

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 $P_{70^{\circ}\text{C}}$ W | POWER RATING $P_{125^{\circ}\text{C}}$ W | MAX. WORKING VOLTAGE ⁽¹⁾ V | RESISTANCE RANGE Ω MIL-R-10509 $\pm 100 \text{ ppm}/^{\circ}\text{C}$ (D) | RESISTANCE RANGE Ω MIL-R-10509 $\pm 50 \text{ ppm}/^{\circ}\text{C}$ (C) | RESISTANCE RANGE Ω MIL-R-10509 $\pm 25 \text{ ppm}/^{\circ}\text{C}$ (E) | RESISTANCE RANGE Ω MIL-PRF-22684 | TOL. ⁽³⁾ $\pm \%$ | 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 $\pm 0.1 \%$, $\pm 0.25 \%$ 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 | Ω | $\geq 10^{10}$ 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 RN55 RN60 RN65 RN70 | E = 25 ppm C = 50 ppm D = 100 ppm | 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 = ± 0.1 % C = ± 0.25 % D = ± 0.5 % F = ± 1 % | 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 | Blank = Standard (Dash number) 88 = Hot solder dip 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 RL20 | S = Solderable | 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 | G = ± 2 % J = ± 5 % | 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 | Blank = Standard (Dash number) 88 = Hot solder dip 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

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) | 0.278 (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.



| 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 |
| TEST | MIL_{max.} | MIL_{max.} | MIL_{max.} | MIL_{max.} |
| 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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