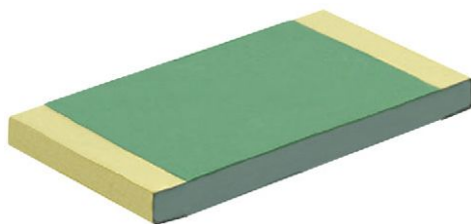


# High Precision Wraparound - Power Enhanced Thin Film Chip Resistors



## LINKS TO ADDITIONAL RESOURCES



## INTRODUCTION

PEP series chip resistors are designed for high power applications, low noise, superior stability, low temperature coefficient of resistance, and low voltage coefficient. The resistive thin film layer can withstand an established temperature as high as 250 °C: hence, the restrictions are mainly due to the robustness of terminations and solder joints.

PEP series is recommended for customers who need to switch to lower size devices, with the same power limits.

## FEATURES

- Load life stability: 0.1 % typical (0.35 % max.) at 2000 h /  $P_n$  / 70° C
- Very low noise < -35 dB and voltage coefficient < 0.01 ppm/V
- Wide resistance range: 39 Ω to 900 kΩ depending on size
- Tolerances down to ± 0.05 %
- Termination: thin film technology
- $P_n$ : up to 1 W for 1206 size, without cooling under PCB required
- Sulfur resistant (per ASTM B809-95 humid vapor test)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

## STANDARD ELECTRICAL SPECIFICATIONS

| MODEL   | SIZE | RESISTANCE RANGE<br>Ω | RATED POWER W<br>$P_n$ <sup>(1)</sup> | RATED POWER W<br>$P_d$ <sup>(1)</sup> | LIMITING ELEMENT VOLTAGE<br>V | TOLERANCE<br>± % <sup>(2)</sup> | TEMPERATURE COEFFICIENT <sup>(2)</sup><br>± ppm/°C |
|---------|------|-----------------------|---------------------------------------|---------------------------------------|-------------------------------|---------------------------------|----------------------------------------------------|
| PEP0402 | 0402 | 39 to 50K             | 0.125                                 | 0.063                                 | 50                            | 0.05, 0.1, 0.5, 1               | 5, 10, 25, 50                                      |
| PEP0603 | 0603 | 39 to 108K            | 0.320                                 | 0.125                                 | 75                            | 0.05, 0.1, 0.5, 1               | 5, 10, 25, 50                                      |
| PEP0805 | 0805 | 39 to 240K            | 0.500                                 | 0.200                                 | 150                           | 0.05, 0.1, 0.5, 1               | 5, 10, 25, 50                                      |
| PEP1206 | 1206 | 39 to 900K            | 0.660 <sup>(3)</sup>                  | 0.330                                 | 200                           | 0.05, 0.1, 0.5, 1               | 5, 10, 25, 50                                      |

### Notes

<sup>(1)</sup>  $P_n$  = nominal power;  $P_d$  = derated power intended to improve stability

<sup>(2)</sup> For ohmic range versus tolerance and TCR, see Best Tolerance and TCR vs. Ohmic Value" table

<sup>(3)</sup>  $P_n$  = 1 W if PEP1206 is mounted on alumina board

## CLIMATIC SPECIFICATIONS

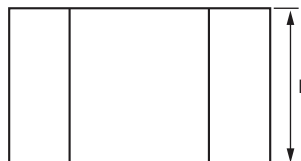
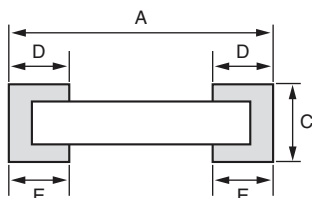
|                             |                 |
|-----------------------------|-----------------|
| Operating temperature range | -55 °C; +155 °C |
|-----------------------------|-----------------|

## PERFORMANCE VS. HUMID SULFUR VAPOR

|                 |                                                                          |
|-----------------|--------------------------------------------------------------------------|
| Test conditions | 50 °C ± 2 °C, 85 % ± 4 % RH, exposure time 500 h                         |
| Test results    | Resistance drift < (0.05 % $R$ + 0.05 Ω), no corrosion products observed |

## MECHANICAL SPECIFICATIONS

|              |                                                                                          |
|--------------|------------------------------------------------------------------------------------------|
| Substrate    | Alumina                                                                                  |
| Technology   | Thin film                                                                                |
| Film         | Nickel chromium based alloy with mineral passivation                                     |
| Protection   | Epoxy + silicone                                                                         |
| Terminations | <b>N type:</b> tin silver over nickel barrier<br><b>G type:</b> gold over nickel barrier |

**DIMENSIONS** in millimeters (inches)


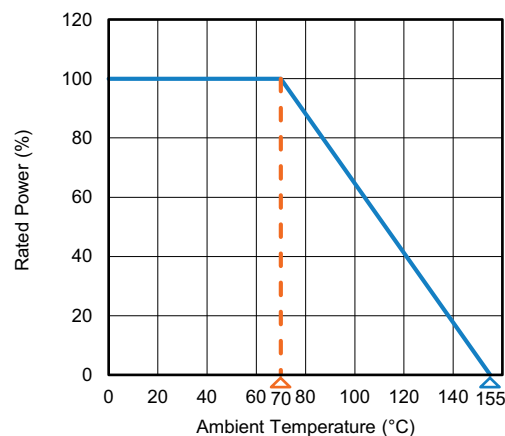
| CASE SIZE | A                                                            | B                                                            | C                                            | D / E                                         |              |
|-----------|--------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------|-----------------------------------------------|--------------|
|           | MAX. TOL.<br>+0.152 (+0.006)<br>MIN. TOL.<br>-0.152 (-0.006) | MAX. TOL.<br>+0.127 (+0.005)<br>MIN. TOL.<br>-0.127 (-0.005) |                                              |                                               |              |
|           | NOMINAL                                                      | NOMINAL                                                      |                                              | NOMINAL                                       | TOLERANCE    |
| 0402      | 1.00 (0.039)                                                 | 0.60 (0.024)                                                 | Termination N:<br>0.5 (0.02) ± 0.127 (0.005) | 0.25 (0.010)                                  | 0.1 (0.004)  |
| 0603      | 1.52 (0.060)                                                 | 0.85 (0.033)                                                 |                                              | Termination G:<br>0.4 (0.016) ± 0.051 (0.002) | 0.38 (0.015) |
| 0805      | 1.91 (0.075)                                                 | 1.27 (0.050)                                                 | 0.40 (0.016)                                 |                                               |              |
| 1206      | 3.06 (0.120)                                                 | 1.60 (0.063)                                                 |                                              |                                               |              |

**SUGGESTED LAND PATTERN** (to IPC-7351A)


| CHIP SIZE | DIMENSIONS in millimeter (inches) |                   |                   |
|-----------|-----------------------------------|-------------------|-------------------|
|           | Z <sub>max.</sub>                 | G <sub>min.</sub> | X <sub>max.</sub> |
| 0402      | 1.55 (0.061)                      | 0.15 (0.006)      | 0.73 (0.029)      |
| 0603      | 2.37 (0.093)                      | 0.35 (0.014)      | 0.98 (0.039)      |
| 0805      | 2.76 (0.109)                      | 0.74 (0.029)      | 1.40 (0.055)      |
| 1206      | 3.91 (0.154)                      | 1.85 (0.073)      | 1.73 (0.068)      |

**TEMPERATURE COEFFICIENT**

| TCR (ppm/°C) | CODE (TEMPERATURE RANGE) |
|--------------|--------------------------|
| ± 5          | Z (0 °C; +70 °C)         |
| ± 10         | Y (-55 °C; +155 °C)      |
| ± 25         | E (-55 °C; +155 °C)      |
| ± 50         | H (-55 °C; +155 °C)      |

**POWER DERATING CURVE**


### BEST TOLERANCE AND TCR VS. OHMIC VALUE

| STYLE | RANGE ( $\Omega$ ) | TOLERANCE ( $\pm$ %) | TCR CODE   |
|-------|--------------------|----------------------|------------|
| 0402  | 39 to < 50         | 0.1, 0.5, 1          | Z; Y; E; H |
|       | 50 to 50K          | 0.05, 0.1, 0.5, 1    | Z; Y; E; H |
| 0603  | 39 to < 50         | 0.1, 0.5, 1          | Z; Y; E; H |
|       | 50 to 108K         | 0.05, 0.1, 0.5, 1    | Z; Y; E; H |
| 0805  | 39 to < 50         | 0.1, 0.5, 1          | Z; Y; E; H |
|       | 50 to 240K         | 0.05, 0.1, 0.5, 1    | Z; Y; E; H |
| 1206  | 39 to < 50         | 0.1, 0.5, 1          | Z; Y; E; H |
|       | 50 to 900K         | 0.05, 0.1, 0.5, 1    | Z; Y; E; H |

### POPULAR OPTIONS

For any option it is recommended to consult Vishay Sfernice for availability first.

#### Option: Marking

Option to order 0013:

Marking of ohmic value and tolerance:

0805 size: 3 digits marking (according to EIA-96)

1206 size: 4 digits marking (same codification than in the ordering procedure)

Tolerance indicated by a color dot.

Option to order 0014:

Marking of ohmic value:

0805 size: 3 digits marking (according to EIA-96)

1206 size: 4 digits marking (same codification than in the ordering procedure)

No standard marking available for smaller sizes.

A price adder will apply to the unit price of the parts for options 0013 and 0014.

### PACKAGING

ESD packaging available: waffle-pack, plastic tape and reel (low conductivity), and paper tape and reel.

| SIZE | MOQ | NUMBER OF PIECES PER PACKAGE |               |      | TAPE WIDTH |
|------|-----|------------------------------|---------------|------|------------|
|      |     | WAFFLE PACK<br>2" x 2"       | TAPE AND REEL |      |            |
|      |     |                              | MIN.          | MAX. |            |
| 0402 | 100 | 340                          | 100           | 5000 | 8 mm       |
| 0603 |     |                              |               |      |            |
| 0805 |     |                              |               |      |            |
| 1206 |     |                              |               |      |            |

### PACKAGING RULES

#### Waffle Pack

Can be filled up to maximum quantity indicated in the table here above, taking into account the minimum order quantity. When quantity ordered exceeds maximum quantity of a single waffle pack, the waffle packs are stacked up on the top of each other and closed by one single cover.

**To get "not stacked up" waffle pack in case of ordered quantity > maximum number of pieces per package: Please consult Vishay Sfernice for specific ordering code.**

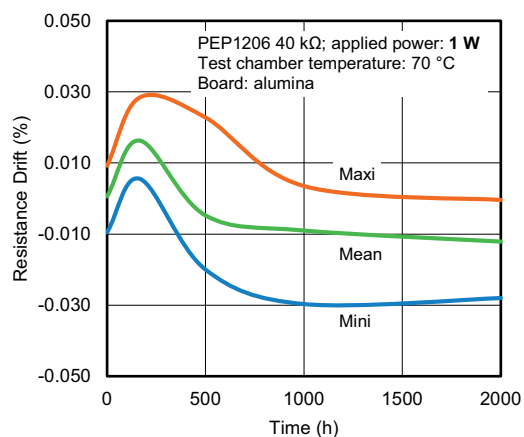
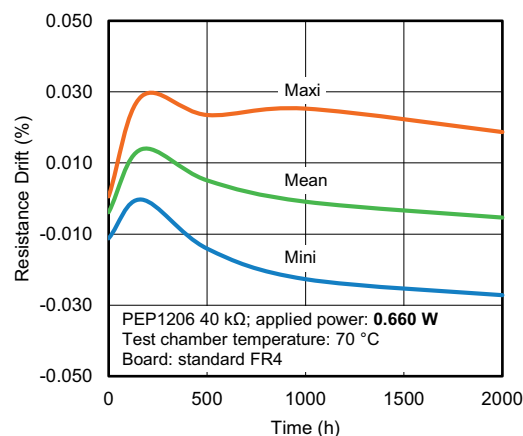
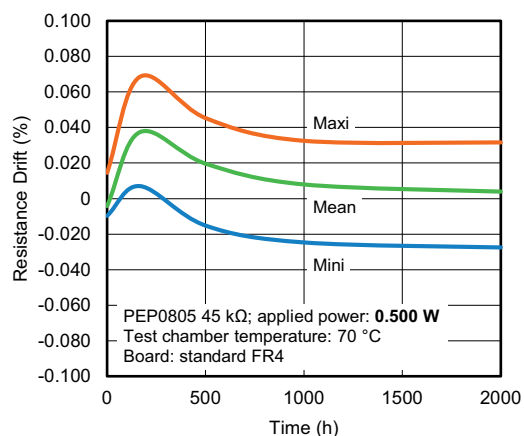
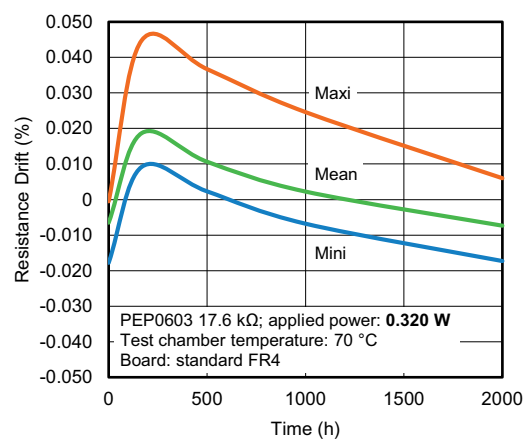
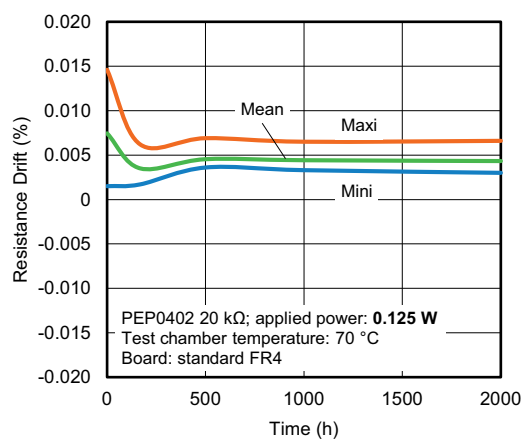
#### Tape and Reel

See Global Part Number Information to get the quantity desired by tape.

### PERFORMANCES

| TESTS                                     | CONDITIONS                                                            | MIL OR CECC REQUIREMENTS | TYPICAL VISHAY PERFORMANCES |
|-------------------------------------------|-----------------------------------------------------------------------|--------------------------|-----------------------------|
| Thermal shock                             | MIL-PRF-55342G<br>MIL-STD-202 F-Method 107 F                          | $\pm 0.05$ %             | $\pm 0.02$ %                |
| Short time overload                       | MIL-PRF-55342G<br>PARA 3.10.4.7.5                                     | $\pm 0.05$ %             | $\pm 0.01$ %                |
| Resistance to solder heat                 | MIL-PRF-55342G<br>PARA 3.12, 4.7.7, 4.7.1.2                           | $\pm 0.05$ %             | $\pm 0.03$ %                |
| Resistance of terminations (bending test) | CECC                                                                  | $\pm 0.05$ %             | $\pm 0.01$ %                |
| Load life                                 | MIL-PRF-55342G<br>2000 h $P_n$ at 70 °C<br>MIL-STD-202 F-Method 108 A | $\pm 0.5$ %              | $\pm 0.1$ %                 |

## STABILITY TEST RESULTS



### Note

- Note about stability test results: all parts reported by reflow with solder paste lead (Pb)-free SAC305 (Sn 96.5 % / Ag 3 % / Cu 0.5 %)



## GLOBAL PART NUMBER INFORMATION

Global Part Numbering: PEP1206Y1003BGTB99

|              |                              |                                                                                        |                                                                                                                                                                                                        |   |   |                                                         |                                                                    |   |                                                            |   |                                                                                                        |   |   |   |   |   |   |
|--------------|------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---------------------------------------------------------|--------------------------------------------------------------------|---|------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|
| P            | E                            | P                                                                                      | 1                                                                                                                                                                                                      | 2 | 0 | 6                                                       | Y                                                                  | 1 | 0                                                          | 0 | 3                                                                                                      | B | G | T | B | 9 | 9 |
| GLOBAL MODEL | SIZE                         | TCR                                                                                    | VALUE                                                                                                                                                                                                  |   |   | TOLERANCE                                               | TERMINATION                                                        |   | PACKAGING                                                  |   | OPTION                                                                                                 |   |   |   |   |   |   |
| PEP          | 0402<br>0603<br>0805<br>1206 | Z = ± 5 ppm<br>(0 °C; +70 °C)<br>Y = ± 10 ppm/°C<br>E = ± 25 ppm/°C<br>H = ± 50 ppm/°C | The first three digits are significant figures and the last digit specifies the number of zeros to follow, R designates decimal point<br><br>Examples:<br>1000 = 100 Ω<br>3901 = 3900 Ω<br>1004 = 1 MΩ |   |   | W = ± 0.05 %<br>B = ± 0.1 %<br>D = ± 0.5 %<br>F = ± 1 % | N = tin silver over nickel barrier<br>G = gold over nickel barrier |   | For more information see “Codification of Packaging” table |   | For more information see “Codification of options on two digits” table<br><br>Leave blank if no option |   |   |   |   |   |   |

## CODIFICATION OF OPTIONS ON TWO DIGITS

| OPTION | OPTION 2 DIGITS |
|--------|-----------------|
| ..     | ..              |
| 0099   | 99              |
| 0100   | 0A              |
| 0101   | 0A              |
| 0102   | 0C              |
| 0103   | 0D              |
| 0104   | 0E              |
| 0105   | 0F              |
| ..     | ..              |
| 0124   | 0Y              |
| 0125   | 0Z              |
| 0126   | 1A              |
| 0127   | 1B              |
| 0128   | 1C              |
| ..     | ..              |
| 0320   | 8M              |
| 0321   | 8N              |
| 0322   | 8O              |
| 0323   | 8P              |
| 0324   | 8Q              |
| 0325   | 8R              |
| ..     | ..              |

## CODIFICATION OF SIZES

| CODE 18 | CODE 40 |
|---------|---------|
| 9       | 0402    |
| C       | 0603    |
| D       | 0805    |
| H       | 1206    |

## CODIFICATION OF PACKAGING

| CODE 18                                  | PACKAGING                                         |
|------------------------------------------|---------------------------------------------------|
| WAFFLE PACK                              |                                                   |
| W                                        | 100 min., 1 mult.                                 |
| WA                                       | 100 min., 100 mult. (available only on size 1206) |
| PLASTIC TAPE (in standard for all sizes) |                                                   |
| T                                        | 100 min., 1 mult.                                 |
| TA                                       | 100 min., 100 mult.                               |
| TB                                       | 250 min., 250 mult.                               |
| TC                                       | 500 min., 500 mult.                               |
| TD                                       | 1000 min., 1000 mult.                             |
| TE                                       | 2500 min., 2500 mult.                             |
| TF                                       | Full tape (quantity depending on size of chips)   |



## 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.