

## 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 isotope case (SOT-227 B)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

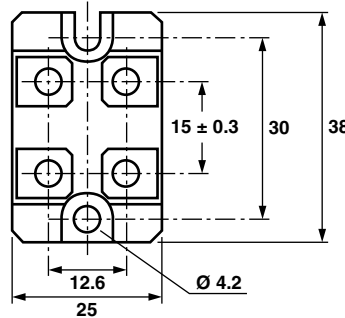
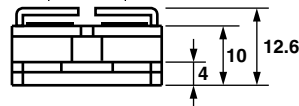

**RoHS**  
COMPLIANT

### DESIGN SUPPORT TOOLS

[click logo to get started](#)
**3D**  
Models  
Available

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 $\Omega$	RATED POWER $P_{25^\circ\text{C}}$ W	TOLERANCE $\pm \%$	TEMPERATURE COEFFICIENT $\pm \text{ppm}/^\circ\text{C}$
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 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.

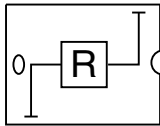
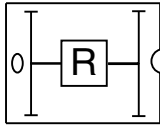
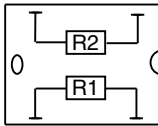
### ENVIRONMENTAL SPECIFICATIONS

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

### TECHNICAL SPECIFICATIONS

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

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 <sup>(1)</sup> 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 <sup>(1)</sup> Connections/Resistors	-	-	2500 V, 1 min 10 mA max.	2500 V, 1 min 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	  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<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 (see table Special Features)
- 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 RTOP 200 power rating 130 W at ambient temperature +30 °C.

Thermal resistance (see table 1) R<sub>TH(j-c)</sub>: 0.5 °C/W

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

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

$$R_{TH(j-c)} = 0.112\text{ °C/W}$$

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



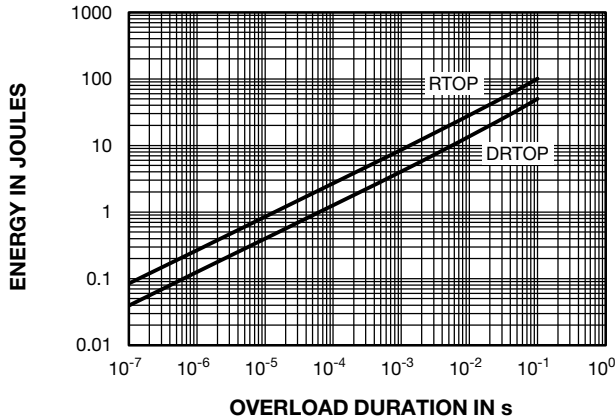
**OVERLOADS**

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

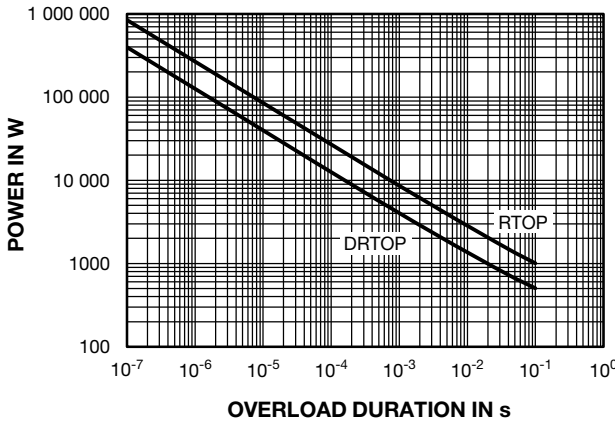
**Accidental overload:** The values indicated in the graph below are applicable to resistors in air or mounted onto a heatsink.

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

**ENERGY CURVE**



**POWER CURVE**

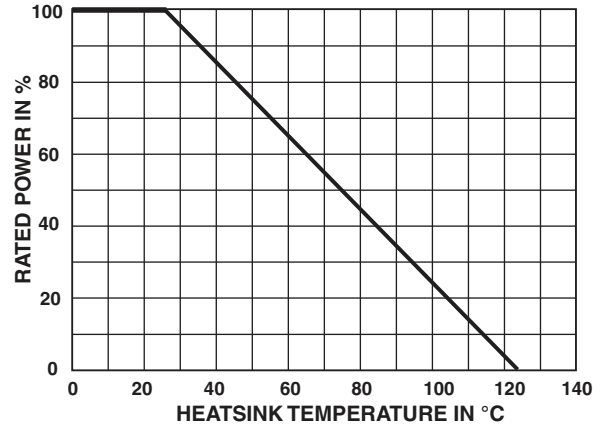


**MARKING**

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								
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		V: screw	Optional		
DRTOP	50		± 1 % ± 2 % ± 5 % ± 10 %		VS: RTOP shunt			

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><b>1012</b> = 10.1 kΩ  <b>48R7</b> = 48.7 Ω  <b>2241</b> = 2.24 kΩ</p>				<p>F = 1 %  G = 2 %  J = 5 %  K = 10 %</p>	B = box 10 pieces	As applicable Ex = UA1						

RELATED DOCUMENTS	
APPLICATION NOTES	
Potentiometers and Trimmers	<a href="http://www.vishay.com/doc?51001">www.vishay.com/doc?51001</a>
Guidelines for Vishay Sfernice Resistive and Inductive Components	<a href="http://www.vishay.com/doc?52029">www.vishay.com/doc?52029</a>



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