

## Cemented 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>$P_{25\text{ }^{\circ}\text{C}}$<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 10K                                 | 1                     |
| PAC06                | 6                                                     | $\sqrt{P \times R}$                   | 0.10 to 12K                                 | 1                     |

#### Notes

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

**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 =<br>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<br>(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<br>Packaging<br>table) | The 3 digits are<br>used for all special<br>part styles.<br>To encode the<br>non standard<br>specifications all<br>special parts of one<br>series are listed in a<br>cross reference<br>table.<br><b>000</b> = Standard |

Product Description: PAC03 4K7 1 % AC

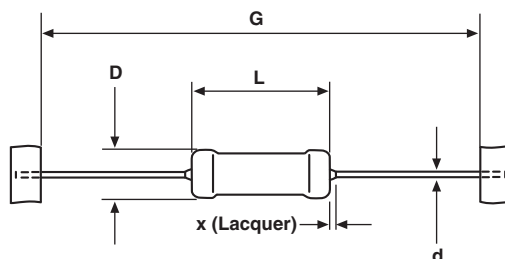
|                      |                      |                               |                                      |
|----------------------|----------------------|-------------------------------|--------------------------------------|
| PAC03                | 4K7                  | 1 %                           | AC                                   |
| 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**

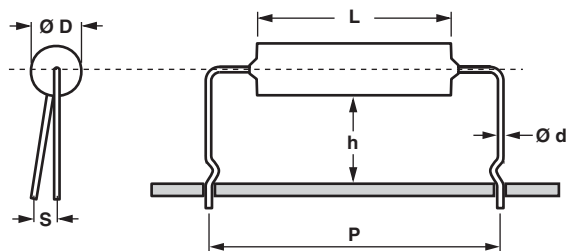
| MODEL       | AMMO   |           |             | LOOSE  |           |             | BLISTER |           |             |
|-------------|--------|-----------|-------------|--------|-----------|-------------|---------|-----------|-------------|
|             | PIECES | PACK CODE | PACK. DESC. | PIECES | 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]


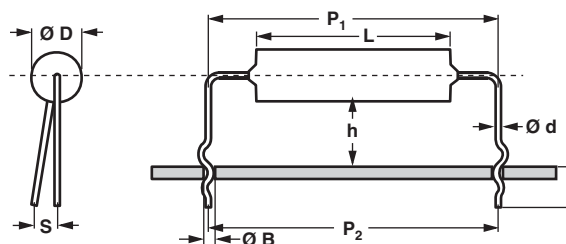
| MODEL | D <sub>max.</sub> | L <sub>max.</sub> | d                             | X <sub>max.</sub> | G                      | WEIGHT g PER UNIT |
|-------|-------------------|-------------------|-------------------------------|-------------------|------------------------|-------------------|
| PAC01 | 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**

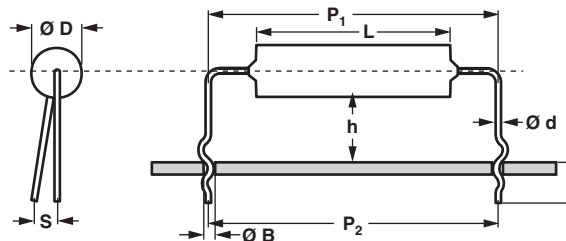
- For packaging dimensions see: [www.vishay.com/doc?28721](http://www.vishay.com/doc?28721)

**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**


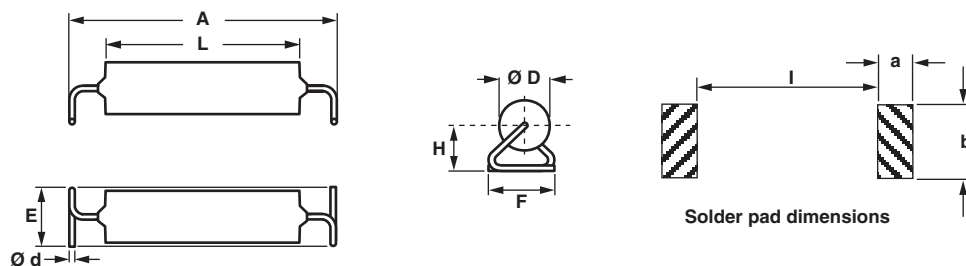
| TYPE          | Ø D | Ø D <sub>max.</sub> | L   | h ± 1 | P <sub>1</sub> ± 1 | P <sub>2</sub> ± 3 | S <sub>max.</sub> | Ø B       | c       |
|---------------|-----|---------------------|-----|-------|--------------------|--------------------|-------------------|-----------|---------|
| PAC01         | 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               |                   |           |         |

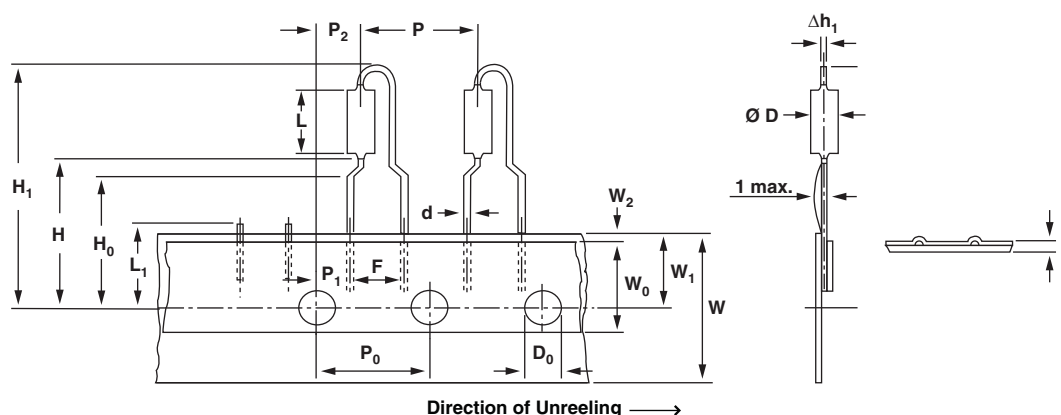
**Note**

(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

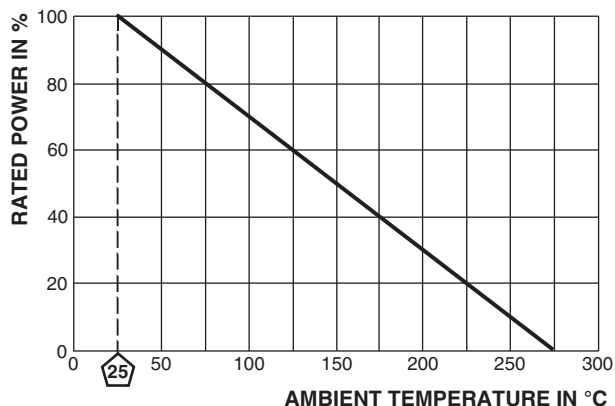
(2) Test over 10 holes - 9 intervals P<sub>0</sub> 12.7 x 9 = 114.3 ± 0.5

(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



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