

## 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](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>$V_{\text{AC}}$ |
| 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

- (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)

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](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             | $0.150 \pm 0.020$<br>(3.81 ± 0.51)  | $0.065 \pm 0.015$<br>(1.65 ± 0.38) | 0.244<br>(6.20)                | $0.016 \pm 0.002$<br>(0.41 ± 0.05) |
| CMF55             | $0.240 \pm 0.020$<br>(6.10 ± 0.51)  | $0.090 \pm 0.008$<br>(2.29 ± 0.20) | 0.278<br>(7.06) <sup>(1)</sup> | $0.025 \pm 0.002$<br>(0.64 ± 0.05) |
| CMF60             | $0.344 \pm 0.031$<br>(8.74 ± 0.79)  | $0.145 \pm 0.015$<br>(3.68 ± 0.38) | 0.425<br>(10.80)               | $0.025 \pm 0.002$<br>(0.64 ± 0.05) |
| CMF65             | $0.562 \pm 0.031$<br>(14.27 ± 0.79) | $0.180 \pm 0.015$<br>(4.57 ± 0.38) | 0.687<br>(17.45)               | $0.025 \pm 0.002$<br>(0.64 ± 0.05) |
| CMF70             | $0.562 \pm 0.031$<br>(14.27 ± 0.79) | $0.180 \pm 0.015$<br>(4.57 ± 0.38) | 0.687<br>(17.45)               | $0.032 \pm 0.002$<br>(0.81 ± 0.05) |
| CMF07             | $0.240 \pm 0.020$<br>(6.10 ± 0.51)  | $0.090 \pm 0.008$<br>(2.29 ± 0.20) | 0.278<br>(7.06)                | $0.025 \pm 0.002$<br>(0.64 ± 0.05) |
| CMF20             | $0.375 \pm 0.040$<br>(9.53 ± 1.02)  | $0.145 \pm 0.015$<br>(3.68 ± 0.38) | 0.425<br>(10.80)               | $0.032 \pm 0.002$<br>(0.81 ± 0.05) |

### Notes

- <sup>(1)</sup> 0.290" (7.37) for ± 0.25 % and ± 0.1 % resistance tolerances.
- <sup>(2)</sup> 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 <sup>(3)</sup>   | RN70               | -                     | -             |

### Notes

- Commercial equivalents of military styles are available with higher power ratings. Consult factory.
- <sup>(3)</sup> 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<br>Tolerance: F = 1 %, D = 0.5 %, C = 0.25 %, B = 0.1 %<br>Value = Three significant figures and multiplier<br>J = JAN (Joint Army - Navy) brand |  |
| RN50: (3 lines)<br><br>J50D JAN, type, characteristic<br>1211 Value<br>F137 Tolerance and 3 digit date code   | RN55, RN60, RN65, RN70 (4 lines)<br><br>DALE Company logo<br>0137J 4 digit date code and JAN brand<br>RN55D Type and characteristic<br>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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