

## High Ohmic (up to 10 M $\Omega$ )/High Voltage (up to 3.5 kV) Metal Film Leaded Resistors



### FEATURES

- Technology: metal film
- High pulse loading (up to 10 kV) capability
- Small size (0207/0411)
- Compatible with lead (Pb)-free and lead containing soldering processes
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- Power supplies
- Electronic ballast
- White goods
- Television

### DESIGN SUPPORT TOOLS

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**3D**  
Models  
Available

A homogenous film of metal alloy is deposited on a high grade ceramic body. After a helical groove has been cut in the resistive layer, tinned electrolytic copper wires are welded to the end-caps. The resistors are coated with a blue, non-flammable lacquer, which provides electrical, mechanical, and climatic protection.

| TECHNICAL SPECIFICATIONS                 |                       |                       |                       |                       |
|------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| DESCRIPTION                              | HVR25                 |                       | HVR37                 |                       |
| Resistance range                         | 100 kΩ to 10 MΩ       |                       | 100 kΩ to 10 MΩ       |                       |
| Resistance tolerance                     | ± 5 %                 | ± 1 %                 | ± 5 %                 | ± 1 %                 |
| E-series                                 | E24 series            | E24/E96 series        | E24 series            | E24/E96 series        |
| Temperature coefficient                  | ± 200 ppm/K           |                       |                       |                       |
| Climatic category (LCT/UCT/days)         | 55/155/56             |                       |                       |                       |
| Rated dissipation, $P_{70}$              | 0.25 W                |                       | 0.5 W                 |                       |
| Maximum permissible voltage $U_{\max}$ . |                       |                       |                       |                       |
| DC                                       | 1600 V                |                       | 3500 V                |                       |
| RMS                                      | 1150 V                |                       | 2500 V                |                       |
| Basic specification                      | IEC 60115-1           |                       |                       |                       |
| Stability after:                         |                       |                       |                       |                       |
| Load (1000 h, $P_{70}$ )                 | ± (5 % $R$ + 0.1 Ω)   | ± (1.5 % $R$ + 0.1 Ω) | ± (5 % $R$ + 0.1 Ω)   | ± (1.5 % $R$ + 0.1 Ω) |
| Long term damp heat test (56 days)       | ± (1.5 % $R$ + 0.1 Ω) | ± (1.5 % $R$ + 0.1 Ω) | ± (1.5 % $R$ + 0.1 Ω) | ± (1.5 % $R$ + 0.1 Ω) |
| Soldering (10 s, 260 °C)                 | ± (1 % $R$ + 0.1 Ω)   | ± (1 % $R$ + 0.1 Ω)   | ± (1 % $R$ + 0.1 Ω)   | ± (1 % $R$ + 0.1 Ω)   |

**PART NUMBER AND PRODUCT DESCRIPTION <sup>(1)</sup>**

Part Number: HVR2500001503JA100

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | V | R | 2 | 5 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 3 | J | A | 1 | 0 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| MODEL/SIZE         | VARIANT     | TCR/MATERIAL | VALUE                                                                                                                     | TOLERANCE              | PACKAGING <sup>(2)</sup> | SPECIAL                         |
|--------------------|-------------|--------------|---------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------------|---------------------------------|
| HVR2500<br>HVR3700 | 0 = neutral | 0 = standard | 3 digit value<br>1 digit multiplier<br>MULTIPLIER<br>3 = *10 <sup>3</sup><br>4 = *10 <sup>4</sup><br>5 = *10 <sup>5</sup> | F = ± 1 %<br>J = ± 5 % | A1<br>A5<br>R5<br>N4     | Up to 2 digits<br>00 = standard |

Product Description: HVR25 5 % A1 150K

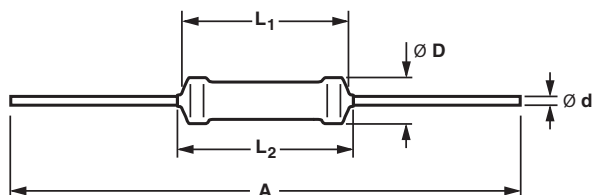
|                |                |                          |                                 |
|----------------|----------------|--------------------------|---------------------------------|
| HVR25          | 5 %            | A1                       | 150K                            |
| Model          | TOLERANCE      | PACKAGING <sup>(2)</sup> | RESISTANCE VALUE                |
| HVR25<br>HVR37 | ± 1 %<br>± 5 % | A1<br>A5<br>R5<br>N4     | 150K = 150 kΩ<br>4M64 = 4.64 MΩ |

**Notes**

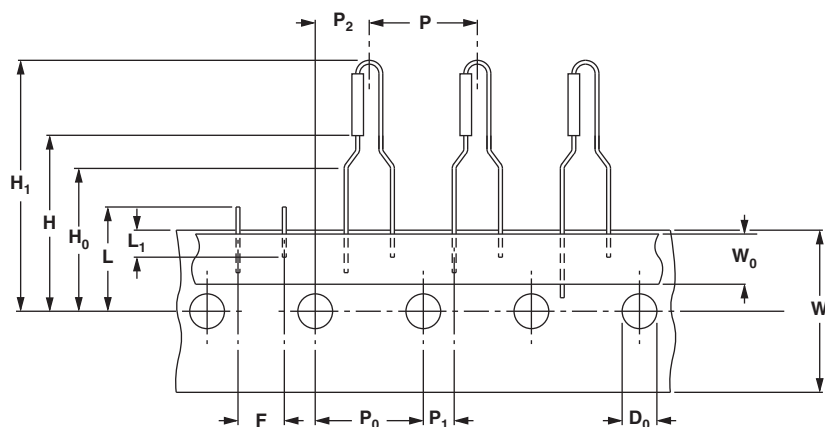
- (1) The PART NUMBER is shown to facilitate the introduction of the unified part numbering system  
(2) Please refer to table PACKAGING, see next page

**PACKAGING**

| MODEL | TAPING       | AMMO PACK |      | REEL   |      |
|-------|--------------|-----------|------|--------|------|
|       |              | PIECES    | CODE | PIECES | CODE |
| HVR25 | Axial, 52 mm | 5000      | A5   | 5000   | R5   |
|       |              | 1000      | A1   |        |      |
|       | Radial       | 4000      | N4   |        |      |
| HVR37 | Axial, 52 mm | 1000      | A1   | 5000   | R5   |

**DIMENSIONS**

**DIMENSIONS - Resistor types, mass and relevant physical dimensions**

| TYPE  | L <sub>1</sub> max.<br>(mm) | L <sub>2</sub> max.<br>(mm) | D <sub>max</sub> .<br>(mm) | Ø d<br>(mm) | A<br>(mm)  | MASS<br>(mg) |
|-------|-----------------------------|-----------------------------|----------------------------|-------------|------------|--------------|
| HVR25 | 6.5                         | 7.5                         | 2.5                        | 0.58 ± 0.05 | 52.5 ± 1.5 | 220          |
| HVR37 | 10                          | 12                          | 4                          | 0.70 ± 0.03 | 52.5 ± 1.5 | 500          |

**PRODUCTS WITH RADIAL LEADS (HVR25)**


| DIMENSIONS - Radial taping |                                                 |       |           |      |
|----------------------------|-------------------------------------------------|-------|-----------|------|
| SYMBOL                     | PARAMETER                                       | VALUE | TOLERANCE | UNIT |
| P                          | Pitch of components                             | 12.7  | ± 1.0     | mm   |
| P <sub>0</sub>             | Feed-hole pitch                                 | 12.7  | ± 0.2     | mm   |
| P <sub>1</sub>             | Feed-hole centre to lead at topside at the tape | 3.85  | ± 0.5     | mm   |
| P <sub>2</sub>             | Feed-hole center to body center                 | 6.35  | ± 1.0     | mm   |
| F                          | Lead-to-lead distance                           | 4.8   | +0.7/-0   | mm   |
| W                          | Tape width                                      | 18.0  | ± 0.5     | mm   |
| W <sub>0</sub>             | Minimum hold down tape width                    | 5.5   | -         | mm   |
| H <sub>1</sub>             | Component height                                | 29    | Max.      | mm   |
| H <sub>0</sub>             | Lead wire clinch height                         | 16.5  | 0.5       | mm   |
| H                          | Height of component from tape center            | 19.5  | ± 1       | mm   |
| D <sub>0</sub>             | Feed-hole diameter                              | 4.0   | ± 0.2     | mm   |
| L                          | Maximum length of snapped lead                  | 11.0  | -         | mm   |
| L <sub>1</sub>             | Minimum lead wire (tape portion) shortest lead  | 2.5   | -         | mm   |

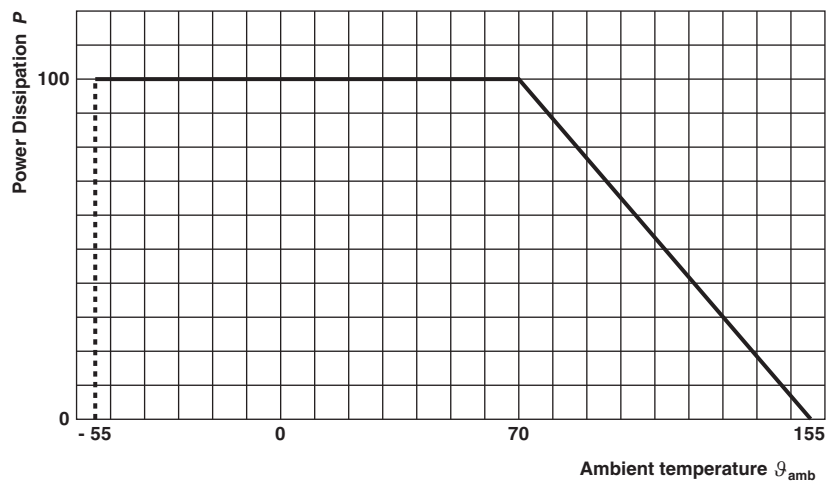
**Note**

- Please refer document number 28721 "Packaging" for more detail

**MARKING**

The nominal resistance and tolerance are marked on the resistor using four or five colored bands in accordance with IEC 60062, marking codes for resistors and capacitors. Standard values of nominal resistance are taken from the E24 and E24/E96 series for resistors with a tolerance of ± 5 % or ± 1 % respectively. The values of the E24/E96 series are in accordance with IEC 60063. Yellow and grey are used instead of gold and silver because metal particles in the lacquer could affect high-voltage properties.

## FUNCTIONAL PERFORMANCE



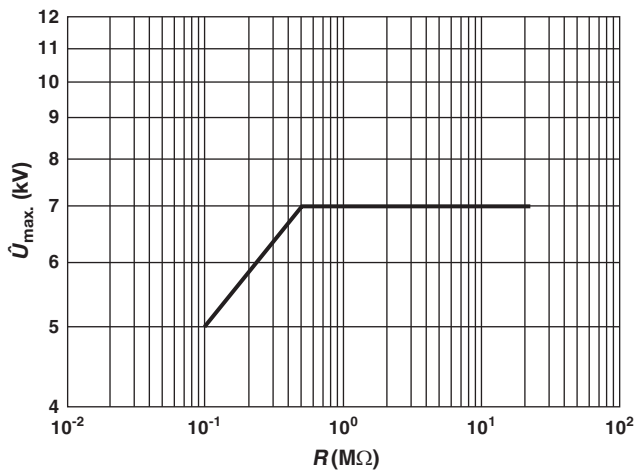
### Derating - Standard Operation

Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of ambient temperature ( $T_{amb}$ )

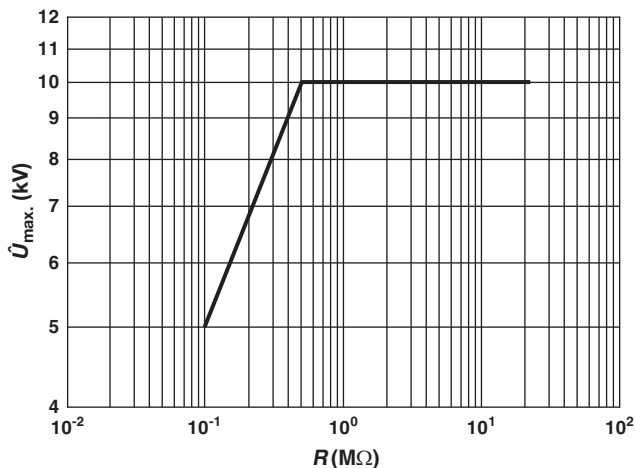
## PULSE LOADING CAPABILITY

### Note

- Maximum allowed peak pulse voltage in accordance with IEC 60065, 14.1.a; 50 discharges from a 1 nF capacitor charged to  $U_{max}$ ; 12 discharges/min



**HVR25**  
 $\Delta R = \pm (4.0 \% R + 0.1 \Omega)$



**HVR37**  
 For 5 % tolerance  $\Delta R = \pm (4.0 \% R + 0.1 \Omega)$   
 For 1 % tolerance  $\Delta R = \pm (2.0 \% R + 0.1 \Omega)$

**TESTS AND REQUIREMENTS**

Essentially all tests are carried out in accordance with IEC 60115-1, category 55/155/56 (rated temperature range -55 °C to +155 °C; damp heat, long term, 56 days) and along the lines of IEC 60068-2-xx test method. The tests are carried out under standard atmospheric conditions according to IEC 60068-1, 5.3 unless otherwise specified. In some instances deviations from IEC recommendations were necessary for our method of specifying.

| PERFORMANCE              |                                        |                                           |                                                                                                                                                                                                               |                                                              |                    |
|--------------------------|----------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------|
| IEC<br>60115-1<br>CLAUSE | IEC<br>60068-2-xx<br>TEST<br>METHOD    | TEST                                      | PROCEDURE                                                                                                                                                                                                     | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R$ )            |                    |
|                          |                                        |                                           |                                                                                                                                                                                                               | HVR25                                                        | HVR37              |
| 4.8                      | -                                      | Temperature coefficient                   | Between -55 °C and +155 °C                                                                                                                                                                                    | $\pm 200$ ppm/K                                              |                    |
| 4.25.1                   | -                                      | Endurance at 70 °C                        | 1000 h;<br>loaded with $P_{70}$ or $U_{\max.}$ ;<br>1.5 h on; 0.5 h off<br><br>for 5 % tolerance<br>for 1 % tolerance                                                                                         | $\pm (5 \% R + 0.1 \Omega)$<br>$\pm (1.5 \% R + 0.1 \Omega)$ |                    |
| 4.24                     | 78 (Cab)                               | Damp heat, steady state                   | 56 days; 40 °C;<br>90 % to 95 % RH<br>loaded with 0.01 $P_{70}$<br><br>for 5 % tolerance<br>for 1 % tolerance                                                                                                 | $\pm (5 \% R + 0.1 \Omega)$<br>$\pm (1.5 \% R + 0.1 \Omega)$ |                    |
| 4.23                     | 2 (Ba)<br>30 (Db)<br>1 (Aa)<br>30 (Db) | Climatic sequence                         | 16 h, 155 °C<br><br>24 h; 25 °C to 55 °C<br>90 % to 100 % RH; 1 cycle<br><br>2 h, -55 °C<br><br>5 days; 25 °C to 55 °C<br>90 to 100 % RH                                                                      | $\pm (1.5 \% R + 0.1 \Omega)$                                |                    |
| 4.23.2                   |                                        | Dry heat                                  |                                                                                                                                                                                                               |                                                              |                    |
| 4.23.3                   |                                        | Damp heat, cyclic                         |                                                                                                                                                                                                               |                                                              |                    |
| 4.23.4                   |                                        | Cold                                      |                                                                                                                                                                                                               |                                                              |                    |
| 4.23.6                   |                                        | Damp heat, (accelerated) remaining cycles |                                                                                                                                                                                                               |                                                              |                    |
| 4.19                     | 14 (Na)                                | Rapid change of temperature               | 30 min at LCT;<br>30 min at UCT;<br>LCT = -55 °C;<br>UCT = 155 °C;<br>5 cycles                                                                                                                                | No visual damage<br>$\pm (1 \% R + 0.1 \Omega)$              |                    |
| 4.13                     | -                                      | Short time overload                       | Room temperature;<br>dissipation $6.25 \times P_{70}$<br>(voltage not more than 2 x limiting voltage,<br>10 000 $V_{\max.}$ );<br>10 cycles 5 s on and 45 s off<br><br>for 5 % tolerance<br>for 1 % tolerance | $\pm (2 \% R + 0.1 \Omega)$<br>$\pm (1 \% R + 0.1 \Omega)$   |                    |
| 4.12                     | -                                      | Noise                                     | IEC 60195                                                                                                                                                                                                     | Max. 5 $\mu V/V$                                             | Max. 2.5 $\mu V/V$ |
| 4.16                     | 21 (Ua1)<br>21 (Ub)<br>21 (Uc)         | Robustness of terminations:               | Load 10 N; 10 s<br><br>Load 5 N; 4 x 90°<br><br>3 x 360° in opposite direction                                                                                                                                | No damage<br>$\pm (1 \% R + 0.1 \Omega)$                     |                    |
| 4.16.2                   |                                        | Tensile all samples                       |                                                                                                                                                                                                               |                                                              |                    |
| 4.16.3                   |                                        | Bending half number of samples            |                                                                                                                                                                                                               |                                                              |                    |
| 4.16.4                   |                                        | Torsion other half of samples             |                                                                                                                                                                                                               |                                                              |                    |
| 4.22                     | 6 (Fc)                                 | Vibration                                 | Frequency 10 Hz to 500 Hz;<br>displacement 1.5 mm or acceleration 10 g;<br>3 directions;<br>total 6 h (3 x 2 h)                                                                                               | $\pm (1.0 \% R + 0.1 \Omega)$                                |                    |

| PERFORMANCE              |                                     |                                 |                                                                                              |                                                              |       |
|--------------------------|-------------------------------------|---------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------|
| IEC<br>60115-1<br>CLAUSE | IEC<br>60068-2-xx<br>TEST<br>METHOD | TEST                            | PROCEDURE                                                                                    | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R$ )            |       |
|                          |                                     |                                 |                                                                                              | HVR25                                                        | HVR37 |
| 4.17                     | 20 (Ta)                             | Solderability<br>(after aging)  | 2 s; 235 °C: Solder bath method;<br>SnPb40<br>3 s; 245 °C: Solder bath method;<br>SnAg3Cu0.5 | Good tinning<br>( $\geq 95$ % covered);<br>no visible damage |       |
| 4.18                     | 20 (Tb)                             | Resistance to<br>soldering heat | Thermal shock: 10 s; 260 °C;<br>3 mm from body                                               | $\pm (1 \% R + 0.1 \Omega)$                                  |       |
| 4.29                     | 45 (XA)                             | Component solvent<br>resistance | Isopropyl alcohol                                                                            | No visible damage                                            |       |
| 4.6.11                   | -                                   | Insulation resistance           | $U = 500 V_{DC}$<br>during 1 min,<br>V-block method                                          | $R_{ins}$ min. 104 M $\Omega$                                |       |
| 4.7                      | -                                   | Voltage proof on<br>insulation  | $U_{RMS} = 700 V$<br>during 1 min,<br>V-block method                                         | No flashover or breakdown                                    |       |

## 12NC INFORMATION FOR HISTORICAL CODING REFERENCE ONLY

- The resistors have a 12 digit ordering code starting with 2306
- The next 4 or 5 digits indicate the resistor type and packaging
- For 5 % tolerance the last 3 digits indicate the resistance value:
  - The first 2 digits indicate the resistance value
  - The last digit indicates the resistance decade in accordance with table
- For 1 % tolerance the last 4 digits indicate the resistance value:
  - The first 3 digits indicate the resistance value
  - The last digit indicates the resistance decade in accordance with table

### Last Digit of 12NC Indicating Resistance Decade

| RESISTANCE<br>DECADE (5 %)       | RESISTANCE<br>DECADE (1 %)       | LAST DIGIT |
|----------------------------------|----------------------------------|------------|
| 100 k $\Omega$ to 910 k $\Omega$ | 100 k $\Omega$ to 976 k $\Omega$ | 4          |
| 1 M $\Omega$ to 9.1 M $\Omega$   | 1 M $\Omega$ to 9.76 M $\Omega$  | 5          |
| = 10 M $\Omega$                  | = 10 M $\Omega$                  | 6          |

### 12NC Example

HVR25, 150 k $\Omega$ ,  $\pm 5$  %, ammpack 1000 pieces is  
**2306 241 13154**

| 12NC - resistor type and packaging |            |           |                       |            |            |                      |
|------------------------------------|------------|-----------|-----------------------|------------|------------|----------------------|
| DESCRIPTION                        |            |           | 2306 ... ..           |            |            |                      |
|                                    |            |           | BANDOLIER IN AMMOPACK |            |            | BANDOLIER<br>ON REEL |
| TYPE                               | TAPE WIDTH | TOLERANCE | RADIAL TAPED          | 1000 UNITS | 5000 UNITS | 5000 UNITS           |
|                                    |            |           | 4000 UNITS            |            |            |                      |
| HVR25                              | 52.5       | $\pm 5$ % | 241 36...             | 241 13...  | 241 53...  | 241 23...            |
|                                    |            | $\pm 1$ % | 241 0....             | 241 8....  | 241 7....  | 241 6....            |
| HVR37                              | 52.5       | $\pm 5$ % | -                     | 242 13...  | -          | 242 23...            |
|                                    |            | $\pm 1$ % | -                     | 242 8....  | -          | 242 6....            |



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