

## Cemented Leaded Wirewound Precision Resistors



### FEATURES

- High power dissipation in small volume
- Ideal for pulse application
- TCR  $\pm 100$  ppm/K
- Maximum permissible hot spot temperature is 275 °C
- Lead (Pb)-free
- Tolerance 1 %
- 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)

The resistor element is a resistive wire which is wound in a single layer on a ceramic rod. Metal caps are pressed over the ends of the rod. The ends of the resistance wire and the leads are connected to the caps by welding. Tinned copper-clad iron leads with poor heat conductivity are employed permitting the use of relatively short leads to obtain stable mounting without overheating the solder joint.

The resistor is coated with a green silicon cement which is not resistant to aggressive fluxes. The coating is non-inflammable, will not drip even at high overloads and is resistant to most commonly used cleaning solvents, in accordance with IEC 60068-2-45.

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL                | POWER RATING<br>$P_{25^{\circ}\text{C}}$<br>W | LIMITING VOLTAGE<br>$U_{\text{max.}}$ | RESISTANCE RANGE <sup>(2)</sup><br>$\Omega$ | TOLERANCE<br>$\pm \%$ |
|----------------------|-----------------------------------------------|---------------------------------------|---------------------------------------------|-----------------------|
| PAC01                | 1                                             | $\sqrt{P \times R}$                   | 0.10 to 2.2K                                | 1                     |
| PAC02 <sup>(1)</sup> | 2                                             | $\sqrt{P \times R}$                   | 0.10 to 3.6K                                | 1                     |
| PAC03                | 3                                             | $\sqrt{P \times R}$                   | 0.10 to 4.7K                                | 1                     |
| PAC04                | 4                                             | $\sqrt{P \times R}$                   | 0.10 to 8.2K                                | 1                     |
| PAC05                | 5                                             | $\sqrt{P \times R}$                   | 0.10 to 12K                                 | 1                     |
| PAC06                | 6                                             | $\sqrt{P \times R}$                   | 0.10 to 12K                                 | 1                     |

#### Notes

- For Pulse Diagrams see AC.. Series ([www.vishay.com/doc?28730](http://www.vishay.com/doc?28730))
- <sup>(1)</sup> PAC02 WSZ:  $P_{25^{\circ}\text{C}} = 1.8$  W
- <sup>(2)</sup> Resistance value to be selected for  $\pm 1$  % tolerance from E24 and E96



## PART NUMBER AND PRODUCT DESCRIPTION

Part Number: PAC300004701FAC000

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | A | C | 3 | 0 | 0 | 0 | 0 | 4 | 7 | 0 | 1 | F | A | C | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| MODEL                                                                                                                                              | VARIANT                                                                                                                                                                                                                                                                                                                                                                            | TCR/MATERIAL                         | VALUE                                                                                                                                                                                                                                                                                                                                                            | TOLERANCE CODE     | PACKAGING CODE        | SPECIAL                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PAC100</b> = PAC01<br><b>PAC200</b> = PAC02<br><b>PAC300</b> = PAC03<br><b>PAC400</b> = PAC04<br><b>PAC500</b> = PAC05<br><b>PAC600</b> = PAC06 | <b>0</b> = neutral<br><b>1</b> = SWI = Special winding <sup>(1)</sup><br><b>2</b> = RT<br><b>3</b> = DK SP 20 mm<br><b>4</b> = DK LP 33 mm <sup>(2)</sup><br><b>5</b> = DK LP 17.8 mm <sup>(2)</sup><br><b>7</b> = DK LP 25.4 mm <sup>(2)</sup><br><b>8</b> = DK SP 25.4 mm<br><b>9</b> = WSZ 6720<br><b>C</b> = E/K 25.4 mm <sup>(2)</sup><br><b>Z</b> = value overflow (special) | <b>0</b> = standard<br>(± 100 ppm/K) | <b>3 digit value</b><br><b>1 digit multiplier</b><br><b>MULTIPLIER</b><br><b>7</b> = *10 <sup>-3</sup><br><b>8</b> = *10 <sup>-2</sup><br><b>9</b> = *10 <sup>-1</sup><br><b>0</b> = *10 <sup>0</sup><br><b>1</b> = *10 <sup>1</sup><br><b>2</b> = *10 <sup>2</sup><br><b>3</b> = *10 <sup>3</sup><br><b>4</b> = *10 <sup>4</sup><br><b>5</b> = *10 <sup>5</sup> | <b>F</b> = ± 1.0 % | (see Packaging table) | The 3 digits are used for all special part styles. To encode the non standard specifications all special parts of one series are listed in a cross reference table.<br><b>000</b> = standard |

Product Description: PAC03 4K7 1 % AC

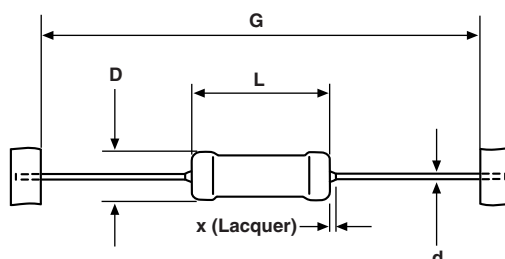
|                      |                      |                               |                                      |
|----------------------|----------------------|-------------------------------|--------------------------------------|
| <b>PAC03</b>         | <b>4K7</b>           | <b>1 %</b>                    | <b>AC</b>                            |
| MODEL <sup>(3)</sup> | VALUE <sup>(3)</sup> | TOLERANCE CODE <sup>(3)</sup> | PACKAGING DESCRIPTION <sup>(4)</sup> |

## Notes

- <sup>(1)</sup> Special winding on request  
<sup>(2)</sup> Other dimensions on request  
<sup>(3)</sup> See "Part Number and Product Description"  
<sup>(4)</sup> See "Packaging Table"

## PACKAGING TABLE

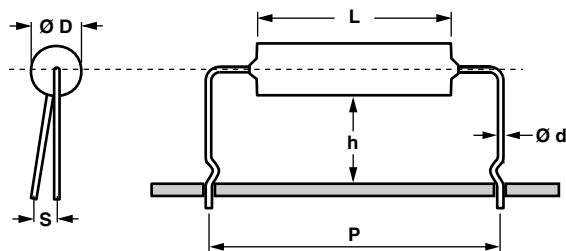
| MODEL       | AMMO   |           |             | LOOSE  |           |             | BLISTER |           |             |
|-------------|--------|-----------|-------------|--------|-----------|-------------|---------|-----------|-------------|
|             | PIECES | PACK CODE | PACK. DESC. | PIECES | PACK CODE | PACK. DESC. | PIECES  | PACK CODE | PACK. DESC. |
| PAC01       | 1000   | A1        | A1          |        |           |             |         |           |             |
| PAC01 DK/EK |        |           |             | 500    | LC        | LC          |         |           |             |
| PAC01RT     | 2500   | AE        | AE          |        |           |             |         |           |             |
| PAC02       | 500    | AC        | AC          |        |           |             |         |           |             |
| PAC02 DK/EK |        |           |             | 500    | LC        | LC          |         |           |             |
| PAC02 WSZ   |        |           |             |        |           |             | 1250    | BM        | BM          |
| PAC03       | 500    | AC        | AC          |        |           |             |         |           |             |
| PAC03 DK/EK |        |           |             | 500    | LC        | LC          |         |           |             |
| PAC04       | 500    | AC        | AC          |        |           |             |         |           |             |
| PAC04 DK/EK |        |           |             | 500    | LC        | LC          |         |           |             |
| PAC05       | 500    | AC        | AC          |        |           |             |         |           |             |
| PAC05 DK/EK |        |           |             | 250    | LB        | LB          |         |           |             |
| PAC06       | 500    | AC        | AC          |        |           |             |         |           |             |
| PAC06 DK/EK |        |           |             | 250    | LB        | LB          |         |           |             |

**DIMENSIONS** in millimeters [inches]


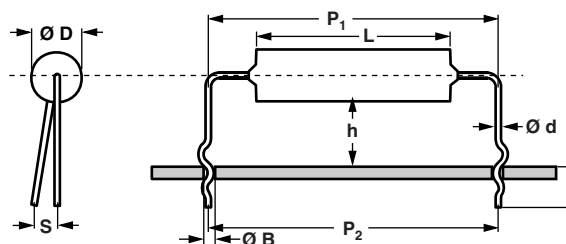
| MODEL | D <sub>max.</sub> | L <sub>max.</sub> | d                             | X <sub>max.</sub> | G                      | WEIGHT g PER UNIT |
|-------|-------------------|-------------------|-------------------------------|-------------------|------------------------|-------------------|
| PAC01 | 4.3 [0.169]       | 11 [0.433]        | 0.8 ± 0.03<br>[0.031 ± 0.001] | 2                 | 63 ± 1 [2.480 ± 0.039] | 0.52              |
| PAC02 | 4.8 [0.189]       | 13 [0.512]        |                               | 2                 | 63 ± 1 [2.480 ± 0.039] | 0.75              |
| PAC03 | 5.5 [0.217]       | 16.5 [0.650]      |                               | 3                 | 63 ± 1 [2.480 ± 0.039] | 1.10              |
| PAC04 | 7.5 [0.295]       | 18 [0.709]        |                               | 3                 | 73 ± 1 [2.874 ± 0.039] | 1.90              |
| PAC05 | 7.5 [0.295]       | 26 [1.024]        |                               | 3                 | 73 ± 1 [2.874 ± 0.039] | 2.60              |
| PAC06 | 7.5 [0.295]       | 26 [1.024]        |                               | 3                 | 73 ± 1 [2.874 ± 0.039] | 2.60              |

**Note**

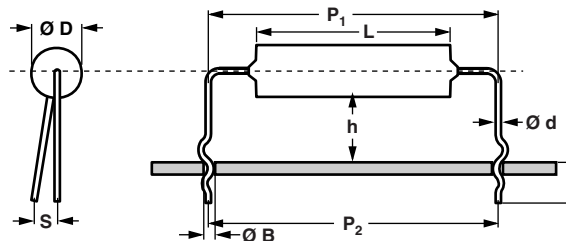
- For packaging dimensions see: [www.vishay.com/doc?28721](http://www.vishay.com/doc?28721)

**BENDING FORMS**
**KINK TYPE S = EK**


| TYPE          | Ø d | Ø D <sub>max.</sub> | L   | h ± 1 | P ± 1 | S <sub>max.</sub> |
|---------------|-----|---------------------|-----|-------|-------|-------------------|
| PAC01         | 0.8 | (1)                 | (1) | 8     | 17.8  | 2                 |
| PAC02 - PAC04 |     |                     |     |       | 25.4  |                   |
| PAC05 - PAC06 |     |                     |     |       | 33.0  |                   |

**DOUBLE KINK SP = DK SP**


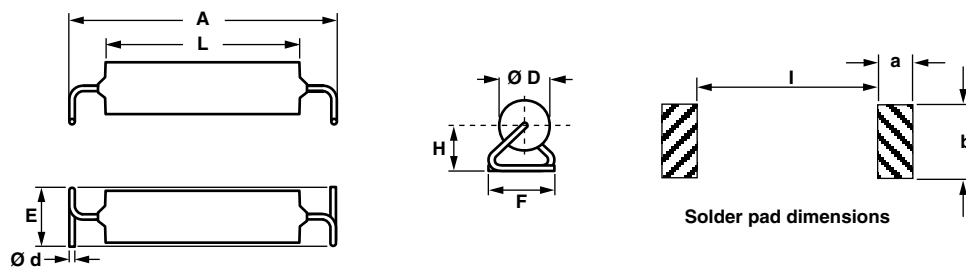
| TYPE          | Ø D | Ø D <sub>max.</sub> | L   | h ± 1 | P <sub>1</sub> ± 1 | P <sub>2</sub> ± 3 | S <sub>max.</sub> | Ø B       | c       |
|---------------|-----|---------------------|-----|-------|--------------------|--------------------|-------------------|-----------|---------|
| PAC01         | 0.8 | (1)                 | (1) | 8     | 19.8               | 17.8               | 2                 | 1.0 ± 0.1 | 4.5 ± 1 |
| PAC02 - PAC04 |     |                     |     |       | 22.0               | 20.0               |                   |           |         |
|               |     |                     |     |       | 27.4               | 25.4               |                   |           |         |
| PAC05 - PAC06 |     |                     |     |       | 35.0               | 33.0               |                   |           |         |

**DOUBLE KINK LP = DK LP**


| TYPE          | Ø D | Ø D <sub>max.</sub> | L   | h ± 1 | P <sub>1</sub> ± 1 | P <sub>2</sub> ± 3 | S <sub>max.</sub> | Ø B       | c       |
|---------------|-----|---------------------|-----|-------|--------------------|--------------------|-------------------|-----------|---------|
| PAC01 - PAC02 | 0.8 | (1)                 | (1) | 8     | 17.8               | 17.8               | 2                 | 1.0 ± 0.1 | 4.5 ± 1 |
| PAC02 - PAC04 |     |                     |     |       | 25.4               | 25.4               |                   |           |         |
| PAC05 - PAC06 |     |                     |     |       | 33.0               | 33.0               |                   |           |         |

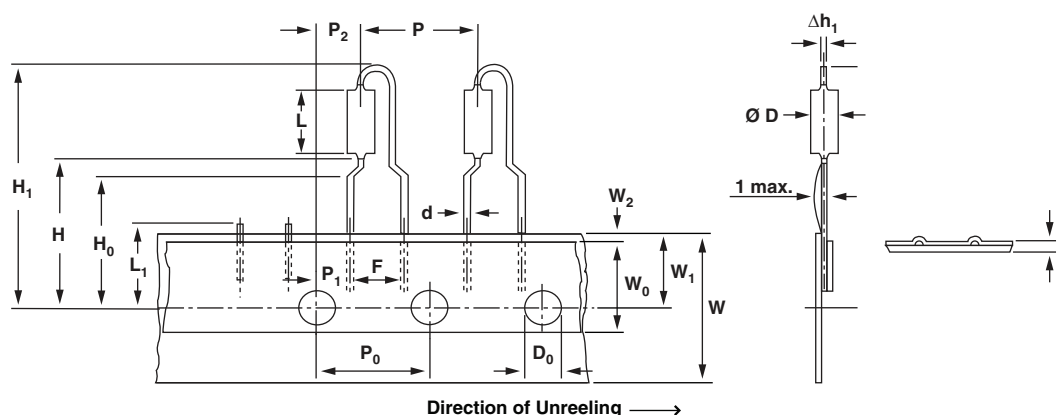
**Note**

(1) See table DIMENSIONS

**BENDING FORMS**
**WSZ**


Solder pad dimensions

| TYPE      | Ø d | Ø D <sub>max.</sub> | A        | L       | F         | H         | E         | a   | b   | l    |
|-----------|-----|---------------------|----------|---------|-----------|-----------|-----------|-----|-----|------|
| PAC02 WSZ | 0.8 | (1)                 | 17 ± 0.5 | 11 - 12 | 4.8 ± 0.5 | 3.6 ± 0.5 | 5.0 ± 0.5 | 2.5 | 5.5 | 14.5 |

**RADIAL TAPED = RT**


Direction of Unreeling →

**TYPE PAC01**

|                                                  |                 |                  |
|--------------------------------------------------|-----------------|------------------|
| Lead Ø                                           | Ø d             | 0.8              |
| Diameter                                         | Ø D             | (1)              |
| Length                                           | L               | (1)              |
| Pitch of components                              | P               | 12.7 ± 1.0       |
| Pitch of spocket holes (2)                       | P <sub>0</sub>  | 12.7 ± 0.3       |
| Distance between hole center and resistor center | P <sub>1</sub>  | 3.85 ± 0.7       |
| Distance between hole center and lead center     | P <sub>2</sub>  | 6.35 ± 1.0       |
| Lead spacing                                     | F               | 5.0 + 0.6, - 0.1 |
| Angle of insertion                               | Δh <sub>1</sub> | 2 max.           |
| Width of carrier tape                            | W               | 18.0 ± 0.5       |
| Width of adhesive tape                           | W <sub>0</sub>  | 12.0 ± 0.5       |
| Position of holes                                | W <sub>1</sub>  | 9.0 ± 0.5        |
| Position of adhesive tape                        | W <sub>2</sub>  | 0.5 max.         |
| Body to hole center                              | H               | 19.5 ± 1.0       |
| Lead crimp to hole center (3)                    | H <sub>0</sub>  | 16.0 ± 0.5       |
| Hole Ø                                           | D <sub>0</sub>  | 4.0 ± 0.2        |
| Thickness of tape (4)                            | t               | 0.9 max.         |
| Height for cutting                               | L <sub>1</sub>  | 11 max.          |
| Height for insertion                             | H <sub>1</sub>  | 32 max.          |

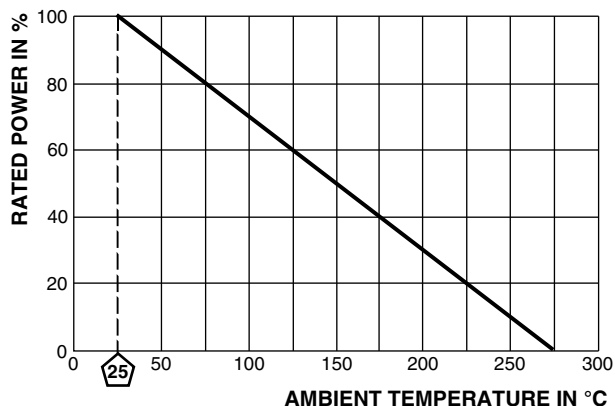
**Notes**

(1) See table DIMENSIONS

(2) Test over 10 holes - 9 intervals P<sub>0</sub> 12.7 x 9 = 114.3 ± 0.5

(3) Parallelism, &lt; 0.5 mm

(4) Thickness of carrier tape: 0.55 mm ± 0.1


**DERATING**


Maximum dissipation ( $P_{max.}$ ) as a function  
of the ambient temperature ( $T_{amb}$ )

| PERFORMANCE                                                                       |                                           |
|-----------------------------------------------------------------------------------|-------------------------------------------|
| TEST                                                                              | PERMISSIBLE CHANGE                        |
| Climatic category (LCT/UCT/Days)                                                  | 55/200/56                                 |
| Climatic Sequence<br>IEC 60115-1 4.23                                             | $\Delta R = \pm (0.5 \% R + 0.05 \Omega)$ |
| Damp Heat, Steady State, IEC 60115-1, 4.24<br>(40 ± 2) °C, 56 days, (93 ± 3) % RH | $\Delta R = \pm (1.0 \% R + 0.05 \Omega)$ |
| Endurance at room temperature (116 % $P_{70}$ ), 1000 h,<br>IEC 60115-1, 4.25.2   | $\Delta R = \pm (0.5 \% R + 0.05 \Omega)$ |
| Storage, UCT, IEC 60115-1, 4.25.3<br>1000 h, 200 °C, no load                      | $\Delta R = \pm (1.0 \% R + 0.05 \Omega)$ |
| Resistance to Soldering Heat, IEC 60115-1, 4.18<br>(260 ± 5) °C, (10 ± 1) s       | $\Delta R = \pm (0.2 \% R + 0.05 \Omega)$ |
| Robustness of Termination, IEC 60115-1, 4.16<br>10N                               | $\Delta R = \pm (0.1 \% R + 0.05 \Omega)$ |
| Short Time Overload, IEC 60115-1, 4.13<br>10 x Rated Power for 5 s                | $\Delta R = \pm (0.2 \% R + 0.05 \Omega)$ |

## HISTORICAL 12NC INFORMATION

- The resistors had a 12-digit ordering code starting with 2306 327
- The subsequent first digit indicated the resistor type and packaging.
- The remaining 4 digits indicated the resistance value:
  - The first 3 digits indicated the resistance value.
  - The last digit indicated the resistance decade in accordance with Resistance Decade table.

## Resistance Decade

| RESISTANCE DECADE      | LAST DIGIT |
|------------------------|------------|
| 0.10 to 0.976 $\Omega$ | 7          |
| 1 to 9.76 $\Omega$     | 8          |
| 10 to 97.6 $\Omega$    | 9          |
| 100 to 976 $\Omega$    | 1          |
| 1 to 9.76 k $\Omega$   | 2          |
| 10 to 12 k $\Omega$    | 3          |

## Ordering Example

The ordering code for an PAC02, resistor value 47  $\Omega$  with  $\pm 1$  % tolerance, supplied in ammpack of 500 units was: 2306 327 04709.

## HISTORICAL 12NC - Resistor type and packaging

| TYPE  | 2306 327 .....        |                |                |
|-------|-----------------------|----------------|----------------|
|       | BANDOLIER IN AMMOPACK |                |                |
|       | RADIAL                | STRAIGHT LEADS |                |
|       | 2500 units            | 500 units      | 1000 units     |
| PAC01 | RT <sup>(1)</sup>     | -              | 2306 327 5.... |
| PAC02 | -                     | 2306 327 0.... | -              |
| PAC03 | -                     | 2306 327 1.... | -              |
| PAC04 | -                     | 2306 327 2.... | -              |
| PAC05 | -                     | 2306 327 3.... | -              |
| PAC06 | -                     | 2306 327 4.... | -              |

## Note

<sup>(1)</sup> Radial parts with tin plated copper leads



## 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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. 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.