-22684 	Metal film resistor with flame retardant epoxy coating. Designed to meet a variety of military and commercial applications; combines high stability, low noise, high power vs. small size and low cost.	MIL-R-22684	CMF-07 CMF-20	RL-07 RL-20	Power: 1/4 and 1/2 watt sizes Resistance Range: 51Ω to 470KΩ, depending on size and T.C. Resistance Tolerance: 2%, 5% T.C.: ±100, ±150, ±200 PPM standard	62
MFF & CMF 	Metal film resistors with flame retardant epoxy coating. Meet electrical and environmental requirements of MIL-R-10509 and MIL-R-22684.	MIL-R-10509 MIL-R-22684 (performance only)	CMF-1/10 MFF-1/8 CMF-1/8 MFF-1/4 MFF-1/2 CMF-1/4 MFF-1 MFF-2	None	Power: 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes Resistance Range: 10Ω to 10 Meg., depending on size and tolerance Resistance Tolerance: 5%, 2%, 1%, .5%, .25%, .1% T.C.: ±25, ±50, ±100, ±150, ±200 PPM standard	64
M (High Value) 	High value (to 100 Meg.) metal film resistor. Multi-layer protective coating.	None	M20 M11 M22 M13 M14	None	Power: 1/8, 1/4, 3/8, 1/2, 1, 2 watt sizes Resistance Range: 10Ω to 100 Meg., depending on size and tolerance Resistance Tolerance: .5%, 1% standard T.C.: ±100, ±150 PPM standard	75
MC 	Epoxy molded carbon film resistor, designed to meet a variety of military and commercial applications; offers exceptional moisture protection.	MIL-R-10509F (Char. B & D)	MC-1/10 MC-1/8 MC-1/4 MCS-1/2 MC-1 MC-2	RN-55 RN-60 RN-65 RN-70 RN-75 RN-80	Power: 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes Resistance Range: 1Ω to 125 Meg., depending on size and tolerance Resistance Tolerance: .5%, 1%, 2%	68
DC 	Epoxy roll-coated carbon film resistor; offers small physical size and low cost performance.	MIL-R-10509D (Char. X, also Char. B performance)	DC-1/4 DCS-1/2 DC-1 DC-2 DC-5	RN-10 RN-20 RN-25 RN-30 None	Power: 1/10, 1/8, 1/4, 1/2, 1, 2 and 5 watt sizes Resistance Range: 1Ω to 125 Meg., depending on size and tolerance Resistance Tolerance: .5%, 1%, 2%	70
D & P 	Precision power film resistors molded into an aluminum housing for complete environmental protection and high stability. Mount to or through chassis. Wide resistance range, low reactance at high frequencies.	None	D5 D10 D15 P8 P8A	None	Power: D=4, 8, 12 watt sizes. P=8 watts Resistance Range: 50Ω to 2.6 Meg., depending on size Resistance Tolerance: 0.1%, .25%, 0.5%, 1% and 2% standard	66



Industrial General Purpose

DF 	Low cost metal film resistor with flame retardant epoxy coating. Meets or exceeds performance requirements of EIA STD RS-196, Level 1.	None	DF1 DF3 DF5	None	Power: 1/4, 1/2, 1 watt sizes Resistance Range: 10Ω to 1 Meg., depending on size and tolerance Resistance Tolerance: 2%, 5%, 10% standard T.C.: ±100, ±150, ±200 PPM standard	72
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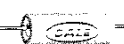
Dale Metal Film Index date 1973

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Industrial General Purpose cont.

DALE TYPE	BASIC DESCRIPTION	APPLICABLE MIL-SPEC.	EQUIV. MIL. TYPES*		CONDENSED SPECIFICATIONS	PAGE
			DALE	MIL.		
F07 F20 	Miniature molded oxide resistor. Meets MIL-R-22684 requirements. Ideal replacement for 5% carbon composition types.	MIL-R-22684	F07 F20	RL-07 RL-20	Power: 1/4 and 1/2 watt sizes Resistance Range: 10Ω to 470KΩ, depending on size and tolerance Resistance Tolerance: 2% and 5% standard. T.C.: ±200 PPM	73
FP 	Power oxide resistor with flame retardant coating. Excellent ability to withstand overloads.	None	FP37 FP38 FP39 FP41	None	Power: 3, 4, 5 and 7 watt sizes Resistance Range: 100 to 100 KΩ, depending on size and tolerance Resistance Tolerance: 5%, 10% standard T.C.: ±350 PPM	74

Special Purpose

HMF 	Epoxy-molded metal film resistor; combines high resistance and precision characteristics.	MIL-R-10509F (performance only)	HMF50 HMF-1/10 HMF-1/8 HMF-1/4 HMF-1/2 HMF-3/4 HMF-1	None	Power: 1/20, 1/10, 1/8, 1/4, 1/2, 3/4 and 1 watt sizes Resistance Range: 100KΩ to 50 Meg., depending on size and T.C. Resistance Tolerance: ±1% standard T.C.: ±25, ±50, ±100, ±150 PPM standard	84
LMF 	Epoxy-molded metal film resistor; combines low resistance and precision characteristics.	MIL-R-10509F (performance only)	LMF-1/10 LMF-1/8 LMF-1/4 LMF-1/2	None	Power: 1/10, 1/8, 1/4 and 1/2 watt sizes Resistance Range: 1Ω to 30Ω, depending on size and T.C. Resistance Tolerance: ±1% standard T.C.: ±25, ±50, ±100, ±150 PPM standard	82
Low T.C. 	Standard Low T.C.'s on MF, MFF and CMF styles, retaining outstanding features of each.	MIL-R-10509F (performance only)	CMF-1/10 MFF-1/8 MF-1/8 CMF-1/8 MFF-1/4 MF-1/4 MFF-1/2 MFS-1/2	None	Power: 1/8, 1/4 and 1/2 watt sizes Resistance Range: 30.1Ω to 750KΩ, depending on size and T.C. Resistance Tolerance: .1%, .25%, .5%, 1% T.C.: ±10, ±15, ±20 PPM standard	81
A (Low Value) 	Ultra low value metal oxide resistor. Molded and coated styles meet environmental specifications of MIL-R-22684.	None	A20 A31 A32	None	Power: 1/2, 1-1/2, 3 watt sizes Resistance Range: 0.27Ω to 27Ω, depending on size and tolerance Resistance Tolerance: 1%, 2%, 5%, 10% standard T.C.: From < 200 PPM to < 500 PPM	76
MH51 MH52 M51 	Ultra high value resistor—to 1,000KΩ with superior stability and consistent voltage coefficient. M51 hermetically sealed in glass; others protected by polyolefin sleeve.	None		None	Power: 1/4 and 1/2 watt sizes Resistance Range: 10M to 1,000KΩ, depending on size and tolerance Resistance Tolerance: 1%, 2%, 5%, 10% and 20% T.C.: ±1200, ±1500 and ±1800 PPM	77
I 	High frequency load resistor for applications involving high power, high accuracy RF measurements.	None		None	Power (Free Air Rating): 2, 10, 40 and 120 watt sizes Resistance Range: 25Ω to 300Ω, depending on size and tolerance Resistance Tolerance: 2% and 5% standard T.C.: 250 PPM maximum	80
F43 F44 	Very high voltage resistor designed for pulse loading and surge discharge.	None		None	Power: 1/2 and 1 watt sizes Resistance Range: 2 Meg. to 150,000 Meg., depending on size and tolerance Resistance Tolerance: 2%, 5%, 10% T.C.: -1200 to -2000 PPM typical	78
F53D F535D F54D 	High voltage industrial grade resistor. Protected by polyolefin sleeve.	None		None	Power: 1, 1-1/2 and 2 watt sizes Resistance Range: 2 Meg. to 1,000 Meg., depending on size and tolerance Resistance Tolerance: 10% and 20% standard T.C.: -1200 to -1500 PPM typical	79
MFH & DCH 	Type MFH=Metal Film Type DCH=Carbon Film Designed to meet a variety of military and commercial applications.	MIL-R-10509	MFH-1/10 MFH-1/4 MFH-1 MFH-2 DCH-1/10 DCH-1/4 DCH-1	RN-55 RN-60 RN-75 RN-80 RN-55 RN-60 RN-75	Power: 1/10, 1/8, 1/4, 1/2, 1 and 2 watt sizes Resistance Range: 2Ω to 15 Meg., depending on type, size and tolerance Resistance Tolerance: .10%, .25%, .5%, 1%, 2%, depending on type	85

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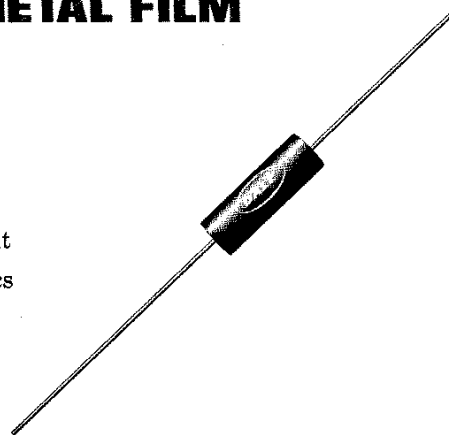


Precision
Film
Resistors

TYPE MF MOLDED METAL FILM MIL-R-10509

FEATURES

- Very low noise
- Controlled temperature coefficient
- Close tracking of temperature coefficient
- Very good high frequency characteristics
- Epoxy-molded construction provides superior moisture protection
- MF50 (1/20 watt) offers precision performance in sub-miniature size



STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	125° C RATING (Char. C & E)	70° C RATING (Char. D)	MAX. WT. (Grams)	MAX. WORKING VOLTAGE
MF50	RN-50	1/20 w	—	.11	200
MF-1/10	RN-55	1/10 w	1/8 w	.35	200
MF-1/8	RN-60	1/8 w	1/4 w	.45	300
MF-1/4	RN-65	1/4 w	1/2 w	.84	350
MFS-1/2	RN-70	1/2 w	3/4 w	1.6	500
MF-3/4	—	3/4 w	—	1.9	500
MF-1	RN-75	—	1 w*	4.4	500
MF-2	RN-80	—	2 w*	7.9	750

*Characteristic B

Tolerance: ±1%, ±.5%, ±0.25%, ±0.10% standard
Special tolerances and matching on request

SPECIAL MODIFICATIONS

- Terminals may be supplied in any commercial material with several type finishes.
- Special T.C. matching can be done between pairs or sets, and between different as well as identical values and sizes.
- Special close-tolerance matching
- Special pre-conditioning (power aging, temperature cycling, etc.) to customer specifications.
- Non-helixed units can be supplied for critical high frequency applications.

TEMPERATURE COEFFICIENT CODE

T.C. CODE	MIL. CHAR.	TEMPERATURE COEFFICIENT*	TEMPERATURE RANGE
T-00		0±200 PPM/°C	-55°C to +175°C
T-0	D	0±150 PPM/°C	-55°C to +175°C
T-1	D	0±100 PPM/°C	-55°C to +175°C
T-2	C	0± 50 PPM/°C	-55°C to +175°C
T-9	E	0± 25 PPM/°C	-55°C to +175°C
T-3		0+100 PPM/°C	-55°C to +175°C
T-4		0-100 PPM/°C	-55°C to +175°C
T-5		0± 25 PPM/°C	+25°C to +145°C
T-6		0 to +50 PPM/°C	-55°C to +175°C
T-7		0 to -50 PPM/°C	-55°C to +175°C
T-8		0± 35 PPM/°C	-55°C to + 25°C
		0± 25 PPM/°C	+25°C to +175°C

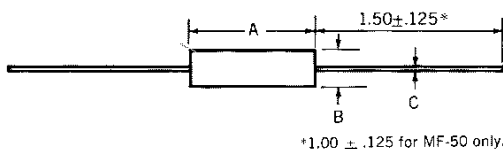
*For lower T.C.'s, see page 81.

RESISTANCE RANGE (Ohms) (For LMF and HMF extended ranges, see pages 82-84.)

	1%, .5%, .25%, .1%			
	T-0* (Char. D)	T-1* (Char. D)	T-2 (Char. C)	T-9 (Char. E)
MF50	24.9Ω-100KΩ	49.9Ω-100KΩ	100Ω-100KΩ	100Ω-100KΩ
MF-1/10	10Ω-499KΩ	30.1Ω-499KΩ	30.1Ω-301KΩ	30.1Ω-301KΩ
MF-1/8	10Ω-1 Meg.	24.9Ω-1 Meg.	30.1Ω-499KΩ	30.1Ω-499KΩ
MF-1/4	10Ω-2 Meg.	24.9Ω-2 Meg.	30.1Ω-1 Meg.	30.1Ω-1 Meg.
MFS-1/2	10Ω-2.49 Meg.	24.9Ω-2.49 Meg.	24.9Ω-1 Meg.	24.9Ω-1 Meg.
MF-3/4	10Ω-2.49 Meg.	24.9Ω-2.49 Meg.	100Ω-1 Meg.	100Ω-1 Meg.
MF-1	10Ω-5.11 Meg.	24.9Ω-4.02 Meg.	49.9Ω-2.61 Meg.	49.9Ω-2.61 Meg.
MF-2	30.1Ω-10 Meg.	100Ω-8 Meg.	100Ω-6 Meg.	200Ω-5.11 Meg.

*T-0 and T-1 are available in tolerance of ±.5% and greater only.

PHYSICAL CONFIGURATIONS



TYPE	DIM. A	DIM. B	DIM. C
MF50	.150 ± .020	.065 ± .015	.016 Dia.
MF-1/10	.260 ± .010	.095 ± .005	.025 Dia.
MF-1/8	.406 ± .015	.135 ± .010	.025 Dia.
MF-1/4	.593 ± .015	.203 ± .015	.025 Dia.
MFS-1/2	.730 ± .020	.250 ± .015	.032 Dia.
MF-3/4	.790 ± .020	.260 ± .015	.032 Dia.
MF-1	1.093 ± .020	.375 ± .015	.032 Dia.
MF-2	2.188 ± .020	.375 ± .015	.032 Dia.

SPECIFICATIONS

APPLICABLE MIL-SPECIFICATION

MIL-R-10509F: The MF series meet or exceed the electrical, environmental and dimensional requirements of MIL-R-10509F. Characteristics D, C or E apply, depending upon T.C. required.

ELECTRICAL

Tolerance: MF types are available in the following standard tolerances: 1%, .5%, .25% and .1%. Special tolerances and matching on request.

Noise: Dale metal film resistors have exceptionally low noise level. Average for standard resistance range is 0.10 micro-volt per volt over a decade of frequency, with low and intermediate resistance values typically below 0.05 micro-volt per volt.

Voltage Coefficient: Maximum voltage coefficient is 5 PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength: 750 VAC for MF-1/10 and MF-1/8; 900 VAC for all others.

Insulation Resistance: 10,000 megohms minimum dry, 100 megohms minimum after moisture test. Typical after moisture test is 200,000 megohms.

MECHANICAL

Terminal Strength: 2 lb. pull test=MF-1/10 thru MF-1/4
5 lb. pull test=MFS-1/2 thru MF-2

Solderability: Continuous, satisfactory coverage when tested in accordance with MIL-R-10509F.

MATERIAL

Element: Vacuum-deposited nickel-chrome alloy

Core: Fire-cleaned high purity ceramic.

Encapsulant: Specially Dale-formulated epoxies and molding compounds - molded construction.

Termination: Conductive terminating bands are vacuum-deposited on each end of the resistance element to assure optimum contact between film and press-fit cap. Standard lead material is solder coated copper.

Weldable Leads: 50 micro-inch gold-plated Dumet leads are available on a standard stocking basis, and can be specified by adding -52 to the standard model number (example: MF-1/4-52). Consult factory for charges on gold-plated Dumet, and for information on other materials such as nickel and other special alloys. Weldable leads per MIL-STD-1276.

ENVIRONMENTAL

Temperature Coefficient: MF resistors are available in 11 standard T.C. codes of which 150 PPM, 100 PPM, 50 PPM and 25 PPM are the most commonly required.

General: Environmental performance is shown in the table below. Test methods are those specified in MIL-R-10509F.

Shelf Life: Resistance shifts due to storage at room temperature are negligible.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

REQUIREMENT	CHAR. B		CHAR. D		CHAR. C		CHAR. E	
Dale Model which meets or exceeds Mil-specs.	RN-50 RN-55 RN-60 RN-65 RN-70 RN-75 RN-80	MF-1 MF-2	NA MF-1/10 MF-1/8 MF-1/4 MFS-1/2 NA NA	NA MF-1/10 MF-1/8 MF-1/4 MFS-1/2 NA NA	MF50 MF-1/10 MF-1/8 MF-1/4 MFS-1/2 MF-1 MF-2	MF50 MF-1/10 MF-1/8 MF-1/4 MFS-1/2 MF-1 MF-2		
Mil. Temp. Coefficient	± 500 PPM		+200 -500 PPM		±50 PPM		±25 PPM	
Applicable Dale T.C. Code	T-00 (200 PPM)		T-1 (100 PPM) T-0 (150 PPM)		T-2 (50 PPM)		T-9 (25 PPM)	
POWER RATING	at 70°C		at 70°C		at 125°C		at 125°C	
RN-50 RN-55 RN-60 RN-65 RN-70 RN-75 RN-80	Derate to 0 at 150°C 1 watt 2 watts		NA 1/8 watt 1/4 watt 1/2 watt 3/4 watt NA NA Derate to 0 at 165°C		1/20 watt 1/10 watt 1/8 watt 1/4 watt 1/2 watt NA NA Derate to 0 at 175°C		1/20 watt 1/10 watt 1/8 watt 1/4 watt 1/2 watt NA NA Derate to 0 at 175°C	
ENVIRONMENTAL TEST	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.
Temperature Cycling	±0.5%ΔR	±0.10%	±0.5%ΔR	±0.10%	±0.25%ΔR	±0.10%	±0.25%ΔR	±0.10%
Low Temp. Operation	±0.5%ΔR	±0.05%	±0.5%ΔR	±0.05%	±0.25%ΔR	±0.05%	±0.25%ΔR	±0.05%
Short Time Overload	±0.5%ΔR	±0.02%	±0.5%ΔR	±0.02%	±0.25%ΔR	±0.02%	±0.25%ΔR	±0.02%
Dielectric Withstanding Voltage	±0.5%ΔR	±0.01%	±0.5%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%
Effect of Soldering	±0.5%ΔR	±0.02%	±0.5%ΔR	±0.02%	±0.1% ΔR	±0.02%	±0.1% ΔR	±0.02%
Moisture Resistance	±1.5%ΔR	±0.05%	±1.5%ΔR	±0.05%	±0.5% ΔR	±0.05%	±0.5% ΔR	±0.05%
Load Life	±1.0%ΔR	±0.05%	±1.0%ΔR	±0.05%	±0.5% ΔR	±0.05%	±0.5% ΔR	±0.05%
Shock	±0.5%ΔR	±0.01%	±0.5%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%
Vibration	±0.5%ΔR	±0.01%	±0.5%ΔR	±0.01%	±0.25%ΔR	±0.01%	±0.25%ΔR	±0.01%

POWER RATING

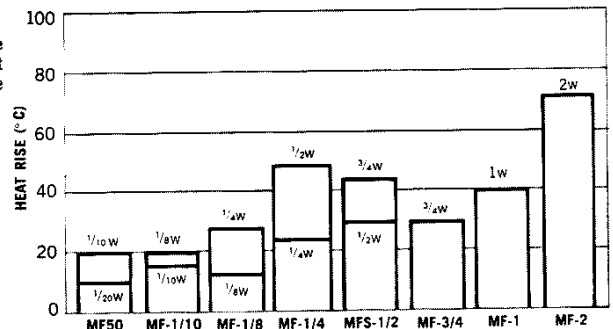
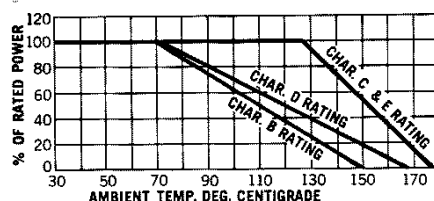
Dale MF resistors have two power ratings, depending on operating temperatures of 70° C and 125° C. Both are based on a maximum ΔR of .5% in 1000-hour load life.

HEAT RISE

The increase in resistor surface temperature due to the rated load is shown in the chart at the right. Resistor surface temperature = heat rise + ambient temperature.

DERATING

Dale MF resistors have an operating temperature range of -65° C to +175° C. They must be derated according to the following curves:



date 1973

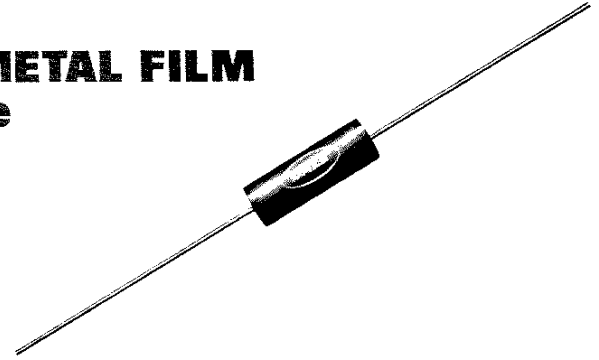


**PRECISION
FILM
RESISTORS**

TYPE HMF MOLDED METAL FILM High Value

FEATURES

- High resistance values (to 50 megohms).
- Controlled temperature coefficient.
- Close tracking of temperature coefficient.
- Very good high frequency characteristics.
- Epoxy-molded construction provides superior moisture protection.
- HMF50 (1/20 watt) offers precision performance in subminiature size.



STANDARD ELECTRICAL SPECIFICATIONS

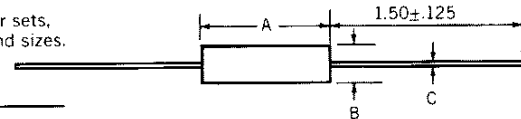
DALE TYPE	125 C RATING	70 C RATING	MAX. WT. (Grams)	MAX. WORKING VOLTAGE	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (OHMS)			
					T-0 0 ± 150 PPM	T-1 0 ± 100 PPM	T-2 0 ± 50 PPM	T-9 0 ± 25 PPM
HMF50	1/20 w	1/10 w	.11	200	101K-700K	101-700K	101-500K	101K-200K
HMF-1/10	1/10 w	1/8 w	.35	200	500K-2.5M	500K-2.5M	302K-2M	302K-500K
HMF-1/8	1/8 w	1/4 w	.45	300	1.01M-5M	1.01M-5M	500K-3M	500K-1M
HMF-1/4	1/4 w	1/2 w	.84	350	2.01M-15M	2.01M-15M	1.01M-10M	1.01M-2M
HMF-1/2	1/2 w	3/4 w	1.6	500	2.5M-30M	2.5M-30M	1.01M-20M	1.01M-3M
HMF-3/4	3/4 w	3/4 w	1.9	500	2.5M-30M	2.5M-30M	1.01M-20M	1.01M-3M
HMF-1	1 w	1 w	4.4	500	5.12M-50M	4.03M-50M	2.62M-30M	2.62M-5M

Tolerance: ± 1% standard. Special tolerances on request.

SPECIAL MODIFICATIONS

- Terminals may be supplied in any commercial material with several type finishes.
- Special T.C. matching can be done between pairs or sets, and between different as well as identical values and sizes.
- Special pre-conditioning (power aging, temperature cycling, etc.) to customer specifications.

PHYSICAL CONFIGURATIONS



SPECIFICATIONS

APPLICABLE MIL-SPECIFICATION

MIL-R-10509F: The HMF Series is designed to meet the electrical, dimensional and environmental requirements of MIL-R-10509F, but has higher resistance values.

ELECTRICAL

Tolerance: ± 1% standard. Special tolerances and matching on request.

Voltage Coefficient: Maximum voltage coefficient is 5 PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength: HMF50 and HMF-1/10 450 VAC; HMF-1/8 - 750 VAC; all other 900 VAC.

Insulation Resistance: 10,000 megohms minimum dry, 100 megohms minimum after moisture test. Typical after moisture test is 200,000 megohms.

MECHANICAL

Terminal Strength: 2 lb. pull test HMF50 thru HMF-1/4; 5 lb. pull test HMF-1/2 thru HMF-1.

Solderability: Continuous, satisfactory coverage when tested in accordance with MIL-R-10509F.

MATERIAL

Element: Vacuum-deposited nickel-chrome alloy.

Core: Fire-cleaned high purity ceramic.

Encapsulant: Specially formulated epoxy-molded construction.

Termination: Conductive terminating bands are vacuum-deposited on each end of the resistance element to assure optimum contact between film and press-fit cap. Standard lead material is solder coated copper.

Weldable Leads: 50 micro-inch gold-plated Dumet leads are available on a standard stocking basis and can be specified by adding -52 to the standard model number (example, HMF-1 4-52). Consult factory for charges on gold-plated Dumet, and for information on other materials such as nickel and other special alloys. Weldable leads per MIL-STD-1276.

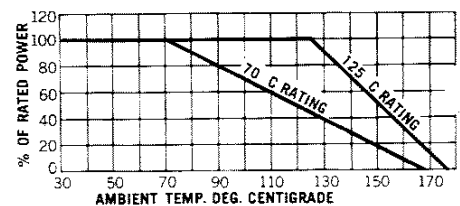
DALE TYPE	DIM. A	DIM. B	DIM. C
HMF50	.150 ± .020	.065 ± .015	.016 Dia.
HMF-1/10	.260 ± .010	.095 ± .005	.025 Dia.
HMF-1/8	.406 ± .015	.135 ± .010	.025 Dia.
HMF 1/4	.593 ± .015	.203 ± .015	.025 Dia.
HMF-1/2	.730 ± .020	.250 ± .015	.032 Dia.
HMF-3/4	.790 ± .020	.260 ± .015	.032 Dia.
HMF-1	1.093 ± .020	.375 ± .015	.032 Dia.

POWER RATING

Dale HMF resistors have two power ratings, depending on operating temperatures of 70 C and 125 C. Both are based on a maximum ΔR of 0.5% in 1000-hour load life.

DERATING

Dale HMF resistors have an operating temperature range of -65 C through -175 C. They must be derated according to the following curves:



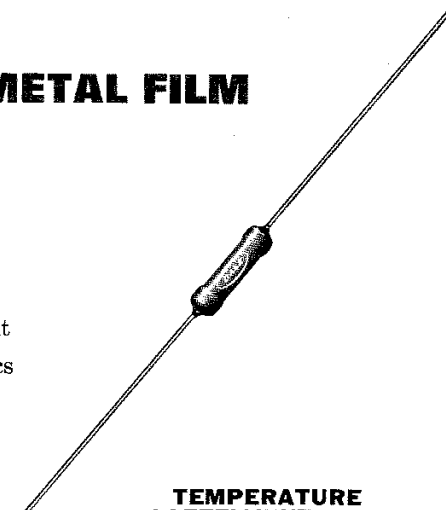


Metal
Film
Resistors

TYPE CMF COATED METAL FILM MIL-R-10509

FEATURES

- Very low noise
- Controlled temperature coefficient
- Close tracking of temperature coefficient
- Very good high frequency characteristics
- Flame retardant epoxy coating



STANDARD ELECTRICAL SPECIFICATIONS

DALE TYPE	MIL. TYPE	125°C RATING (Char. C & E)	70°C RATING (Char. D)	MAX. WT. (Grams)	MAX. WORKING VOLTAGE
CMF-55	RN-55	1/10 w	1/8 w	.30	200
CMF-60	RN-60	1/8 w	1/4 w	.55	300
CMF-65	RN-65	1/4 w	1/2 w	1.00	350

Tolerance: $\pm 1\%$, $\pm 5\%$, $\pm 25\%$, $\pm 10\%$ standard.
Special tolerances and matching on request.

SPECIAL MODIFICATIONS

- Terminals may be supplied in any commercial material with several type finishes.
- Special T.C. matching can be done between pairs or sets and between different as well as identical values and sizes.
- Special close tolerance matching.
- Special pre-conditioning (power aging, temperature cycling, etc.) to customer specifications.
- Non-helixed resistors can be supplied for critical high frequency applications.

TEMPERATURE COEFFICIENT CODE

T.C. CODE	MIL. CHAR.	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE
T-00		0 ± 200 PPM/°C	-55°C to +175°C
T-0	D	0 ± 150 PPM/°C	-55°C to +175°C
T-1	D	0 ± 100 PPM/°C	-55°C to +175°C
T-2	C	0 ± 50 PPM/°C	-55°C to +175°C
T-9	E	0 ± 25 PPM/°C	-55°C to +175°C
T-3		$0 + 100$ PPM/°C	-55°C to +175°C
T-4		$0 - 100$ PPM/°C	-55°C to +175°C
T-5		0 ± 25 PPM/°C	+25°C to +145°C
T-6		$0 + 50$ PPM/°C	-55°C to +175°C
T-7		$0 - 50$ PPM/°C	-55°C to +175°C
T-8		0 ± 35 PPM/°C 0 ± 25 PPM/°C	-55°C to +25°C +25°C to +175°C

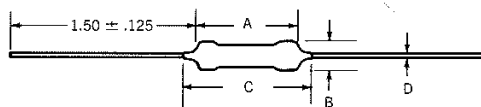
RESISTANCE RANGE (Ohms)

1%, .5%, .25%, .10%

DALE TYPE	T-0* (Char. D)	T-1* (Char. D)	T-2 (Char. C)	T-9 (Char. E)
CMF-55	10 Ω -499K	30.1 Ω -499K	30.1 Ω -301K	30.1 Ω -301K
CMF-60	10 Ω -1 Meg.	10 Ω -1 Meg.	30.1 Ω -499K	30.1 Ω -499K
CMF-65	10 Ω -2 Meg.	24.9 Ω -2 Meg.	30.1 Ω -1 Meg.	30.1 Ω -1 Meg.

*T-0 and T-1 are available in tolerances of $\pm 5\%$ and greater only.

PHYSICAL CONFIGURATIONS



DALE TYPE	DIM. A	DIM. B	DIM. C	DIM. D
CMF-55	.250 \pm .031	.095 \pm .010	.395 (Max.)	.025 \pm .002
CMF-60	.390 \pm .031	.145 \pm .015	.525 (Max.)	.025 \pm .002
CMF-65	.562 \pm .031	.190 \pm .015	.687 (Max.)	.025 \pm .002

SPECIFICATIONS

APPLICABLE MIL-SPECIFICATION

MIL-R-10509F: The CMF series meet or exceed the electrical, environmental and dimensional requirements of MIL-R-10509F. Characteristics D, C or E apply, depending upon T.C. required.

ELECTRICAL

Tolerance: CMF types are available in the following standard tolerances: 1%, .5%, .25% and .1%. Special tolerances and matching on request.

Noise: Dale metal film resistors have exceptionally low noise level. Average for standard resistance range is 0.10 micro-volt per volt over a decade of frequency, with low and intermediate resistance values typically below 0.05 micro-volt per volt.

Voltage Coefficient: Maximum voltage coefficient is 5 PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength: 450 VAC for CMF-55; 750 VAC for CMF-60; 900 VAC for CMF-65.

Insulation Resistance: 10,000 megohms minimum dry; 100 megohms minimum after moisture test.

MECHANICAL

Terminal Strength: 2 lb. pull test for CMF-55, CMF-60 and CMF-65.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509F.

MATERIAL

Element: Vacuum-deposited nickel-chrome alloy.

Core: Fire-cleaned high purity ceramic.

Coating: Dale-developed flame retardant epoxy, formulated for superior moisture protection.

Termination: Conductive terminating bands are vacuum deposited on each end of the resistance element to assure optimum contact between film and press-fit cap. Standard lead material is solder-coated copper.

Weldable Leads: 50 micro-inch gold-plated Dumet leads are available on a standard stocking basis, and can be specified by adding "-52" to the standard model number (example: CMF-60-52). Consult factory for charges on gold-plated Dumet and for information on other materials such as nickel and other special alloys. Lead materials per MIL-STD-1276.

ENVIRONMENTAL

Temperature Coefficient: CMF resistors are available in 11 standard T.C. codes of which 150 PPM, 100 PPM, 50 PPM and 25 PPM are the most commonly required.

General: Environmental performance is shown in the table below. Test methods are those specified in MIL-R-10509.

Shelf Life: Resistance shifts due to storage at room temperature are negligible.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

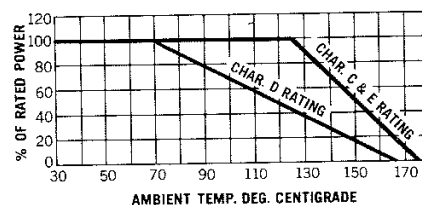
REQUIREMENT	CHAR. D		CHAR. C		CHAR. E	
RN-55	CMF-55		CMF-55		CMF-55	
RN-60	CMF-60		CMF-60		CMF-60	
RN-65	CMF-65		CMF-65		CMF-65	
Mil. Temp. Coefficient	+200-500 PPM		±50 PPM		±25 PPM	
Applicable T.C. Code	T-1 (100 PPM) T-0 (150 PPM)		T-2 (50 PPM)		T-9 (25 PPM)	
POWER RATING	at 70°C		at 125°C		at 125°C	
RN-55	1/8 watt		1/10 watt		1/10 watt	
RN-60	1/4 watt		1/8 watt		1/8 watt	
RN-65	1/2 watt		1/4 watt		1/4 watt	
		Derate to 0 at 165°C		Derate to 0 at 175°C		Derate to 0 at 175°C
ENVIRONMENTAL TEST	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.	MIL. MAX.	DALE TYP.
Temperature Cycling	±0.5% ΔR	±0.1%	±0.25% ΔR	±0.1%	±0.25% ΔR	±0.1%
Low Temp. Operation	±0.5% ΔR	±0.05%	±0.25% ΔR	±0.05%	±0.25% ΔR	±0.05%
Short Time Overload	±0.5% ΔR	±0.02%	±0.25% ΔR	±0.02%	±0.25% ΔR	±0.02%
Dielectric Withstanding Voltage	±0.5% ΔR	±0.01%	±0.25% ΔR	±0.01%	±0.25% ΔR	±0.01%
Effect of Solder	±0.5% ΔR	±0.02%	±0.1% ΔR	±0.02%	±0.1% ΔR	±0.02%
Moisture Resistance	±1.5% ΔR	±0.05%	±0.5% ΔR	±0.05%	±0.5% ΔR	±0.05%
Load Life	±1.0% ΔR	±0.15%	±0.5% ΔR	±0.15%	±0.5% ΔR	±0.15%
Shock	±0.5% ΔR	±0.01%	±0.25% ΔR	±0.01%	±0.25% ΔR	±0.01%
Vibration	±0.5% ΔR	±0.01%	±0.25% ΔR	±0.01%	±0.25% ΔR	±0.01%

POWER RATING

Dale CMF resistors have two power ratings depending on operating temperatures of 70°C and 125°C. Both are based on a maximum ΔR of .5% in 1,000 hour load life.

DERATING

Dale CMF resistors have an operating temperature range of -65°C to +175°C. They must be derated according to the following curves:



HEAT RISE

The increase in resistor surface temperature due to rated load is shown in the chart at the right. Resistor temperature = heat rise + ambient temperature.

