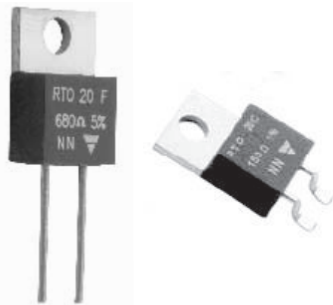


## 20 W Power Resistor, Thick Film Technology, TO-220



The well known TO-220 package is compact and easy to mount.

### FEATURES

- 20 W at 25 °C heatsink mounted
- High power dissipation to size ratio
- Wide resistance range from 0.01 Ω to 550 kΩ
- Negligible inductance
- Easy mounting
- TO-220 package: Compact and easy to mount
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

Two versions of this thick film resistor are available:

- A radial leaded version for PCB mounting
- A flat lead version for surface mounting

DIMENSIONS in millimeters	
<b>RTO 20F - LEADED</b> 	<b>RTO 20C - FOR SURFACE MOUNTING</b> 
<p>• Only for RTO 20 version C = during surface mount soldering temperature profile must not cause the metal tab of this device to exceed 220 °C.</p>	

#### Note

- Tolerances unless stated: ± 0.4 mm

STANDARD ELECTRICAL SPECIFICATIONS							
MODEL	SIZE	RESISTANCE RANGE Ω	RATED POWER $P_{25^{\circ}\text{C}}$ W	LIMITING ELEMENT VOLTAGE $U_L$ V	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C	CRITICAL RESISTANCE Ω
RTO 20	TO-220	0.010 to 550K <sup>(1)</sup>	20	250	1, 2, 5, 10	150	3.12K

#### Note

- <sup>(1)</sup> E24 series

MECHANICAL SPECIFICATIONS	
Mechanical Protection	Insulated case
Resistive Element	Thick film
Substrate	Alumina onto base of nickel coated copper
Connections	Tinned copper
Weight	2.2 g max.

ENVIRONMENTAL SPECIFICATIONS	
Temperature Range	- 55 °C to 155 °C
Climatic Category	55/155/56
Sealing	Sealed container, solder immersion
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

TECHNICAL SPECIFICATIONS	
Dissipation and Associated	Onto a heatsink
Thermal Resistance and Nominal Power	20 W at + 25 °C $R_{TH(j-c)}$ : 6.5 °C/W Free air: 2 W at + 25 °C
Dielectric Strength MIL STD 202	2000 $V_{RMS}$ - 1 min - 10 mA max. (between terminals and heatsink)
Insulation Resistance	≥ 10 <sup>6</sup> MΩ
Inductance	≤ 0.1 μH

DIMENSIONS	
Standard Package	TO-220 insulated case

#### Note

- Not compatible with RoHS reflow profile



PERFORMANCE		
TESTS	CONDITIONS	REQUIREMENTS
Momentary Overload	EN 60115-1 2 Pr 5 s for $R < 2 \Omega$ 1.6 Pr 5 s for $R \geq 2 \Omega$ $U_S < 1.5 U_L$	$\pm (0.25 \% + 0.005 \Omega)$
Rapid Temperature Change	EN 60115-1/60068-2-14 5 cycles - 55 °C to + 155 °C	$\pm (0.5 \% + 0.005 \Omega)$
Load Life	EN 60115-1 1000 h Pr at + 25 °C	$\pm (1 \% + 0.005 \Omega)$
Humidity (Steady State)	EN 60115-1 56 days RH 95 %	$\pm (0.5 \% + 0.005 \Omega)$
High Temperature Exposure	NF EN 140 000 1000 h - 40 % Pr at + 100 °C	$\pm (0.5 \% + 0.005 \Omega)$
Vibration	MIL STD 202, Method 204 C Test D	$\pm (0.2 \% + 0.005 \Omega)$
Terminal Strength	MIL STD 202, Method 211 Test A1	$\pm (0.2 \% + 0.005 \Omega)$
Shock	IEC 60115-1 IEC 60068-2-27 Saw tooth: 100 g/6 ms	$\pm (0.5 \% + 0.005 \Omega)$

RESISTANCE VALUE IN RELATION TO TOLERANCE AND TCR				
Resistance Values	$\geq 0.01$	$\geq 0.015$	$\geq 0.1$	$\geq 0.5$
Tolerances	$\pm 1 \%$ at $\pm 10 \%$			
Typical Temperature Coefficient Range (- 55 °C to + 155 °C)	$\pm 900$ ppm/°C	$\pm 700$ ppm/°C	$\pm 250$ ppm/°C	$\pm 150$ ppm/°C

**Note**

- For very low ohmic values, TCR for information

**CHOICE OF THE BOARD**

The user must choose the board 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:

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

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.

$R_{TH(c-a)}$ : Thermal resistance value measured between outer side of the resistor and room temperature. It is the thermal resistance of the heatsink itself (type, shape) and the quality of the fastening device.

**Example:**

$R_{TH(c-a)}$  for RTO 20 power rating 10 W at ambient temperature + 25 °C

Thermal resistance  $R_{TH(j-c)}$ : 6.5 °C/W

Considering equation (1) we have:

$$\Delta T = 155 \text{ °C} - 25 \text{ °C} = 130 \text{ °C}$$

$$R_{TH(j-c)} + R_{TH(c-a)} = \frac{\Delta T}{P} = \frac{130}{10} = 13 \text{ °C/W}$$

$$R_{TH(c-a)} = 13 \text{ °C/W} - 6.5 \text{ °C/W} = 6.5 \text{ °C/W}$$



**OVERLOADS**

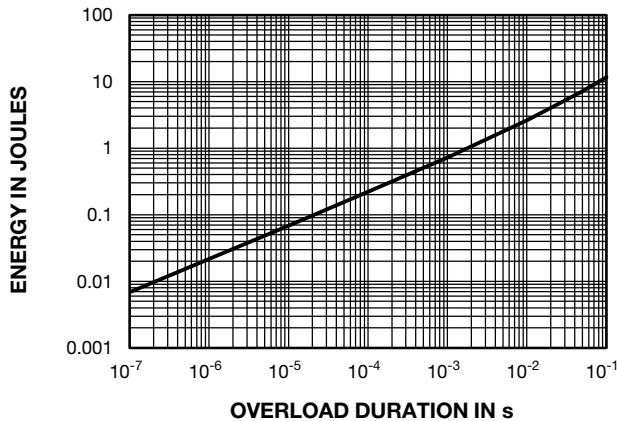
In any case the applied voltage must be lower than the maximum overload voltage of 375 V.

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

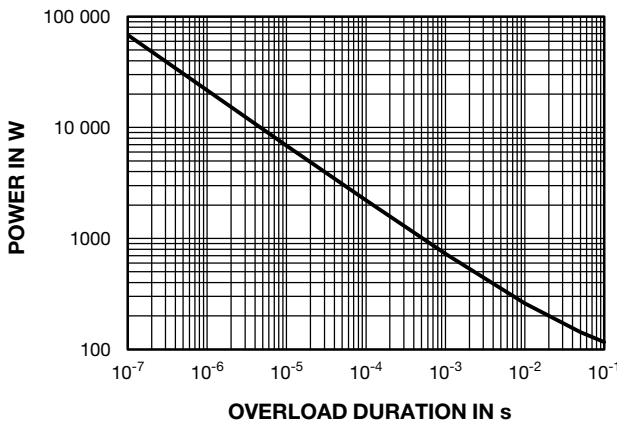
**MARKING**

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

**ENERGY CURVE**



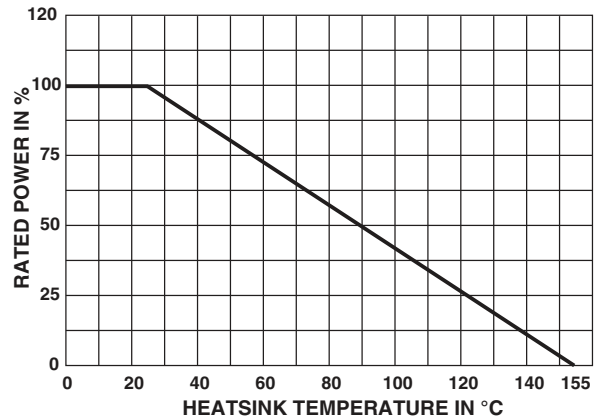
**POWER CURVE**



**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. Spring clip can also be used to mount the component on an heatsink (ex: Kunze, clip KU4-498).



**PACKAGING**

Tube of 50 units



ORDERING INFORMATION							
<b>RTO</b>	<b>20</b>	<b>F</b>	<b>U68</b>	<b>5 %</b>	<b>xxx</b>	<b>TU50</b>	<b>e3</b>
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
		<b>F:</b> Radial leads <b>C:</b> Surface mount		± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: Special TCR, shape etc.		





## 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.

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.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.