

## Aluminum Capacitors +125 °C, Miniature, Radial Lead


**FEATURES**

- +125 °C performance
- Suitable for tantalum foil replacement applications
- Low DC leakage currents
- Very stable, long life
- Case sizes through 0.709" x 1.417" [18.0 mm x 36.0 mm]
- Optional third lead on diameters  $\geq 0.492$ " [12.5 mm]
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

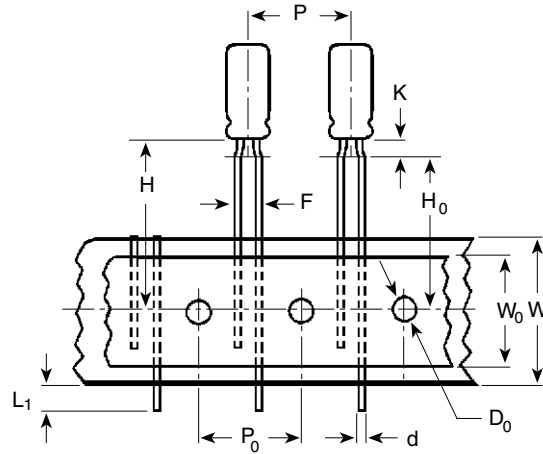


| QUICK REFERENCE DATA                       |   |
|--|---|
| DESCRIPTION                                | VALUE   |
| Nominal case size<br>Ø D x L in mm         | 0.236" x 0.433" [6.0 x 11.0]<br>to 0.709" x 1.417" [18.0 x 36.0]  |
| Operating temperature                      | -40 °C to +125 °C   |
| Rated capacitance range, C <sub>R</sub>    | 1.0 µF to 6800 µF   |
| Tolerance on C <sub>R</sub>                | ± 20 %  |
| Rated voltage range, U <sub>R</sub>        | 6.3 WV <sub>DC</sub> to 63 WV <sub>DC</sub>   |
| Termination                                | 2 and 3 radial leads  |
| Life validation test at 125 °C             | 2000 h: ΔCAP ≤ 15 %<br>(6.3 WV <sub>DC</sub> to 10 WV <sub>DC</sub> ),<br>≤ 10 % (16 WV <sub>DC</sub> to 63 WV <sub>DC</sub> )<br>from initial measurement.<br>ΔDF ≤ 1.25 x initial specified limit.<br>ΔDCL ≤ initial specified limit. |
| Shelf life at 105 °C                       | 500 h: ΔCAP ≤ 12 % from<br>initial measurement.<br>ΔDF ≤ 1.25 x initial specified limit.<br>ΔDCL ≤ 2.0 x initial specified limit.   |
| DC leakage current<br>(after 2 min charge) | I = 0.01 CV<br>I in µA, C in µF, V in Volts   |

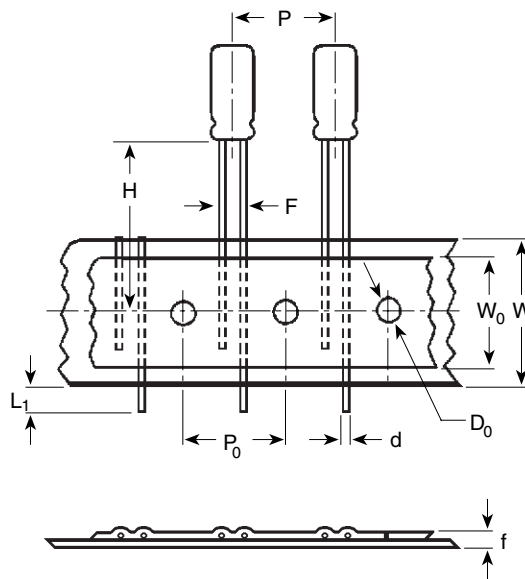
| RIPPLE CURRENT MULTIPLIERS |             |            |            |           |
|----------------------------|-------------|------------|------------|-----------|
| TEMPERATURE                |             |            |            |           |
| AMBIENT TEMPERATURE        | MULTIPLIERS |            |            |           |
| +125 °C                    | 0.4         |            |            |           |
| +105 °C                    | 1.0         |            |            |           |
| +85 °C                     | 1.41        |            |            |           |
| +75 °C                     | 1.58        |            |            |           |
| ≤ +65 °C                   | 1.73        |            |            |           |
| FREQUENCY (Hz)             |             |            |            |           |
| FREQUENCY (Hz)             | 50 TO 60    | 100 TO 120 | 300 TO 400 | 1K AND UP |
| MULTIPLIERS                | 0.85        | 1.00       | 1.05       | 1.10      |
|                            | 0.80        | 1.00       | 1.30       | 1.40      |

| LOW TEMPERATURE PERFORMANCE   |                       |
|---|-----------------------|
| CAPACITANCE RATIO C <sup>-55 °C</sup> / C <sup>+25 °C</sup> MINIMUM AT 120 Hz |                       |
| RATED VOLTAGE (WV <sub>DC</sub> )   | CAPACITANCE REMAINING |
| 6.3 to 10   | 75 %                  |
| 16 to 25  | 80 %                  |
| 36 to 63  | 85 %                  |
| ESR RATIO ESR <sup>-55 °C</sup> / ESR <sup>+25 °C</sup> MAXIMUM AT 120 Hz     |                       |
| RATED VOLTAGE (WV <sub>DC</sub> )   | MULTIPLIER            |
| 6.3 to 10   | 35                    |
| 16 to 25  | 30                    |
| 36 to 63  | 25                    |

| DIMENSIONS in inches [millimeters] |              |              |                |              |                |              |                  |                  |               |         |
|------------------------------------|--------------|--------------|----------------|--------------|----------------|--------------|------------------|------------------|---------------|---------|
| CASE CODE                          | NOMINAL      |              | STYLES 2 AND 4 |              | STYLES 3 AND 5 |              | LEAD SPACING     |                  | LEAD DIAMETER |         |
|                                    | D            | L            | D (max.)       | L (max.)     | D (max.)       | L (max.)     | S ± 0.024 [0.60] | T ± 0.020 [0.50] | NOMINAL       | AWG NO. |
| BB                                 | 0.315 [8.0]  | 0.472 [12.0] | 0.335 [8.5]    | 0.512 [13.0] | 0.335 [8.5]    | 0.551 [14.0] | 0.138 [3.5]      | n/a              | 0.025 [0.63]  | 22      |
| BD                                 | 0.315 [8.0]  | 0.630 [16.0] | 0.335 [8.5]    | 0.669 [17.0] | 0.335 [8.5]    | 0.709 [18.0] | 0.138 [3.5]      | n/a              | 0.025 [0.63]  | 22      |
| CC                                 | 0.394 [10.0] | 0.512 [13.0] | 0.413 [10.5]   | 0.563 [14.3] | 0.413 [10.5]   | 0.630 [16.0] | 0.197 [5.0]      | n/a              | 0.025 [0.63]  | 22      |
| CG                                 | 0.394 [10.0] | 0.787 [20.0] | 0.413 [10.5]   | 0.846 [21.5] | 0.413 [10.5]   | 0.906 [23.0] | 0.197 [5.0]      | n/a              | 0.025 [0.63]  | 22      |
| DG                                 | 0.492 [12.5] | 0.787 [20.0] | 0.512 [13.0]   | 0.846 [21.5] | 0.512 [13.0]   | 0.906 [23.0] | 0.197 [5.0]      | 0.098 [2.5]      | 0.028 [0.71]  | 20      |
| DK                                 | 0.492 [12.5] | 0.984 [25.0] | 0.512 [13.0]   | 1.043 [26.5] | 0.512 [13.0]   | 1.142 [29.0] | 0.197 [5.0]      | 0.098 [2.5]      | 0.032 [0.81]  | 20      |
| EN                                 | 0.630 [16.0] | 1.260 [32.0] | 0.650 [16.5]   | 1.319 [33.5] | 0.650 [16.5]   | 1.417 [36.0] | 0.295 [7.5]      | 0.150 [3.8]      | 0.032 [0.81]  | 20      |
| ER                                 | 0.630 [16.0] | 1.417 [36.0] | 0.650 [16.5]   | 1.476 [37.5] | 0.650 [16.5]   | 1.575 [40.0] | 0.295 [7.5]      | 0.150 [3.8]      | 0.032 [0.81]  | 20      |
| FR                                 | 0.709 [18.0] | 1.417 [36.0] | 0.728 [18.5]   | 1.476 [37.5] | 0.728 [18.5]   | 1.575 [40.0] | 0.295 [7.5]      | 0.150 [3.8]      | 0.032 [0.81]  | 20      |

**DIMENSIONS in inches [millimeters] AND AVAILABLE FORMS**
**Formed Leads**


| <b>DIMENSIONS in inches [millimeters] AND PACKAGING QUANTITIES</b> |                |               |
|--|----------------|---------------|
| CASE SIZE  | F LEAD SPACING | STD. QTY/REEL |
| 0.236 x 0.433 [6.0 x 11.0]   | 0.197 [5.0]    | 800           |
| 0.315 x 0.472 [8.0 x 12.0]   | 0.197 [5.0]    | 700           |

**Unformed (Straight) Leads**


| <b>DIMENSIONS in inches [millimeters] AND PACKAGING QUANTITIES</b> |                            |               |
|--|----------------------------|---------------|
| CASE SIZE  | F LEAD SPACING             | STD. QTY/REEL |
| 0.236 x 0.433 [6.0 x 11.0]   | 0.098 [2.5] <sup>(1)</sup> | 800           |
| 0.315 x 0.472 [8.0 x 12.0]   | 0.140 [3.5] <sup>(1)</sup> | 700           |
| 0.394 x 0.512 [10.0 x 13.0]  | 0.197 [5.0]                | 500           |
| 0.394 x 0.630 [10.0 x 16.0]  | 0.197 [5.0]                | 500           |
| 0.394 x 0.787 [10.0 x 20.0]  | 0.197 [5.0]                | 500           |

**Note**
<sup>(1)</sup> Available as special order.



| DIMENSIONS in inches [millimeters]       |                               |                               |                                |                                |                                |
|--|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|
| ITEM                                     | CASE SIZE (Diameter x Length) |                               |                                |                                |                                |
|  | 0.236 x 0.433<br>[6.0 x 11.0] | 0.315 x 0.472<br>[8.0 x 12.0] | 0.394 x 0.512<br>[10.0 x 13.0] | 0.394 x 0.630<br>[10.0 x 16.0] | 0.394 x 0.787<br>[10.0 x 20.0] |
| d - Lead-wire diameter                   | 0.025 [0.63]                  | 0.025 [0.63]                  | 0.025 [0.63]                   | 0.025 [0.63]                   | 0.025 [0.63]                   |
| P - Pitch of component                   | 0.500 [12.7]                  | 0.500 [12.7]                  | 0.500 [12.7]                   | 0.500 [12.7]                   | 0.500 [12.7]                   |
| P <sub>0</sub> - Feed hole pitch         | 0.500 [12.7]                  | 0.500 [12.7]                  | 0.500 [12.7]                   | 0.500 [12.7]                   | 0.500 [12.7]                   |
| F - Lead-to-lead distance                | 0.197 [5.0]                   | 0.197 [5.0]                   | 0.197 [5.0]                    | 0.197 [5.0]                    | 0.197 [5.0]                    |
| K - Clinch height                        | 0.098 [2.5]                   | 0.157 [4.0]                   | n/a                            | n/a                            | n/a                            |
| H - Height of component from tape center | 0.728 [18.5]                  | 0.787 [20.0]                  | 0.906 [23.0]                   | 0.906 [23.0]                   | 0.906 [23.0]                   |
| H <sub>0</sub> - Lead-wire clinch height | 0.630 [16.0]                  | 0.630 [16.0]                  | n/a                            | n/a                            | n/a                            |
| W - Tape width                           | 0.709 [18.0]                  | 0.709 [18.0]                  | 0.709 [18.0]                   | 0.709 [18.0]                   | 0.709 [18.0]                   |
| W <sub>0</sub> - Hold down tape width    | 0.591 [15.0]                  | 0.591 [15.0]                  | 0.591 [15.0]                   | 0.591 [15.0]                   | 0.591 [15.0]                   |
| D <sub>0</sub> - Feed hole diameter      | 0.157 [4.0]                   | 0.157 [4.0]                   | 0.157 [4.0]                    | 0.157 [4.0]                    | 0.157 [4.0]                    |
| t - Total tape thickness                 | 0.028 [0.7]                   | 0.028 [0.7]                   | 0.028 [0.7]                    | 0.028 [0.7]                    | 0.028 [0.7]                    |
| L <sub>1</sub> - Maximum lead protrusion | 0.118 [3.0]                   | 0.118 [3.0]                   | 0.118 [3.0]                    | 0.118 [3.0]                    | 0.118 [3.0]                    |

**Note**

- Positive leader is standard. Negative leader is available by special order.

**ORDERING EXAMPLE**

Electrolytic capacitor 510DX series: 510DX 227 M 050 DG 2 D

| DESCRIPTION |   |
|-------------|---|
| CODE        | EXPLANATION                               |
| 510DX       | Product type                              |
| 227         | Capacitance value (220 μF)                |
| M           | Tolerance (M = ± 20 %)                    |
| 050         | Voltage rating at 105 °C (050 = 50 V)     |
| DG          | Can size (see "Dimensions" table)         |
| 2           | Sleeve and sealing (2 = polyester sleeve) |
| D           | Packaging (D = bulk; straight leads)      |

**Note**

- For lead (Pb)-free / RoHS compliant products add suffix "E3" to part number.  
Example: 510DX227M050DG2DE3

| ELECTRICAL DATA AND ORDERING INFORMATION          |                  |  |                            |                  |                               |                  |                                       |
|---|------------------|--|----------------------------|------------------|-------------------------------|------------------|---------------------------------------|
| CAPACITANCE<br>(μF)                               | PART NUMBER (1)  | NOMINAL CASE SIZE<br>D x L<br>IN INCHES (mm) | MAX. ESR<br>AT +25 °C (mΩ) |                  | MAX. RIPPLE<br>AT +105 °C (A) |                  | MAX. Z<br>AT +25 °C<br>(mΩ)<br>100 Hz |
|   |                  |  | 120 Hz                     | 20 kHz TO 40 kHz | 120 Hz                        | 20 kHz TO 40 kHz |                                       |
| <b>6.3 WV<sub>DC</sub> AT 125 °C, SURGE = 8 V</b> |                  |  |                            |                  |                               |                  |                                       |
| 330.0   | 510DX337M6R3CC2D | 0.394 x 0.512 [10.0 x 13.0]                  | 1206.0                     | 507.0            | 0.294                         | 0.454            | 457.0                                 |
| 1000.0  | 510DX108M6R3DG2D | 0.492 x 0.787 [12.5 x 20.0]                  | 398.0                      | 201.0            | 0.697                         | 0.984            | 181.0                                 |
| 1500.0  | 510DX158M6R3DK2D | 0.492 x 0.984 [12.5 x 25.0]                  | 265.0                      | 133.0            | 0.931                         | 1.313            | 121.0                                 |
| 4700.0  | 510DX478M6R3ER2D | 0.630 x 1.417 [16.0 x 36.0]                  | 85.0                       | 40.0             | 2.193                         | 3.193            | 36.0                                  |
| <b>10 WV<sub>DC</sub> AT 125 °C, SURGE = 13 V</b> |                  |  |                            |                  |                               |                  |                                       |
| 150.0   | 510DX157M010BB2D | 0.315 x 0.472 [8.0 x 12.0]                   | 2210.0                     | 948.0            | 0.182                         | 0.278            | 854.0                                 |
| 220.0   | 510DX227M010BD2D | 0.315 x 0.630 [8.0 x 16.0]                   | 1507.0                     | 528.0            | 0.247                         | 0.417            | 475.0                                 |
| 1200.0  | 510DX128M010DK2D | 0.492 x 0.984 [12.5 x 25.0]                  | 276.0                      | 138.0            | 0.911                         | 1.287            | 124.0                                 |
| 4700.0  | 510DX478M010FR2D | 0.709 x 1.417 [18.0 x 36.0]                  | 71.0                       | 37.0             | 2.582                         | 3.576            | 33.0                                  |
| <b>16 WV<sub>DC</sub> AT 125 °C, SURGE = 20 V</b> |                  |  |                            |                  |                               |                  |                                       |
| 150.0   | 510DX157M016BD2D | 0.315 x 0.630 [8.0 x 16.0]                   | 1415.0                     | 549.0            | 0.255                         | 0.409            | 494.0                                 |
| 470.0   | 510DX477M016DG2D | 0.492 x 0.787 [12.5 x 20.0]                  | 451.0                      | 216.0            | 0.654                         | 0.946            | 194.0                                 |
| 2200.0  | 510DX228M016ER2D | 0.630 x 1.417 [16.0 x 36.0]                  | 96.0                       | 43.0             | 2.060                         | 3.078            | 39.0                                  |



| ELECTRICAL DATA AND ORDERING INFORMATION          |                            |  |                                     |                  |                               |                  |  |
|---|----------------------------|--|-------------------------------------|------------------|-------------------------------|------------------|--|
| CAPACITANCE<br>( $\mu$ F)                         | PART NUMBER <sup>(1)</sup> | NOMINAL CASE SIZE<br>D x L<br>IN INCHES (mm) | MAX. ESR<br>AT +25 °C (m $\Omega$ ) |                  | MAX. RIPPLE<br>AT +105 °C (A) |                  | MAX. Z<br>AT +25 °C<br>(m $\Omega$ )<br>100 Hz |
|   |                            |  | 120 Hz                              | 20 kHz TO 40 kHz | 120 Hz                        | 20 kHz TO 40 kHz |  |
| <b>25 WV<sub>DC</sub> AT 125 °C, SURGE = 32 V</b> |                            |  |                                     |                  |                               |                  |  |
| 100.0   | 510DX107M025BD2D           | 0.315 x 0.630 [8.0 x 16.0]                   | 1459.0                              | 571.0            | 0.251                         | 0.401            | 514.0  |
| 100.0   | 510DX107M025CC2D           | 0.394 x 0.512 [10.0 x 13.0]                  | 1459.0                              | 571.0            | 0.268                         | 0.428            | 514.0  |
| 330.0   | 510DX337M025DG2D           | 0.492 x 0.787 [12.5 x 20.0]                  | 442.0                               | 224.0            | 0.661                         | 0.927            | 202.0  |
| 470.0   | 510DX477M025DK2D           | 0.492 x 0.984 [12.5 x 25.0]                  | 310.0                               | 150.0            | 0.859                         | 1.238            | 135.0  |
| 1500.0  | 510DX158M025ER2D           | 0.630 x 1.417 [16.0 x 36.0]                  | 97.0                                | 45.0             | 2.049                         | 3.009            | 40.0   |
| <b>35 WV<sub>DC</sub> AT 125 °C, SURGE = 44 V</b> |                            |  |                                     |                  |                               |                  |  |
| 47.0  | 510DX476M035BB2D           | 0.315 x 0.472 [8.0 x 12.0]                   | 2822.0                              | 1067.0           | 0.161                         | 0.262            | 960.0  |
| 100.0   | 510DX107M035CC2D           | 0.394 x 0.512 [10.0 x 13.0]                  | 1326.0                              | 593.0            | 0.281                         | 0.421            | 534.0  |
| 220.0   | 510DX227M035CG2D           | 0.394 x 0.787 [10.0 x 20.0]                  | 603.0                               | 248.0            | 0.496                         | 0.774            | 223.0  |
| 470.0   | 510DX477M035DK2D           | 0.492 x 0.984 [12.5 x 25.0]                  | 282.0                               | 156.0            | 0.901                         | 1.214            | 140.0  |
| 1200.0  | 510DX128M035EN2D           | 0.630 x 1.260 [16.0 x 32.0]                  | 111.0                               | 58.0             | 1.826                         | 2.527            | 52.0   |
| 1500.0  | 510DX158M035ER2D           | 0.630 x 1.417 [16.0 x 36.0]                  | 88.0                                | 47.0             | 2.151                         | 2.944            | 42.0   |
| <b>50 WV<sub>DC</sub> AT 125 °C, SURGE = 63 V</b> |                            |  |                                     |                  |                               |                  |  |
| 220.0   | 510DX227M050DG2D           | 0.492 x 0.787 [12.5 x 20.0]                  | 543.0                               | 243.0            | 0.597                         | 0.892            | 218.0  |
| 330.0   | 510DX337M050DK2D           | 0.492 x 0.984 [12.5 x 25.0]                  | 362.0                               | 162.0            | 0.796                         | 1.191            | 146.0  |
| 1000.0  | 510DX108M050ER2D           | 0.630 x 1.417 [16.0 x 36.0]                  | 119.0                               | 49.0             | 1.847                         | 2.883            | 44.0   |
| <b>63 WV<sub>DC</sub> AT 125 °C, SURGE = 79 V</b> |                            |  |                                     |                  |                               |                  |  |
| 47.0  | 510DX476M063BD2D           | 0.315 x 0.630 [8.0 x 16.0]                   | 1975.0                              | 642.0            | 0.215                         | 0.378            | 578.0  |
| 47.0  | 510DX476M063CC2D           | 0.394 x 0.512 [10.0 x 13.0]                  | 1975.0                              | 642.0            | 0.231                         | 0.404            | 578.0  |
| 220.0   | 510DX227M063DK2D           | 0.492 x 0.984 [12.5 x 25.0]                  | 422.0                               | 168.0            | 0.737                         | 1.167            | 151.0  |
| 1000.0  | 510DX108M063FR2D           | 0.709 x 1.417 [18.0 x 36.0]                  | 93.0                                | 45.0             | 2.256                         | 3.243            | 41.0   |

Statements about product lifetime are based on calculations and internal testing. They should only be interpreted as estimations. Also due to external factors, the lifetime in the field application may deviate from the calculated lifetime. In general, nothing stated herein shall be construed as a guarantee of durability.



## **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.