Power Resistor Thick Film Technology

DESIGN SUPPORT TOOLS AVAILABLE

3D Models

FEATURES

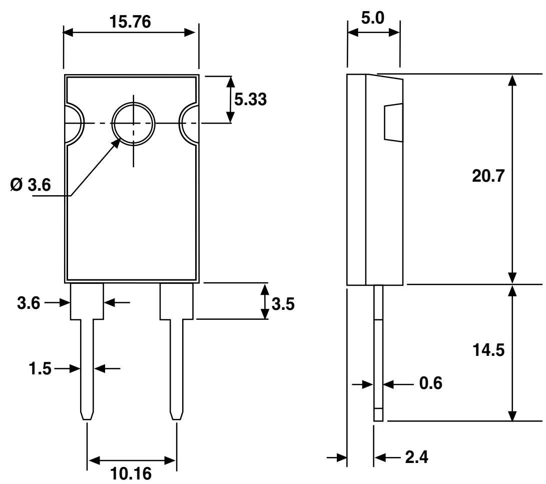
- 100 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: 0.015 Ω to 1 MΩ
- Non inductive
- TO-247 package: compact and easy to mount
- **AEC-Q200 qualified**
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

RoHS COMPLIANT

LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

DIMENSIONS in millimeters



Note

- Tolerances unless stated: ± 0.3 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
LTO 100	TO-247	0.015 to 1 M	100	500	1, 2, 5, 10	200, 350, 900	2.5 K

MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	3.5 g max.
Mounting Torque	1 Nm

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	-55 °C to +175 °C
Climatic Category	55 / 175 / 56
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

TECHNICAL SPECIFICATIONS

Dissipation and Associated	Onto a heatsink
Power Rating and Thermal Resistance of the Component	100 W at +25 °C (case temp.) $R_{TH\,(j-c)}$: 1.5 °C/W Free air: 3.5 W at +25 °C
Temperature Coefficient	See Performance table ± 150 ppm/°C
Dielectric Strength MIL STD 202	3000 V_{RMS} - 1 min 10 mA max.
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH

PERFORMANCE		
TESTS	**CONDITIONS**	**REQUIREMENTS**
Momentary Overload	EN 60115-1 1.5 Pr/5 s $U_S < 1.5\ U_L$	± (0.5 % + 0.005 Ω)
Load Life	EN 60115-1 1000 h Pr at +25 °C	± (1 % + 0.005 Ω)
High Temperature Exposure	AEC-Q200 REV D conditions: MIL-STD-202 method 108 1000 h, +175 °C, unpowered	± (0.25 % + 0.005 Ω)
Temperature Cycling	AEC-Q200 REV D conditions: JESD22 method JA-104 1000 cycles, -55 °C to +125 °C dwell time -15 min	± (1 % + 0.005 Ω)
Biased Humidity	AEC-Q200 REV D conditions: MIL-STD-202 method 103 1000 h, 85 °C, 85 % RH	± (1 % +0.005 Ω)
Operational Life	AEC-Q200 REV D conditions: MIL-STD-202 method 108 2000 h, 90/30, powered, +125 °C	± (1 % +0.005 Ω)
ESD Human Body Model	AEC-Q200 REV D conditions: AEC-Q200-002 25 kV_{AD}	± (0.5 % +0.005 Ω)
Vibration	AEC-Q200 REV D conditions: MIL-STD-202 method 204 5 *g*'s for 20 min, 12 cycles test from 10 Hz to 2000 Hz	± (0.5 % +0.005 Ω)
Mechanical Shock	AEC-Q200 REV D conditions: MIL-STD-202 method 213 100 *g*'s, 6 ms, 3.75 m/s 3 shocks/direction	± (0.5 % +0.005 Ω)
Terminal Strength	AEC-Q200 REV D conditions: AEC-Q200-006 2 kgf, 60 sec	± (0.25 % +0.01 Ω)

SPECIAL FEATURES			
Resistance Values	≥ 0.015	≥ 0.1	> 20
Tolerances	± 1 % at ± 10 %		
Typical Temperature Coefficient (-55 ° to +175 °C)	± 900 ppm/°C	± 350 ppm/°C	± 200 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 175 °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.

$R_{TH\ (c-h)}$: 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:

$R_{TH\ (c-h)} + R_{TH\ (h-a)}$ for LTO 100 power rating 10 W at ambient temperature +25 °C
Thermal resistance $R_{TH\ (j-c)}$: 1.5 °C/W
Considering equation (1) we have:

$$\Delta T = 175\ °C - 25\ °C = 150\ °C$$

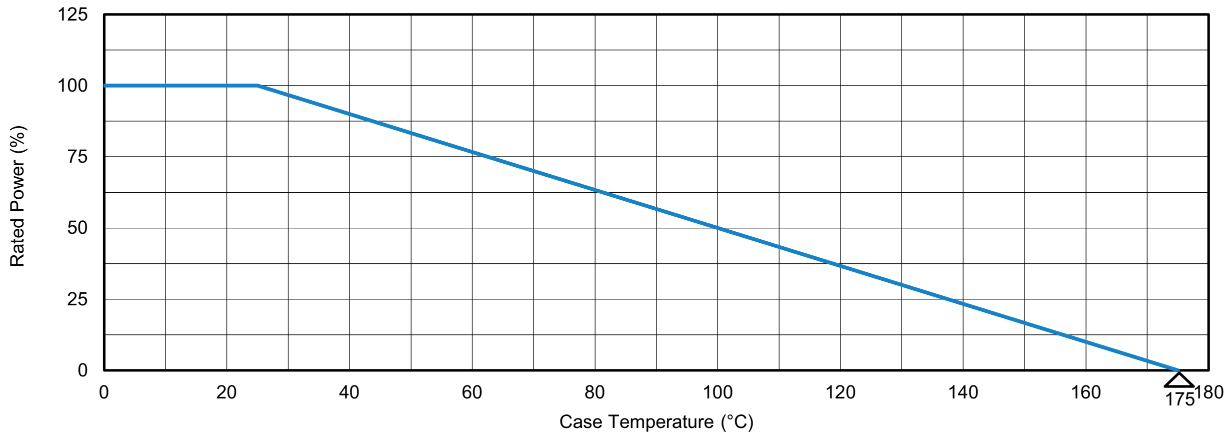
$$R_{TH\ (j-c)} + R_{TH\ (c-h)} + R_{TH\ (h-a)} = \frac{\Delta T}{P} = \frac{150}{10} = 15\ °C/W$$

$$R_{TH\ (c-h)} + R_{TH\ (h-a)} = 15\ °C/W - 1.5\ °C/W = 13.5\ °C/W$$

with a thermal grease $R_{TH\ (c-h)}$ = 1 °C/W, we need a heatsink with $R_{TH\ (h-a)}$ = 12.5 °C/W.

POWER RATING

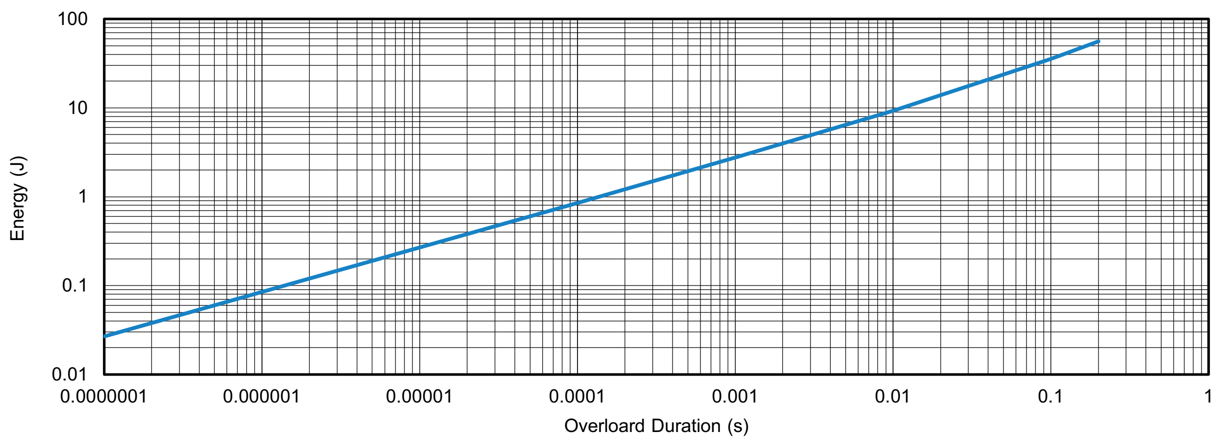
The temperature of the case should be maintained within the limits specified.
To improve the thermal conductivity, surfaces in contact should be coated with a silicone grease and the torque applied on the screw for tightening should be around 1 Nm.



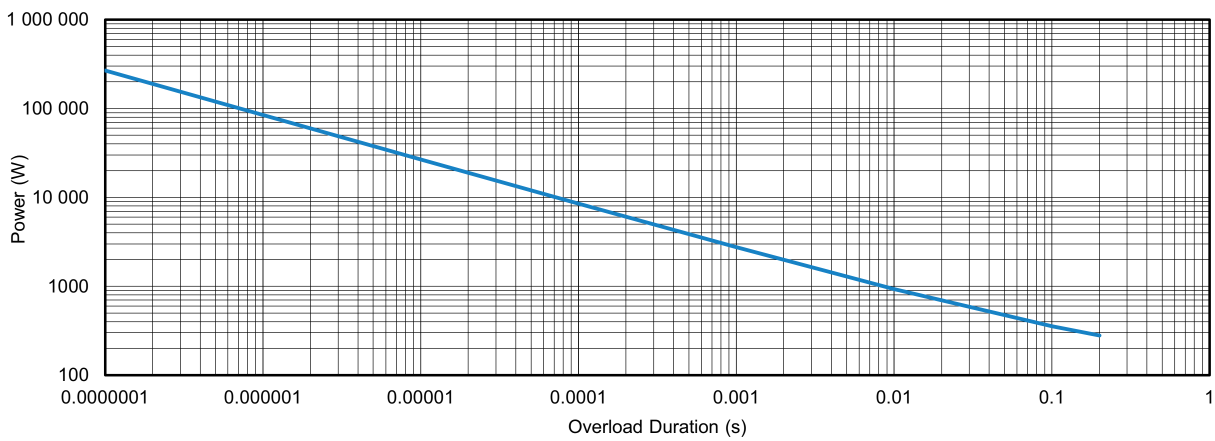
OVERLOADS

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.

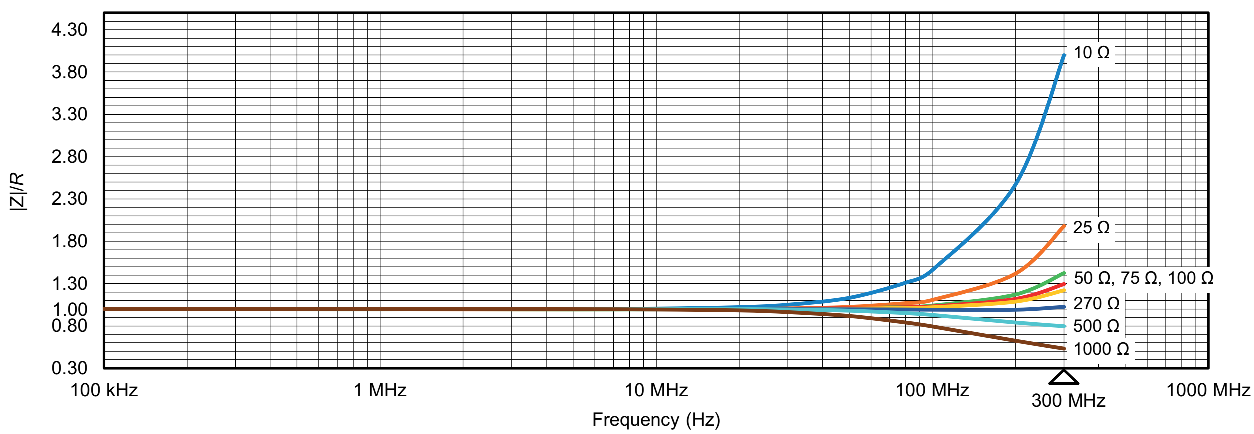
ENERGY CURVE



POWER CURVE



IMPEDANCE CURVE 10 Ω to 1 kΩ from 100 kHz to 300 MHz



PACKAGING
Tube of 30 units

MARKING

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

ORDERING INFORMATION

LTO	100	F	2.7 kΩ	± 1 %	xxx	TU30	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
				± 1 % ± 2 % ± 5 % ± 10 %	Optional on request: special TCR, shape etc.		

GLOBAL PART NUMBER INFORMATION

L	T	O	1	0	0	F	2	7	0	0	0	J	T	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
LTO	**100**	**F** = radial leads	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 **R4700** = 0.47 Ω **27000** = 2700 Ω = 2.7 kΩ	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = tube Tube 30 pieces	**E3** = pure tin

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