

Power Resistor Thick Film Technology



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

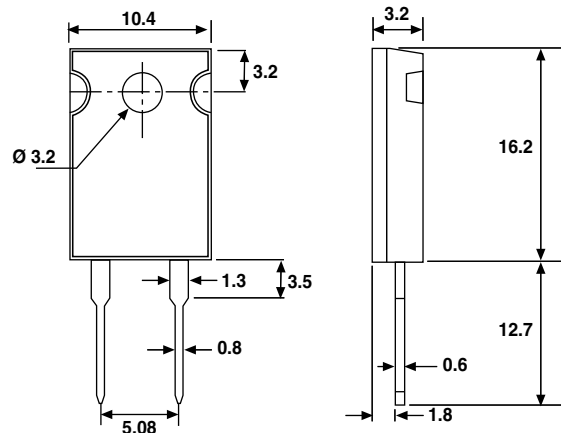

RoHS
COMPLIANT

LINKS TO ADDITIONAL RESOURCES



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 $P_{25\text{ °C}}$ W | LIMITING ELEMENT VOLTAGE U_L V | TOLERANCE ± % | TEMPERATURE COEFFICIENT ± ppm/°C | CRITICAL RESISTANCE Ω |
|--------|--------|-----------------------|--|-------------------------------------|------------------|-------------------------------------|--------------------------|
| LTO 50 | TO-220 | 0.01 to < 0.5 | 50 | 500 | 5, 10 | 250, 700, 900 | n/a |
| | | 0.5 to 550K | 50 | 500 | 1, 2, 5, 10 | 150 | 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 Application time: $t_a = 10$ s Burning duration: $t_b < 30$ 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 | See Performance table |
| Dielectric Strength MIL STD 202 | ± 150 ppm/°C |
| Insulation Resistance | 1500 V _{RMS} - 1 min 10 mA max. |
| Inductance | ≥ 10 ⁴ MΩ |
| | ≤ 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 | ≥ 0.01 | ≥ 0.015 | ≥ 0.1 | ≥ 0.5 |
| Tolerances | | 5 %, 10 % | | 1 %, 2 %, 5 %, 10 % |
| Typical Temperature Coefficient (-55 °C 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:

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

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

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

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

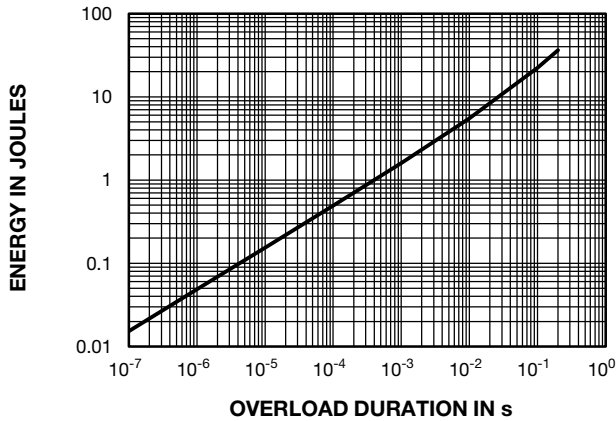


OVERLOADS

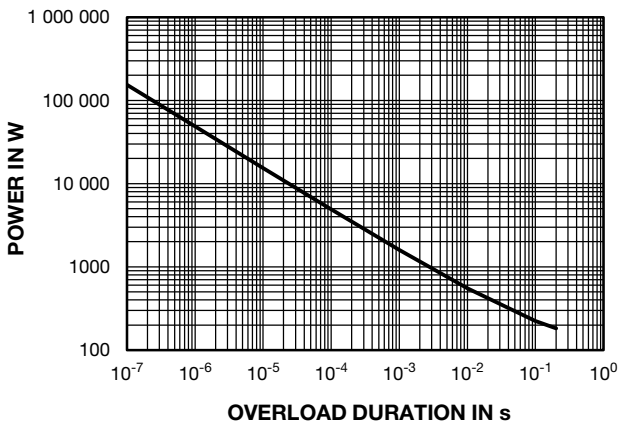
In any case the applied voltage must be lower than the maximum overload voltage of 750 V.

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

ENERGY CURVE



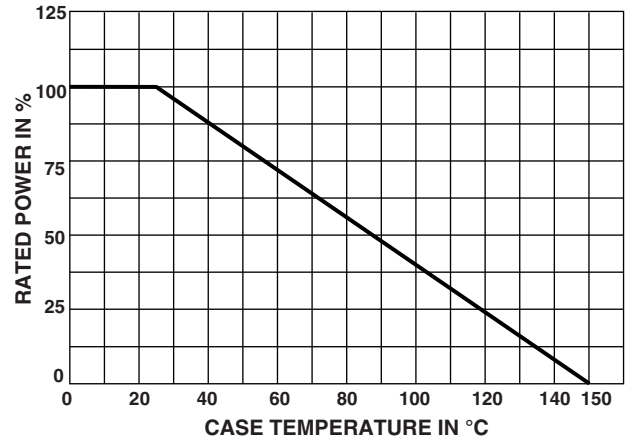
POWER CURVE



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 | <p>The first four digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.</p> <p>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</p> | | | | <p>F = 1 % G = 2 % J = 5 % K = 10 %</p> | <p>T = tube tube 50 pieces</p> | 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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