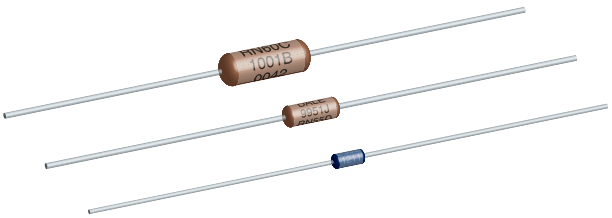
# Metal Film Resistors, Military, MIL-R-10509 Qualified, Precision, Type RN and MIL-PRF-22684 Qualified, Type RL



## 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)

## STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL | MIL STYLE | MIL SPEC. SHEET | POWER RATING $P_{70\,°C}$ W | POWER RATING $P_{125\,°C}$ W | MAX. WORKING VOLTAGE (1) V | RESISTANCE RANGE Ω MIL-R-10509 ± 100 ppm/°C (D) | RESISTANCE RANGE Ω MIL-R-10509 ± 50 ppm/°C (C) | RESISTANCE RANGE Ω MIL-R-10509 ± 25 ppm/°C (E) | RESISTANCE RANGE Ω MIL-PRF-22684 | TOL. (3) ± % | DIELECTRIC STRENGTH $V_{AC}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 (2) | 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**

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

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

(3) Tolerances of ± 0.1 %, ± 0.25 % and ± 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 | Ω | ≥ $10^{10}$ min. dry; ≥ $10^{8}$ min. after moisture test |
| Operating Temperature Range | °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 |



For technical questions, contact: ff2aresistors@vishay.com

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## 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 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| MIL STYLE | CHARACTERISTIC | RESISTANCE VALUE | TOLERANCE CODE | PACKAGING | SPECIAL |
|---|---|---|---|---|---|
| **RN50**<br>**RN55**<br>**RN60**<br>**RN65**<br>**RN70** | **E** = 25 ppm<br>**C** = 50 ppm<br>**D** = 100 ppm | 3 digit significant figure, followed by a multiplier<br>Use "R" for values < 100 Ω<br>**10R0** = 10 Ω<br>**2152** = 21.5 kΩ<br>**2494** = 2.49 MΩ | **B** = ± 0.1 %<br>**C** = ± 0.25 %<br>**D** = ± 0.5 %<br>**F** = ± 1 % | **B14** = Tin/lead, bulk<br>**BSL** = Tin/lead, bulk, single lot date code<br>**R36** = Tin/lead, T/R (full)<br>**RE6** = Tin/lead, T/R (1000 pieces)<br>**RSL** = Tin/lead, T/R, single lot date code | Blank = Standard (Dash number)<br>**88** = Hot solder dip<br>**143** = Non-magnetic |

**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 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| MIL STYLE | LEAD MATERIAL | RESISTANCE VALUE | TOLERANCE CODE | PACKAGING | SPECIAL |
|---|---|---|---|---|---|
| **RL07**<br>**RL20** | **S** = Solderable | 2 digit significant figure, followed by a multiplier<br>Use "R" for values < 10 Ω<br>**4R3** = 4.3 Ω<br>**202** = 2.0 kΩ<br>**474** = 470 kΩ | **G** = ± 2 %<br>**J** = ± 5 % | **B14** = Tin/lead, bulk<br>**BSL** = Tin/lead, bulk, single lot date code<br>**R36** = Tin/lead, T/R (full)<br>**RE6** = Tin/lead, T/R (1000 pieces)<br>**RSL** = Tin/lead, T/R, single lot date code | Blank = Standard (Dash number)<br>**88** = Hot solder dip<br>**143** = Non-magnetic |

**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).

## 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**

## 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. |

## 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.



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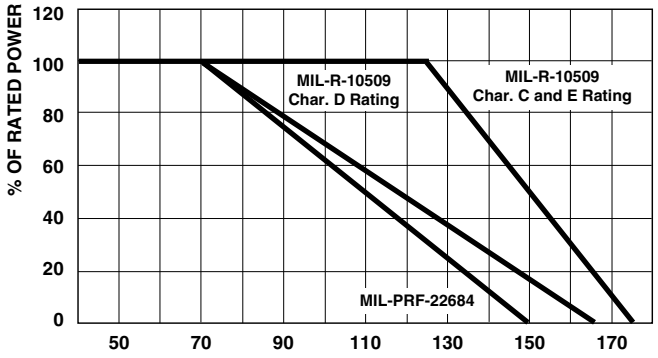
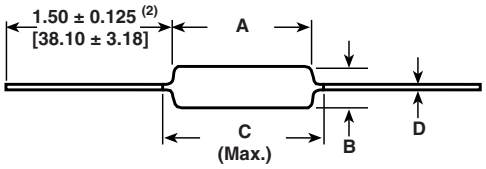
Vishay Dale CMF resistors have an operating temperature range of - 65 °C to + 175 °C. They must be derated according to the following curves:




**DERATING**

## 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) | 0.278 (7.06) (1) | 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) | 0.278 (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) 0.290" (7.37) for ± 0.25 % and ± 0.1 % resistance tolerances.

(2) 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 (3) | RN70 | - | - |

**Notes**

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

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



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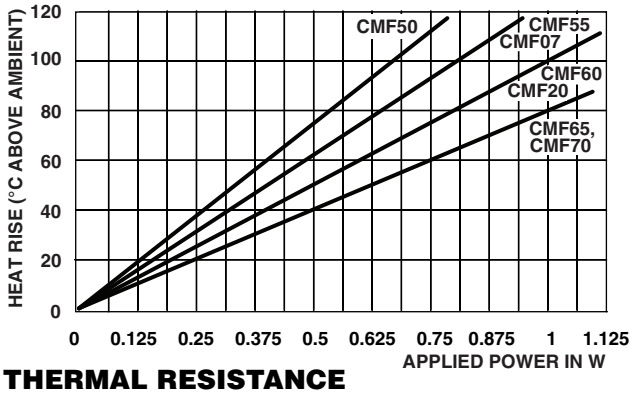


**THERMAL RESISTANCE**

## 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)

| | |
|---|---|
| J50D | JAN, type, characteristic |
| 1211 | Value |
| F137 | Tolerance and 3 digit date code |

RN55, RN60, RN65, RN70 (4 lines)

| | |
|---|---|
| DALE | Company logo |
| 0137J | 4 digit date code and JAN brand |
| RN55D | Type and characteristic |
| 1211F | Value and Tolerance |

**Note**

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

## PERFROMANCE

| 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 |
| **TEST** | **$MIL_{max.}$** | **$MIL_{max.}$** | **$MIL_{max.}$** | **$MIL_{max.}$** |
| Thermal Shock | ± 0.50 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 1.00 % $\Delta R$ |
| Short Time Overload | ± 0.50 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.50 % $\Delta R$ |
| Low Temperature Operation | ± 0.50 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.50 % $\Delta R$ |
| Moisture Resistance | ± 1.50 % $\Delta R$ | ± 0.50 % $\Delta R$ | ± 0.50 % $\Delta R$ | ± 1.50 % $\Delta R$ |
| Shock | ± 0.50 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.50 % $\Delta R$ |
| Vibration | ± 0.50 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.50 % $\Delta R$ |
| Load Life | ± 1.00 % $\Delta R$ | ± 0.50 % $\Delta R$ | ± 0.50 % $\Delta R$ | ± 2.00 % $\Delta R$ |
| Dielectric Withstanding Voltage | ± 0.50 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.25 % $\Delta R$ | ± 0.50 % $\Delta R$ |
| Effect of Solder | ± 0.50 % $\Delta R$ | ± 0.10 % $\Delta R$ | ± 0.10 % $\Delta R$ | ± 0.50 % $\Delta R$ |



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