Power Resistor Thick Film Technology

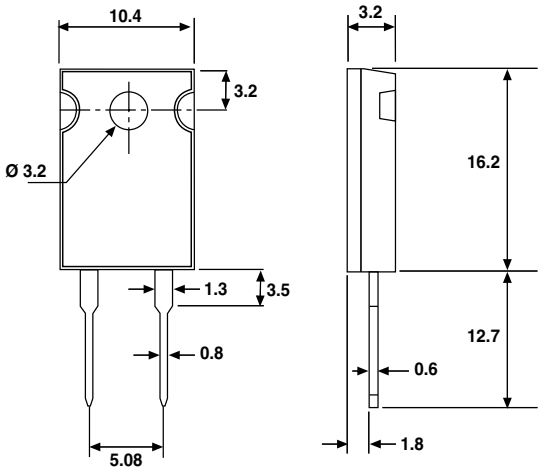
LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

FEATURES

- 50 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: 0.010 Ω to 550 kΩ
- Non inductive
- TO-220 package: Compact and easy to mount
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

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 50	TO-220	0.010 to 550K	50	500	1, 2, 5, 10	150, 250, 700, 900	5K

MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	2 g max.
Mounting Torque	1 Nm

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	-55 °C to +150 °C
Climatic Category	55 / 155 / 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	50 W at +25 °C (case temp.) $R_{TH\,(j-c)}$: 2.5 °C/W Free air: 2.5 W at +25 °C
Temperature Coefficient **Standard**	See Performance table ± 150 ppm/°C
Dielectric Strength MIL STD 202	1500 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)
Rapid Temperature Change	EN 60115-1 IEC 60068-2-14 Test Na 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)	MIL-STD-202 method 103 B cond. D	± (0.5 % + 0.005 Ω)
Vibration	MIL-STD-202 method 204 cond. D	± (0.2 % + 0.005 Ω)
Terminal Strength	MIL-STD-202 method 211 cond. A1	± (0.2 % + 0.005 Ω)
Shock	100G, MIL-STD-202 method 213 cond. I	± (0.5 % + 0.005 Ω)

SPECIAL FEATURES				
Resistance Values	≥ 0.010	≥ 0.015	≥ 0.1	≥ 0.5
Tolerances	± 1 % at ± 10 %			
Typical Temperature Coefficient (-55 ° to +155 °C)	± 900 ppm/°C	± 700 ppm/°C	± 250 ppm/°C	± 150 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 150 °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:

$R_{TH\ (c\ -\ a)}$ for LTO 50 power rating 10 W at ambient temperature +25 °C

Thermal resistance $R_{TH\ (j\ -\ c)}$: 2.5 °C/W

Considering equation (1) we have:

$$\Delta T = 150\ °C - 25\ °C = 125\ °C$$

$$R_{TH\ (j\ -\ c)} + R_{TH\ (c\ -\ h)} + R_{TH\ (h\ -\ a)} = \frac{\Delta T}{P} = \frac{125}{10} = 12.5\ °C/W$$

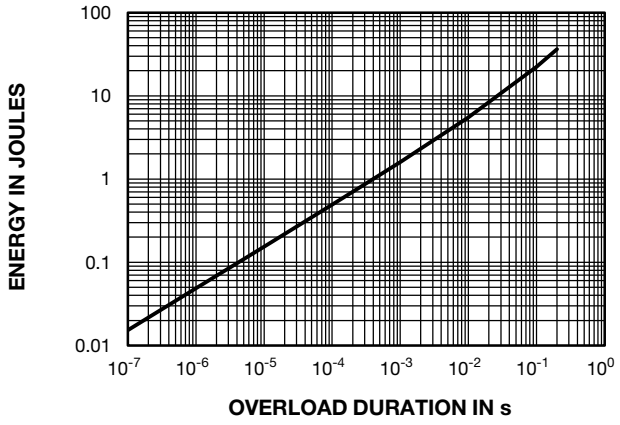
$$R_{TH\ (c\ -\ h)} + R_{TH\ (h\ -\ a)} = 12.5\ °C/W - 2.5\ °C/W = 10\ °C/W$$

with a thermal grease $R_{TH\ (c\ -\ h)}$ = 1 °C/W, we need a heatsink with $R_{TH\ (h\ -\ a)}$ = 9 °C/W.

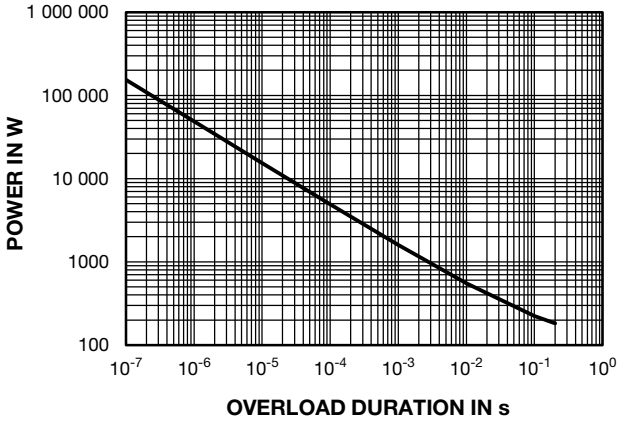
OVERLOADS

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

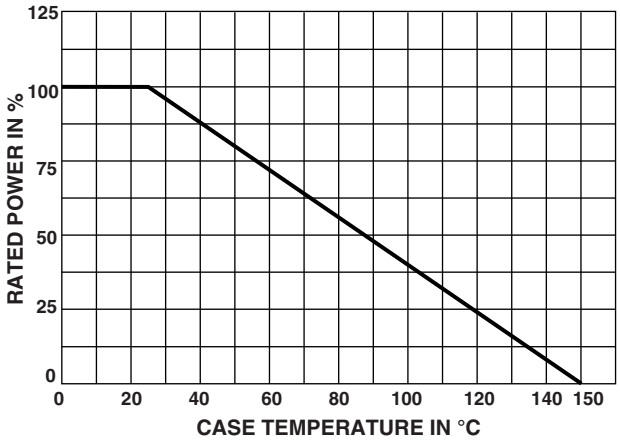


POWER CURVE



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.



PACKAGING

Tube of 50 units

MARKING

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

ORDERING INFORMATION

LTO	50	F	2.7 kΩ	± 1 %	xxx	TU50	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	0	5	0	F	2	7	0	0	0	J	T	E	3

GLOBAL MODEL	SIZE	LEADS	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD (Pb)-FREE
LTO	**050**	**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 50 pieces	**E3** = pure tin

RELATED DOCUMENTS

APPLICATION NOTES	
Potentiometers and Trimmers	www.vishay.com/doc?51001
Guidelines for Vishay Sfernice Resistive and Inductive Components	www.vishay.com/doc?52029

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