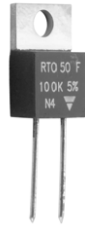


# 50 W Power Resistor, Thick Film Technology, TO-220



## FEATURES

- 50 W at 25 °C heatsink mounted
- Adjusted by sand trimming
- Leaded or surface mount versions
- High power to size ratio
- Non inductive element
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

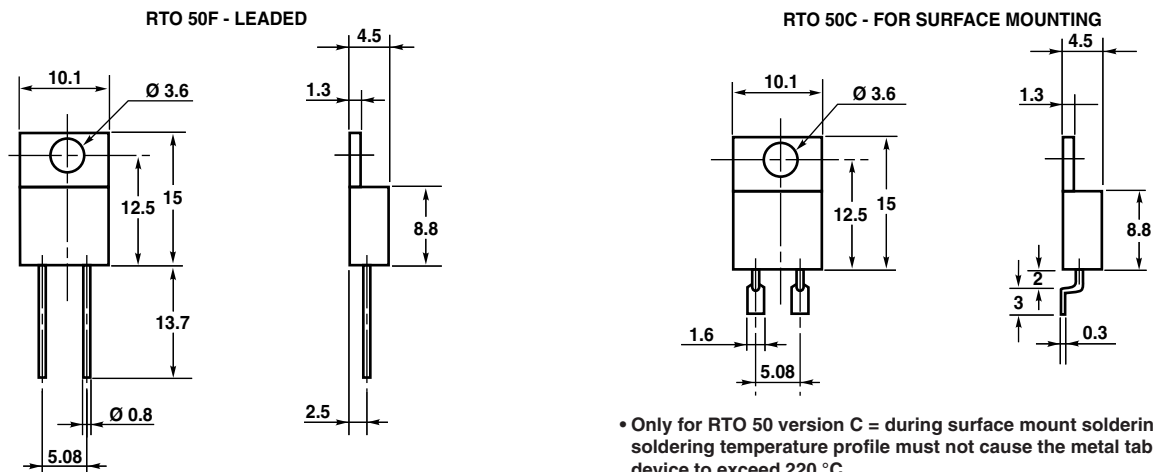

**RoHS**  
COMPLIANT

## DESIGN SUPPORT TOOLS

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

Because of the knowledge and experience in Thick Film technology, Vishay Sfernice has been able to develop a high power resistor in a TO-220 package called RTO 50. The special design of this component allows the dissipation of 50 W when mounted on a heatsink.

## DIMENSIONS in millimeters



## STANDARD ELECTRICAL SPECIFICATIONS

| MODEL  | SIZE   | RESISTANCE RANGE<br>$\Omega$ | RATED POWER<br>$P_{25^\circ\text{C}}$<br>W | LIMITING ELEMENT VOLTAGE $U_L$<br>V | TOLERANCE<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>$\pm \text{ppm}/^\circ\text{C}$ | CRITICAL RESISTANCE<br>$\Omega$ |
|--------|--------|------------------------------|--|-------------------------------------|-----------------------|--|---------------------------------|
| RTO 50 | TO-220 | 0.010 to 550K <sup>(1)</sup> | 50   | 500                                 | 1, 2, 5, 10           | 150  | 5K                              |

**Note**
<sup>(1)</sup> E24 series

## MECHANICAL SPECIFICATIONS

|                       |                     |
|-----------------------|---------------------|
| Mechanical Protection | Molded              |
| Resistive Element     | Thick film          |
| Connections           | Tinned copper alloy |
| Weight                | 2.2 g max.          |

## ENVIRONMENTAL SPECIFICATIONS

|                   |  |
|-------------------|--|
| Temperature Range | -55 °C to 155 °C   |
| Climatic Category | 55 / 155 / 156   |
| Sealing           | Sealed container, solder immersion                       |
| Flammability      | IEC 60695-11-5,<br>2 applications 30 s separated by 60 s |

**Note**

- Not compatible with RoHS reflow profile

## TECHNICAL SPECIFICATIONS

|                                       |   |
|---------------------------------------|---|
| Dissipation and Associated            | Onto a heatsink   |
| Thermal Resistance and Nominal Power  | 50 W at +25 °C<br>$R_{\text{TH}(j-c)}$ : 2.6 °C/W<br>Free air: 2.25 W at +25 °C |
| Dielectric Strength MIL STD 202 (301) | 2000 $V_{\text{RMS}}$ - 1 min<br>10 mA max.                                     |
| Insulation Resistance                 | $\geq 10^6 \text{ M}\Omega$   |
| Inductance                            | $\leq 0.1 \mu\text{H}$  |

## DIMENSIONS

|                  |                       |
|------------------|-----------------------|
| Standard Package | TO-220 insulated case |
|------------------|-----------------------|



| PERFORMANCE              |   |                     |
|--------------------------|---|---------------------|
| TESTS                    | CONDITIONS  | REQUIREMENTS        |
| Momentary Overload       | EN 60115-1<br>2 Pr 5 s for R < 2 Ω<br>1.6 Pr 5 s for R ≥ 2 Ω<br>U <sub>S</sub> < 1.5 U <sub>L</sub> | ± (0.25 % + 0.05 Ω) |
| Rapid Temperature Change | EN 60115-1<br>60 068-2-14<br>5 cycles -55 °C to +155 °C   | ± (0.5 % + 0.05 Ω)  |
| Load Life                | EN 60115-1<br>Pr at +25 °C, 1000 h CEI 115_1  | ± (1 % + 0.05 Ω)    |
| Humidity (Steady State)  | EN 60115-1<br>56 days RH 95 %   | ± (0.5 % + 0.05 Ω)  |
| Vibration                | MIL STD 202<br>method 204 C test D  | ± (0.2 % + 0.05 Ω)  |
| Terminal Strength        | MIL STD 202<br>method 211 test A1   | ± (0.2 % + 0.05 Ω)  |

| RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR |                 |              |              |                              |
|---|-----------------|--------------|--------------|------------------------------|
| Resistance Values                                 | ≥ 0.01 Ω        | ≥ 0.015 Ω    | ≥ 0.1 Ω      | ≥ 0.5 Ω                      |
| Tolerances  | ± 1 % at ± 10 % |              |              |                              |
| Temperature Coefficient<br>(-55 °C to +155 °C)    | Standard        | ± 900 ppm/°C | ± 700 ppm/°C | ± 250 ppm/°C<br>± 150 ppm/°C |

**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 155 °C. The dissipated power is simply calculated by the following ratio:

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

- 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: (Special Features Table)
- 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 RTO 50 power rating 13 W at ambient temperature +30 °C

Thermal resistance R<sub>TH(j-c)</sub>: 2.6 °C/W

Considering equation (1) we have:

$$\Delta T \leq 155 \text{ °C} - 30 \text{ °C} = 125 \text{ °C}$$

$$R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)} = \frac{\Delta T}{P} = \frac{125}{13} = 9.6 \text{ °C/W}$$

$$R_{TH(c-a)} + R_{TH(h-a)} \leq 9.6 \text{ °C/W} - 2.6 \text{ °C/W} \leq 7 \text{ °C/W}$$



**OVERLOADS**

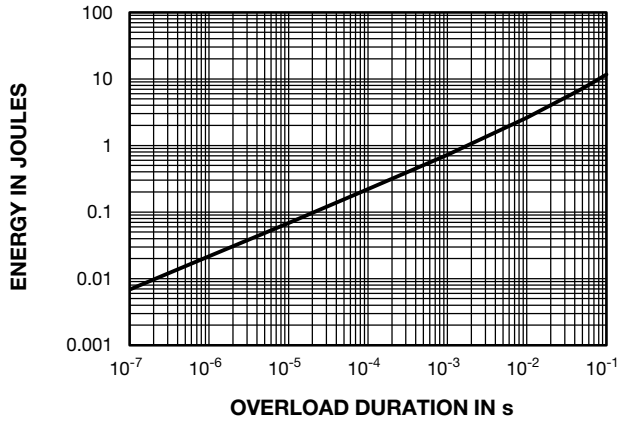
The applied voltage must always be lower than the maximum overload voltage of 750 V.

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

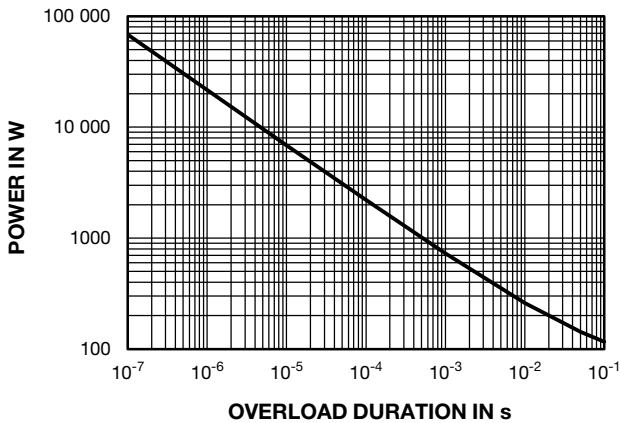
**MARKING**

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

**ENERGY CURVE**



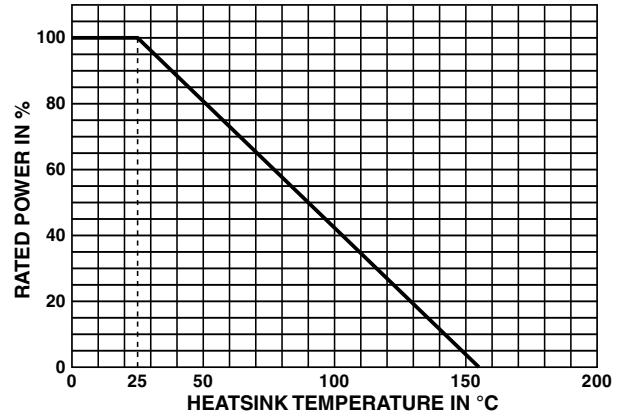
**POWER CURVE**



**POWER RATING**

The temperature of the heatsink should be maintained within the limits specified.

To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm.



**PACKAGING**

Tube of 50 units



| ORDERING INFORMATION |       |                                     |                  |                               |  |           |                |
|----------------------|-------|-------------------------------------|------------------|-------------------------------|--|-----------|----------------|
| RTO                  | 50    | F                                   | 100K             | ± 1%                          | XXX  | TU50      | e1             |
| MODEL                | STYLE | CONNECTIONS                         | RESISTANCE VALUE | TOLERANCE                     | CUSTOM DESIGN  | PACKAGING | LEAD (Pb)-FREE |
|                      |       | F: radial leads<br>C: surface mount |                  | ± 1%<br>± 2%<br>± 5%<br>± 10% | optional<br>on request:<br>special TCR,<br>shape, etc. |           |                |

| GLOBAL PART NUMBER INFORMATION |      |                                       |   |  |   |   |   |   |   |   |   |   |   |   |   |
|--------------------------------|------|---------------------------------------|---|--|---|---|---|---|---|---|---|---|---|---|---|
| R                              | T    | O                                     | 0 | 5  | 0 | F | R | 6   | 8 | 0   | 0 | J | T | E | 1 |
| GLOBAL MODEL                   | SIZE | LEADS                                 |   | OHMIC VALUE  |   |   |   | TOLERANCE                                 |   | PACKAGING                                     |   |   |   |   |   |
| RTO                            | 050  | F = radial leads<br>C = surface mount |   | The first four digits are significant figures and the last digit specifies the number of zeros to follow.<br>R designates decimal point.<br><b>48R70</b> = 48.7 Ω<br><b>48701</b> = 48 700 Ω<br><b>10002</b> = 100 000 Ω<br><b>R0100</b> = 0.01 Ω<br><b>R6800</b> = 0.68 Ω<br><b>27000</b> = 2700 Ω = 2.7 kΩ |   |   |   | F = 1 %<br>G = 2 %<br>J = 5 %<br>K = 10 % |   | T = tube<br>Size 30 and 50:<br>tube 50 pieces |   |   |   |   |   |

| 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> |



## **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.