

## 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](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### DIMENSIONS in millimeters



#### Note

- Tolerances unless stated: ± 0.3 mm

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL  | SIZE   | RESISTANCE RANGE<br>Ω | RATED POWER<br>$P_{25\text{ °C}}$<br>W | LIMITING ELEMENT<br>VOLTAGE $U_L$<br>V | TOLERANCE<br>± % | TEMPERATURE<br>COEFFICIENT<br>± ppm/°C | CRITICAL<br>RESISTANCE<br>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 + 155 °C  |
| Climatic Category | 55/155/56  |
| Flammability      | IEC 60695-11-5<br>2 applications 30 s<br>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.)<br>$R_{TH(j-c)}$ : 2.5 °C/W<br>Free air:<br>2.5 W at + 25 °C |
| Temperature Coefficient<br>Standard                  | See Performance table<br>± 150 ppm/°C   |
| Dielectric Strength<br>MIL STD 202                   | 1500 $V_{RMS}$ - 1 min<br>10 mA max.  |
| Insulation Resistance                                | ≥ 10 <sup>4</sup> MΩ  |
| Inductance   | ≤ 0.1 μH  |



| PERFORMANCE              |   |                               |
|--------------------------|---|-------------------------------|
| TESTS                    | CONDITIONS  | REQUIREMENTS                  |
| Momentary Overload       | EN 60115-1<br>1.5 Pr/5 s<br>$U_S < 1.5 U_L$                             | $\pm (0.5 \% + 0.005 \Omega)$ |
| Rapid Temperature Change | EN 60115-1<br>IEC 60068-2-14 Test Na<br>5 cycles<br>- 55 °C to + 155 °C | $\pm (0.5 \% + 0.005 \Omega)$ |
| Load Life                | EN 60115-1<br>1000 h Pr at + 25 °C                                      | $\pm (1 \% + 0.005 \Omega)$   |
| Humidity (Steady State)  | MIL-STD-202<br>method 103 B cond. D                                     | $\pm (0.5 \% + 0.005 \Omega)$ |
| Vibration                | MIL-STD-202<br>method 204 cond. D                                       | $\pm (0.2 \% + 0.005 \Omega)$ |
| Terminal Strength        | MIL-STD-202<br>method 211 cond. A1                                      | $\pm (0.2 \% + 0.005 \Omega)$ |
| Shock                    | 100G, MIL-STD-202<br>method 213 cond. I                                 | $\pm (0.5 \% + 0.005 \Omega)$ |

| SPECIAL FEATURES   |                           |                  |                  |                  |
|--|---------------------------|------------------|------------------|------------------|
| Resistance Values  | $\geq 0.010$              | $\geq 0.015$     | $\geq 0.1$       | $\geq 0.5$       |
| Tolerances   | $\pm 1 \%$ at $\pm 10 \%$ |                  |                  |                  |
| Typical Temperature Coefficient<br>(- 55 °C to + 155 °C) | $\pm 900$ ppm/°C          | $\pm 700$ ppm/°C | $\pm 250$ ppm/°C | $\pm 150$ 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

$\Delta T$ : 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.

$R_{TH(c-a)}$ : 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:

$$\Delta T = 150 \text{ °C} - 25 \text{ °C} = 125 \text{ °C}$$

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

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

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



**OVERLOADS**

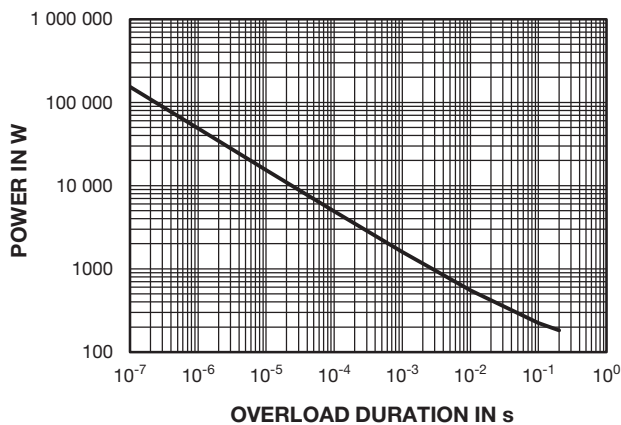
In any case the applied voltage must be lower than the maximum overload voltage of 750 V.

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

**ENERGY CURVE**



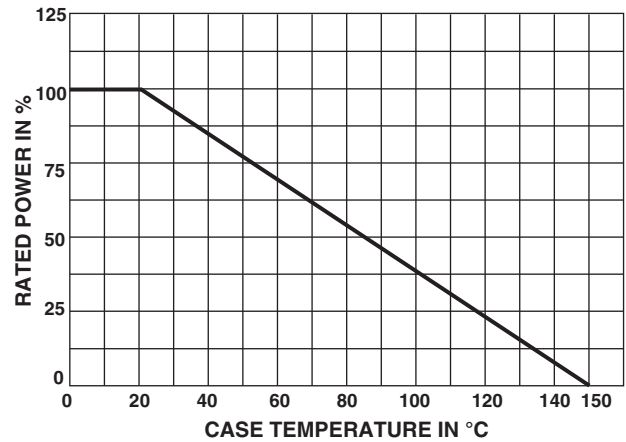
**POWER CURVE**



**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 %<br>± 2 %<br>± 5 %<br>± 10 % | Optional<br>on request:<br>Special TCR,<br>shape etc. |           |                |





## 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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. 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.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

## Данный компонент на территории Российской Федерации

### Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9