



## Wirewound Resistors, Industrial Power, Flat (HL)



## FEATURES

- High temperature silicon coating
- Mounting accommodations ideally suited to high density packaging
- Self-stacking hardware for horizontal or vertical placement
- Withstands high vibrations without loosening
- Mounting hardware functions as a heat sink allowing greater heat dissipation and less derating of stacked units
- Available in non-inductive styles (type NHL) with Aryton-Perry winding
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



Available



RoHS\*

Available

HALOGEN

FREE

Available

GREEN

(5-2008)

Available

## Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

## STANDARD ELECTRICAL SPECIFICATIONS

| GLOBAL MODEL    | HISTORICAL MODEL | POWER RATING<br>$P_{25^{\circ}\text{C}}$<br>W | RESISTANCE RANGE $\Omega$<br>$\pm 5\%$ | RESISTANCE RANGE $\Omega$<br>$\pm 10\%$ | WEIGHT<br>(typical)<br>g |
|-----------------|------------------|-----------------------------------------------|----------------------------------------|-----------------------------------------|--------------------------|
| HL024<br>NHL024 | HL-24<br>NHL-24  | 30                                            | 1.0 to 11K<br>1.0 to 1.2K              | 0.10 to 11K<br>1.0 to 1.2K              | 20.14                    |
| HL035<br>NHL035 | HL-35<br>NHL-35  | 40                                            | 1.0 to 26K<br>1.0 to 3K                | 0.10 to 26K<br>1.0 to 3K                | 30.07                    |
| HL055<br>NHL055 | HL-55<br>NHL-55  | 55                                            | 1.0 to 54K<br>1.0 to 6.8K              | 0.10 to 54K<br>1.0 to 6.8K              | 51.25                    |
| HL070<br>NHL070 | HL-70<br>NHL-70  | 70                                            | 1.0 to 77K<br>1.0 to 9.4K              | 0.10 to 77K<br>1.0 to 9.4K              | 60.48                    |
| HL095<br>NHL095 | HL-95<br>NHL-95  | 95                                            | 1.0 to 99.9K<br>1.0 to 12.4K           | 0.10 to 99.9K<br>1.0 to 12.4K           | 76.51                    |

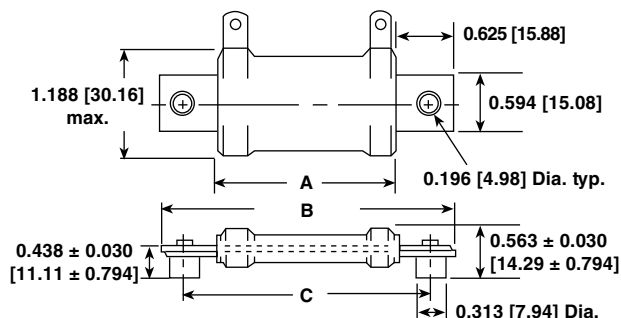
## TECHNICAL SPECIFICATIONS

| PARAMETER                       | UNIT                    | HL, NHL FLAT RESISTOR CHARACTERISTICS                                                                                     |
|---------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Temperature Coefficient         | ppm/ $^{\circ}\text{C}$ | $\pm 90$ for 0.1 $\Omega$ to 0.99 $\Omega$ ; $\pm 50$ for 1 $\Omega$ to 9.9 $\Omega$ ; $\pm 30$ for 10 $\Omega$ and above |
| Dielectric Withstanding Voltage | $V_{AC}$                | 1000, from terminal to mounting hardware                                                                                  |
| Short Time Overload             | -                       | 10 x rated power for 5 s                                                                                                  |
| Maximum Working Voltage         | V                       | $(P \times R)^{1/2}$                                                                                                      |
| Insulation Resistance           | $\Omega$                | 1000 M $\Omega$ minimum dry, 100 M $\Omega$ minimum after moisture test                                                   |
| Operating Temperature Range     | $^{\circ}\text{C}$      | -55 to +350                                                                                                               |

## GLOBAL PART NUMBER INFORMATION

Global Part Numbering example: NHL02409Z10R00JJ

|                                                                                       |                      |                                                    |                                                               |                             |                                                                    |   |                                                           |   |   |   |   |   |   |   |   |  |  |
|---------------------------------------------------------------------------------------|----------------------|----------------------------------------------------|---------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------|---|-----------------------------------------------------------|---|---|---|---|---|---|---|---|--|--|
| N                                                                                     | H                    | L                                                  | 0                                                             | 2                           | 4                                                                  | 0 | 9                                                         | Z | 1 | 0 | R | 0 | 0 | J | J |  |  |
| GLOBAL MODEL                                                                          | TERMINAL DESIGNATION | TERMINAL FINISH                                    | RESISTANCE VALUE                                              | TOLERANCE                   | PACKAGING CODE                                                     |   | SPECIAL                                                   |   |   |   |   |   |   |   |   |  |  |
| NHL024<br>(see "Standard Electrical Specifications" table above for additional P/N's) | 09<br>16             | E = lead (Pb)-free<br>Z = tin / lead<br>N = nickel | R = decimal<br>K = thousand<br>10R00 = 10.0 Ω<br>1K000 = 1 kΩ | J = ± 5.0 %<br>K = ± 10.0 % | E = lead (Pb)-free skin pack<br>J <sup>(1)</sup> = skin pack (J01) |   | (dash number) (up to 2 digits) from 1 to 99 as applicable |   |   |   |   |   |   |   |   |  |  |
| Note<br>(1) Tin / lead for type "Z", lead (Pb)-free for type "N"                      |                      |                                                    |                                                               |                             |                                                                    |   |                                                           |   |   |   |   |   |   |   |   |  |  |
| Historical Part Number example: NHL-24-09Z 10 Ω 5 % J01                               |                      |                                                    |                                                               |                             |                                                                    |   |                                                           |   |   |   |   |   |   |   |   |  |  |
| NHL-24                                                                                | 09Z                  | 10 Ω                                               | 5 %                                                           | J01                         |                                                                    |   |                                                           |   |   |   |   |   |   |   |   |  |  |
| HISTORICAL MODEL                                                                      | TERMINAL/FINISH      | RESISTANCE VALUE                                   | TOLERANCE                                                     | PACKAGING                   |                                                                    |   |                                                           |   |   |   |   |   |   |   |   |  |  |

**DIMENSIONS** in inches [millimeters]**TYPE HL FLAT STYLE**

| MODEL           | DIMENSIONS in inches [millimeters] |                       |                       |                                   | TERMINAL DESIGNATION |          |
|-----------------|------------------------------------|-----------------------|-----------------------|-----------------------------------|----------------------|----------|
|                 | A                                  | B                     | C                     | DISTANCE BETWEEN TERMINALS (ref.) | STANDARD             | OPTIONAL |
|                 | $\pm 0.063$<br>[1.59]              | $\pm 0.063$<br>[1.59] | $\pm 0.031$<br>[0.79] |                                   |                      |          |
| HL024<br>NHL024 | 1.250<br>[31.75]                   | 2.500<br>[63.50]      | 2.000<br>[50.80]      | 0.718<br>[18.24]                  | 09Z                  | 16N      |
| HL035<br>NHL035 | 2.000<br>[50.80]                   | 3.250<br>[82.55]      | 2.750<br>[69.85]      | 1.468<br>[37.29]                  | 09Z                  | 16N      |
| HL055<br>NHL055 | 3.500<br>[88.90]                   | 4.750<br>[120.65]     | 4.250<br>[107.95]     | 2.968<br>[75.39]                  | 09Z                  | 16N      |
| HL070<br>NHL070 | 4.750<br>[120.65]                  | 6.000<br>[152.40]     | 5.500<br>[139.70]     | 4.218<br>[107.14]                 | 09Z                  | 16N      |
| HL095<br>NHL095 | 6.000<br>[152.40]                  | 7.250<br>[184.15]     | 6.750<br>[171.45]     | 5.468<br>[138.89]                 | 09Z                  | 16N      |

**POWER RATING**

Vishay HL flat resistor wattage ratings are based on mounting horizontally to 10" x 10" x 0.04" [254.0 mm x 254.0 mm x 1.02 mm] steel plate in 25 °C ambient with no air flow.

**EXCLUSIVE BRACKET DESIGN**

Mounting strap fits snugly through resistor core and is bound against unit by two eccentric spacers. The bracket eliminates expensive cements and improves heat transfer and power handling capabilities.

**MATERIAL SPECIFICATIONS**

**Element:** copper-nickel alloy of nickel-chrome alloy, depending on resistance value

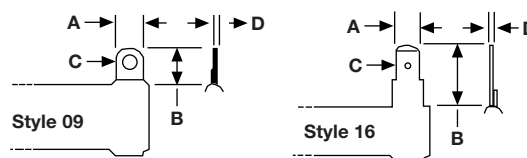
**Core:** ceramic, steatite

**Coating:** special high temperature silicone

**Standard Terminals:** model "E" terminals are tinned steel

**Terminal Bands:** steel

**Part Marking:** DALE, model, wattage, value, tolerance, date code

**TERMINAL DIMENSIONS**

| DIMENSION | DIMENSIONS in inches [millimeters] |                  |
|-----------|------------------------------------|------------------|
|           | STYLE 09                           | STYLE 16         |
| A         | 0.188<br>[4.76]                    | 0.188<br>[4.76]  |
| B         | 0.500<br>[12.70]                   | 0.563<br>[14.29] |
| C         | 0.104<br>[2.64]                    | 0.050<br>[1.27]  |
| D         | 0.020<br>[0.51]                    | 0.020<br>[0.51]  |

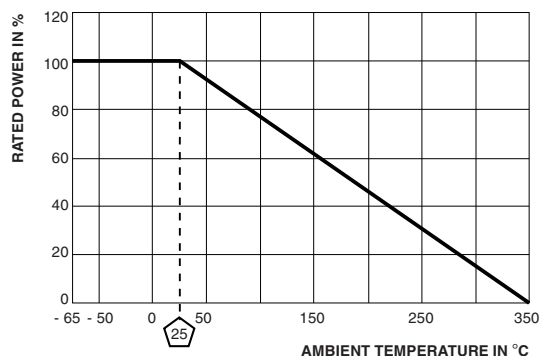
**TERMINAL FINISH**

"E" Finish - 100 % Sn coated steel. "Z" Finish - 60/40 Sn/Pb coated steel. "N" Finish - Nickel coated steel. Finish for terminal style 16 is limited to nickel plated steel (N).

**NHL NON-INDUCTIVE**

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by adding the letter N to the front of the HL type designation (NHL024, for example). For NHL models maximum resistance values are lower, see STANDARD ELECTRICAL SPECIFICATIONS table.

Derating is required for ambient temperatures above 25 °C per the following graph.

**DERATING**

| PERFORMANCE                     |                                                                                |                                       |
|---------------------------------|--------------------------------------------------------------------------------|---------------------------------------|
| TEST                            | CONDITIONS OF TEST                                                             | TEST LIMITS                           |
| Thermal Shock                   | Rated power applied until thermally stable, then a minimum of 15 min at -55 °C | $\pm (2.0 \% + 0.05 \Omega) \Delta R$ |
| Short Time Overload             | 10x rated power for 5 s                                                        | $\pm (2.0 \% + 0.05 \Omega) \Delta R$ |
| Dielectric Withstanding Voltage | 1000 V <sub>RMS</sub> , 1 min                                                  | $\pm (0.1 \% + 0.05 \Omega) \Delta R$ |
| Low Temperature Storage         | -55 °C for 24 h                                                                | $\pm (2.0 \% + 0.05 \Omega) \Delta R$ |
| High Temperature Exposure       | 250 h at + 350 °C                                                              | $\pm (2.0 \% + 0.05 \Omega) \Delta R$ |
| Moisture Resistance             | MIL-STD-202 Method 106, 7b not applicable                                      | $\pm (2.0 \% + 0.05 \Omega) \Delta R$ |
| Shock, Specified Pulse          | MIL-STD-202 Method 213, 100 g's for 6 ms, 10 shocks                            | $\pm (0.2 \% + 0.05 \Omega) \Delta R$ |
| Vibration, High Frequency       | Frequency varied 10 Hz to 2000 Hz, 20 g peak, 2 directions 6 h each            | $\pm (0.2 \% + 0.05 \Omega) \Delta R$ |
| Load Life                       | 1000 h at rated power, + 25 °C, 1.5 h "ON", 0.5 h "OFF"                        | $\pm (3.0 \% + 0.05 \Omega) \Delta R$ |



## 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.