

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



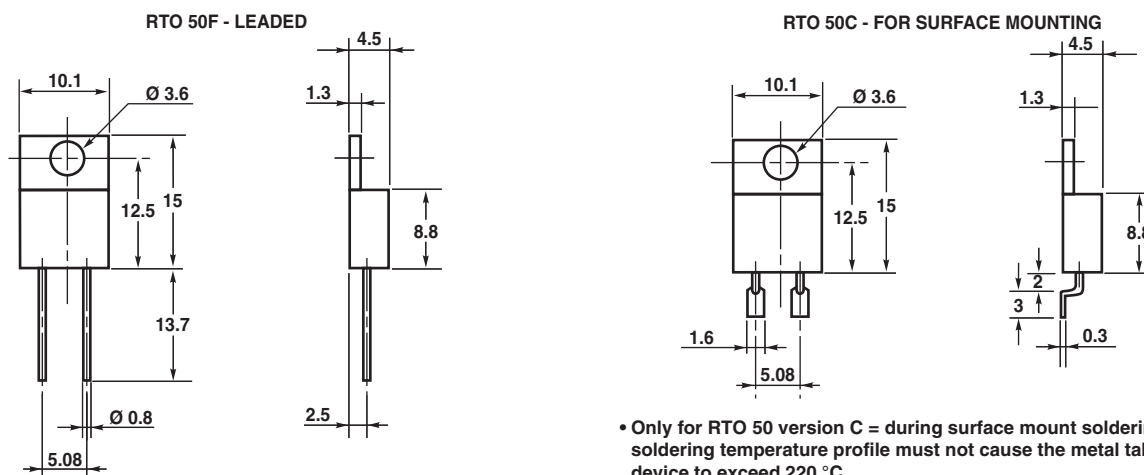
## FEATURES

- 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

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. The ohmic value is adjusted by sand trimming. This process does not generate hot spots as in laser trimming, which could lead to microcracks on each side of the curve. This process improves the reliability and the stability of the resistor and at the same time gives a good overload capability.

## 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, 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>$R_{TH(j-c)}$ : 2.6 °C/W<br>Free air: 2.25 W at +25 °C |
| Dielectric Strength MIL STD 202 (301) | 2000 $V_{RMS}$ - 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 $R < 2 \Omega$<br>1.6 Pr 5 s for $R \geq 2 \Omega$<br>$U_S < 1.5 U_L$ | $\pm (0.25 \% + 0.05 \Omega)$ |
| Rapid Temperature Change | EN 60115-1<br>60 068-2-14<br>5 cycles -55 °C to +155 °C                                          | $\pm (0.5 \% + 0.05 \Omega)$  |
| Load Life                | EN 60115-1<br>Pr at +25 °C, 1000 h CEI 115_1                                                     | $\pm (1 \% + 0.05 \Omega)$    |
| Humidity (Steady State)  | EN 60115-1<br>56 days RH 95 %                                                                    | $\pm (0.5 \% + 0.05 \Omega)$  |
| Vibration                | MIL STD 202<br>method 204 C test D                                                               | $\pm (0.2 \% + 0.05 \Omega)$  |
| Terminal Strength        | MIL STD 202<br>method 211 test A1                                                                | $\pm (0.2 \% + 0.05 \Omega)$  |

| RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR |                                  |                                      |                                      |                                      |
|---------------------------------------------------|----------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| Resistance Values                                 | $\geq 0.01 \Omega$               | $\geq 0.015 \Omega$                  | $\geq 0.1 \Omega$                    | $\geq 0.5 \Omega$                    |
| Tolerances                                        | $\pm 1 \% \text{ at } \pm 10 \%$ |                                      |                                      |                                      |
| Temperature Coefficient<br>(-55 °C to +155 °C)    | Standard                         | $\pm 900 \text{ ppm}/^\circ\text{C}$ | $\pm 700 \text{ ppm}/^\circ\text{C}$ | $\pm 250 \text{ ppm}/^\circ\text{C}$ |
|                                                   |                                  | $\pm 150 \text{ ppm}/^\circ\text{C}$ |                                      |                                      |

## 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                                                                                                                                                                                                      |
| $\Delta T$ :    | 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: (Special Features Table)                                                   |
| $R_{TH(c-h)}$ : | 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 RTO 50 power rating 13 W at ambient temperature +30 °C

Thermal resistance  $R_{TH(j-c)}$ : 2.6 °C/W

Considering equation (1) we have:

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

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

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



## OVERLOADS

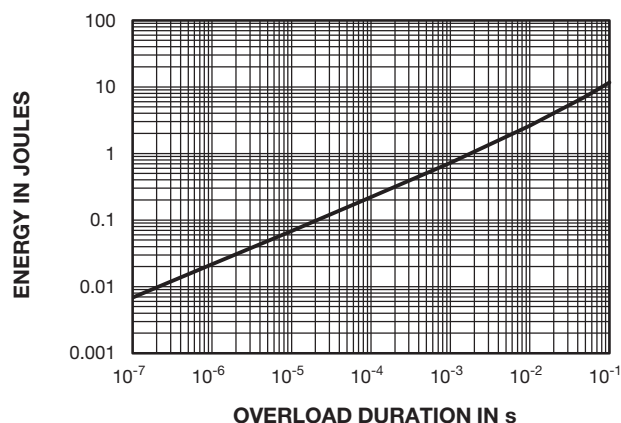
The applied voltage must always be lower than the maximum overload voltage of 750 V.

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

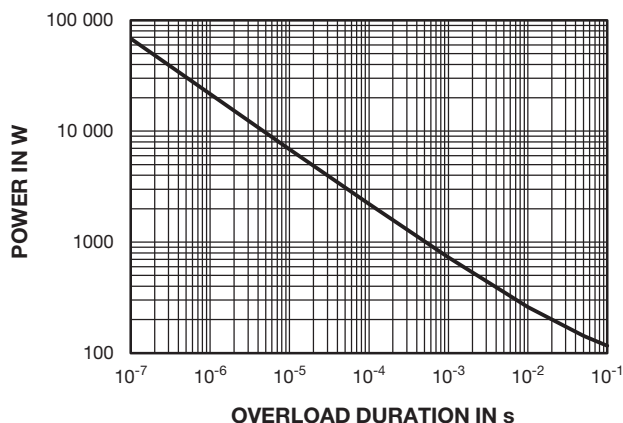
## MARKING

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

## ENERGY CURVE



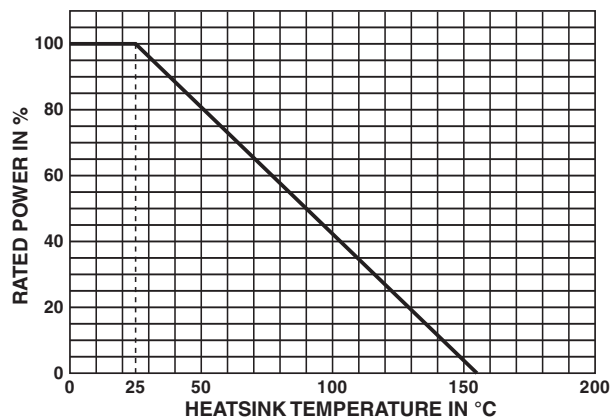
## POWER CURVE



## 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

|              |          |                                       |                                                                                                                                                                                                                                                                    |          |          |          |                                           |                                               |          |          |          |          |          |          |          |
|--------------|----------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|-------------------------------------------|-----------------------------------------------|----------|----------|----------|----------|----------|----------|----------|
| <b>R</b>     | <b>T</b> | <b>O</b>                              | <b>0</b>                                                                                                                                                                                                                                                           | <b>5</b> | <b>0</b> | <b>F</b> | <b>R</b>                                  | <b>6</b>                                      | <b>8</b> | <b>0</b> | <b>0</b> | <b>J</b> | <b>T</b> | <b>E</b> | <b>1</b> |
| 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>48R70 = 48.7 Ω<br>48701 = 48 700 Ω<br>10002 = 100 000 Ω<br>R0100 = 0.01 Ω<br>R6800 = 0.68 Ω<br>27000 = 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 |          |          |          |          |          |          |          |



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