

# Commercial Axial Cemented Leaded Wirewound Resistors



## FEATURES

- Flameproof: non-flammable silicone cement coating conforming to UL 94 V-0
- High grade ceramic core
- WSZ-form lead bending available for SMD mounting
- 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)

## APPLICATIONS

- Energy meters
- Power supply
- Appliances
- Lighting

## LINKS TO ADDITIONAL RESOURCES



The Z300-C00 series, is the perfect choice for general purpose power applications. The robust silicone cement coating can handle challenging ambient and operating conditions. Typical applications include but are not limited to energy meters, power supplies, etc.

| STANDARD ELECTRICAL SPECIFICATIONS |                          |                          |                                 |                                     |                                        |
|------------------------------------|--------------------------|--------------------------|---------------------------------|-------------------------------------|----------------------------------------|
| TYPE                               | POWER RATING<br>$P_{40}$ | POWER RATING<br>$P_{70}$ | RESISTANCE RANGE                | RESISTANCE TOLERANCE <sup>(1)</sup> | TEMPERATURE COEFFICIENT <sup>(2)</sup> |
| Z301-C00                           | 1 W                      | 0.9 W                    | 0.30 $\Omega$ to 2 k $\Omega$   | $\pm 5 \%$ ,<br>$\pm 10 \%$         | $\pm 100$ ppm/K,<br>$\pm 200$ ppm/K    |
| ZDA0411-C00                        | 2 W                      | 1.8 W                    | 0.10 $\Omega$ to 4.3 k $\Omega$ |                                     |                                        |
| Z302-C00                           | 3 W                      | 2.7 W                    | 0.10 $\Omega$ to 3.3 k $\Omega$ |                                     |                                        |
| Z303-C00                           | 4 W                      | 3.5 W                    | 0.47 $\Omega$ to 3.9 k $\Omega$ |                                     |                                        |
| Z304-C00                           | 5 W                      | 4.4 W                    | 0.62 $\Omega$ to 5.6 k $\Omega$ |                                     |                                        |
| Z305-C00                           | 6 W                      | 5.3 W                    | 0.15 $\Omega$ to 10 k $\Omega$  |                                     |                                        |
| Z306M-C00                          | 7 W                      | 6.3 W                    | 10 $\Omega$ to 3.9 k $\Omega$   |                                     |                                        |

## Notes

- <sup>(1)</sup> Resistance value to be selected for  $\pm 10 \%$  tolerance from E12 and for  $\pm 5 \%$  from E24, 1 % tolerance available on request  
<sup>(2)</sup> Temperature coefficient of resistive wire



## PART NUMBER AND PRODUCT DESCRIPTION

Part Number: Z34081834700J6DC00  
Z36082631000J6BC00

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Z | 3 | 4 | 0 | 8 | 1 | 8 | 3 | 4 | 7 | 0 | 0 | J | 6 | D | C | 0 | 0 |
| Z | 3 | 6 | 0 | 8 | 2 | 6 | 3 | 1 | 0 | 0 | 0 | J | 6 | B | C | 0 | 0 |

| TYPE                                                                                                                                         | TCR / MATERIAL / VARIANT                                                                                          | RESISTANCE                                                                                                                                                                               | TOLERANCE CODE                      | PACKAGING CODE        |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------|
| Z310309 = Z301-C<br>ZDA0411 = ZDA0411-C<br>Z320414 = Z302-C<br>Z330617 = Z303-C<br>Z340818 = Z304-C<br>Z350922 = Z305-C<br>Z360826 = Z306M-C | 1 = $\pm 100$ ppm/K<br>3 = $\pm 200$ ppm/K<br>4 = SWI<br>(special winding)<br>K = Z302-C00 WSZ or<br>Z304-C00 WSZ | 3 digit value<br>1 digit multiplier<br>MULTIPLIER<br>7 = $\times 10^{-3}$<br>8 = $\times 10^{-2}$<br>9 = $\times 10^{-1}$<br>0 = $\times 10^0$<br>1 = $\times 10^1$<br>2 = $\times 10^2$ | J = $\pm 5.0$ %<br>K = $\pm 10.0$ % | (see Packaging table) |

Product Description: Z304-C 3 470R 5 % AB G63  
Z306M-C 3 100R 5 % AB G83

| Z304-C                                                                 | 3                        | 470R         | 5 %            | AB G63                                                                              |
|------------------------------------------------------------------------|--------------------------|--------------|----------------|-------------------------------------------------------------------------------------|
| Z306M-C                                                                | 3                        | 100R         | 5 %            | AB G83                                                                              |
| TYPE                                                                   | TCR / MATERIAL / VARIANT | RESISTANCE   | TOLERANCE CODE | PACKAGING DESCRIPTION                                                               |
| Z301-C<br>ZDA0411-C<br>Z302-C<br>Z303-C<br>Z304-C<br>Z305-C<br>Z306M-C |                          | 100R<br>470R | 5 %<br>10 %    | A1 G53<br>AC G53<br>AC G73<br>AC G83<br>AB G63<br>AB G83<br>BW<br>BM<br>S1<br>AC RT |



| PACKAGING    |      |             |          |                                               |       |        |                          |
|--------------|------|-------------|----------|-----------------------------------------------|-------|--------|--------------------------|
| TYPE         | CODE | DESCRIPTION | QUANTITY | PACKAGING STYLE                               | WIDTH | PITCH  | DIMENSIONS               |
| Z301-C00     | 21   | A1 G53      | 1000     | Taped acc. to IEC 60286-1 fan-folded in a box | 53 mm | 5 mm   | 84 mm x 73 mm x 326 mm   |
| ZDA0411-C00  | 21   | A1 G53      | 1000     |                                               |       |        | 84 mm x 83 mm x 326 mm   |
| Z302-C00     | 2C   | AC G53      | 500      |                                               | 53 mm | 5 mm   | 82 mm x 50 mm x 326 mm   |
|              | 4C   | AC G73      | 500      |                                               | 73 mm |        | 100 mm x 43 mm x 325 mm  |
|              | 6C   | AC G83      | 500      |                                               | 83 mm | 10 mm  | 110 mm x 87 mm x 324 mm  |
|              | S1   | S1          | 1000     | Taped acc. to IEC 60286-2 on reel             | -     | 5 mm   | 60 mm x 365 mm x 370 mm  |
| Z302-C00 WSZ | BM   | BM          | 1250     | Blister taped acc. to IEC 60286-3 on reel     | -     | 8 mm   | 350 mm x 335 mm x 35 mm  |
| Z303-C00     | 2C   | AC G53      | 500      | Taped acc. to IEC 60286-1 fan-folded in a box | 53 mm | 5 mm   | 82 mm x 49 mm x 324 mm   |
|              | 6C   | AC G83      | 500      |                                               | 83 mm | 10 mm  | 110 mm x 103 mm x 324 mm |
| Z304-C00     | 6D   | AB G63      | 250      |                                               | 63 mm | 10 mm  | 84 mm x 80 mm x 326 mm   |
|              | 6E   | AB G83      | 250      |                                               | 83 mm |        | 110 mm x 87 mm x 326 mm  |
|              | GC   | AC RT       | 500      | Taped acc. to IEC 60286-2 on reel             | -     | 7.5 mm | 67 mm x 365 mm x 370 mm  |
| Z304-C00 WSZ | BW   | BW          | 350      | Blister taped acc. to IEC 60286-3 on reel     | -     | 16 mm  | 350 mm x 335 mm x 60 mm  |
| Z305-C00     | 6B   | AB G83      | 250      | Taped acc. to IEC 60286-1 fan-folded in a box | 83 mm | 10 mm  | 110 mm x 87 mm x 326 mm  |
| Z306M-C00    |      |             |          |                                               |       |        |                          |



## DESCRIPTION

Wirewound resistors are best suited for use in high power, high current applications. The silicone cement lacquer coating enables Z300-C00 to withstand challenging operating and ambient conditions.

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. The winding is done with a specific material on a specially developed fine ceramic body ( $\text{Al}_2\text{O}_3$ ). The ceramic meets the highest requirements against mechanical resistance, thermal shocks, dielectric strength, and insulation resistance at high temperatures. With different diameters and turn spacing's, a large ohmic value range can be covered. The coating is resistant to cleaning solvents specified in IEC 60115-1 <sup>(1)</sup>. The resistors are marked with resistance and tolerance.

The result of the determined production is verified by an extensive testing procedure performed on 100 % of the individual resistors. Only accepted products are stuck directly on the adhesive tapes in accordance with IEC 60286-1 (for axial leaded) or for the radial versions in accordance with IEC 60286-2 or blister taped for the WSZ version in accordance with IEC 60286-3.

Product quality is verified by testing procedures, performed on all individual resistors. Resistance is measured on the lead wires at a distance of 6 mm from the resistor body. If a greater length of lead wire is used in the application, the user may need to consider the additional wire resistance, particularly with low resistance products.

## MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein <sup>(2)</sup>
- The Global Automotive Declarable Substance List (GADSL) <sup>(3)</sup>
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) <sup>(4)</sup> for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see [www.vishay.com/how/leadfree](http://www.vishay.com/how/leadfree). Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at [www.vishay.com/doc?49037](http://www.vishay.com/doc?49037).

## Notes

- <sup>(1)</sup> Other cleaning solvents with aggressive chemicals should be evaluated in actual cleaning process for their suitability
- <sup>(2)</sup> The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at <http://std.iec.ch/iec62474>
- <sup>(3)</sup> The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at [www.gadsl.org](http://www.gadsl.org)
- <sup>(4)</sup> The SVHC list is maintained by the European Chemical Agency (ECHA) and available at <http://echa.europa.eu/candidate-list-table>

## ASSEMBLY

The resistors are axial or bend leads for soldering. Z bend leads offer SMD mounting compatibility. The terminals of the resistors are completely lead (Pb)-free, the special matte tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes.

Special lead forms may be available on request, please inquire at [ww1resistors@vishay.com](mailto:ww1resistors@vishay.com).

These components are high dissipation power resistors, customers are advised to use a high melting point solder.

## APPLICATION INFORMATION

The power dissipation of the resistor generates a temperature rise with respect to the ambient. The permissible dissipation is derated for temperatures above 40 °C, as shown in the derating diagram, in order to avoid overheating of the resistor. The heat dissipated from the resistor may affect adjacent components, hence proper clearance will be required in order to avoid overheating. The resistive wire is hermetically encapsulated.

All materials used are non-flammable and inorganic.

These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.

## RELATED PRODUCTS

In similar continuous power applications and challenging environmental conditions, see the datasheets:

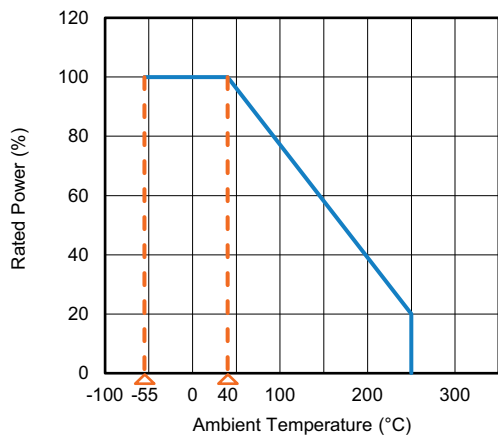
- AC Series - Cemented Wirewound Resistors  
[www.vishay.com/doc?28730](http://www.vishay.com/doc?28730)
- Z300-Cxx - High Surge Axial Cemented Wirewound Resistors  
[www.vishay.com/doc?21027](http://www.vishay.com/doc?21027)

For precision applications, there is the cemented leaded wirewound PAC series, see the datasheet:

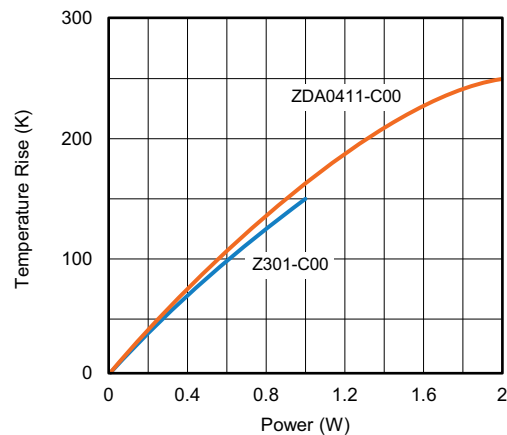
- PAC Series - Cemented Wirewound Precision Resistors  
[www.vishay.com/doc?28731](http://www.vishay.com/doc?28731)



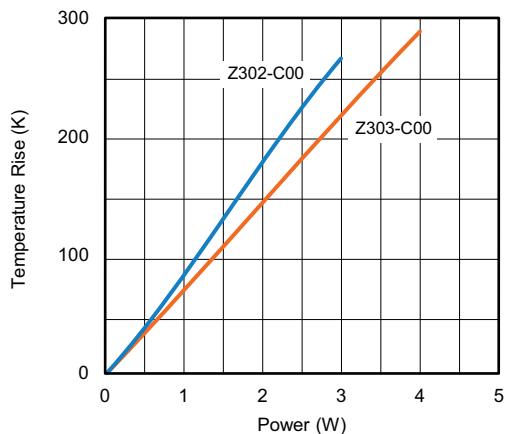
## FUNCTIONAL PERFORMANCE



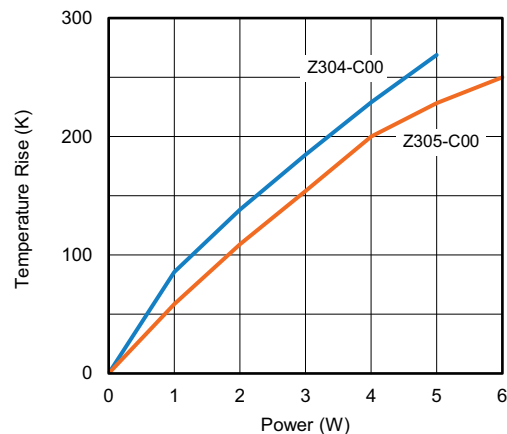
Derating



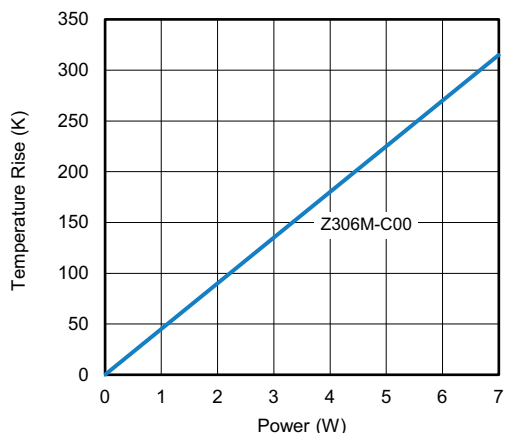
Temperature Rise



Temperature Rise



Temperature Rise



Temperature Rise

## TESTS PROCEDURES AND REQUIREMENTS

All tests are carried out in accordance with the following specifications:

- IEC 60115-1, generic specification (includes tests)

The test and requirements table contains only the most important tests. For the full test schedule refer to the documents listed above.

The tests are carried out with reference to IEC 60115-1, in accordance with IEC 60068-2-xx test method and under standard atmospheric conditions in accordance with IEC 60068-1, 4.3.

A climatic category 40 / 200 / 56 is applied, defined by the lower category temperature (LCT = -40 °C), the upper category temperature (UCT = 200 °C), and the duration of exposure in the damp heat, steady state test (56 days).

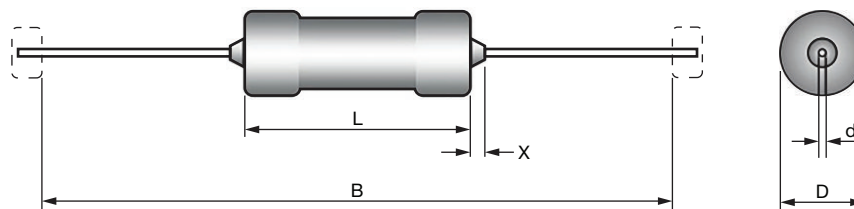
Unless otherwise specified the following values apply:

- Temperature: 15 °C to 35 °C
- Relative humidity: 45 % to 75 %
- Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar).

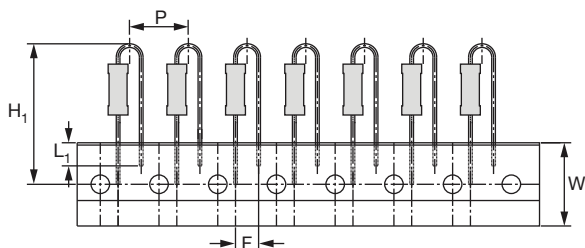
For performing some of the tests, the components are mounted on a test board in accordance with IEC 60115-1, 5.5.

In test procedures and requirements table, only the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2-xx test methods. A short description of the test procedure is also given.

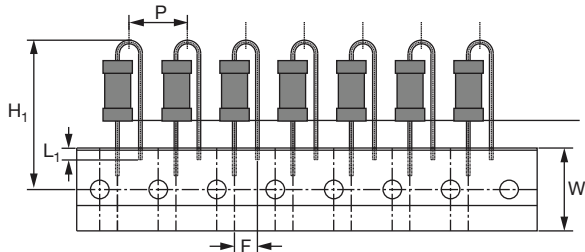
| TEST PROCEDURES AND REQUIREMENTS |                                                                  |                                                     |                                                                      |                                                         |
|----------------------------------|------------------------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------|
| IEC 60115-1<br>CLAUSE            | IEC 60068-2<br>TEST<br>METHOD                                    | TEST                                                | PROCEDURE                                                            | REQUIREMENTS<br>PERMISSIBLE CHANGE ( $\Delta R_{MAX}$ ) |
| 8.1                              | -                                                                | Short-term overload                                 | Room temperature;<br>10x rated power $P_{40}$ ;<br>5 s               | $\pm (2 \% R + 0.05 \Omega)$                            |
| 9.5                              | 21 (Ua)<br>21 (Ub)<br>21 (Uc)                                    | Robustness of<br>terminations                       | Tensile, bending and torsion                                         | No damage<br>$\pm (0.5 \% R + 0.05 \Omega)$             |
| 11.2                             | 20 (Tb)                                                          | Resistance to<br>soldering heat                     | Unmounted components<br>(260 $\pm$ 5) °C; (10 $\pm$ 1) s             | $\pm (1 \% R + 0.05 \Omega)$                            |
| 10.3                             | 2 (Bb)<br><br>30 (Db)<br><br>1 (Ab)<br><br>13 (M)<br><br>30 (Db) | Climatic sequence:                                  |                                                                      | $\pm (3 \% R + 0.1 \Omega)$                             |
| 10.3.4.2                         |                                                                  | dry heat                                            | 16 h; 200 °C                                                         |                                                         |
| 10.3.4.3                         |                                                                  | Damp heat<br>(accelerated)<br>1 <sup>st</sup> cycle | 24 h; 55 °C;<br>90 % to 100 % RH                                     |                                                         |
| 10.3.4.4                         |                                                                  | cold                                                | 2 h; -55 °C                                                          |                                                         |
| 10.3.4.5                         |                                                                  | low air pressure                                    | 2 h; 8.5 kPa; 15 °C to 35 °C                                         |                                                         |
| 10.3.4.6                         |                                                                  | damp heat remaining<br>cyclic                       | 5 days; 55 °C;<br>95 % to 100 % RH; 5 cycles                         |                                                         |
| 10.4                             | 78 (Cab)                                                         | Damp heat,<br>(steady state)                        | 56 days; (40 $\pm$ 2) °C;<br>(93 $\pm$ 5) % RH                       | $\pm (3 \% R + 0.1 \Omega)$                             |
| 7.2                              | -                                                                | Endurance<br>(at room temperature)                  | 1000 h;<br>loaded with 116 % of $P_{70}$ ;<br>1.5 h ON and 0.5 h OFF | $\pm (3 \% R + 0.1 \Omega)$                             |
| 7.3                              | -                                                                | Endurance<br>(at 200 °C)                            | 1000 h;<br>loaded with 30 % of $P_{70}$ ;<br>1.5 h ON and 0.5 h OFF  | $\pm (3 \% R + 0.1 \Omega)$                             |

**DIMENSIONS**


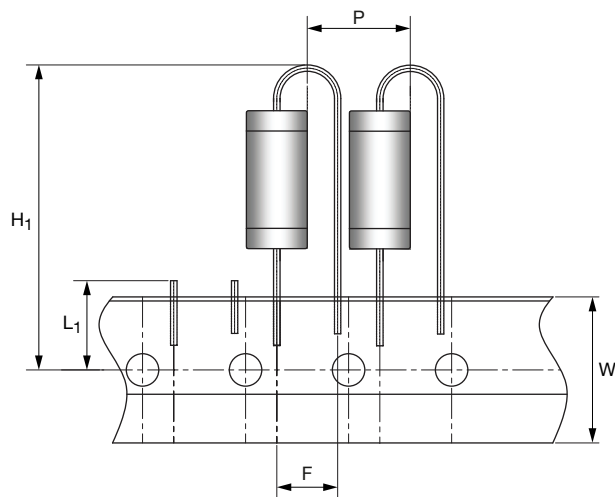
| TYPE        | DIMENSIONS in millimeters (inches) |                   |                   |                                                                           |                   | MASS (g)          |
|-------------|------------------------------------|-------------------|-------------------|---------------------------------------------------------------------------|-------------------|-------------------|
|             | L <sub>MAX.</sub>                  | D <sub>MAX.</sub> | d <sub>MAX.</sub> | B                                                                         | X <sub>MAX.</sub> |                   |
| Z301-C00    | 8.5 (0.355)                        | 3 (0.118)         | 0.7 (0.027)       | 53 ± 1 (2.087 ± 0.039)                                                    | 2 (0.079)         | 0.5               |
| ZDA0411-C00 | 11 (0.433)                         | 4 (0.157)         | 0.7 (0.027)       | 53 ± 1 (2.087 ± 0.039)                                                    | 2 (0.079)         | 0.8               |
| Z302-C00    | 13 (0.512)                         | 4.8 (0.189)       | 0.8 (0.031)       | 53 ± 1 (2.087 ± 0.039)<br>73 ± 1 (2.87 ± 0.039)<br>83 ± 1 (3.268 ± 0.039) | 2 (0.079)         | 0.6<br>0.7<br>0.8 |
| Z303-C00    | 15.8 (0.622)                       | 5.5 (0.217)       | 0.8 (0.031)       | 53 ± 1 (2.087 ± 0.039)<br>83 ± 1 (3.268 ± 0.039)                          | 2 (0.079)         | 1.0<br>1.1        |
| Z304-C00    | 18 (0.709)                         | 7.5 (0.295)       | 0.8 (0.031)       | 63 ± 1 (2.48 ± 0.039)<br>83 ± 1 (3.268 ± 0.039)                           | 2 (0.079)         | 1.8<br>2.0        |
| Z305-C00    | 22.3 (0.878)                       | 8.7 (0.343)       | 0.8 (0.031)       | 83 ± 1 (3.268 ± 0.039)                                                    | 2 (0.079)         | 3.8               |
| Z306M-C00   | 26 (1.023)                         | 7.5 (0.295)       |                   |                                                                           | 3 (0.118)         | 2.9               |

**ZDA0411-C RADIAL**

**DIMENSIONS in millimeters**

|                                             |                |                 |
|---------------------------------------------|----------------|-----------------|
| Pitch of components                         | P              | 12.7 ± 1.0      |
| Lead to lead distance                       | F              | 4.8 + 0.7 / - 0 |
| Tape width                                  | W              | 18 ± 0.5        |
| Component height                            | H <sub>1</sub> | 30.0 ± 3        |
| Min. lead wire (tape portion) shortest lead | L <sub>1</sub> | 4.3             |

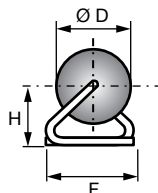
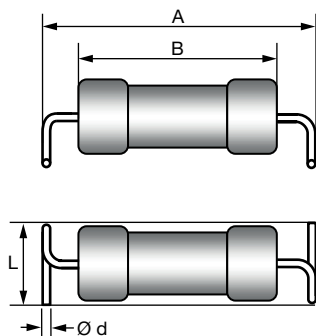
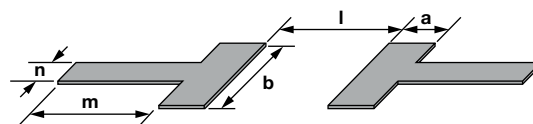
**Z302-C RADIAL**

**DIMENSIONS in millimeters**

|                                             |                |            |
|---------------------------------------------|----------------|------------|
| Pitch of components                         | P              | 12.7 ± 1.0 |
| Lead to lead distance                       | F              | 5.00 ± 0.5 |
| Tape width                                  | W              | 18 ± 0.5   |
| Maximum component height                    | H <sub>1</sub> | 34         |
| Min. lead wire (tape portion) shortest lead | L <sub>1</sub> | 2.5        |

**Z304-C RADIAL**
**LEAD BENDING STYLE = RT (Radial Taped)**

**DIMENSIONS** in millimeters

|                             |                |            |
|-----------------------------|----------------|------------|
| Pitch of components         | P              | 12.7 ± 1.0 |
| Lead spacing                | F              | 7.50 ± 0.5 |
| Width of carrier tape       | W              | 18.0 ± 0.5 |
| Height for cutting (max.)   | L <sub>1</sub> | 11         |
| Height for insertion (max.) | H <sub>1</sub> | 37         |

**Z-FORM LEADS FOR SMD MOUNTING** in millimeters

**LEAD BENDING  
STYLE = WSZ  
(Z-form)**

**Recommended solder pad dimensions**


| TYPE WSZ            | Ø d        | Ø D <sub>max.</sub> | A          | B       | F         | H          | L         | a | b  | l    | m  | n |
|---------------------|------------|---------------------|------------|---------|-----------|------------|-----------|---|----|------|----|---|
| <b>Z302-C00 WSZ</b> | 0.8 ± 0.03 | 4.8                 | 17 ± 0.3   | 11 - 12 | 4.8 ± 0.3 | 3.6 ± 0.2  | 5.0 ± 0.5 | 4 | 8  | 12.2 | 25 | 2 |
| <b>Z304-C00 WSZ</b> | 0.8 ± 0.03 | 7.5                 | 23.5 ± 0.5 | 18 max. | 7.7 ± 0.5 | 5.73 ± 0.5 | 7.9 ± 0.7 | 4 | 10 | 18.7 | 25 | 2 |



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