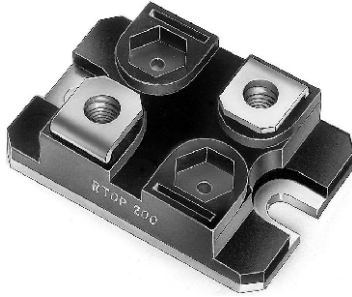


Power Resistors for Mounting Onto a Heatsink Thick Film Technology



FEATURES

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

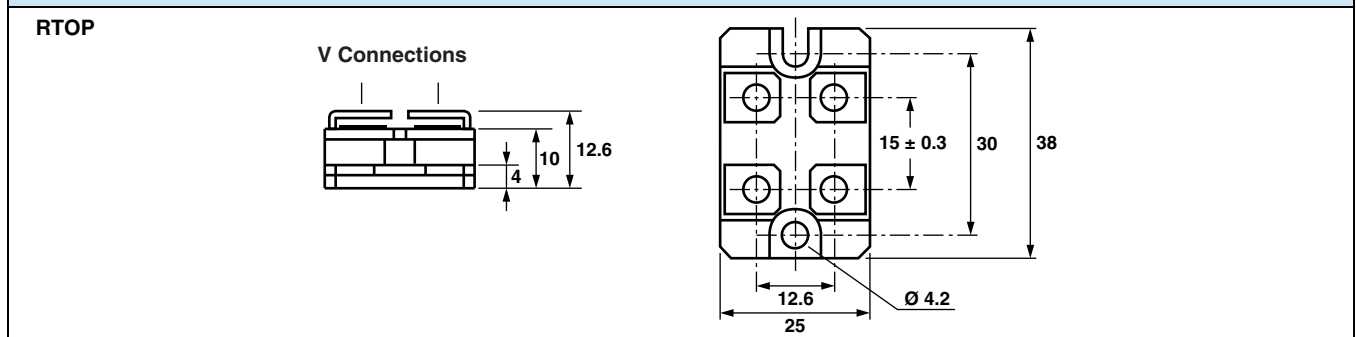

RoHS
COMPLIANT

LINKS TO ADDITIONAL RESOURCES



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



Note

- Tolerances unless otherwise specified: ± 0.3 mm

STANDARD ELECTRICAL SPECIFICATIONS

| MODEL | SIZE | RESISTANCE RANGE Ω | RATED POWER $P_{25^\circ\text{C}}$ W | TOLERANCE $\pm \%$ | TEMPERATURE COEFFICIENT \pm 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 | | 0.046 to 1M | 200 | 1, 2, 5, 10 | 150, 300 |
| RTOP200 | | 0.046 to 1M | 200 | 1, 2, 5, 10 | 150, 300 |

MECHANICAL SPECIFICATIONS

| | |
|-------------------------------|-----------------------------|
| Flammability | 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. |

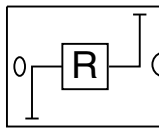
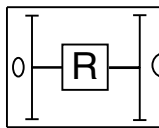
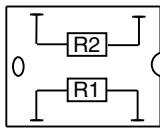
ENVIRONMENTAL SPECIFICATIONS

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

TECHNICAL SPECIFICATIONS

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

| PERFORMANCE | | |
|--------------------------|---|---------------------------------|
| TESTS | CONDITIONS | REQUIREMENTS |
| Momentary Overload | IEC 60115-1 2.5 Pr/5 s $U_S < 2 U_L$ | $< \pm (0.25 \% + 0.05 \Omega)$ |
| Rapid Temperature Change | IEC 60115-1 5 cycles, -55 °C, +125 °C | $< \pm (0.25 \% + 0.05 \Omega)$ |
| Load Life | IEC 60115-1 Pr at 25 °C, 1000 h | $< \pm (0.5 \% + 0.05 \Omega)$ |
| Humidity (Steady State) | IEC 60115-1 / IEC 60068-2-3 Test Ca 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 Chassis Mounted Resistors Unmounted Resistors | 200 W 5 W | 100 W 5 W | 100 W 3.5 W | 50 W 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 ⁽¹⁾ Connections/Chassis | 2500 V, 1 min 10 mA max. | 2500 V, 1 min 10 mA max. | 2500 V, 1 min 10 mA max. | 2500 V, 1 min 10 mA max. |
| Dielectric Strength ⁽¹⁾ Connections/Resistors | - | - | 2500 V, 1 min 10 mA max. | 2500 V, 1 min 10 mA max. |
| Ohmic Value Range | 0.046 Ω to 1 M Ω | | 0.091 Ω to 1 M Ω | |
| Tolerance | $\pm 1 \%$ to $\pm 10 \%$ | | $\pm 1 \%$ to $\pm 10 \%$ | |
| Electrical Diagrams |   Shunt version | |  | |

Note
⁽¹⁾ 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.

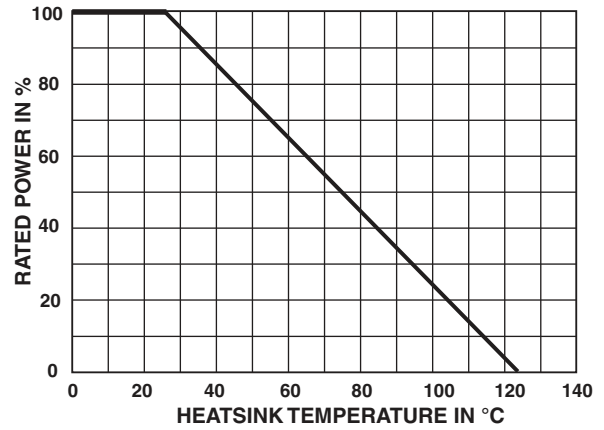
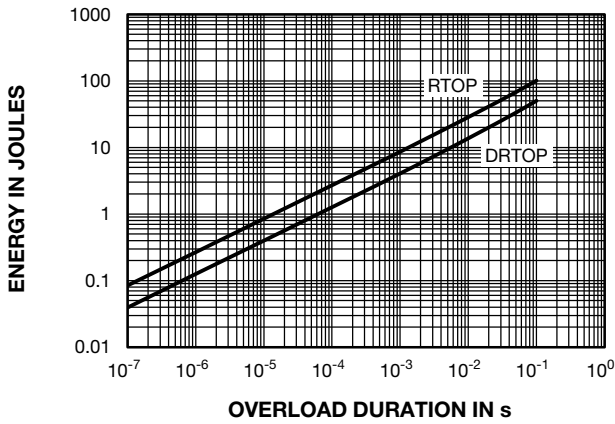
Accidental overload: The values indicated in the graph below are applicable to resistors in air or mounted onto a heatsink.

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

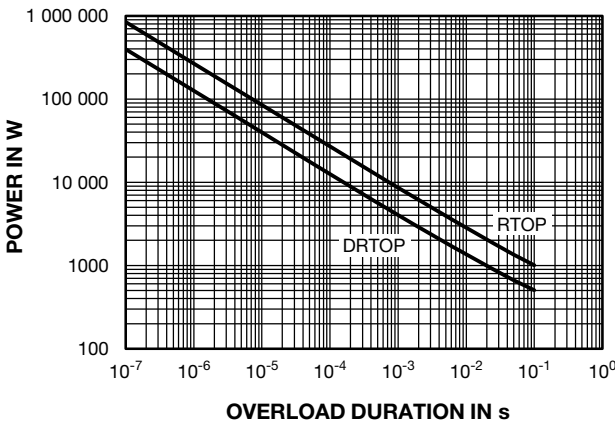
POWER RATING

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.

ENERGY CURVE



POWER CURVE



PACKAGING

Box of 10 units

MARKING

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



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

| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | |
|--------------------------------|------------|------------------------------|---|--|---|---|---|----------------------|---------------------------|---|---|---|---|--|
| R | T | O | P | 1 | 0 | 0 | V | 5 | R | 0 | 0 | J | B | |
| MODEL | SIZE | LEADS | | OHMIC VALUE | | | TOLERANCE | PACKAGING | SPECIAL | | | | | |
| RTOP | 100 200 | V = screw VS = RTOP shunt | | The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. 48R7 = 48.7 Ω 4871 = 4870 Ω 1002 = 10 000 Ω R010 = 0.01 Ω R680 = 0.68 Ω 2710 = 2.7 kΩ | | | F = 1 % G = 2 % J = 5 % K = 10 % | B = box 10 pieces | As applicable Ex = UA1 | | | | | |

| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | | | | |
|--------------------------------|------------|-----------|---|--|--|---|----------------------|---------------------------|---|---|---|---|---|---|---|---|--|
| D | R | T | O | P | 0 | 5 | 0 | V | 1 | 0 | 3 | 1 | 0 | 3 | J | B | |
| GLOBAL MODEL | SIZE | LEADS | | VALUE No. 1 | VALUE No. 2 | TOLERANCE | PACKAGING | SPECIAL | | | | | | | | | |
| DRTOP | 050 100 | V = screw | | The first two digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. 103 = 10 kΩ 470 = 47.0 Ω 222 = 2.20 kΩ | The first two digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. 103 = 10 kΩ 470 = 47.0 Ω 222 = 2.20 kΩ | F = 1 % G = 2 % J = 5 % K = 10 % | B = box 10 pieces | As applicable Ex = UA1 | | | | | | | | | |



| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | | |
|--------------------------------|------------|-----------|---|---|---|---|--|--------------------------------------|---|---|---|---|---|---|--|
| D | R | T | O | P | 1 | 0 | 0 | V | 1 | 0 | 1 | 2 | J | B | |
| MODEL | SIZE | LEADS | VALUE (two values are identical and cannot be coded in three digits) in four digits | | | | TOLERANCE | PACKAGING | SPECIAL | | | | | | |
| DRTOP | 050 100 | V = screw | <p>The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.</p> <p>1012 = 10.1 kΩ 48R7 = 48.7 Ω 2241 = 2.24 kΩ</p> | | | | <p>F = 1 % G = 2 % J = 5 % K = 10 %</p> | <p>B = box 10 pieces</p> | <p>As applicable Ex = UA1</p> | | | | | | |

| RELATED DOCUMENTS | |
|---|--|
| APPLICATION NOTES | |
| Potentiometers and Trimmers | www.vishay.com/doc?51001 |
| Guidelines for Vishay Sfernice Resistive and Inductive Components | www.vishay.com/doc?52029 |



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