

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



### FEATURES

- AEC-Q200 qualified
- Compliant with requirement #26 of NF-EN45545-2
- High power 600 W at 85 °C bottom case temperature
- Wide resistance range: 0.3  $\Omega$  to 900 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)

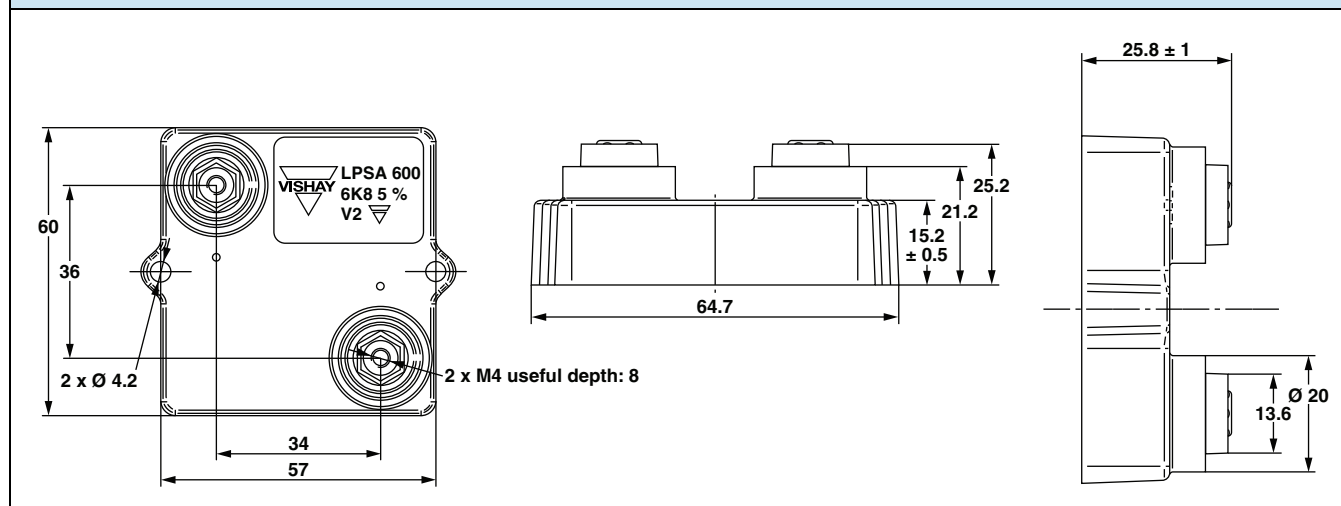

**RoHS**  
COMPLIANT

### LINKS TO ADDITIONAL RESOURCES



LPSA is a fully AEC-Q200 qualified high power resistor. Its high power / energy capability makes it a perfect fit for automotive precharge and discharge applications requiring high levels of performance.

### DIMENSIONS in millimeters



#### Note

- Tolerances unless stated:  $\pm 0.2$  mm

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL    | RESISTANCE RANGE<br>$\Omega$ | RATED POWER<br>$P_{85^\circ\text{C}}$<br>W | LIMITING ELEMENT VOLTAGE $U_L$<br>V | TOLERANCE<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>$\pm \text{ppm}/^\circ\text{C}$ | CRITICAL RESISTANCE ( $\Omega$ ) |
|----------|------------------------------|--|-------------------------------------|-----------------------|--|----------------------------------|
| LPSA 600 | 0.3 to 900K                  | 600  | 5K                                  | 1, 2, 5, 10           | 150, 300, 500  | 41.66K                           |

| MECHANICAL SPECIFICATIONS     |                          |
|-------------------------------|--------------------------|
| Flammability                  | Insulated case UL 94 V-0 |
| Resistive Element             | Thick film               |
| Substrate                     | Alumina                  |
| End Connections               | Screws M4                |
| Tightening Torque Connections | 2 Nm                     |
| Tightening Torque Heatsink    | 2 Nm                     |
| Maximum Torque                | 2.5 Nm                   |
| Weight                        | 83 g ± 10 %              |

| ENVIRONMENTAL SPECIFICATIONS |                   |
|------------------------------|-------------------|
| Temperature Range            | -55 °C to +155 °C |
| Climatic Category            | 55/155/56         |

| TECHNICAL SPECIFICATIONS   |  |
|--|--|
| Power Rating and Thermal Resistance                                    | 600 W at + 85 °C<br>bottom case temperature<br>$R_{TH(j-c)}$ : 0.112 °C/W  |
| Temperature Coefficient<br>-55 °C / +155 °C<br>IEC 60115-1<br>Standard | $R \leq 1 \Omega$ : ± 500 ppm/°C<br>$1 \Omega < R \leq 10 \Omega$ : ± 300 ppm/°C<br>$10 \Omega < R$ : ± 150 ppm/°C |
| Dielectric Strength<br>IEC 60115-1, 1 min,<br>10 mA max.               | 7 kV <sub>RMS</sub> or 12 kV <sub>RMS</sub>  |
| Lightning test 1.2/50 µs<br>IEC 61000-4-5                              | Until 12 kV  |
| Insulation Resistance  | ≥ 10 <sup>4</sup> MΩ   |
| Inductance   | ≤ 0.1 µH   |
| Partial Discharge<br>(for LPSA 600 D only)                             | ≤ 100 pC/7 kV<br>≤ 10 pC/5 kV<br>Other cases: Consult us   |

| PERFORMANCE               |  |                     |
|---------------------------|--|---------------------|
| TESTS                     | CONDITIONS   | REQUIREMENTS        |
| Momentary Overload        | IEC 60115-1<br>2 x P <sub>r</sub> /10 s<br>$U_{max.} \leq U_L = 5000$ V  | ± (0.5 % + 0.005 Ω) |
| Load Life                 | IEC 60115-1<br>1000 h (90/30) P <sub>r</sub> at 85 °C  | ± (0.5 % + 0.05 Ω)  |
| High Temperature Exposure | AEC-Q200 rev. D conditions:<br>MIL-STD-202 method 108<br>1000 h, +125 °C, unpowered                              | ± (0.5 % + 0.005 Ω) |
| Temperature Cycling       | AEC-Q200 rev. D conditions:<br>JESD22 method JA-104<br>1000 cycles, -55 °C to +125 °C<br>dwell time -15 min      | ± (1 % + 0.005 Ω)   |
| Biased Humidity           | AEC-Q200 rev. D conditions:<br>MIL-STD-202 method 103<br>1000 h, +85 °C, 85 % RH                                 | ± (0.5 % + 0.005 Ω) |
| Operational Life          | AEC-Q200 rev. D conditions:<br>MIL-STD-202 method 108<br>1000 h, 90/30, powered, +25 °C                          | ± (1 % + 0.005 Ω)   |
| ESD Human Body Model      | AEC-Q200 rev. D conditions:<br>AEC-Q200-002<br>25 kV <sub>AD</sub>   | ± (0.5 % + 0.005 Ω) |
| Vibration                 | AEC-Q200 rev. D conditions:<br>MIL-STD-202 method 204<br>5 g for 20 min, 12 cycles<br>test from 10 Hz to 2000 Hz | ± (0.5 % + 0.005 Ω) |
| Mechanical Shock          | AEC-Q200 rev. D conditions:<br>MIL-STD-202 method 213<br>100 g; 6 ms, 3.75 m/s<br>3 shocks/direction             | ± (0.5 % + 0.005 Ω) |
| Terminal Strength         | AEC-Q200 rev. D conditions:<br>AEC-Q200-006<br>2.27 kg, 60 s   | ± (0.25 % + 0.01 Ω) |

## 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 (alumina, heatsink) should be coated with a silicone grease (type Bluesil Past 340 from BlueStar Silicones) or a thermal film (type Q pad II) easier and faster to install than the grease.
- 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 | LPSA 600 |
|                               | 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

The user must choose the heatsink 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:

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

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: (see specifications environmental paragraph).

$R_{TH(c-h)}$ : 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 LPSA 600 power dissipation 180 W at +50 °C room temperature.

$\Delta T \leq 155\text{ °C} - 50\text{ °C} = 105\text{ °C}$

$R_{TH(j-c)} + R_{TH(c-h)} + R_{TH(h-a)} = \frac{\Delta T}{P} = \frac{105}{180} = 0.58\text{ °C/W}$

$R_{TH(j-c)} = 0.112\text{ °C/W}$

$R_{TH(c-h)} + R_{TH(h-a)} = 0.58\text{ °C/W} - 0.112\text{ °C/W} = 0.468\text{ °C/W}$

## OVERLOADS

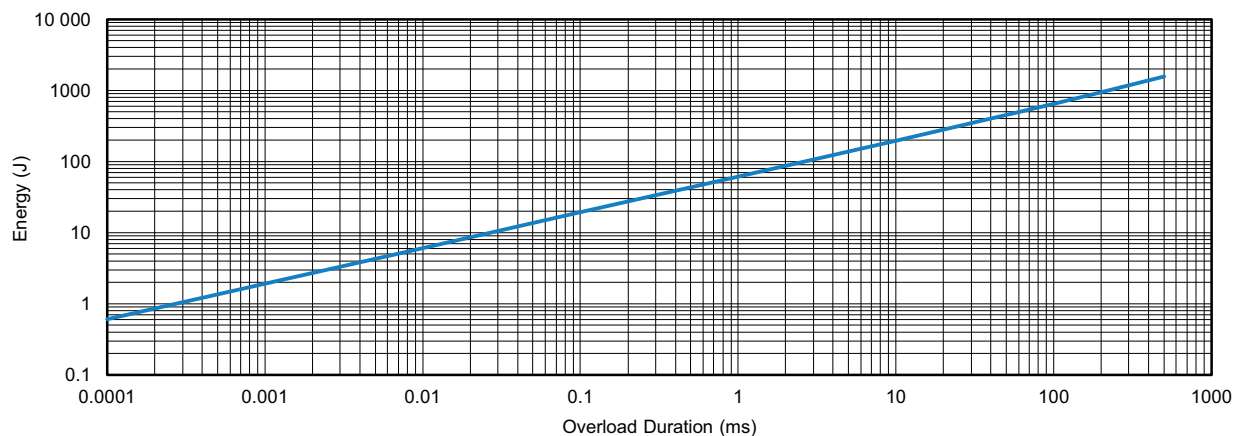
In any case the applied voltage must be lower than  $U_L = 5000\text{ V}$ .

**Short time overload:**  $2 \times P_r/10\text{ s}$

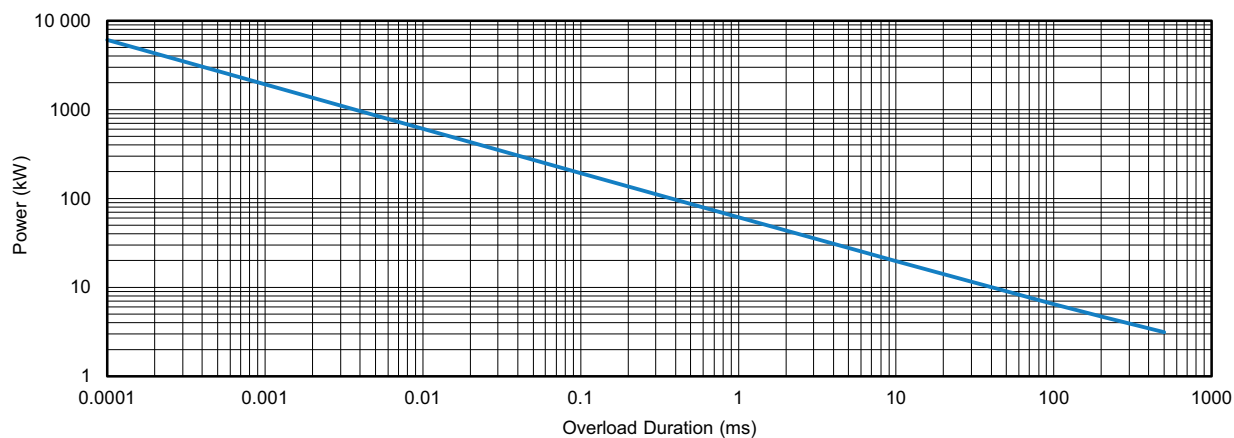
**Accidental overload:** The values indicated on the following graph are applicable to resistors in air or mounted onto a heatsink.



## ENERGY CURVE



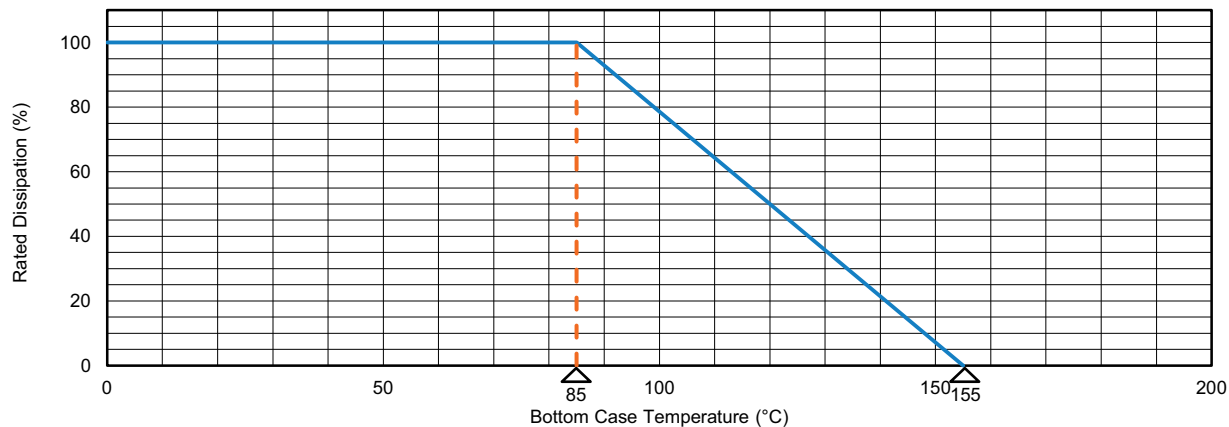
## POWER CURVE



## POWER RATING

The temperature of the case should be maintained within the limits specified 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.





## MARKING

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

## PACKAGING

Box of 15 units

## ORDERING INFORMATION

| LPSA  | 600   | 100 k $\Omega$      | $\pm 1 \%$  | xxx   | B015      | e              |
|-------|-------|---------------------|---|---|-----------|----------------|
| MODEL | STYLE | RESISTANCE<br>VALUE | TOLERANCE   | CUSTOM DESIGN   | PACKAGING | LEAD (Pb)-FREE |
|       |       |                     | $\pm 1 \%$<br>$\pm 2 \%$<br>$\pm 5 \%$<br>$\pm 10 \%$ | Optional<br>on request:<br>special TCR,<br>shape etc. |           |                |

## GLOBAL PART NUMBER INFORMATION

|                 |   |   |  |   |   |   |   |   |                   |   |                      |   |   |  |
|-----------------|---|---|--|---|---|---|---|---|-------------------|---|----------------------|---|---|--|
| L               | P   | S | A  | 6 | 0 | 0 | H   | 4 | 7                 | R | 0                    | J | B |  |
| GLOBAL<br>MODEL | DIELECTRIC  |   | OHMIC VALUE  |   |   |   | TOLERANCE                                 |   | PACKAGING         |   | SPECIAL              |   |   |  |
| LPSA 600        | L = dielectric<br>strength 7 kV<br>H = dielectric<br>strength 12 kV<br>D = partial discharge<br>$\leq 100$ pC/7 kV and<br>$\leq 10$ pC/5 kV |   | The first three digits are<br>significant figures and the<br>last digit specifies the<br>number of zeros to follow.<br>R designates decimal point.<br>48R7 = 48.7 $\Omega$<br>47R0 = 47 $\Omega$<br>1001 = 1 k $\Omega$<br>4R70 = 4.7 $\Omega$<br>R240 = 0.24 $\Omega$ |   |   |   | F = 1 %<br>G = 2 %<br>J = 5 %<br>K = 10 % |   | B = box 15 pieces |   | As applicable<br>ZAx |   |   |  |



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