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





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

RoHS COMPLIANT

DESIGN SUPPORT TOOLS

click logo to get started

3D Models Available

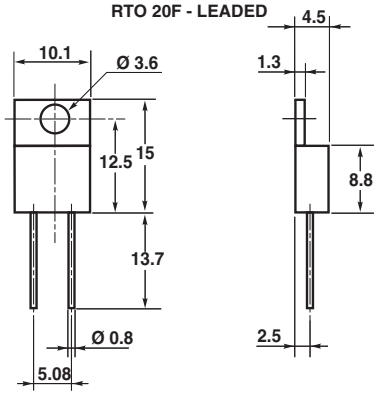
The well known TO-220 package is compact and easy to mount.

Two versions of this thick film resistor are available:

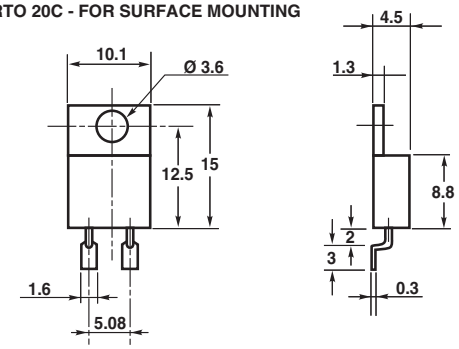
- A radial leaded version for PCB mounting
- A flat lead version for surface mounting

DIMENSIONS in millimeters

RTO 20F - LEADED



RTO 20C - FOR SURFACE MOUNTING



• 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.

Note

- Tolerances unless stated: ± 0.4 mm

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	SIZE	RESISTANCE RANGE Ω	RATED POWER $P_{25\,°C}$ W	LIMITING ELEMENT VOLTAGE U_L V	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C	CRITICAL RESISTANCE Ω
RTO 20	TO-220	0.010 to 550K (1)	20	500	1, 2, 5, 10	150	12.5K

Note

(1) 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

Note

- Not compatible with RoHS reflow profile

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	≥ 10^6 MΩ
Inductance	≤ 0.1 µH

DIMENSIONS

Standard Package	TO-220 insulated case

For technical questions, contact: sferfixedresistors@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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

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

Note

- For very low ohmic values, TCR for information

CHOICE OF THE HEATSINK

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:

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

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: 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 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:

$\Delta T = 155\ °C - 25\ °C = 130\ °C$

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

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

For technical questions, contact: sferfixedresistors@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

OVERLOADS

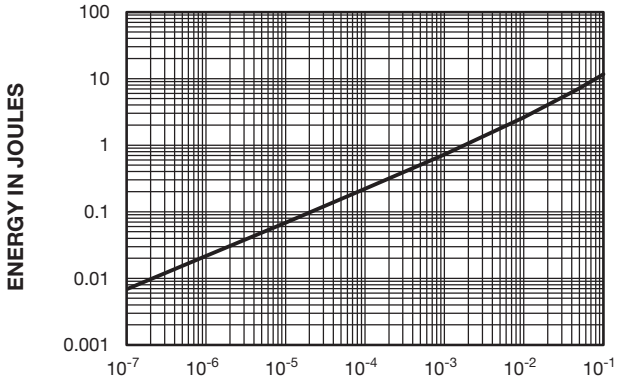
In any case the applied voltage must be lower than the maximum overload voltage of 750 V.

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

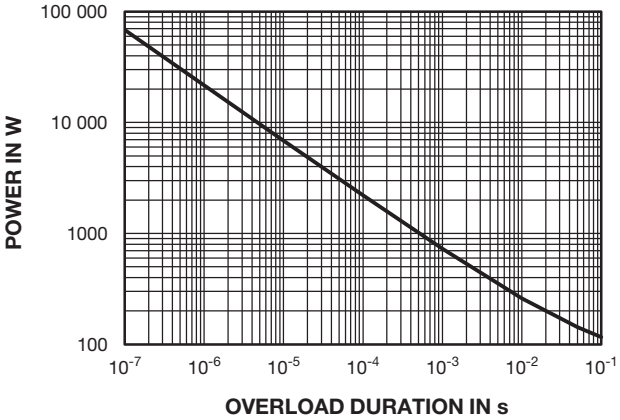
MARKING

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

ENERGY CURVE



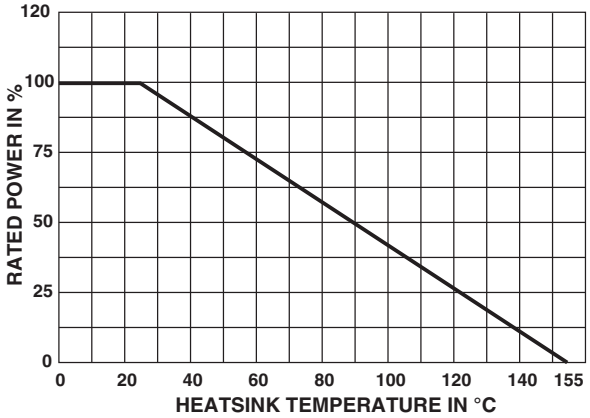
POWER CURVE



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



PACKAGING
Tube of 50 units

For technical questions, contact: sferfixedresistors@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

ORDERING INFORMATION

RTO	20	F	U68	5 %	xxx	TU50	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
		F: radial leads **C**: surface mount		± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: special TCR, shape etc.		

GLOBAL PART NUMBER INFORMATION

R	T	O	0	2	0	F	R	6	8	0	0	J	T	E	3

GLOBAL MODEL	STYLE	DIELECTRIC	OHMIC VALUE	TOLERANCE	PACKAGING
RTO	**020**	**F** = radial leads **C** = surface mount	The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point. **48R70** = 48.7 Ω **48701** = 48 700 Ω **10002** = 100 000 Ω **R0100** = 0.01 Ω **R6800** = 0.68 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = tube Size 30 and 50: Tube 50 pieces

For technical questions, contact: sferfixedresistors@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.

© 2024 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000