

## Metal Film Resistors, Axial, Industrial, Precision



### FEATURES

- Small size - conformal coated
- Flammability tested according to IEC/EN 60695-11-5
- Controlled temperature coefficient
- Excellent high frequency characteristics
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

| STANDARD ELECTRICAL SPECIFICATIONS |                  |                                             |                                               |                              |                       |                                                              |
|------------------------------------|------------------|---------------------------------------------|-----------------------------------------------|------------------------------|-----------------------|--------------------------------------------------------------|
| GLOBAL MODEL                       | HISTORICAL MODEL | MAXIMUM WORKING VOLTAGE <sup>(1)</sup><br>V | POWER RATING<br>$P_{70^{\circ}\text{C}}$<br>W | RESISTANCE RANGE<br>$\Omega$ | TOLERANCE<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>$\pm \text{ppm}/^{\circ}\text{C}$ |
| CMF50                              | CMF-50           | 200                                         | 0.4                                           | 43 to 332K                   | 0.1                   | 25                                                           |
|                                    |                  |                                             |                                               | 22 to 332K                   | 0.25                  |                                                              |
|                                    |                  |                                             |                                               | 10 to 475K                   | 0.5, 1                |                                                              |
|                                    |                  |                                             |                                               | 43 to 332K                   | 0.1                   | 50                                                           |
|                                    |                  |                                             |                                               | 22 to 332K                   | 0.25                  |                                                              |
|                                    |                  |                                             |                                               | 10 to 475K                   | 0.5                   |                                                              |
|                                    |                  |                                             |                                               | 1 to 10M                     | 1, 2                  |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 10M                  | 5                     |                                                              |
|                                    |                  |                                             |                                               | 1 to 10M                     | 1, 2                  | 100, 150, 200                                                |
|                                    |                  |                                             |                                               | 0.22 to 10M                  | 5                     |                                                              |
| CMF55                              | CMF-55           | 350                                         | 0.6                                           | 10 to 1M                     | 0.1, 0.25, 0.5, 1     | 25                                                           |
|                                    |                  |                                             |                                               | 10 to 1M                     | 0.1, 0.25, 0.5        | 50                                                           |
|                                    |                  |                                             |                                               | 1 to 10M                     | 1                     |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 10M                  | 2                     |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 22M                  | 5                     |                                                              |
|                                    |                  |                                             |                                               | 1 to 10M                     | 1                     | 100, 150, 200                                                |
|                                    |                  |                                             |                                               | 0.22 to 10M                  | 2                     |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 22M                  | 5                     |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 10M                  | 2                     |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 22M                  | 5                     | 300                                                          |
| CMF60                              | CMF-60           | 500                                         | 1                                             | 43 to 1M                     | 0.1                   | 25                                                           |
|                                    |                  |                                             |                                               | 22 to 1.5M                   | 0.25                  |                                                              |
|                                    |                  |                                             |                                               | 10 to 2.43M                  | 0.5, 1                |                                                              |
|                                    |                  |                                             |                                               | 43 to 1M                     | 0.1                   | 50                                                           |
|                                    |                  |                                             |                                               | 22 to 1.5M                   | 0.25                  |                                                              |
|                                    |                  |                                             |                                               | 10 to 2.43M                  | 0.5                   |                                                              |
|                                    |                  |                                             |                                               | 1 to 22M                     | 1, 2                  |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 22M                  | 5                     |                                                              |
|                                    |                  |                                             |                                               | 1 to 22M                     | 1, 2                  | 100, 150, 200                                                |
|                                    |                  |                                             |                                               | 0.22 to 22M                  | 5                     |                                                              |
|                                    |                  |                                             |                                               | 1 to 22M                     | 2                     |                                                              |
|                                    |                  |                                             |                                               | 0.22 to 22M                  | 5                     | 300                                                          |

### Note

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

**GLOBAL PART NUMBER INFORMATION**

Global Part Numbering: CMF55301R00FKEA

| C                                                              | M | F | 5                                                                                                                                                   | 5 | 3 | 0                                                                                                                           | 1 | R | 0                                                                                                               | 0 | F | K                                                                                            | E | A |
|----------------------------------------------------------------|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------------------------------------------------------------------------------|---|---|-----------------------------------------------------------------------------------------------------------------|---|---|----------------------------------------------------------------------------------------------|---|---|
| GLOBAL MODEL<br>(See Standard Electrical Specifications table) |   |   | RESISTANCE VALUE<br>R = $\Omega$<br>K = k $\Omega$<br>M = M $\Omega$<br>R10000 = 0.1 $\Omega$<br>680K00 = 680 k $\Omega$<br>1M0000 = 1.0 M $\Omega$ |   |   | TOLERANCE CODE<br>B = $\pm 0.1\%$<br>C = $\pm 0.25\%$<br>D = $\pm 0.5\%$<br>F = $\pm 1\%$<br>G = $\pm 2\%$<br>J = $\pm 5\%$ |   |   | TEMPERATURE COEFFICIENT<br>E = 25 ppm<br>H = 50 ppm<br>K = 100 ppm<br>L = 150 ppm<br>N = 200 ppm<br>M = 300 ppm |   |   | PACKAGING<br>EA = lead (Pb)-free, T/R (full)<br>EB = lead (Pb)-free, ammo pack (1000 pieces) |   |   |

**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))

**DIMENSIONS** in millimeters


| GLOBAL MODEL | D <sub>max.</sub> | L <sub>max.</sub> | d <sub>nom.</sub> | I <sub>min.</sub> | M <sub>min.</sub> | MASS (mg) |
|--------------|-------------------|-------------------|-------------------|-------------------|-------------------|-----------|
| CMF50        | 1.6               | 3.6               | 0.5               | 29                | 5                 | 125       |
| CMF55        | 2.5               | 6.5               | 0.6               | 28                | 10                | 220       |
| CMF60        | 4.2               | 11.9              | 0.8               | 31                | 15                | 700       |

**TECHNICAL SPECIFICATIONS**

| PARAMETER                     | UNIT             | CMF50       | CMF55 | CMF60 |
|-------------------------------|------------------|-------------|-------|-------|
| Maximum Working Voltage       | V <sub>≡</sub>   | ≤ 200       | ≤ 350 | ≤ 500 |
| Insulation Voltage (1 Min)    | V <sub>eff</sub> | 300         | 500   | 800   |
| Dielectric Strength           | V <sub>AC</sub>  | 300         | 450   | 750   |
| Insulation Resistance         | $\Omega$         | ≥ 1G        |       |       |
| Operating Temperature Range   | °C               | -55 to +155 |       |       |
| Terminal Strength (Pull Test) | lb               | 2           | 2     | 2     |

**TEMPERATURE COEFFICIENT CODES**

| GLOBAL TC CODE | TEMPERATURE COEFFICIENT |
|----------------|-------------------------|
| E              | 25 ppm/°C               |
| H              | 50 ppm/°C               |
| K              | 100 ppm/°C              |
| L              | 150 ppm/°C              |
| N              | 200 ppm/°C              |
| M              | 300 ppm/°C              |

**LOAD LIFE SHIFT DUE TO POWER AND DERATING AT +70 °C**

The power rating for the CMF parts is tied to the derating temperature, the heat rise of the parts, and the  $\Delta R$  for the load life performance. When the tables/graphs below are used together they show that when the parts are run at their higher power ratings, the parts will run hotter, which has the potential of causing the resistance of the parts to shift more over the life of the part.

**LOAD LIFE SHIFT VS. POWER RATING**

| LOAD LIFE                        | MAXIMUM $\Delta R/R$ FOR 8000 h |             |
|----------------------------------|---------------------------------|-------------|
|                                  | $\pm 0.5\%$                     | $\pm 1.0\%$ |
| APPLIED MAXIMUM FILM TEMPERATURE | 125 °C                          | 155 °C      |
| MODEL                            | POWER RATING AT +70 °C          |             |
| CMF50                            | 0.25 W                          | 0.4 W       |
| CMF55                            | 0.4 W                           | 0.6 W       |
| CMF60                            | 0.65 W                          | 1 W         |

CMF resistors have an operating temperature range of -55 °C to +155 °C. They must be derated at high ambient temperatures according to the derating curve.

**DERATING****MATERIAL SPECIFICATIONS**

|           |                                                                                 |               |                                                                                                                             |
|-----------|---------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------|
| Element   | Material and application process dependent on type, R-value, TCR, and tolerance | Coating       | Polyurethane based lacquer, formulated for superior moisture protection. Flammability tested according to IEC/EN 60695-11-5 |
| Core      | Fire-cleaned high purity ceramic                                                |               |                                                                                                                             |
| Terminals | Matte tin-plated copper termination with whisker resistant diffusion barrier    | Solderability | Continuous satisfactory coverage when tested in accordance with JSTD-002                                                    |

**MARKING**

|        | CMF50         | CMF55           | CMF60 |
|--------|---------------|-----------------|-------|
| Line 1 | *ohmic value* | CMF55           | CMF60 |
| Line 2 | *tolerance*   | *ohmic value*   |       |
| Line 3 | -             | *tolerance*TCR* |       |

Stamp text never contains spaces!  
Max. 7 characters per line.

| OHMIC VALUE |         |
|-------------|---------|
| 0.1         | 0R1     |
| 0.12        | 0R12    |
| 1           | 1R0     |
| 1.2         | 1R2     |
| 1.23        | 1R23    |
| 12          | 12R     |
| 12.3        | 12R3    |
| 123         | 123R    |
| 1000        | 1K0     |
| 1200        | 1K2     |
| 10 000      | 10K     |
| 1 000 000   | 1M0     |
| 1 200 000   | 1M2     |
| 123 456 000 | 123M456 |

Leading zero if < 1; at least two numeric digits  
(trailing zero if only one digit before the R, K, M)

| TOLERANCE |      | TCR |     |
|-----------|------|-----|-----|
| 0.1       | .1%  | 25  | T9  |
| 0.25      | .25% | 50  | T2  |
| 0.5       | .5%  | 100 | T1  |
| 1         | 1%   | 150 | T0  |
| 2         | 2%   | 200 | T00 |
| 5         | 5%   | 300 | M   |

Without leading zeroes!



| PERFORMANCE                     |                                                                                                                                             |                                                           |                                                      |                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------|-------------------------------------|
| TEST                            | PROCEDURE                                                                                                                                   | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R_{\max.}$ ) |                                                      |                                     |
|                                 | Stability for product line:                                                                                                                 | STABILITY CLASS 0.5                                       | STABILITY CLASS 1                                    | STABILITY CLASS 2                   |
|                                 | CMF50                                                                                                                                       | 1 $\Omega$ to 332 $\Omega$                                | 0.22 $\Omega$ to < 1 $\Omega$                        | > 332 $\Omega$                      |
|                                 | CMF55                                                                                                                                       | 1 $\Omega$ to 1 M $\Omega$                                | 0.22 $\Omega$ to < 1 $\Omega$                        | > 1 M $\Omega$                      |
|                                 | CMF60                                                                                                                                       | 1 $\Omega$ to 2.43 M $\Omega$                             | 0.22 $\Omega$ to < 1 $\Omega$                        | > 2.43 M $\Omega$                   |
| Short time overload             | Room temperature<br>$U = 2.5 \times \sqrt{P_{70} \times R}$ or<br>$U = 2 \times U_{\max.}$ ; 5 s                                            | $\pm (0.1 \% R + 0.01 \Omega)$<br>no visible damage       | $\pm (0.25 \% R + 0.05 \Omega)$<br>no visible damage | $\pm 0.5 \% R$<br>no visible damage |
| Shock                           | Shock duration: 6 ms<br>Peak value: 100 gn<br>Waveform: half-sine<br>Number of shocks:<br>3 in both directions of the 3 axes ( $\Sigma$ 18) | $\pm (0.1 \% R + 0.01 \Omega)$<br>no visible damage       | $\pm (0.25 \% R + 0.05 \Omega)$<br>no visible damage | $\pm 0.5 \% R$<br>no visible damage |
| Vibration                       | 10 sweep cycles per direction;<br>10 Hz to 2000 Hz;<br>1.5 mm or 200 m/s <sup>2</sup>                                                       | $\pm (0.1 \% R + 0.01 \Omega)$<br>no visible damage       | $\pm (0.25 \% R + 0.05 \Omega)$<br>no visible damage | $\pm 0.5 \% R$<br>no visible damage |
| Temperature cycling             | 30 min at -55 °C<br>30 min at 155 °C<br>5 cycles                                                                                            | $\pm (0.1 \% R + 0.01 \Omega)$                            | $\pm (0.25 \% R + 0.05 \Omega)$                      | $\pm 0.5 \% R$                      |
|                                 | CMF50: 500 cycles<br>CMF55: 200 cycles<br>CMF60: 100 cycles                                                                                 | $\pm (0.5 \% R + 0.05 \Omega)$                            |                                                      |                                     |
| Load life                       | Varies based on power rating used; see “Load Life Shift Due To Power And Derating” table                                                    |                                                           |                                                      |                                     |
| Dielectric withstanding voltage | $U_{\text{RMS}} = U_{\text{ins}}$ ; 60 s                                                                                                    | No flashover or breakdown                                 |                                                      |                                     |
| Effect of solder                | Unmounted components;<br>(260 $\pm$ 5) °C, (10 $\pm$ 1) s                                                                                   | $\pm (0.1 \% R + 0.01 \Omega)$<br>no visible damage       | $\pm (0.25 \% R + 0.05 \Omega)$<br>no visible damage | $\pm 0.5 \% R$<br>no visible damage |



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