

## Power Resistor Thick Film Technology



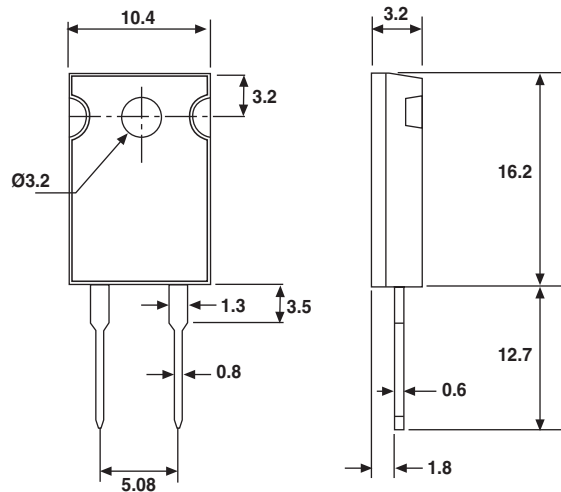
LTO series are the extension of RTO types. We used the direct ceramic mounting design (no metal tab) of our RCH power resistors applied to semiconductor packages.

### FEATURES

- 50 Watt 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



• Tolerance unless otherwise specified:  $\pm 0.3$  mm

### MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick Film
Substrate	Alumina
Connections	Tinned Copper
Weight	2 g max.
Mounting Torque	1 N-m

### DIMENSIONS

Standard Package	TO-220 Isolated case
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### ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 150 °C
Climatic Category	55/155/56

### ELECTRICAL SPECIFICATIONS

Resistance Range	0.010 $\Omega$ to 550 k $\Omega$
Tolerances (Standard)	$\pm 1$ % to $\pm 10$ %
Dissipation and Associated	Onto a heatsink
Power Rating and Thermal Resistance of the component	50 W at + 25 °C (case temperature) $R_{TH}$ (j-c): 2.5 °C/W free air: 2.5 W at + 25 °C
Temperature Coefficient	See Performance table
Standard	$\pm 150$ ppm/°C
Limiting Element Voltage	250 V
Dielectric Strength MIL STD 202	1500 V <sub>RMS</sub> - 1 minute - 10 mA max.
Insulation Resistance	$\geq 10^4$ M $\Omega$
Inductance	$\leq 0.1$ $\mu$ H
Critical Resistance	1.25 k $\Omega$



PERFORMANCE		
TESTS	CONDITIONS	TYPICAL DRIFTS
Momentary Overload	EN60115-1 1.5 Pr/5 s Us < 1.5 UL	± (0.5 % + 0.005 Ω)
Rapid Temperature Change	EN60115-1 IEC 60068-2-14 Tests Na 5 cycles - 55 °C to + 155 °C	± (0.5 % + 0.005 Ω)
Load Life	EN60115-1 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 °C/+ 150 °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 155 °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<sub>TH</sub> (j-c): thermal resistance value measured between resistive layer and outer side of the resistor. It is the thermal resistance of the component.

R<sub>TH</sub> (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), the quality of the fastening device, and the thermal resistance of the thermal compound.

Example:

R<sub>TH</sub> (c-a) for LTO50 power rating 10 W at ambient temperature + 30 °C.

Thermal resistance R<sub>TH</sub> (j-c): 2.5 °C/W

Considering equation (1) we have:

$$\Delta T = 155 \text{ °C} - 30 \text{ °C} = 125 \text{ °C}$$

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

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

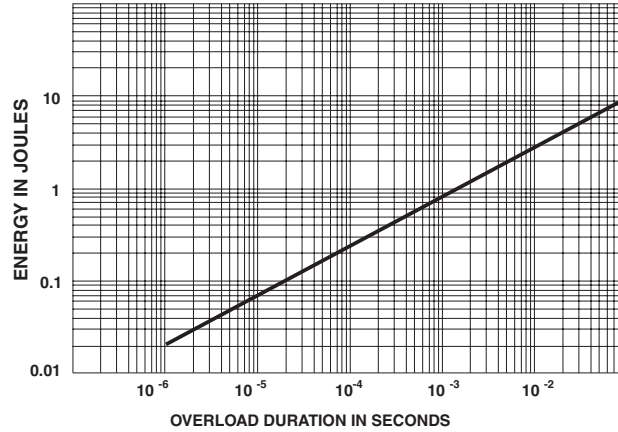
with a thermal grease R<sub>TH</sub> (c - h) = 1 °C/W, we need a heat sink with R<sub>TH</sub> (h - a) = 9 °C/W.



**OVERLOADS**

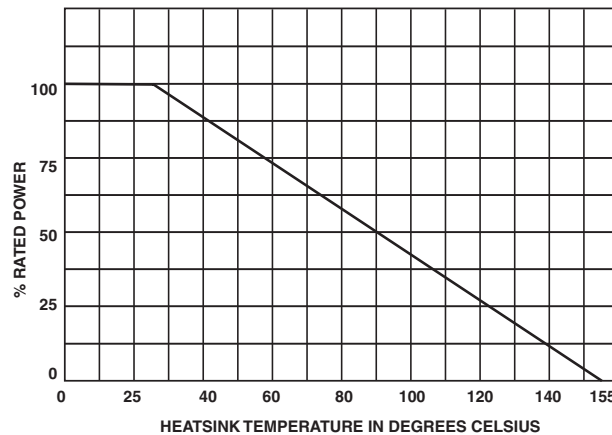
In any case the applied voltage must be lower than the maximum overload voltage of 375V. The values indicated on the graph below are applicable to resistors in air or mounted onto a heatsink.

**ENERGY CURVE**



**POWER RATING CHART**

The temperature of the heatsink 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.

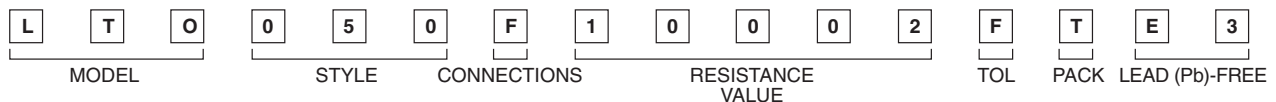
**PACKAGING**

Tube of 50 units

**ORDERING INFORMATION**

LTO	50	F	100 kΩ	± 1 %	xxx	TU50	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
				± 1 %	Optional		
				± 2 %	on request:		
				± 5 %	special TCR,		
				± 10 %	shape etc.		

**SAP PART NUMBERING GUIDELINES**



SAP Part Number LTO050F10002FTE3



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