

## Solid-Electrolyte TANTALEX™ Capacitors, Resin-Coated, Radial-Lead



### FEATURES

- Terminations: tin / lead (SnPb), 100 % tin (Sn)
- Economy and high performance are combined in these radial-lead, solid-electrolyte TANTALEX™ capacitors
- Rugged, reliable capacitors featuring low leakage current and low dissipation factor
- Six miniature case sizes and five lead styles. All case sizes are available in standard tape and reel packaging per EIA-468
- Standard ratings include replacements for type 196D capacitors
- Lead (Pb)-free capacitors have “L” in body marking
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### Note

\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

### APPLICATIONS

Suitable for a broad range of consumer, commercial and industrial equipment

### PERFORMANCE CHARACTERISTICS

**Operating Temperature:** -55 °C to +85 °C (to +125 °C with voltage derating)

**Capacitance Tolerance:** at 120 Hz, +25 °C, ± 20 %, ± 10 % standard. ± 5 % available as special

**Dissipation Factor:** at 120 Hz, +25 °C. Dissipation factor, shall not exceed the values listed in the Standard Ratings tables.

#### DC Leakage Current (DCL Max.):

**at +25 °C:** leakage current shall not exceed the values listed in the Standard Ratings tables.

**at +85 °C:** leakage current shall not exceed 10 times the values listed in the Standard Ratings tables.

**at +125 °C:** leakage shall not exceed 15 times the values listed in the Standard Ratings tables.

**Life Test:** capacitors shall withstand rated DC voltage applied at +85 °C for 1000 h with a circuit resistance not greater than 3 Ω.

Following the life test:

1. DCL shall not exceed 125 % of the initial requirements
2. Dissipation factor shall meet the initial requirement
3. Change in capacitance shall not exceed ± 10 %

| ORDERING INFORMATION |                                                                                                                                |                                                                 |                                                                                                                                                    |                                   |                  |                                                         |                                                                               |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------|---------------------------------------------------------|-------------------------------------------------------------------------------|
| 199D                 | 475                                                                                                                            | X9                                                              | 003                                                                                                                                                | A                                 | 1 <sup>(1)</sup> | V1                                                      | E3                                                                            |
| MODEL                | CAPACITANCE                                                                                                                    | CAPACITANCE TOLERANCE                                           | DC VOLTAGE RATING AT +85 °C                                                                                                                        | CASE CODE                         | LEAD STYLE       | PACKAGING                                               | RoHS COMPLIANT                                                                |
|                      | This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow. | X0 = ± 20 %<br>X9 = ± 10 %<br>** X5 = ± 5 %<br>** Special Order | This is expressed in V. To complete the three-digit block, zeros precede the voltage rating. A decimal point is indicated by an “R” (6R3 = 6.3 V). | See Ratings and Case Codes table. |                  | V1 = bulk<br>B1 = tape and reel<br>A1 = tape / ammo box | E3 = 100 % tin termination (RoHS compliant)<br>Blank = tin / lead termination |

### Note

<sup>(1)</sup> See lead styles table

| LEAD STYLE CONFIGURATIONS AND CODES        |                                          |                                         |                     |                         |
|--------------------------------------------|------------------------------------------|-----------------------------------------|---------------------|-------------------------|
| STRAIGHT UNEVEN LEADS<br>CODES 1, 3, AND Y | STRAIGHT EVEN LEADS<br>CODES 2, 4, AND 5 | “OUTSIDE HOCKEY STICK”<br>CODES 6 AND 7 | “SNAP-IN”<br>CODE 9 | “HAIRPIN”<br>CODES X, Z |
|                                            |                                          |                                         |                     |                         |

**Notes**

- Wire diameter (nominal) 0.020" (0.51 mm)
- L = lead length
- P = pitch or lead spacing

| AVAILABLE LEAD STYLES AND PACKAGING TYPES PER CASE SIZE |      |                      |      |                     |                      |                      |                      |                      |                      |      |                      |
|---------------------------------------------------------|------|----------------------|------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|------|----------------------|
| LEAD STYLE / CASE                                       | 1    | 2                    | 3    | 4                   | 5                    | 6                    | 7                    | 9                    | X                    | Y    | Z                    |
| A                                                       | Bulk | Bulk<br>Reel<br>Ammo | -    | -                   | Bulk<br>Reel<br>Ammo | Bulk<br>Reel<br>Ammo | Bulk<br>Reel<br>Ammo | Bulk<br>Reel<br>Ammo | Bulk<br>Reel<br>Ammo | Bulk | Bulk<br>Reel<br>Ammo |
| B                                                       |      |                      |      |                     |                      |                      |                      |                      |                      |      |                      |
| C                                                       |      |                      |      |                     |                      |                      |                      |                      |                      |      |                      |
| D                                                       |      |                      |      |                     |                      |                      |                      |                      |                      |      |                      |
| E                                                       | -    | -                    | Bulk | Bulk / Reel<br>Ammo | -                    | -                    | -                    | -                    | -                    | -    |                      |
| F                                                       | -    | -                    | Bulk | Bulk / Reel<br>Ammo | -                    | -                    | -                    | -                    | -                    | -    |                      |

| DIMENSIONS FOR LEAD STYLES 1, 2, 3, 4, 5, Y, 6 in inches [millimeters] |                 |                                       |                  |                            |                                      |                                      |                                      |                                       |                          |                               |
|------------------------------------------------------------------------|-----------------|---------------------------------------|------------------|----------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------|-------------------------------|
| LEAD STYLE                                                             |                 | 1, 2, 3, 4                            |                  | 1, 3                       | 2, 4                                 | 5, Y                                 |                                      | 6                                     |                          |                               |
| CASE                                                                   | D<br>(max.)     | P <sup>(1)</sup><br>± 0.024<br>[0.60] | H<br>(max.)      | L <sup>(2)</sup><br>(min.) | L <sup>(2)</sup><br>± 0.118<br>[3.0] | P <sup>(1)</sup><br>± 0.03<br>[0.76] | L <sup>(2)</sup><br>± 0.118<br>[3.0] | P <sup>(1)</sup><br>± 0.024<br>[0.60] | H <sub>1</sub><br>(max.) | L <sup>(2)</sup>              |
| A                                                                      | 0.173<br>[4.40] | 0.100<br>[2.54]                       | 0.280<br>[7.11]  | 0.591<br>[15.0]            | 0.748<br>[19.0]                      | 0.125<br>[3.18]                      | 0.748<br>[19.0]                      | 0.200<br>[5.08]                       | 0.378<br>[9.61]          | 0.240 ± 0.030<br>[6.1 ± 0.76] |
| B                                                                      | 0.197<br>[5.00] | 0.100<br>[2.54]                       | 0.300<br>[7.62]  | 0.591<br>[15.0]            | 0.748<br>[19.0]                      | 0.125<br>[3.18]                      | 0.748<br>[19.0]                      | 0.200<br>[5.08]                       | 0.398<br>[10.11]         | 0.240 ± 0.030<br>[6.1 ± 0.76] |
| C                                                                      | 0.217<br>[5.50] | 0.100<br>[2.54]                       | 0.360<br>[9.14]  | 0.591<br>[15.0]            | 0.748<br>[19.0]                      | 0.125<br>[3.18]                      | 0.748<br>[19.0]                      | 0.200<br>[5.08]                       | 0.458<br>[11.64]         | 0.240 ± 0.030<br>[6.1 ± 0.76] |
| D                                                                      | 0.236<br>[6.00] | 0.100<br>[2.54]                       | 0.400<br>[10.16] | 0.591<br>[15.0]            | 0.748<br>[19.0]                      | 0.125<br>[3.18]                      | 0.748<br>[19.0]                      | 0.200<br>[5.08]                       | 0.498<br>[12.66]         | 0.240 ± 0.030<br>[6.1 ± 0.76] |
| E                                                                      | 0.339<br>[8.60] | 0.200<br>[5.08]                       | 0.492<br>[12.50] | 0.591<br>[15.0]            | 0.748<br>[19.0]                      | n/a                                  | n/a                                  | 0.200<br>[5.08]                       | 0.591<br>[15.00]         | 1.0 ± 0.122<br>[25.4 ± 3.1]   |
| F                                                                      | 0.378<br>[9.60] | 0.200<br>[5.08]                       | 0.650<br>[16.50] | 0.591<br>[15.0]            | 0.748<br>[19.0]                      | n/a                                  | n/a                                  | 0.200<br>[5.08]                       | 0.748<br>[19.00]         | 1.0 ± 0.122<br>[25.4 ± 3.1]   |

**Notes**

- (1) Pitch or lead spacing P measured within 0.05" [1.27 mm] of the body of the capacitor or from the bottom of the crimp
- (2) Lead length L is for bulk packaging



| DIMENSIONS FOR LEAD STYLES 7, 9, X, Z in inches [millimeters] |              |                                 |                     |                                |                                 |                     |                                |              |               |                     |                                  |                                 |                                 |   |
|---------------------------------------------------------------|--------------|---------------------------------|---------------------|--------------------------------|---------------------------------|---------------------|--------------------------------|--------------|---------------|---------------------|----------------------------------|---------------------------------|---------------------------------|---|
| LEAD STYLE                                                    |              | 7                               |                     |                                |                                 | 9                   |                                |              | X, Z          |                     |                                  |                                 | X                               | Z |
| CASE                                                          | D max.       | P <sup>(1)</sup> ± 0.024 [0.60] | H <sub>1</sub> max. | L <sup>(2)</sup> ± 0.03 [0.76] | P <sup>(1)</sup> ± 0.024 [0.60] | H <sub>1</sub> max. | L <sup>(2)</sup> ± 0.03 [0.76] | D max.       | H max.        | H <sub>1</sub> max. | L <sup>(2)</sup> ± 0.125 [3.175] | P <sup>(1)</sup> ± 0.024 [0.60] | P <sup>(1)</sup> ± 0.024 [0.60] |   |
| A                                                             | 0.173 [4.40] | 0.25 [6.35]                     | 0.378 [9.61]        | 0.240 ± 0.030 [6.1 ± 0.76]     | 0.200 [5.08]                    | 0.398 [10.11]       | 0.240 [6.10]                   | 0.173 [4.40] | 0.280 [7.11]  | 0.340 [8.64]        | 0.750 [19.05]                    | 0.100 [2.54]                    | 0.125 [3.175]                   |   |
| B                                                             | 0.197 [5.00] | 0.25 [6.35]                     | 0.398 [10.12]       | 0.240 ± 0.030 [6.1 ± 0.76]     | 0.200 [5.08]                    | 0.418 [10.62]       | 0.240 [6.10]                   | 0.197 [5.00] | 0.300 [7.62]  | 0.360 [9.14]        | 0.750 [19.05]                    | 0.100 [2.54]                    | 0.125 [3.175]                   |   |
| C                                                             | 0.217 [5.50] | 0.25 [6.35]                     | 0.458 [11.64]       | 0.240 ± 0.030 [6.1 ± 0.76]     | 0.200 [5.08]                    | 0.478 [12.14]       | 0.240 [6.10]                   | 0.217 [5.50] | 0.360 [9.14]  | 0.420 [10.67]       | 0.750 [19.05]                    | 0.100 [2.54]                    | 0.125 [3.175]                   |   |
| D                                                             | 0.236 [6.00] | 0.25 [6.35]                     | 0.498 [12.66]       | 0.240 ± 0.030 [6.1 ± 0.76]     | 0.200 [5.08]                    | 0.518 [13.16]       | 0.240 [6.10]                   | 0.236 [6.00] | 0.400 [10.16] | 0.460 [11.68]       | 0.750 [19.05]                    | 0.100 [2.54]                    | 0.125 [3.175]                   |   |

Notes

- (1) Pitch or lead spacing P measured within 0.05" [1.27 mm] of the body of the capacitor or from the bottom of the crimp
- (2) Lead length L is for bulk packaging

| 199D OBSOLETE VS. CURRENT ORDERING CROSS REFERENCE |     |                                                                     |
|----------------------------------------------------|-----|---------------------------------------------------------------------|
| OBSOLETE                                           | NEW | DESCRIPTION                                                         |
| A1                                                 | 1V1 | PITCH 0.100, UNEVEN STRAIGHT LEADS, BULK CASES A - D                |
| A1                                                 | 3V1 | PITCH 0.200, UNEVEN STRAIGHT LEADS, BULK, CASES E, F                |
| A1                                                 | 2V1 | PITCH 0.100, EVEN STRAIGHT LEADS, BULK, CASES A - D                 |
| A6                                                 | 2B1 | PITCH 0.100, EVEN STRAIGHT LEADS, REEL POSITIVE LEADER, CASES A - D |
| A6                                                 | 2A1 | PITCH 0.100, EVEN STRAIGHT LEADS, AMMO, CASES A - D                 |
| A1                                                 | 4V1 | PITCH 0.200, EVEN STRAIGHT LEADS, BULK, CASES E, F                  |
| A6                                                 | 4B1 | PITCH 0.200, EVEN STRAIGHT LEADS, REEL POSITIVE LEADER, CASES E, F  |
| A6                                                 | 4A1 | PITCH 0.200, EVEN STRAIGHT LEADS, AMMO, CASES E, F                  |
| A2                                                 | 5V1 | PITCH 0.125, EVEN STRAIGHT LEADS, BULK, CASES A - D                 |
| A7                                                 | 5B1 | PITCH 0.125, EVEN STRAIGHT LEADS, REEL POSITIVE LEADER, CASES A - D |
| A7                                                 | 5A1 | PITCH 0.125, EVEN STRAIGHT LEADS, AMMO, CASES A - D                 |
| A2                                                 | YV1 | PITCH 0.125, UNEVEN STRAIGHT LEADS, BULK, CASES A - D               |
| B1                                                 | XV1 | PITCH 0.100, HAIRPIN LEADS, BULK CASES A - D                        |
| B6                                                 | XB1 | PITCH 0.100, HAIRPIN LEADS, REEL POSITIVE LEADER, CASES A - D       |
| B6                                                 | XA1 | PITCH 0.100, HAIRPIN LEADS, AMMO, CASES A - D                       |
| B2                                                 | ZV1 | PITCH 0.125, HAIRPIN LEADS, BULK, CASES A - D                       |
| B7                                                 | ZB1 | PITCH 0.125, HAIRPIN LEADS, REEL POSITIVE LEADER, CASES A - D       |
| B7                                                 | ZA1 | PITCH 0.125, HAIRPIN LEADS, AMMO, CASES A - D                       |
| E2                                                 | 6V1 | PITCH 0.200, HOCKEY STICK LEADS, BULK, CASES A - F                  |
| E7                                                 | 6B1 | PITCH 0.200, HOCKEY STICK LEADS, REEL POSITIVE LEADER, CASES A - F  |
| E7                                                 | 6A1 | PITCH 0.200, HOCKEY STICK LEADS, AMMO, CASES A - F                  |
| E3                                                 | 7V1 | PITCH 0.250, HOCKEY STICK LEADS, BULK, CASES A - D                  |
| E8                                                 | 7B1 | PITCH 0.250, HOCKEY STICK LEADS, REEL POSITIVE LEADER, CASES A - D  |
| E8                                                 | 7A1 | PITCH 0.250, HOCKEY STICK LEADS, AMMO, CASES A - D                  |
| E4                                                 |     | OBSOLETE                                                            |
| G2                                                 | 9V1 | PITCH 0.200, SNAP-IN LEADS, BULK, CASES A - D                       |
| G7                                                 | 9B1 | PITCH 0.200, SNAP-IN LEADS, REEL POSITIVE LEADER, CASES A - D       |
| G7                                                 | 9A1 | PITCH 0.200, SNAP-IN LEADS, AMMO, CASES A - D                       |



| STANDARD RATINGS                                                                             |           |                      |                                     |                                    |
|----------------------------------------------------------------------------------------------|-----------|----------------------|-------------------------------------|------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                                                    | CASE CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz (%) |
| <b>3 V<sub>DC</sub> AT +85 °C, SURGE = 3.6 V; 2 V<sub>DC</sub> AT +125 °C, SURGE = 2.4 V</b> |           |                      |                                     |                                    |
| 4.7                                                                                          | A         | 199D475(1)003A(2)(3) | 0.5                                 | 6                                  |
| 6.8                                                                                          | A         | 199D685(1)003A(2)(3) | 0.5                                 | 6                                  |
| 10                                                                                           | A         | 199D106(1)003A(2)(3) | 0.5                                 | 8                                  |
| 15                                                                                           | A         | 199D156(1)003A(2)(3) | 0.5                                 | 8                                  |
| 22                                                                                           | B         | 199D226(1)003B(2)(3) | 0.6                                 | 8                                  |
| 33                                                                                           | B         | 199D336(1)003B(2)(3) | 1.0                                 | 8                                  |
| 47                                                                                           | C         | 199D476(1)003C(2)(3) | 1.4                                 | 8                                  |
| 68                                                                                           | C         | 199D686(1)003C(2)(3) | 2.0                                 | 8                                  |
| 100                                                                                          | D         | 199D107(1)003D(2)(3) | 3.0                                 | 10                                 |
| 150                                                                                          | D         | 199D157(1)003D(2)(3) | 4.0                                 | 10                                 |
| 220                                                                                          | E         | 199D227(1)003E(2)(3) | 5.0                                 | 10                                 |
| 330                                                                                          | E         | 199D337(1)003E(2)(3) | 6.0                                 | 10                                 |
| 470                                                                                          | F         | 199D477(1)003F(2)(3) | 8.0                                 | 10                                 |
| 680                                                                                          | F         | 199D687(1)003F(2)(3) | 10.0                                | 10                                 |
| <b>6.3 V<sub>DC</sub> AT +85 °C, SURGE = 8 V; 4 V<sub>DC</sub> AT +125 °C, SURGE = 5 V</b>   |           |                      |                                     |                                    |
| 4.7                                                                                          | A         | 199D475(1)6R3A(2)(3) | 0.5                                 | 6                                  |
| 6.8                                                                                          | A         | 199D685(1)6R3A(2)(3) | 0.5                                 | 6                                  |
| 10                                                                                           | B         | 199D106(1)6R3B(2)(3) | 0.6                                 | 8                                  |
| 15                                                                                           | B         | 199D156(1)6R3B(2)(3) | 0.9                                 | 8                                  |
| 22                                                                                           | C         | 199D226(1)6R3C(2)(3) | 1.3                                 | 8                                  |
| 33                                                                                           | C         | 199D336(1)6R3C(2)(3) | 2.0                                 | 8                                  |
| 47                                                                                           | D         | 199D476(1)6R3D(2)(3) | 2.9                                 | 8                                  |
| 68                                                                                           | D         | 199D686(1)6R3D(2)(3) | 4.0                                 | 8                                  |
| 100                                                                                          | D         | 199D107(1)6R3D(2)(3) | 5.0                                 | 10                                 |
| 150                                                                                          | E         | 199D157(1)6R3E(2)(3) | 6.0                                 | 10                                 |
| 220                                                                                          | E         | 199D227(1)6R3E(2)(3) | 7.0                                 | 10                                 |
| 330                                                                                          | F         | 199D337(1)6R3F(2)(3) | 8.0                                 | 10                                 |
| <b>10 V<sub>DC</sub> AT +85 °C, SURGE = 13 V; 7 V<sub>DC</sub> AT +125 °C, SURGE = 9 V</b>   |           |                      |                                     |                                    |
| 3.3                                                                                          | A         | 199D335(1)010A(2)(3) | 0.5                                 | 6                                  |
| 4.7                                                                                          | A         | 199D475(1)010A(2)(3) | 0.5                                 | 6                                  |
| 6.8                                                                                          | B         | 199D685(1)010B(2)(3) | 0.6                                 | 6                                  |
| 10                                                                                           | B         | 199D106(1)010B(2)(3) | 1.0                                 | 8                                  |
| 15                                                                                           | C         | 199D156(1)010C(2)(3) | 1.5                                 | 8                                  |
| 22                                                                                           | C         | 199D226(1)010C(2)(3) | 2.0                                 | 8                                  |
| 33                                                                                           | D         | 199D336(1)010D(2)(3) | 3.0                                 | 8                                  |
| 39                                                                                           | D         | 199D396(1)010D(2)(3) | 3.9                                 | 8                                  |
| 47                                                                                           | D         | 199D476(1)010D(2)(3) | 4.0                                 | 8                                  |
| 68                                                                                           | D         | 199D686(1)010D(2)(3) | 5.0                                 | 8                                  |
| 100                                                                                          | E         | 199D107(1)010E(2)(3) | 6.0                                 | 10                                 |
| 150                                                                                          | E         | 199D157(1)010E(2)(3) | 7.0                                 | 10                                 |
| 220                                                                                          | F         | 199D227(1)010F(2)(3) | 8.0                                 | 10                                 |

**Note**

- Part number definitions:
  - For capacitance tolerance: X0 =  $\pm$  20 %, X9 =  $\pm$  10 % or X5 = 5 %
  - To specify lead style / spacing / packaging insert the last three characters in the part number. Use the appropriate code shown in the Current Ordering Cross Reference table and explained in the Ordering Information and Lead Styles table
  - E3 = RoHS-compliant 100 % tin leads. Blank or no suffix = standard tin / lead termination



| STANDARD RATINGS                                                                             |           |                      |                                     |                                    |
|----------------------------------------------------------------------------------------------|-----------|----------------------|-------------------------------------|------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                                                    | CASE CODE | PART NUMBER          | MAX. DCL<br>AT +25 °C<br>( $\mu$ A) | MAX. DF<br>AT +25 °C<br>120 Hz (%) |
| <b>16 V<sub>DC</sub> AT +85 °C, SURGE = 20 V; 10 V<sub>DC</sub> AT +125 °C, SURGE = 12 V</b> |           |                      |                                     |                                    |
| 2.2                                                                                          | A         | 199D225(1)016A(2)(3) | 0.5                                 | 6                                  |
| 3.3                                                                                          | A         | 199D335(1)016A(2)(3) | 0.5                                 | 6                                  |
| 4.7                                                                                          | B         | 199D475(1)016B(2)(3) | 0.7                                 | 6                                  |
| 6.8                                                                                          | B         | 199D685(1)016B(2)(3) | 1.0                                 | 6                                  |
| 10                                                                                           | C         | 199D106(1)016C(2)(3) | 1.5                                 | 8                                  |
| 15                                                                                           | C         | 199D156(1)016C(2)(3) | 2.4                                 | 8                                  |
| 22                                                                                           | D         | 199D226(1)016D(2)(3) | 3.5                                 | 8                                  |
| 33                                                                                           | D         | 199D336(1)016D(2)(3) | 4.0                                 | 8                                  |
| 47                                                                                           | E         | 199D476(1)016E(2)(3) | 5.0                                 | 8                                  |
| 68                                                                                           | E         | 199D686(1)016E(2)(3) | 6.0                                 | 8                                  |
| 100                                                                                          | F         | 199D107(1)016F(2)(3) | 7.0                                 | 10                                 |
| 150                                                                                          | F         | 199D157(1)016F(2)(3) | 8.0                                 | 10                                 |
| <b>20 V<sub>DC</sub> AT +85 °C, SURGE = 26 V; 13 V<sub>DC</sub> AT +125 °C, SURGE = 16 V</b> |           |                      |                                     |                                    |
| 1.0                                                                                          | A         | 199D105(1)020A(2)(3) | 0.5                                 | 4                                  |
| 2.7                                                                                          | B         | 199D275(1)020B(2)(3) | 0.7                                 | 6                                  |
| 3.3                                                                                          | B         | 199D335(1)020B(2)(3) | 0.8                                 | 6                                  |
| 4.7                                                                                          | B         | 199D475(1)020B(2)(3) | 1.0                                 | 6                                  |
| 6.8                                                                                          | C         | 199D685(1)020C(2)(3) | 1.5                                 | 6                                  |
| 10                                                                                           | C         | 199D106(1)020C(2)(3) | 2.0                                 | 8                                  |
| 15                                                                                           | D         | 199D156(1)020D(2)(3) | 2.5                                 | 8                                  |
| 22                                                                                           | D         | 199D226(1)020D(2)(3) | 3.0                                 | 8                                  |
| 33                                                                                           | E         | 199D336(1)020E(2)(3) | 4.0                                 | 8                                  |
| 47                                                                                           | E         | 199D476(1)020E(2)(3) | 5.0                                 | 8                                  |
| 68                                                                                           | F         | 199D686(1)020F(2)(3) | 6.0                                 | 8                                  |
| 100                                                                                          | F         | 199D107(1)020F(2)(3) | 7.0                                 | 10                                 |
| <b>25 V<sub>DC</sub> AT +85 °C, SURGE = 33 V; 17 V<sub>DC</sub> AT +125 °C, SURGE = 21 V</b> |           |                      |                                     |                                    |
| 1.0                                                                                          | A         | 199D105(1)025A(2)(3) | 0.5                                 | 4                                  |
| 1.5                                                                                          | A         | 199D155(1)025A(2)(3) | 0.5                                 | 6                                  |
| 2.2                                                                                          | A         | 199D225(1)025A(2)(3) | 0.5                                 | 6                                  |
| 3.3                                                                                          | B         | 199D335(1)025B(2)(3) | 0.8                                 | 6                                  |
| 4.7                                                                                          | B         | 199D475(1)025B(2)(3) | 1.0                                 | 6                                  |
| 6.8                                                                                          | C         | 199D685(1)025C(2)(3) | 1.5                                 | 6                                  |
| 10                                                                                           | C         | 199D106(1)025C(2)(3) | 2.5                                 | 8                                  |
| 15                                                                                           | D         | 199D156(1)025D(2)(3) | 3.0                                 | 8                                  |
| 22                                                                                           | D         | 199D226(1)025D(2)(3) | 4.0                                 | 8                                  |
| 33                                                                                           | E         | 199D336(1)025E(2)(3) | 5.0                                 | 8                                  |
| 47                                                                                           | E         | 199D476(1)025E(2)(3) | 6.0                                 | 8                                  |
| 68                                                                                           | F         | 199D686(1)025F(2)(3) | 7.0                                 | 8                                  |

**Note**

- Part number definitions:

(1) For capacitance tolerance: X0 =  $\pm$  20 %, X9 =  $\pm$  10 % or X5 = 5 %

(2) To specify lead style / spacing / packaging insert the last three characters in the part number. Use the appropriate code shown in the Current Ordering Cross Reference table and explained in the Ordering Information and Lead Styles table

(3) E3 = RoHS-compliant 100 % tin leads. Blank or no suffix = standard tin / lead termination



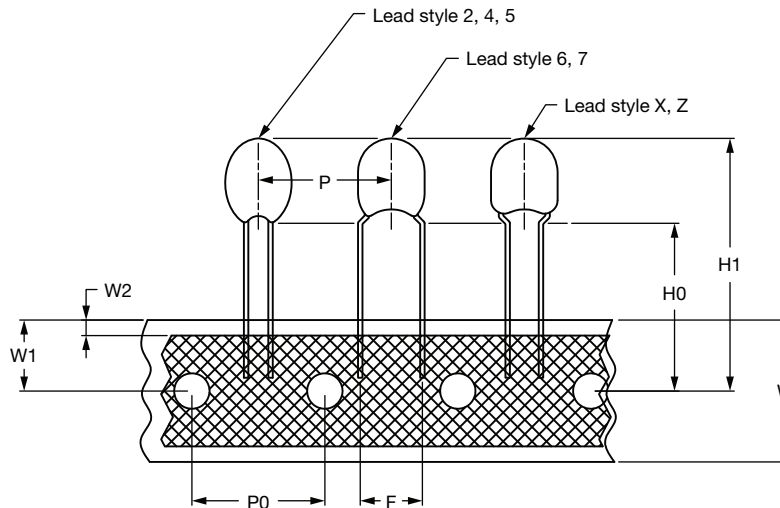
| <b>STANDARD RATINGS</b>                                                                      |                  |                      |                                                       |                                             |  |
|----------------------------------------------------------------------------------------------|------------------|----------------------|-------------------------------------------------------|---------------------------------------------|--|
| <b>CAPACITANCE<br/>(<math>\mu</math>F)</b>                                                   | <b>CASE CODE</b> | <b>PART NUMBER</b>   | <b>MAX. DCL<br/>AT +25 °C<br/>(<math>\mu</math>A)</b> | <b>MAX. DF<br/>AT +25 °C<br/>120 Hz (%)</b> |  |
| <b>35 V<sub>DC</sub> AT +85 °C, SURGE = 46 V; 23 V<sub>DC</sub> AT +125 °C, SURGE = 28 V</b> |                  |                      |                                                       |                                             |  |
| 0.10                                                                                         | A                | 199D104(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.15                                                                                         | A                | 199D154(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.22                                                                                         | A                | 199D224(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.33                                                                                         | A                | 199D334(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.47                                                                                         | A                | 199D474(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.68                                                                                         | A                | 199D684(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 1.0                                                                                          | A                | 199D105(1)035A(2)(3) | 0.5                                                   | 4                                           |  |
| 1.5                                                                                          | A                | 199D155(1)035A(2)(3) | 0.5                                                   | 6                                           |  |
| 1.8                                                                                          | B                | 199D185(1)035B(2)(3) | 0.7                                                   | 6                                           |  |
| 2.2                                                                                          | B                | 199D225(1)035B(2)(3) | 0.7                                                   | 6                                           |  |
| 3.3                                                                                          | B                | 199D335(1)035B(2)(3) | 1.0                                                   | 6                                           |  |
| 4.7                                                                                          | C                | 199D475(1)035C(2)(3) | 1.5                                                   | 6                                           |  |
| 5.6                                                                                          | D                | 199D565(1)035D(2)(3) | 1.9                                                   | 6                                           |  |
| 6.8                                                                                          | D                | 199D685(1)035D(2)(3) | 2.3                                                   | 6                                           |  |
| 10                                                                                           | D                | 199D106(1)035D(2)(3) | 3.5                                                   | 8                                           |  |
| 15                                                                                           | E                | 199D156(1)035E(2)(3) | 4.0                                                   | 8                                           |  |
| 22                                                                                           | E                | 199D226(1)035E(2)(3) | 5.0                                                   | 8                                           |  |
| 33                                                                                           | F                | 199D336(1)035F(2)(3) | 6.0                                                   | 8                                           |  |
| 47                                                                                           | F                | 199D476(1)035F(2)(3) | 7.0                                                   | 8                                           |  |
| <b>50 V<sub>DC</sub> AT +85 °C, SURGE = 65 V; 33 V<sub>DC</sub> AT +125 °C, SURGE = 40 V</b> |                  |                      |                                                       |                                             |  |
| 0.10                                                                                         | A                | 199D104(1)050A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.15                                                                                         | A                | 199D154(1)050A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.22                                                                                         | A                | 199D224(1)050A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.33                                                                                         | A                | 199D334(1)050A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.47                                                                                         | A                | 199D474(1)050A(2)(3) | 0.5                                                   | 4                                           |  |
| 0.68                                                                                         | A                | 199D684(1)050A(2)(3) | 0.5                                                   | 4                                           |  |
| <b>50 V<sub>DC</sub> AT +85 °C, SURGE = 65 V; 33 V<sub>DC</sub> AT +125 °C, SURGE = 40 V</b> |                  |                      |                                                       |                                             |  |
| 1.0                                                                                          | B                | 199D105(1)050B(2)(3) | 0.5                                                   | 4                                           |  |
| 1.5                                                                                          | C                | 199D155(1)050C(2)(3) | 0.7                                                   | 6                                           |  |
| 2.2                                                                                          | C                | 199D225(1)050C(2)(3) | 1.1                                                   | 6                                           |  |
| 3.3                                                                                          | D                | 199D335(1)050D(2)(3) | 1.5                                                   | 6                                           |  |
| 4.7                                                                                          | D                | 199D475(1)050D(2)(3) | 2.0                                                   | 6                                           |  |
| 6.8                                                                                          | F                | 199D685(1)050F(2)(3) | 3.0                                                   | 6                                           |  |
| 10                                                                                           | F                | 199D106(1)050F(2)(3) | 4.0                                                   | 8                                           |  |
| 15                                                                                           | F                | 199D156(1)050F(2)(3) | 5.0                                                   | 8                                           |  |
| 22                                                                                           | F                | 199D226(1)050F(2)(3) | 6.0                                                   | 8                                           |  |

**Note**

- Part number definitions:
  - For capacitance tolerance: X0 =  $\pm$  20 %, X9 =  $\pm$  10 % or X5 = 5 %
  - To specify lead style / spacing / packaging insert the last three characters in the part number. Use the appropriate code shown in the Current Ordering Cross Reference table and explained in the Ordering Information and Lead Styles table
  - E3 = RoHS-compliant 100 % tin leads. Blank or no suffix = standard tin / lead termination

**STANDARD TAPE AND REEL / AMMO BOX PACKAGING DIMENSIONS PER EIA-468**

in inches [millimeters]



| SYMBOL | DESCRIPTION                                      | DIMENSIONS                              | TOLERANCE                          |
|--------|--------------------------------------------------|-----------------------------------------|------------------------------------|
| P      | Component pitch                                  | 0.500 [12.7]                            | $\pm 0.039$ [ $\pm 1.0$ ]          |
| P0     | Feed hole pitch                                  | 0.500 [12.7]                            | $\pm 0.012$ [ $\pm 0.3$ ]          |
| W      | Tape width                                       | 0.709 [18.0]                            | +0.039 / -0.020 [ $+1.0$ / -0.5]   |
| W0     | Hold down tape width                             | 0.20 [5.0]                              | Minimum                            |
| W1     | Feed hole position                               | 0.354 [9.0]                             | +0.030 / -0.020 [ $+0.075$ / -0.5] |
| W2     | Hold down tape position                          | 0.118 [3.0]                             | Maximum                            |
| H1     | Overall component height above tape central line | 1.27 [32.26]                            | Maximum                            |
| D0     | Feed hole diameter                               | 0.157 [4.0]                             | $\pm 0.012$ [ $\pm 0.3$ ]          |
| t      | Tape thickness                                   | 0.028 [0.7]                             | Maximum                            |
| H0     | Height to seating plane                          | 0.63 [16.0]                             | $\pm 0.02$ [ $\pm 0.5$ ]           |
| F      | Pitch or lead wire spacing                       | See "Dimensions for Lead Styles" tables |                                    |

**Tape and Reel Packaging:** type 199D radial-leaded tantalum capacitors, all lead styles except 1, 3, and Y are available taped and reeled per EIA-468.

| CASE CODE                | A    | B    | C    | D    | E   | F |
|--------------------------|------|------|------|------|-----|---|
| Quantity per box bulk    | 1000 |      | 500  |      | 100 |   |
| Quantity per box ammpack | 2500 | 2000 | 1500 | 1000 | 500 |   |
| Quantity per reel        | 1000 |      |      |      | 500 |   |



## **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.

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.