

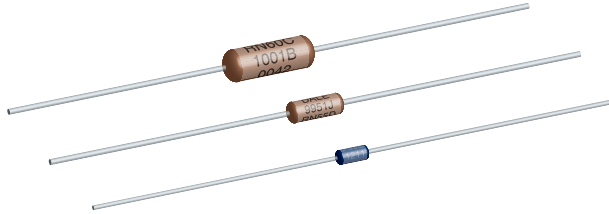


**THE DATASHEET OF  
RN60D2111FB14**





Metal Film Resistors, Axial, Military, MIL-R-10509 Qualified, Precision, Type RN and MIL-PRF-22684 Qualified, Type RL



FEATURES

- Very low noise (-40 dB)
- Very low voltage coefficient (5 ppm/V)
- Controlled temperature coefficient
- Flame retardant epoxy coating
- Commercial alternatives to military styles are available with higher power ratings. See CMF Industrial data sheet: ([www.vishay.com/doc?31018](http://www.vishay.com/doc?31018))

STANDARD ELECTRICAL SPECIFICATIONS											
GLOBAL MODEL	MIL STYLE	MIL SPEC. SHEET	POWER RATING $P_{70^{\circ}\text{C}}$ W	POWER RATING $P_{125^{\circ}\text{C}}$ W	MAX. WORKING VOLTAGE <sup>(1)</sup> V	RESISTANCE RANGE $\Omega$ MIL-R-10509 $\pm 100 \text{ ppm}/^{\circ}\text{C}$ (D)	RESISTANCE RANGE $\Omega$ MIL-R-10509 $\pm 50 \text{ ppm}/^{\circ}\text{C}$ (C)	RESISTANCE RANGE $\Omega$ MIL-R-10509 $\pm 25 \text{ ppm}/^{\circ}\text{C}$ (E)	RESISTANCE RANGE $\Omega$ MIL-PRF-22684	TOL. <sup>(3)</sup> $\pm$ %	DIELECTRIC STRENGTH $V_{\text{AC}}$
CMF50	RN50	08	-	0.05	200	-	10 to 100K	10 to 100K	-	0.1, 0.25, 0.5, 1	450
CMF55	RN55	07	0.125	0.10	200	10 to 301K	49.9 to 100K	49.9 to 100K	-	0.1, 0.25, 0.5, 1	450
CMF60	RN60	01	0.25	0.125	300	10 to 1M	49.9 to 499K	49.9 to 499K	-	0.1, 0.25, 0.5, 1	500
CMF65	RN65	02	0.50	0.25	350	10 to 2M	49.9 to 1M	49.9 to 1M	-	0.1, 0.25, 0.5, 1	900
CMF70	RN70	03	0.75 <sup>(2)</sup>	0.50	500	10 to 2.49M	24.9 to 1M	24.9 to 1M	-	0.1, 0.25, 0.5, 1	900
CMF07	RL07	01	0.25	-	250	-	-	-	51 to 150K	2, 5	450
CMF20	RL20	02	0.50	-	350	-	-	-	4.3 to 470K	2, 5	700

Notes

- <sup>(1)</sup> Continuous working voltage shall be  $\sqrt{P \times R}$  or maximum working voltage, whichever is less.
- <sup>(2)</sup> Formerly rated at 1 W and is the direct replacement for RN70 of MIL-R-10509 rev. D.
- <sup>(3)</sup> Tolerances of  $\pm 0.1$  %,  $\pm 0.25$  % and  $\pm 0.5$  % are not applicable to characteristic D.

TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	CONDITION
Voltage Coefficient	ppm/V	5 when measured between 10 % and full rated voltage
Insulation Resistance	$\Omega$	$\geq 10^{10}$ min. dry; $\geq 10^8$ min. after moisture test
Operating Temperature Range	$^{\circ}\text{C}$	-65/+175 (see derating curves for military range)
Terminal Strength	lb	5 pound pull test for RL07/RL20; 2 pound pull test for all others
Solderability		Continuous satisfactory coverage when tested in accordance with MIL-R-10509 and MIL-PRF-22684



**GLOBAL PART NUMBER INFORMATION**

New Global Part Numbering: RN60D3483FR36 (preferred part numbering format)

R N 6 0 D 3 4 8 3 F R 3 6

<b>MIL STYLE</b> RN50 RN55 RN60 RN65 RN70	<b>CHARACTERISTIC</b> E = 25 ppm C = 50 ppm D = 100 ppm	<b>RESISTANCE VALUE</b> 3 digit significant figure, followed by a multiplier Use "R" for values < 100 Ω 10R0 = 10 Ω 2152 = 21.5 kΩ 2494 = 2.49 MΩ	<b>TOLERANCE CODE</b> B = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 %	<b>PACKAGING</b> B14 = tin/lead, bulk BSL = tin/lead, bulk, single lot date code R36 = tin/lead, T/R (full) RE6 = tin/lead, T/R (1000 pieces) RSL = tin/lead, T/R, single lot date code	<b>SPECIAL</b> Blank = standard (Dash number) 88 = hot solder dip 143 = non-magnetic
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Historical Part Number example: RN60D3483F (will continue to be accepted)

RN60	D	3483	F	R36
MIL STYLE	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

New Global Part Numbering: RL07S471JR36 (preferred part numbering format)

R L 0 7 S 4 7 1 J R 3 6

<b>MIL STYLE</b> RL07 RL20	<b>LEAD MATERIAL</b> S = solderable	<b>RESISTANCE VALUE</b> 2 digit significant figure, followed by a multiplier Use "R" for values < 10 Ω 4R3 = 4.3 Ω 202 = 2.0 kΩ 474 = 470 kΩ	<b>TOLERANCE CODE</b> G = ± 2 % J = ± 5 %	<b>PACKAGING</b> B14 = tin/lead, bulk BSL = tin/lead, bulk, single lot date code R36 = tin/lead, T/R (full) RE6 = tin/lead, T/R (1000 pieces) RSL = tin/lead, T/R, single lot date code	<b>SPECIAL</b> Blank = standard (Dash number) 88 = hot solder dip 143 = non-magnetic
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Historical Part Number example: RL07S471J (will continue to be accepted)

RL07	S	471	J	R36
MIL STYLE	LEAD MATERIAL	RESISTANCE VALUE	TOLERANCE CODE	PACKAGING

**Note**

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

MATERIAL SPECIFICATIONS	
Element	Nickel-chrome alloy
Coating	Flame retardant epoxy, formulated for superior moisture protection
Core	Fire-cleaned high purity ceramic
Termination	Standard lead material is solder-coated copper. Solderable and weldable.

**CAGE CODE: 91637**

**APPLICABLE MIL-SPECS**

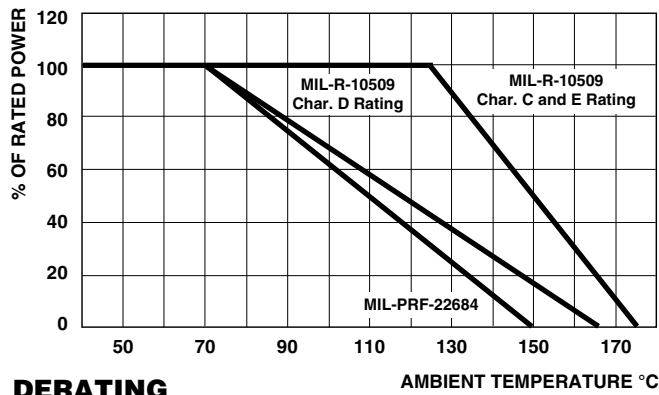
**MIL-R-10509 and MIL-PRF-22684:** The CMF models meet or exceed the electrical, environmental and dimensional requirements of MIL-R-10509 and MIL-PRF-22684.

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

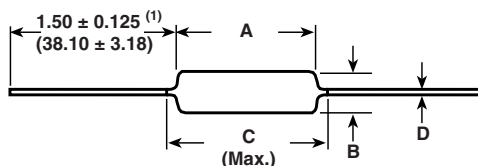
ENVIRONMENTAL SPECIFICATIONS	
General	Environmental performance is shown in the Environmental Performance table. Test methods are those specified in MIL-R-10509 and MIL-PRF-22684.
Shelf Life	Resistance shifts due to storage at room temperature are negligible.



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



**DIMENSIONS** in inches (millimeters)



VISHAY DALE MODEL	A	B	C (MAX.)	D
CMF50	0.150 ± 0.020 (3.81 ± 0.51)	0.065 ± 0.015 (1.65 ± 0.38)	0.244 (6.20)	0.016 ± 0.002 (0.41 ± 0.05)
CMF55	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)
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 (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)	0.290 (7.37)	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)

**Note**

(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.

MILITARY POWER RATING			
WATTAGE	MILITARY QUALIFIED		
	MIL-R-10509		MIL-PRF-22684
	AT +70 °C (D)	AT +125 °C (C and E)	AT +70 °C
0.05	-	RN50	-
0.10	-	RN55	-
0.125	RN55	RN60	-
0.25	RN60	RN65	RL07
0.50	RN65	RN70	RL20
0.75 (1)	RN70	-	-

**Notes**

• Commercial equivalents of military styles are available with higher power ratings. Consult factory.

(1) Formerly rated at 1 W and is the direct replacement for RN70 of MIL-R-10509 rev. D.



MARKING (per MIL-PRF-10509)	
Characteristics: D = 100 ppm, C = 50 ppm, E = 25 ppm Tolerance: F = 1 %, D = 0.5 %, C = 0.25 %, B = 0.1 % Value = Three significant figures and multiplier J = JAN (Joint Army - Navy) brand	
RN50: (3 lines)	RN55, RN60, RN65, RN70 (4 lines)
J50D JAN, type, characteristic	DALE Company logo
1211 Value	0137J 4 digit date code and JAN brand
F137 Tolerance and 3 digit date code	RN55D Type and characteristic
	1211F Value and Tolerance

**Note**

- RL series are color banded per MIL-PRF-22684.

PERFORMANCE				
REQUIREMENT	MIL-R-10509			MIL-PRF-22684
	CHARACTERISTIC D	CHARACTERISTIC C	CHARACTERISTIC E	
MIL Temperature Coefficient	+200 ppm/°C -500 ppm/°C	± 50 ppm/°C	± 25 ppm/°C	± 200 ppm/°C
Applicable Vishay Dale Temperature Coefficient	± 100 ppm/°C	± 50 ppm/°C	± 25 ppm/°C	± 200 ppm/°C
<b>TEST</b>	<b>MIL<sub>max.</sub></b>	<b>MIL<sub>max.</sub></b>	<b>MIL<sub>max.</sub></b>	<b>MIL<sub>max.</sub></b>
Thermal Shock	± 0.50 % ΔR	± 0.25 % ΔR	± 0.25 % ΔR	± 1.00 % ΔR
Short Time Overload	± 0.50 % ΔR	± 0.25 % ΔR	± 0.25 % ΔR	± 0.50 % ΔR
Low Temperature Operation	± 0.50 % ΔR	± 0.25 % ΔR	± 0.25 % ΔR	± 0.50 % ΔR
Moisture Resistance	± 1.50 % ΔR	± 0.50 % ΔR	± 0.50 % ΔR	± 1.50 % ΔR
Shock	± 0.50 % ΔR	± 0.25 % ΔR	± 0.25 % ΔR	± 0.50 % ΔR
Vibration	± 0.50 % ΔR	± 0.25 % ΔR	± 0.25 % ΔR	± 0.50 % ΔR
Load Life	± 1.00 % ΔR	± 0.50 % ΔR	± 0.50 % ΔR	± 2.00 % ΔR
Dielectric Withstanding Voltage	± 0.50 % ΔR	± 0.25 % ΔR	± 0.25 % ΔR	± 0.50 % ΔR
Effect of Solder	± 0.50 % ΔR	± 0.10 % ΔR	± 0.10 % ΔR	± 0.50 % ΔR



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