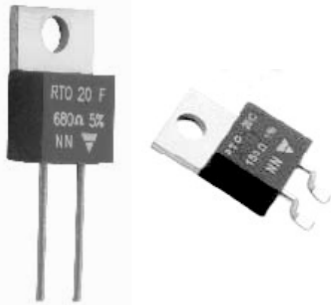


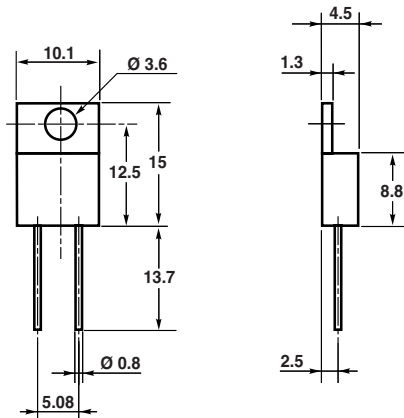
## 20 W Power Resistors, Thick Film Technology, TO-220



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

### DIMENSIONS in millimeters

#### RTO 20F - LEADED



• Tolerance unless otherwise specified:  $\pm 0.4$  mm

### FEATURES

- 20 W at 25 °C heatsink mounted
- High power dissipation to size ratio
- Wide resistance range from 0.01  $\Omega$  to 550 k $\Omega$
- Negligible inductance
- Easy mounting
- TO-220 package: Compact and easy to mount
- Compliant to RoHS directive 2002/95/EC

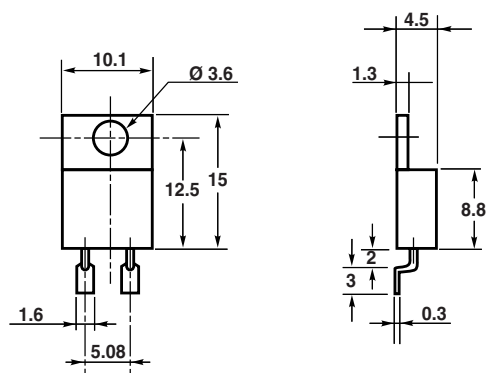


**RoHS**  
COMPLIANT

Two versions of this thick film resistor are available:

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

#### 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.

### MECHANICAL SPECIFICATIONS

<b>Mechanical Protection</b>	Insulated case
<b>Resistive Element</b>	Thick Film
<b>Connections</b>	Tinned copper
<b>Weight</b>	2.2 g max.

### DIMENSIONS

<b>Standard Package</b>	TO-220 Insulated case
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### ENVIRONMENTAL SPECIFICATIONS

<b>Temperature Range</b>	- 55 °C to + 155 °C
<b>Climatic Category</b>	55/155/56
<b>Sealing</b>	Sealed container Solder immersion
<b>Flammability</b>	IEC 60695-11-5 2 applications 30 s separated by 60 s

### ELECTRICAL SPECIFICATIONS

<b>Resistance Range</b>	0.010 $\Omega$ to 550 k $\Omega$ serie E24
<b>Tolerances (Standard)</b>	$\pm 1$ % to $\pm 10$ %
<b>Dissipation and Associated:</b>	Onto a heatsink
<b>Thermal Resistance and Nominal Power</b>	20 W at + 25 °C $R_{TH(j-c)}$ : 6.5 °C/W free air: 2 W at + 25 °C
<b>Temperature Coefficient Standard (- 55 °C; + 150 °C)</b>	See Performance table $\pm 150$ ppm/°C
<b>Limiting Element Voltage <math>U_L</math></b>	250 V
<b>Dielectric Strength MIL STD 202</b>	2000 $V_{RMS}$ - 1 min - 10 mA max. (between terminals and heatsink)
<b>Insulation Resistance</b>	$\geq 10^6$ M $\Omega$
<b>Inductance</b>	$\leq 0.1$ $\mu$ H
<b>Critical Resistance</b>	3.12 k $\Omega$

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 R.H. 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	$\pm (0.5 \% + 0.005 \Omega)$

SPECIAL FEATURES				
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)	$\pm 900 \text{ ppm/}^\circ\text{C}$	$\pm 700 \text{ ppm/}^\circ\text{C}$	$\pm 250 \text{ ppm/}^\circ\text{C}$	$\pm 150 \text{ ppm/}^\circ\text{C}$

**Note**

- For very low ohmic values, TCR for information

**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:

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

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:

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

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

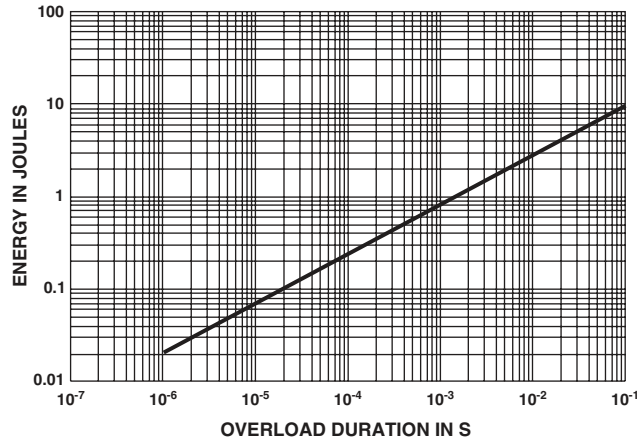
$$R_{TH(c-a)} = 13 \text{ }^\circ\text{C/W} - 6.5 \text{ }^\circ\text{C/W} = 6.5 \text{ }^\circ\text{C/W}$$

### 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.

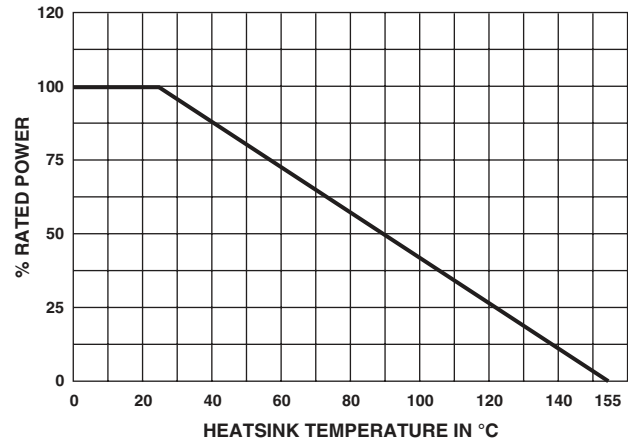
### ENERGY CURVE



### POWER RATING CHART

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 a heatsink (ex: Kunze, clip KU4-498).



### MARKING

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

### PACKAGING

Tube of 50 units

### ORDERING INFORMATION

MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
RTO	20	F	U68	5 %	xxx	TU50	e3
		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		SIZE		LEADS		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 = 2K7 Ω					F = 1 % G = 2 % J = 5 % K = 10 %		T = Tube  Size 30 and 50: Tube 50 pieces		



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