

## Power Resistor, for Mounting onto a Heatsink Thick Film Technology



Manufactured in cermet thick film technology, these power resistors exhibit remarkable characteristics and the series includes 4 types ranging from 5 W to 50 W.

Designed to be mounted onto a heatsink, the resistors can bear high short time overloads and 3 types of terminations are available.

The resistors are non inductive and are particularly suitable for high frequency operation and cut-out circuits.

### FEATURES

- 5 W to 50 W
- High power rating
- High overload capabilities up to 2500 V<sub>RMS</sub>
- Wide resistance range from 0.24 MΩ to 1 MΩ
- High thermal capacity up to 0.8 °C/W
- Easy mounting
- Reduced size and weight
- High insulation: 10<sup>6</sup> MΩ
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### DIMENSIONS in millimeters



| MODEL              | RCH5 | RCH10 | RCH25 | RCH50 |
|--------------------|------|-------|-------|-------|
| L                  | 16.6 | 19    | 28    | 47.8  |
| W                  | 9    | 11    | 14    | 15.5  |
| H                  | 16.4 | 20.6  | 27.5  | 29.5  |
| P Leads Pitch      | 10.2 | 12.7  | 18.3  | 30.5  |
| F Connection Pitch | 11.3 | 14.3  | 18.3  | 39.7  |
| T                  | 12.5 | 15.9  | 19.8  | 21.4  |
| S                  | 5.3  | 5     | 7.7   | 8     |
| Ø D                | 2.4  | 2.4   | 3.2   | 3.2   |
| Weight (g)         | 4    | 5     | 7     | 12    |

#### Note

- Tolerances unless stated: ± 0.3 mm

**STANDARD ELECTRICAL SPECIFICATIONS**

| MODEL | RESISTANCE RANGE<br>$\Omega$ | RATED POWER<br>$P_{25\text{ }^\circ\text{C}}$<br>W | TOLERANCE<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>$\pm \text{ppm}/^\circ\text{C}$ |
|-------|------------------------------|--|-----------------------|--|
| RCH   | 0.24 to 1 M<br>E24 range     | 5 to 50  | 1, 2, 5, 10           | 150, 250   |

**MECHANICAL SPECIFICATIONS**

|                       |                     |
|-----------------------|---------------------|
| Mechanical Protection | Insulated case      |
| Resistive Element     | Cermet              |
| Substrate             | Alumina             |
| Connections           | Tinned copper alloy |

**ENVIRONMENTAL SPECIFICATIONS**

|                   |  |
|-------------------|--|
| Temperature Range | - 55 °C to + 125 °C  |
| Climatic Category | 55/125/56  |
| Flammability      | IEC 60695-11-5<br>2 applications 30 s<br>separated by 60 s |

**TECHNICAL SPECIFICATIONS**

|   |                                      |
|---|--------------------------------------|
| Dissipation and Associated                    | Onto a heatsink                      |
| Power Rating:<br>Chassis Mounted<br>Unmounted | 5 W to 50 W<br>2 W to 5.5 W          |
| Temperature Coefficient                       | $\pm 150 \text{ ppm}/^\circ\text{C}$ |
| Insulation Resistance                         | $10^6 \text{ M}\Omega$               |
| Total Inductance                              | $\leq 0.1 \mu\text{H}$               |

**PERFORMANCE**

| TESTS                    | CONDITIONS  | REQUIREMENTS                    |
|--------------------------|---|---------------------------------|
| Momentary Overload       | NF EN140000 CEI 115_1<br>2 Pr/5 s<br>$U_S < 1.5 U_L$                    | $< \pm (0.25 \% + 0.05 \Omega)$ |
| Rapid Temperature Change | NF EN140000 125 °C CEI 68215 Test Na<br>5 cycles<br>- 55 °C to + 125 °C | $< \pm (0.25 \% + 0.05 \Omega)$ |
| Load Life                | NF EN140000 CEI 115_1<br>1000 h Pr at + 25 °C                           | $< \pm (0.5 \% + 0.05 \Omega)$  |
| Humidity (Steady State)  | 56 days RH 95 %<br>MIL-STD-202 Method 103 B and C                       | $< \pm (0.5 \% + 0.05 \Omega)$  |

**RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR**

|                      |                                      |                                      |
|----------------------|--------------------------------------|--------------------------------------|
| Resistance Values    | $< 1 \Omega$                         | $> 1 \Omega$                         |
| Standard Tolerances  | $\pm 5 \%$<br>$\pm 10 \%$            |                                      |
| Standard TCR         | $\pm 250 \text{ ppm}/^\circ\text{C}$ | $\pm 150 \text{ ppm}/^\circ\text{C}$ |
| Tolerance on Request | $\pm 1 \%$ to $\pm 2 \%$             |                                      |

**SPECIAL FEATURES**

| MODEL   | RCH 5         | RCH 10        | RCH 25          | RCH 50          |
|---|---------------|---------------|-----------------|-----------------|
| Power Rating-Chassis Mounted  | 5 W           | 10 W          | 25 W            | 50 W            |
| Power Rating-Unmounted  | 2 W           | 2.5 W         | 4 W             | 5.5 W           |
| Thermal Resistance $R_{th(j-c)}$  | 4.8 °C/W      | 3.2 °C/W      | 1.4 °C/W        | 0.8 °C/W        |
| Limiting Element Voltage ( $V_{RMS}$ )  | 160 V         | 250 V         | 550 V           | 1285 V          |
| Max. Overload Voltage ( $V_{RMS}$ )   | 320 V         | 500 V         | 1100 V          | 2500 V          |
| Dielectric Strength ( $V_{RMS}$ ) 50 Hz, 1 min<br>MIL-STD-202 Method 301 10 mA max. | 2000 V        | 2000 V        | 3500 V          | 3500 V          |
| Critical Resistance   | 5120 $\Omega$ | 6250 $\Omega$ | 12 100 $\Omega$ | 33 024 $\Omega$ |



**RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK**

- Surfaces in contact must be carefully cleaned.
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm.
- Roughness of the heatsink must be around 6.3 μm. In order to improve thermal conductivity, surfaces in contact (alumina, heatsink) are coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).
- The fastening of the resistor to the heatsink is under pressure control of two screws (not supplied).

| Tightening Torque on heatsink | RCH 5 | RCH 10 | RCH 25 | RCH 50 |
|-------------------------------|-------|--------|--------|--------|
|                               |       | 0.5 Nm | 0.6 Nm | 0.7 Nm |

- In order to improve the dissipation, either forced-air cooling or liquid cooling may be used.
- A low thermal radiation of the case allows several resistors to be mounted onto the same heatsink.
- Do not forget to respect an insulation value between two resistors (dielectric strength in dry air 1 kV/mm).
- In any case the hot spot temperature, measured locally on the case must not exceed 125 °C.
- Tests should be performed by the user.

**CHOICE OF THE HEATSINK**

The user must choose according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 125 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{TH(j-c)} + R_{TH(c-a)}]} \quad (1)$$

- P: Expressed in W
- ΔT: Difference between maximum working temperature and room temperature or fluid cooling temperature.
- R<sub>th(j-c)</sub>: Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component: 0.039 °C/W.
- R<sub>th(c-h)</sub>: Thermal resistance value measured between outer side of the resistor and upper side of the heatsink. This is the thermal resistance of the interface (grease, thermal pad), and the quality of the fastening device.
- R<sub>th(h-a)</sub>: Thermal resistance of the heatsink.

**Example:**

R<sub>TH(c-a)</sub> for RCH 25 power rating 20 W at ambient temperature + 50 °C

Thermal resistance R<sub>TH(j-c)</sub>: 2.5 °C/W

Considering equation (1) we have:

$$\Delta T \leq 125 \text{ °C} - 50 \text{ °C} \leq 75 \text{ °C}$$

$$R_{TH(j-c)} = 1.4 \text{ °C/W (Special Features)}$$

$$R_{TH(j-c)} + R_{TH(c-a)} = \frac{\Delta T}{P} = \frac{75}{20} = 3.75 \text{ °C/W}$$

$$R_{TH(c-a)} \leq 3.75 \text{ °C/W} - 1.4 \text{ °C/W} \leq 2.35 \text{ °C/W}$$



**OVERLOADS**

The applied voltage must always be lower than the maximum overload voltage as shown in the special features table.

The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

**ENERGY CURVE**



**POWER CURVE**



**POWER RATING**

For resistors mounted onto heatsink and thermal resistance of 1 °C/W.

To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease.



**MARKING**

Model, style, resistance value (in Ω), tolerance (in %), manufacturing date, Vishay Sfernice trademark.



| ORDERING INFORMATION |           |                  |   |   |               |
|----------------------|-----------|------------------|---|---|---------------|
| <b>RCH</b>           | <b>25</b> | <b>3.3 kΩ</b>    | <b>± 5 %</b>                                  | <b>R</b>  | <b>xxx</b>    |
| MODEL                | STYLE     | RESISTANCE VALUE | TOLERANCE                                     | CONNECTIONS   | CUSTOM DESIGN |
|                      |           |                  | Optional<br>± 1 %<br>± 2 %<br>± 5 %<br>± 10 % | Optional<br>S: Flat with hole<br>R: Round lead<br>V: M2 screw | Optional      |





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