

## 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

- 100 W at 25 °C case temperature heatsink mounted
- Direct mounting ceramic on heatsink
- Broad resistance range: 0.015 Ω to 1 MΩ
- Non inductive
- TO-247 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 Ω	RATED POWER $P_{25\text{ }^\circ\text{C}}$ W	LIMITING ELEMENT VOLTAGE $U_L$ V	TOLERANCE ± %	TEMPERATURE COEFFICIENT ± ppm/°C	CRITICAL RESISTANCE Ω
LTO 100	TO-247	0.015 to 1 M	100	500	1, 2, 5, 10	150, 250, 700, 900	2.5 K

### MECHANICAL SPECIFICATIONS

Mechanical Protection	Molded
Resistive Element	Thick film
Substrate	Alumina
Connections	Tinned copper
Weight	3.5 g max.
Mounting Torque	1 Nm

### ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 175 °C
Climatic Category	55/175/56
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	100 W at + 25 °C (case temp.) $R_{TH(j-c)}$ : 4.2 °C/W Free air: 2.25 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 <sup>4</sup> MΩ
Inductance	≤ 0.1 μH



PERFORMANCE		
TESTS	CONDITIONS	REQUIREMENTS
Momentary Overload	EN 60115-1 1.5 Pr/5 s $U_S < 1.5 U_L$	$\pm (0.5 \% + 0.005 \Omega)$
Load Life	EN 60115-1 1000 h Pr at + 25 °C	$\pm (1 \% + 0.005 \Omega)$
High Temperature Exposure	AEC-Q200 REV D conditions: MIL-STD-202 method 108 1000 h, + 175 °C, unpowered	$\pm (0.25 \% + 0.005 \Omega)$
Temperature Cycling	AEC-Q200 REV D conditions: Pre-conditioning 3 reflows according JESTD020D for $R < 10 \Omega$ 500 cycles - 55 °C/+ 125 °C for $R \geq 10 \Omega$ 1000 cycles - 55 °C/+ 125 °C dwell time - 15 min	$\pm (0.5 \% + 0.005 \Omega)$
Biased Humidity	AEC-Q200 REV D conditions: MIL-STD-202 method 103 1000 h, 85 °C, 85 % RH	$\pm (1 \% + 0.005 \Omega)$
Operational Life	AEC-Q200 REV D conditions: Pre-conditioning 3 reflows according JESTD020D MIL-STD-202 method 108 1000 h, 90/30, powered, + 125 °C	$\pm (1 \% + 0.005 \Omega)$
ESD Human Body Model	AEC-Q200 REV D conditions: AEC-Q200-002 25 kV <sub>AD</sub>	$\pm (0.5 \% + 0.005 \Omega)$
Vibration	AEC-Q200 REV D conditions: MIL-STD-202 method 204 5 g's for 20 min, 12 cycles test from 10 Hz to 2000 Hz	$\pm (0.5 \% + 0.005 \Omega)$
Mechanical Shock	AEC-Q200 REV D conditions: MIL-STD-202 method 213 100 g's, 6 ms, 3.75 m/s 3 shocks/direction	$\pm (0.5 \% + 0.005 \Omega)$
Terminal Strength	AEC-Q200 REV D conditions: AEC-Q200-006 2 kgf, 60 sec	$\pm (0.25 \% + 0.01 \Omega)$

SPECIAL FEATURES			
Resistance Values	$\geq 0.015$	$\geq 0.1$	$> 20$
Tolerances	$\pm 1 \%$ at $\pm 10 \%$		
Typical Temperature Coefficient (- 55 ° to + 175 °C)	$\pm 900$ ppm/°C	$\pm 350$ 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 175 °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

$\Delta T$ : 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.

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

$R_{TH(c-h)} + R_{TH(h-a)}$  for LTO 100 power rating 10 W at ambient temperature + 25 °C

Thermal resistance  $R_{TH(j-c)}$ : 1.5 °C/W

Considering equation (1) we have:

$$\Delta T = 175 \text{ °C} - 25 \text{ °C} = 150 \text{ °C}$$

$$R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)} = \frac{\Delta T}{P} = \frac{150}{10} = 15 \text{ °C/W}$$

$$R_{TH(c-h)} + R_{TH(h-a)} = 15 \text{ °C/W} - 1.5 \text{ °C/W} = 13.5 \text{ °C/W}$$

with a thermal grease  $R_{TH(c-h)} = 1 \text{ °C/W}$ , we need a heatsink with  $R_{TH(h-a)} = 12.5 \text{ °C/W}$ .



**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**



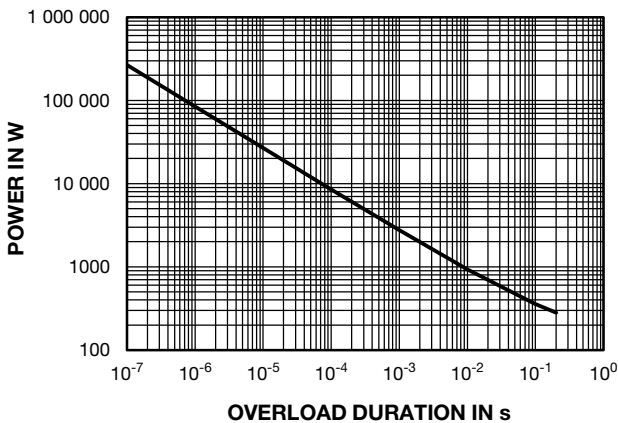
**POWER RATING**

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.



**POWER CURVE**



**PACKAGING**

Tube of 30 units

**MARKING**

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



ORDERING INFORMATION							
LTO	100	F	2.7 kΩ	± 1 %	xxx	TU30	e3
MODEL	STYLE	CONNECTIONS	RESISTANCE VALUE	TOLERANCE	CUSTOM DESIGN	PACKAGING	LEAD (Pb)-FREE
				± 1 %	Optional		
				± 2 %	on request:		
				± 5 %	Special TCR,		
				± 10 %	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.**

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».



## JONHON

«**JONHON**» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А