

## Power Resistors for Mounting onto a Heatsink Thick Film Technology



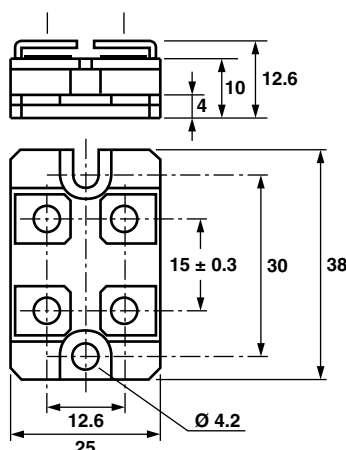
### FEATURES

- 1 % tolerance available
- High power rating = 200 W
- Wide ohmic value range = 0.046  $\Omega$  to 1 M $\Omega$
- Non inductive
- Easy mounting
- Low thermal radiation of the case
- Standard isotop case (SOT-227 B)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

This series of thick film power resistors include modules which can incorporate up to 2 different resistor values in the same SOT-227B package. Two types of terminations are available along with a 4 terminal device for measurement applications in the case of the single resistor version. This product range benefits from Vishay Sfernice's experience in thick film power resistor technology i.e. high power: volume ratio, low tolerance or individual resistors and excellent overload capabilities (due to the trimming technique).

### DIMENSIONS in millimeters

**RTOP**
**V Connections**

**Note**

- Tolerances unless otherwise specified:  $\pm 0.3$  mm

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL               | SIZE     | RESISTANCE RANGE<br>$\Omega$ | RATED POWER<br>$P_{25^\circ\text{C}}$<br>W | TOLERANCE<br>$\pm \%$ | TEMPERATURE<br>COEFFICIENT<br>$\pm \text{ppm}/^\circ\text{C}$ |
|---------------------|----------|------------------------------|--------------------------------------------|-----------------------|---------------------------------------------------------------|
| DRTOP50             | SOT-227B | 0.091 to 1M                  | 50                                         | 1, 2, 5, 10           | 150, 300                                                      |
| RTOP100             |          | 0.046 to 1M                  | 100                                        | 1, 2, 5, 10           | 150, 300                                                      |
| DRTOP100<br>RTOP200 |          | 0.046 to 1M                  | 200                                        | 1, 2, 5, 10           | 150, 300                                                      |

### MECHANICAL SPECIFICATIONS

|                               |                             |
|-------------------------------|-----------------------------|
| Mechanical Protection         | Insulated case              |
| Resistive Element             | Cermet                      |
| Substrate                     | Alumina on insulated base   |
| End Connections               | V connections: screw M4 x 6 |
| Tightening Torque Connections | 1 Nm                        |
| Tightening Torque Heatsink    | 2 Nm                        |
| Weight                        | 30 g max.                   |

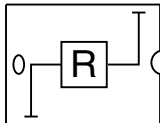
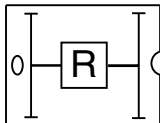
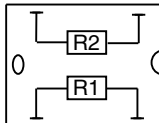
### ENVIRONMENTAL SPECIFICATIONS

|                   |                                               |
|-------------------|-----------------------------------------------|
| Temperature Range | -55 $^\circ\text{C}$ to +125 $^\circ\text{C}$ |
| Climatic Category | 55/125/56                                     |

### TECHNICAL SPECIFICATIONS

|                                                                             |          |                                                                                                      |
|-----------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------|
| Temperature Coefficient<br>(-55 $^\circ\text{C}$ to +125 $^\circ\text{C}$ ) | Standard | $\pm 300 \text{ ppm}/^\circ\text{C}$ ( $R < 1$ )<br>$\pm 150 \text{ ppm}/^\circ\text{C}$ ( $R > 1$ ) |
| Insulation Resistance                                                       |          | $> 10^6 \text{ M}\Omega$                                                                             |

| PERFORMANCE              |                                                            |                                 |
|--------------------------|------------------------------------------------------------|---------------------------------|
| TESTS                    | CONDITIONS                                                 | REQUIREMENTS                    |
| Momentary Overload       | IEC 60115-1<br>2.5 Pr/5 s $U_S < 2 U_L$                    | $< \pm (0.25 \% + 0.05 \Omega)$ |
| Rapid Temperature Change | IEC 60115-1<br>5 cycles -55 °C +125 °C                     | $< \pm (0.25 \% + 0.05 \Omega)$ |
| Load Life                | IEC 60115-1<br>Pr at 25 °C 1000 h                          | $< \pm (0.5 \% + 0.05 \Omega)$  |
| Humidity (Steady State)  | IEC 60115-1/IEC 60068-2-3 Test Ca<br>56 days 95 % RH/40 °C | $< \pm (0.5 \% + 0.05 \Omega)$  |

| SPECIAL FEATURES                                                           |                                                                                                                                                                                             |                             |                                                                                       |                             |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------|-----------------------------|
| MODEL                                                                      | RTOP 200                                                                                                                                                                                    | RTOP 100                    | DRTOP 100                                                                             | DRTOP 50                    |
| Power Rating at +25 °C<br>Chassis Mounted Resistors<br>Unmounted Resistors | 200 W<br>5 W                                                                                                                                                                                | 100 W<br>5 W                | 100 W<br>3.5 W                                                                        | 50 W<br>3.5 W               |
| Thermal Resistance (per Resistor)                                          | 0.5 °C/W                                                                                                                                                                                    | 1 °C/W                      | 0.5 °C/W                                                                              | 1 °C/W                      |
| Limiting Voltage $U_L$                                                     | 1500 V                                                                                                                                                                                      | 1500 V                      | 500 V                                                                                 | 500 V                       |
| Dielectric Strength <sup>(1)</sup><br>Connections/Chassis                  | 2500 V, 1 min<br>10 mA max.                                                                                                                                                                 | 2500 V, 1 min<br>10 mA max. | 2500 V, 1 min<br>10 mA max.                                                           | 2500 V, 1 min<br>10 mA max. |
| Dielectric Strength <sup>(1)</sup><br>Connections/Resistors                | -                                                                                                                                                                                           | -                           | 2500 V, 1 min<br>10 mA max.                                                           | 2500 V, 1 min<br>10 mA max. |
| Ohmic Value Range                                                          | 0.046 $\Omega$ to 1 M $\Omega$                                                                                                                                                              |                             | 0.091 $\Omega$ to 1 M $\Omega$                                                        |                             |
| Tolerance                                                                  | $\pm 1 \%$ to $\pm 10 \%$                                                                                                                                                                   |                             | $\pm 1 \%$ to $\pm 10 \%$                                                             |                             |
| Electrical Diagrams                                                        | <br><br>Shunt version |                             |  |                             |

**Note**
<sup>(1)</sup> MIL-STD-202 Method 301

**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) should be coated with a silicone grease (type SI 340 from Rhône-Poulenc or Dow 340 from Dow Corning).

|                               |      |
|-------------------------------|------|
| Tightening Torque on Heatsink | RTOP |
|                               | 2 Nm |

- For the electrical connections, it is recommended to use M4 x 6 screws and if necessary a washer of 1mm thickness. The recommended screw tightening torque is 1 Nm.

**CHOICE OF THE HEATSINK**

The user must choose the heatsink 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:

$$P = \frac{\Delta T}{R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)}}$$

P: Expressed in W

ΔT: Difference between maximum working temperature and room temperature.

$R_{TH(j-c)}$ : Thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component (see table Special Features).

$R_{TH(c-h)}$ : 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.

$R_{TH(h-a)}$ : Thermal resistance of the heatsink.

**Example:**

$R_{TH(c-a)}$ : For RTOP 200 power rating 130 W at ambient temperature + 30 °C.

Thermal resistance (see table 1)  $R_{TH(j-c)}$ : 0.5 °C/W

$$\Delta T = 125\text{ °C} - 30\text{ °C} \leq 95\text{ °C}$$

$$R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)} = \frac{\Delta T}{P} = \frac{95}{130} = 0.73\text{ °C/W}$$

$$R_{TH(j-c)} = 0.112\text{ °C/W}$$

$$R_{TH(c-h)} + R_{TH(h-a)} = 0.73\text{ °C/W} - 0.5\text{ °C/W} \leq 0.23\text{ °C/W}$$



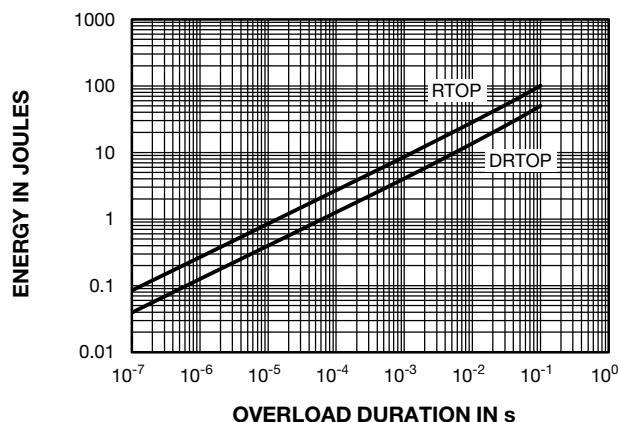
## OVERLOADS

The applied power is 2.5 x rated power for 5 s with a max. voltage of 2 x nominal voltage.

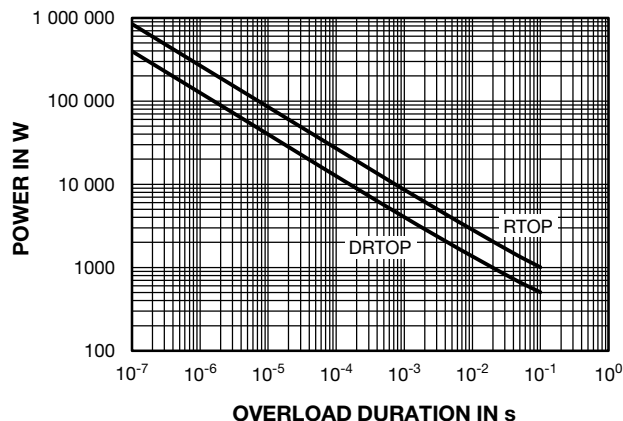
**Accidental overload:** The values indicated in the graph below are applicable to resistors in air or mounted onto a heatsink.

In case of multi-resistor devices, (DRTOP, TROP and QROP) the results apply to each resistor value in the device.

## ENERGY CURVE



## POWER CURVE

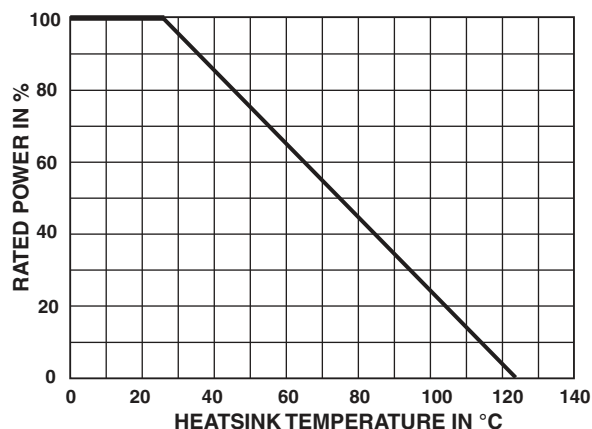


## MARKING

Series, style, ohmic value (in), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

## POWER RATING

The temperature of the heater should be maintained in the limit specified. To improve the thermal conductivity, surfaces in contact should be laid on with a silicon grease and the torque applied on the screw for tightening should be around 2 Nm.



## PACKAGING

Box of 10 units

**ORDERING INFORMATION**

|              |              |                    |                                        |            |                    |                      |                  |                       |
|--------------|--------------|--------------------|----------------------------------------|------------|--------------------|----------------------|------------------|-----------------------|
| <b>RTOP</b>  | <b>200</b>   | <b>5U</b>          | <b>± 1 %</b>                           | <b>± %</b> | <b>V</b>           |                      |                  |                       |
| <b>DRTOP</b> | <b>50</b>    | <b>150U</b>        | <b>5 %</b>                             | <b>15U</b> | <b>5 %</b>         | <b>V</b>             | <b>XXX</b>       | <b>BO10</b>           |
|              |              |                    |                                        | R1         | T1                 | R2                   |                  | <b>e</b>              |
| <b>MODEL</b> | <b>STYLE</b> | <b>OHMIC VALUE</b> | <b>ABSOLUTE TOLERANCE PER RESISTOR</b> |            | <b>CONNECTIONS</b> | <b>CUSTOM DESIGN</b> | <b>PACKAGING</b> | <b>LEAD (Pb)-FREE</b> |
| RTOP         | 100          |                    | Optional                               |            | V: screw           | Optional             |                  |                       |
| DRTOP        | 50           |                    | To be precise for each resistor        |            | VS: RTOP shunt     |                      |                  |                       |
|              |              |                    | ± 1 %<br>± 2 %<br>± 5 %<br>± 10 %      |            |                    |                      |                  |                       |

**GLOBAL PART NUMBER INFORMATION**

|                     |          |                    |          |                                      |          |                                                                                                                                                                                                                                                                                          |          |          |                                                                       |          |                             |          |                                  |  |
|---------------------|----------|--------------------|----------|--------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------------------------------------------------|----------|-----------------------------|----------|----------------------------------|--|
| <b>R</b>            | <b>T</b> | <b>O</b>           | <b>P</b> | <b>1</b>                             | <b>0</b> | <b>0</b>                                                                                                                                                                                                                                                                                 | <b>V</b> | <b>5</b> | <b>R</b>                                                              | <b>0</b> | <b>0</b>                    | <b>K</b> | <b>B</b>                         |  |
| <b>GLOBAL MODEL</b> |          | <b>SIZE</b>        |          | <b>LEADS</b>                         |          | <b>OHMIC VALUE</b>                                                                                                                                                                                                                                                                       |          |          | <b>TOLERANCE</b>                                                      |          | <b>PACKAGING</b>            |          | <b>SPECIAL</b>                   |  |
| <b>RTOP</b>         |          | <b>100<br/>200</b> |          | <b>V = screw<br/>VS = RTOP shunt</b> |          | The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.<br><b>48R7</b> = 48.7 Ω<br><b>4871</b> = 4870 Ω<br><b>1002</b> = 10 000 Ω<br><b>R010</b> = 0.01 Ω<br><b>R680</b> = 0.68 Ω<br><b>2701</b> = 2.7 kΩ |          |          | <b>F</b> = 1 %<br><b>G</b> = 2 %<br><b>J</b> = 5 %<br><b>K</b> = 10 % |          | <b>B</b> = box<br>10 pieces |          | As applicable<br><b>Ex</b> = UA1 |  |



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