Power Resistor Thick Film Technology

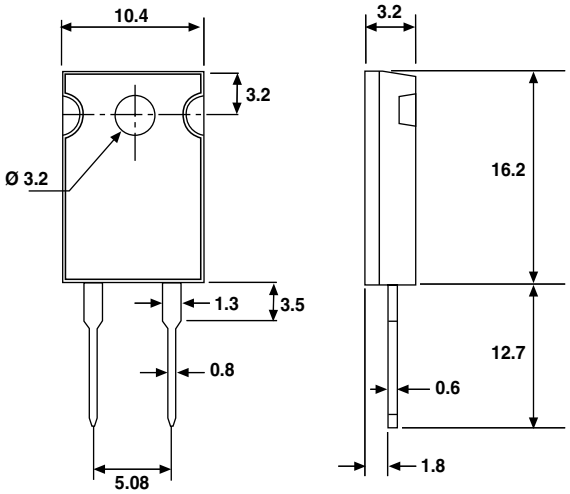
LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

FEATURE

RoHS COMPLIANT

- 50 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: R010 to 550K
- Non inductive
- TO-220 package: Compact and easy to mount
- RoHS compliant
- Isolated case

DIMENSIONS in millimeters



MECHANICAL SPECIFICATIONS

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

DIMENSIONS

Standard Package	TO-220 isolated case

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/155/56
Flammability	IEC 60695-11-5 2 applications 30 s separated by 60 s

ELECTRICAL SPECIFICATIONS	
Resistance Range	0.010 Ω to 550 kΩ
Tolerances (Standard)	± 1 % to ± 10 %
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
Limiting Element Voltage U_L	250 V
Dielectric Strength MIL STD 202	1500 V_{RMS} - 1 min 10 mA max.
Insulation Resistance	≥ 10^4 MΩ
Inductance	≤ 0.1 µH
Critical Resistance	1.25 kΩ

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 Tests 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:

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

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 - 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, and the thermal resistance of the thermal compound.

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:

ΔT = 150 °C - 25 °C = 125 °C

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

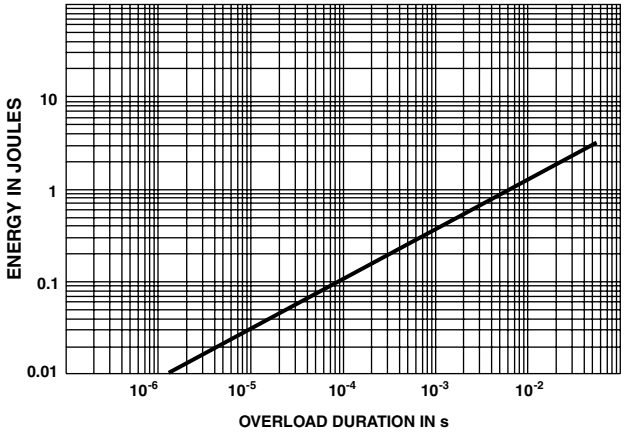
R_{TH} (c - a) = 12.5 °C/W - 2.5 °C/W = 10 °C/W

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

OVERLOADS

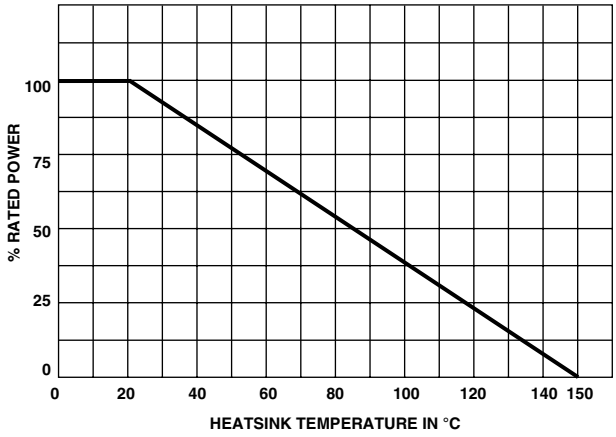
In any case the applied voltage must be lower than the maximum overload voltage of 375 V.
The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

ENERGY CURVE



POWER RATING CHART

The temperature of the 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.



MARKING

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

PACKAGING

Tube of 50 units

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 firts 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 = 2K7 Ω	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**T** = Tube Tube 50 pieces	**E3** = Pure tin

Disclaimer

All product specifications and data are subject to change without notice.

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 herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.