

## Power Resistor for Mounting onto a Heatsink Thick Film Technology



### FEATURES

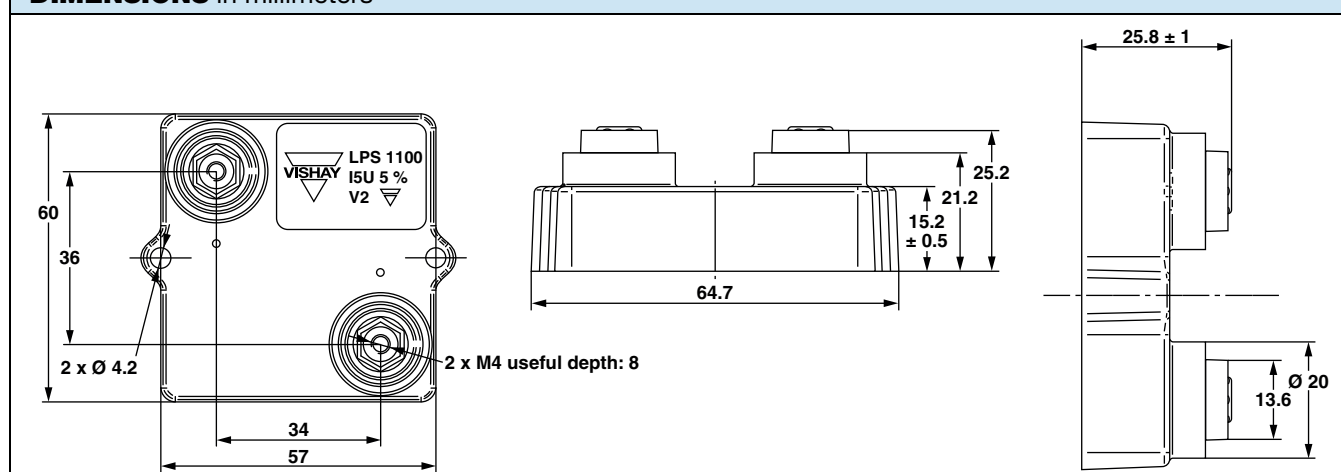
- Compliant with requirement #26 of NF-EN45545-2
- LPS high power: 1100 W
- Wide resistance range: 1  $\Omega$  to 1.3 k $\Omega$  E24 series
- Non inductive
- Easy mounting
- Low thermal radiation of the case
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### LINKS TO ADDITIONAL RESOURCES



### DIMENSIONS in millimeters



#### Notes

- Tolerances unless stated:  $\pm 0.2$  mm
- Power dissipation is 1100 W by using a water cooled heatsink at  $T_{\text{water}} = 15$   $^{\circ}\text{C}$  of  $R_{\text{th}} = 0.059$   $^{\circ}\text{C/W}$  (25  $^{\circ}\text{C}$  to the nearest point of the resistor onto heatsink) and  $R_{\text{th}}$  contact estimated at 0.07  $^{\circ}\text{C/W}$

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL    | RESISTANCE RANGE<br>$\Omega$ | RATED POWER $P_{25^{\circ}\text{C}}$<br>W | TOLERANCE<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>$\pm \text{ppm}/^{\circ}\text{C}$ |
|----------|------------------------------|-------------------------------------------|-----------------------|--------------------------------------------------------------|
| LPS 1100 | 1 to 1.3K                    | 1100                                      | 1, 2, 5, 10           | 150                                                          |

### MECHANICAL SPECIFICATIONS

|                               |                                                |
|-------------------------------|------------------------------------------------|
| Flammability                  | Insulated case and resin for potting UL 94 V-0 |
| Resistive Element             | Thick film                                     |
| End Connections               | Screws M4                                      |
| Tightening Torque Connections | 2 Nm                                           |
| Tightening Torque Heatsink    | 2 Nm                                           |
| Maximum Torque                | 2.5 Nm                                         |
| Weight                        | 79 g $\pm 10$ %                                |

### ENVIRONMENTAL SPECIFICATIONS

|                   |                                                   |
|-------------------|---------------------------------------------------|
| Temperature Range | -55 $^{\circ}\text{C}$ to +200 $^{\circ}\text{C}$ |
| Climatic Category | 55 / 200 / 56                                     |

### TECHNICAL SPECIFICATIONS

|                                                                                                 |                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power Rating and Thermal Resistance                                                             | 1100 W at +25 $^{\circ}\text{C}$<br>On heatsink<br>$R_{\text{th(j-c)}}$ : 0.039 $^{\circ}\text{C/W}$                                                                              |
| Temperature Coefficient<br>(-55 $^{\circ}\text{C}$ to +200 $^{\circ}\text{C}$ ),<br>IEC 60115-1 | $R \leq 1 \Omega$ : $\pm 500$ ppm/ $^{\circ}\text{C}$<br>$1 \Omega < R \leq 10 \Omega$ : $\pm 300$ ppm/ $^{\circ}\text{C}$<br>$10 \Omega < R$ : $\pm 150$ ppm/ $^{\circ}\text{C}$ |
| Dielectric Strength<br>IEC 60115-1,<br>1 min, 10 mA max.                                        | 7 kV <sub>RMS</sub> or 12 kV <sub>RMS</sub>                                                                                                                                       |
| Lightning test 1.2/50 $\mu\text{s}$<br>IEC 61000-4-5                                            | Until 12 kV                                                                                                                                                                       |
| Insulation                                                                                      | $\geq 10^4$ M $\Omega$                                                                                                                                                            |
| Inductance                                                                                      | $\leq 0.1$ $\mu\text{H}$                                                                                                                                                          |
| Partial Discharge<br>(for LPS 1100 D only)                                                      | $\leq 100$ pC/7 kV<br>$\leq 10$ pC/5 kV<br>Other cases: Consult us                                                                                                                |

| PERFORMANCE                     |                                                                                                                                                                                                                          |                                                                                                       |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| TESTS                           | CONDITIONS                                                                                                                                                                                                               | REQUIREMENTS                                                                                          |
| <b>Momentary Overload</b>       | IEC 60115-1: $2 \times P_r / 10$ s for heatsink with $R_{th(h-a)} \geq 0.26$ °C/W (maximum power: 700 W)<br>$1.6 \times P_r / 1$ s for heatsink with $0.26$ °C/W $> R_{th(h-a)} \geq 0.059$ °C/W (maximum power: 1800 W) | $\pm (0.25 \% + 0.05 \Omega)$                                                                         |
| <b>Rapid Temperature Change</b> | AEC-Q200 conditions: IEC 60115-1/IEC 60068-2-14, Test Na<br>50 cycles (-55 °C to +200 °C)                                                                                                                                | $\pm (0.5 \% + 0.05 \Omega)$ for all the ohmic values                                                 |
|                                 | 1000 cycles (-55 °C to +200 °C)                                                                                                                                                                                          | $\pm (5 \% + 0.05 \Omega)$ for $R < 38 \Omega$<br>$\pm (0.5 \% + 0.05 \Omega)$ for $R \geq 38 \Omega$ |
| <b>Load Life</b>                | AEC-Q200 conditions: IEC 60115-1<br>2000 h (90/30) $P_r$                                                                                                                                                                 | $\pm (5 \% + 0.05 \Omega)$ for $R < 38 \Omega$<br>$\pm (0.5 \% + 0.05 \Omega)$ for $R \geq 38 \Omega$ |
| <b>Humidity (Steady State)</b>  | AEC-Q200 conditions: IEC 60115-1, 1000 h RH 85 % / 85 °C                                                                                                                                                                 | $\pm (0.5 \% + 0.05 \Omega)$                                                                          |
| <b>Mechanical Shock</b>         | AEC-Q200 conditions: MIL-STD-202 method 213 condition D<br>(100 g's / 6 ms 3.75 m/s)                                                                                                                                     | $\pm (1 \% + 0.05 \Omega)$                                                                            |
| <b>Vibration</b>                | AEC-Q200 conditions: MIL-STD-202 method 204 condition D<br>(5 g, 20 min 10/2000 Hz)                                                                                                                                      | $\pm (1 \% + 0.05 \Omega)$                                                                            |
| <b>Climatic Sequence</b>        | AEC-Q200 conditions: IEC 60115-1 (55 / 200 / 56)                                                                                                                                                                         | $\pm (1 \% + 0.05 \Omega)$                                                                            |

### RECOMMENDATIONS FOR MOUNTING ONTO A HEATSINK

- Surfaces in contact must be carefully cleaned
- The heatsink must have an acceptable flatness: From 0.05 mm to 0.1 mm/100 mm
- Roughness of the heatsink must be around 6.3 µm. In order to improve thermal conductivity, surfaces in contact (ceramic, heatsink) should be coated with a silicone grease (type Bluesil Past 340 from Blue Star Silicones). Thermal film (type Q-pad II from Berquist) is also possible, easier and faster to install than grease but with a lower efficiency for the power dissipation
- The fastening of the resistor to the heatsink is under pressure control of two screws tightened at 2 Nm for full power availability

|                               |          |
|-------------------------------|----------|
| Tightening Torque on Heatsink | LPS 1100 |
|                               | 2 Nm     |

- The following accessories are supplied with each product:
  - 2 screws CHC M4 x 25 class 8.8 and 2 M4 contact lock washers for heatsink mounting
  - 2 screws TH M4 x 6/6 and 2 M4 contact lock washers for connections

### CHOICE OF THE HEATSINK AND THE THERMAL INTERFACE

The user must choose the heatsink according to the working conditions of the component (power, room temperature). Maximum working temperature must not exceed 200 °C. The dissipated power is simply calculated by the following ratio:

$$P = \frac{\Delta T}{[R_{th(j-c)}] + [R_{th(c-h)}] + [R_{th(h-a)}]}$$

P: Expressed in W

$\Delta T$ : Difference between maximum working temperature and room temperature or fluid cooling 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: 0.039 °C/W

$R_{th(c-h)}$ : 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 LPS 1100 power dissipation 850 W at +18 °C fluid temperature

$$\Delta T \leq 200 \text{ °C} - 18 \text{ °C} = 182 \text{ °C}$$

$$R_{th(j-c)} + R_{th(c-h)} + R_{th(h-a)} = \frac{\Delta T}{P} = \frac{182}{850} = 0.214 \text{ °C/W}$$

$$R_{th(j-c)} = 0.039 \text{ °C/W}$$

$$R_{th(c-h)} + R_{th(h-a)} = 0.214 \text{ °C/W} - 0.039 \text{ °C/W} = 0.175 \text{ °C/W}$$

|                                  | CONFIG. 1:<br>WATER COOLING<br>HEATSINK CP15 AND<br>THERMAL GREASE<br>BLUESIL PAST 340 | CONFIG. 2:<br>AIR COOLING<br>HEATSINK P207/250 AND<br>THERMAL GREASE<br>BLUESIL PAST 340 | CONFIG. 3:<br>WATER COOLING<br>HEATSINK CP15 AND<br>THERMAL PAD Q-PAD II | CONFIG. 4:<br>AIR COOLING<br>HEATSINK P207/250 AND<br>THERMAL PAD Q-PAD II |
|----------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Power Dissipation (W)            | 1100                                                                                   | 350                                                                                      | 650                                                                      | 285                                                                        |
| T° Resistive Element (°C)        | 200                                                                                    | 200                                                                                      | 200                                                                      | 200                                                                        |
| R <sub>th(i-c)</sub> max. (°C/W) | 0.039                                                                                  | 0.039                                                                                    | 0.039                                                                    | 0.039                                                                      |
| R <sub>th(c-h)</sub> typ. (°C/W) | 0.070                                                                                  | 0.201                                                                                    | 0.187                                                                    | 0.315                                                                      |
| R <sub>th(h-a)</sub> max. (°C/W) | 0.059                                                                                  | 0.260                                                                                    | 0.059                                                                    | 0.260                                                                      |
| Fluid T° (°C)                    | 15 (water)                                                                             | 25 (air)                                                                                 | 15 (water)                                                               | 25 (air)                                                                   |

**Note**

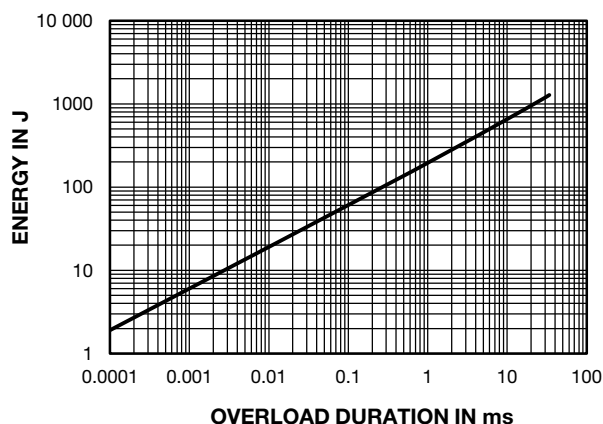
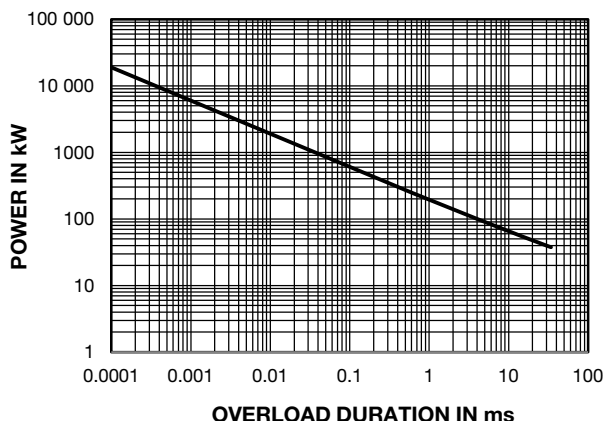
- Configuration 1: Water cooling heatsink (CP15 from Lytron (304 mm x 95.3 mm x 8 mm) with water flow rate 4LPM and thermal grease Bluesil Past 340 from BlueStar Silicones
- Configuration 2: Air cooling heatsink P207/250 from Semikron (250 mm x 200 mm x 72 mm) and thermal grease Bluesil Past 340 from BlueStar Silicones
- Configuration 3: Water cooling heatsink (CP15 from Lytron (304 mm x 95.3 mm x 8 mm) with water flow rate 4LPM and thermal pad Q-pad II from Berquist
- Configuration 4: Air cooling heatsink P207/250 from Semikron (250 mm x 200 mm x 72 mm) and thermal pad Q-pad II from Berquist

**OVERLOAD**

In any case the applied voltage must be lower than  $U_1 = 6600$  V.

**Short time overload:** 2 x Pr/10 s for heatsink with  $R_{th(h-a)} \geq 0.26$  °C/W (maximum power: 700 W) and 1.6 x Pr/1 s for heatsink with  $0.26$  °C/W >  $R_{th(h-a)} \geq 0.059$  °C/W (maximum power: 1800 W).

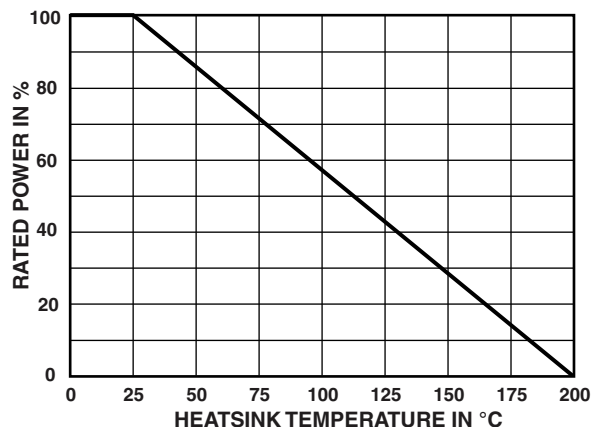
**Accidental overload:** The values indicated on the following graph are applicable to resistors in air or mounted onto a heatsink.

**ENERGY CURVE**

**POWER CURVE**

**MARKING**

Series, style, ohmic value (in  $\Omega$ ), tolerance (in %), manufacturing date, Vishay Sfernice trademark.

**POWER RATING**

The temperature of the case should be maintained within the limit specified in the following figure. To optimize the thermal conduction, contacting surfaces should be coated with silicone grease or thermal film, and heatsink mounting screws tightened to 2 Nm.


**PACKAGING**

Box of 15 units



### ORDERING INFORMATION

|       |       |                     |                                                       |                                                        |           |                |
|-------|-------|---------------------|-------------------------------------------------------|--------------------------------------------------------|-----------|----------------|
| LPS   | 1100  | 1 k $\Omega$        | $\pm 1 \%$                                            | xxx                                                    | BO15      | e              |
| MODEL | STYLE | RESISTANCE<br>VALUE | TOLERANCE                                             | CUSTOM<br>DESIGN                                       | PACKAGING | LEAD (Pb)-FREE |
|       |       |                     | $\pm 1 \%$<br>$\pm 2 \%$<br>$\pm 5 \%$<br>$\pm 10 \%$ | Optional on<br>request:<br>special TCR,<br>shape, etc. |           |                |

### GLOBAL PART NUMBER INFORMATION

|                 |                                                                                                                                                      |   |                                                                                                                                                                                                                                                                                               |   |   |   |                                                                       |   |                          |   |                              |   |   |  |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----------------------------------------------------------------------|---|--------------------------|---|------------------------------|---|---|--|
| L               | P                                                                                                                                                    | S | 1                                                                                                                                                                                                                                                                                             | 1 | 0 | 0 | H                                                                     | 4 | 7                        | R | 0                            | J | B |  |
| GLOBAL<br>MODEL | DIELECTRIC                                                                                                                                           |   | OHMIC VALUE                                                                                                                                                                                                                                                                                   |   |   |   | TOLERANCE                                                             |   | PACKAGING                |   | SPECIAL                      |   |   |  |
| LPS 1100        | <b>L</b> = dielectric strength 7 kV<br><b>H</b> = dielectric strength 12 kV<br><b>D</b> = partial discharge $\leq 100$ pC/7 kV and $\leq 10$ pC/5 kV |   | The first three digits are significant figures and the last digit specifies the number of zeros to follow. R designates decimal point.<br><b>48R7</b> = 48.7 $\Omega$<br><b>47R0</b> = 47 $\Omega$<br><b>1001</b> = 1 k $\Omega$<br><b>4R70</b> = 4.7 $\Omega$<br><b>R240</b> = 0.24 $\Omega$ |   |   |   | <b>F</b> = 1 %<br><b>G</b> = 2 %<br><b>J</b> = 5 %<br><b>K</b> = 10 % |   | <b>B</b> = box 15 pieces |   | As applicable<br><b>ZA</b> x |   |   |  |



## 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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.