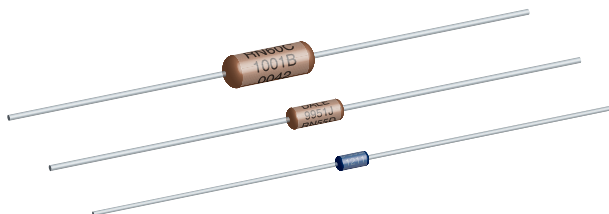


# Metal Film Resistors, Axial, Military, MIL-R-10509 Qualified, Precision, Type RN and MIL-PRF-22684 Qualified, Type RL



## 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<br>$P_{70^{\circ}\text{C}}$<br>W | POWER RATING<br>$P_{125^{\circ}\text{C}}$<br>W | MAX. WORKING VOLTAGE <sup>(1)</sup><br>V | RESISTANCE RANGE<br>$\Omega$<br>MIL-R-10509<br>$\pm 100 \text{ ppm}/^{\circ}\text{C}$<br>(D) | RESISTANCE RANGE<br>$\Omega$<br>MIL-R-10509<br>$\pm 50 \text{ ppm}/^{\circ}\text{C}$<br>(C) | RESISTANCE RANGE<br>$\Omega$<br>MIL-R-10509<br>$\pm 25 \text{ ppm}/^{\circ}\text{C}$<br>(E) | RESISTANCE RANGE<br>$\Omega$<br>MIL-PRF-22684 | TOL. <sup>(3)</sup><br>$\pm \%$ | DIELECTRIC STRENGTH<br>$V_{AC}$ |
|--------------|-----------|-----------------|-----------------------------------------------|------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------|---------------------------------|
| 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 <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

- (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  $\pm 0.1 \%$ ,  $\pm 0.25 \%$  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)

|                                      |          |                                         |          |          |                                                                                                                                        |          |          |                                                         |          |                                                                                                                                                                                              |          |          |                                                                             |  |  |
|--------------------------------------|----------|-----------------------------------------|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------|----------|----------|---------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------------------------------------------------------|--|--|
| <b>R</b>                             | <b>N</b> | <b>6</b>                                | <b>0</b> | <b>D</b> | <b>3</b>                                                                                                                               | <b>4</b> | <b>8</b> | <b>3</b>                                                | <b>F</b> | <b>R</b>                                                                                                                                                                                     | <b>3</b> | <b>6</b> |                                                                             |  |  |
| <b>MIL STYLE</b>                     |          | <b>CHARACTERISTICS</b>                  |          |          | <b>RESISTANCE VALUE</b>                                                                                                                |          |          | <b>TOLERANCE CODE</b>                                   |          | <b>PACKAGING</b>                                                                                                                                                                             |          |          | <b>SPECIAL</b>                                                              |  |  |
| 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)

|             |                |                  |                |            |
|-------------|----------------|------------------|----------------|------------|
| <b>RN60</b> | <b>D</b>       | <b>3483</b>      | <b>F</b>       | <b>R36</b> |
| 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)

|             |               |                  |                |            |
|-------------|---------------|------------------|----------------|------------|
| <b>RL07</b> | <b>S</b>      | <b>471</b>       | <b>J</b>       | <b>R36</b> |
| 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**

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

**APPLICABLE MIL-SPECS**

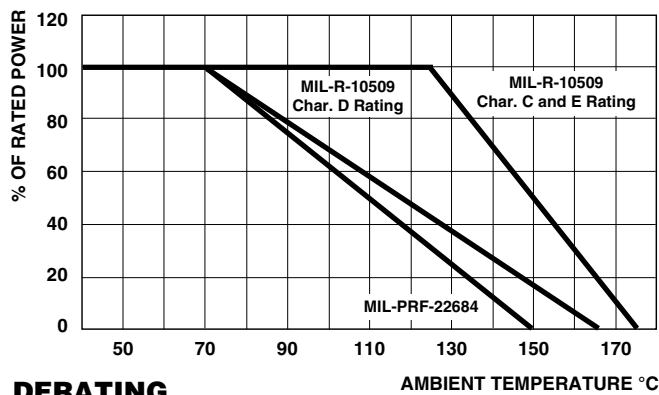
**MIL-R-10509 and MIL-PRF-22684:** The CMF models meet or exceed the electrical, environmental and dimensional requirements of MIL-R-10509 and MIL-PRF-22684.

**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.

**CAGE CODE: 91637****ENVIRONMENTAL SPECIFICATIONS**

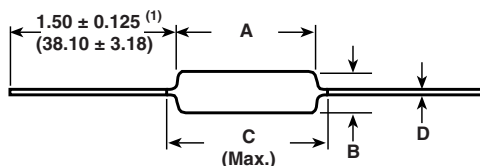
|                   |                                                                                                                                               |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>    | Environmental performance is shown in the Environmental Performance table. Test methods are those specified in MIL-R-10509 and MIL-PRF-22684. |
| <b>Shelf Life</b> | 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:



### DERATING

### DIMENSIONS in inches (millimeters)



| VISHAY DALE MODEL | A                               | B                              | C (MAX.)         | D                              |
|-------------------|---------------------------------|--------------------------------|------------------|--------------------------------|
| CMF50             | 0.150 ± 0.020<br>(3.81 ± 0.51)  | 0.065 ± 0.015<br>(1.65 ± 0.38) | 0.244<br>(6.20)  | 0.016 ± 0.002<br>(0.41 ± 0.05) |
| CMF55             | 0.240 ± 0.020<br>(6.10 ± 0.51)  | 0.090 ± 0.008<br>(2.29 ± 0.20) | 0.290<br>(7.37)  | 0.025 ± 0.002<br>(0.64 ± 0.05) |
| CMF60             | 0.344 ± 0.031<br>(8.74 ± 0.79)  | 0.145 ± 0.015<br>(3.68 ± 0.38) | 0.425<br>(10.80) | 0.025 ± 0.002<br>(0.64 ± 0.05) |
| CMF65             | 0.562 ± 0.031<br>(14.27 ± 0.79) | 0.180 ± 0.015<br>(4.57 ± 0.38) | 0.687<br>(17.45) | 0.025 ± 0.002<br>(0.64 ± 0.05) |
| CMF70             | 0.562 ± 0.031<br>(14.27 ± 0.79) | 0.180 ± 0.015<br>(4.57 ± 0.38) | 0.687<br>(17.45) | 0.032 ± 0.002<br>(0.81 ± 0.05) |
| CMF07             | 0.240 ± 0.020<br>(6.10 ± 0.51)  | 0.090 ± 0.008<br>(2.29 ± 0.20) | 0.290<br>(7.37)  | 0.025 ± 0.002<br>(0.64 ± 0.05) |
| CMF20             | 0.375 ± 0.040<br>(9.53 ± 1.02)  | 0.145 ± 0.015<br>(3.68 ± 0.38) | 0.425<br>(10.80) | 0.032 ± 0.002<br>(0.81 ± 0.05) |

#### Note

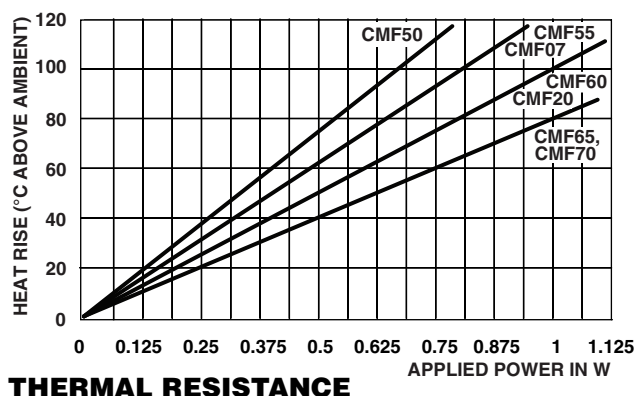
- (1) Lead length for product in bulk pack. For product supplied in tape and reel, the actual lead length would be based on the body size, tape spacing and lead trim

| 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)

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.

**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        |
| TEST                                           | MIL <sub>max.</sub>     | MIL <sub>max.</sub> | MIL <sub>max.</sub> | MIL <sub>max.</sub> |
| 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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