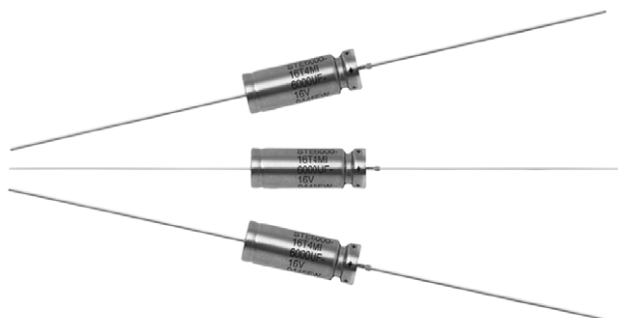


# SuperTan® Extended (STE) Capacitors, Wet Tantalum Capacitors With Hermetic Seal



## FEATURES

Vishay SuperTan® Extended (STE) represents a major breakthrough in wet tantalum capacitor technology. Its unique cathode system, also used in the ST, provides the highest capacitance per unit volume available. The STE combines the inherent reliability of wet tantalum with the capacitance stability of solid tantalum, and there are no circuit impedance restrictions. The range is exceptionally well suited for low voltage filtering and energy storage applications. Ideal for designs targeting the military and aerospace industry.

The SuperTan® Extended (STE) is housed in an all tantalum, hermetically sealed case and is manufactured to withstand high stress and hazardous environments.

- Axial through-hole terminations: standard tin / lead (Sn / Pb), 100 % tin (RoHS-compliant) available
- 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



## PERFORMANCE CHARACTERISTICS

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

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

**DC Leakage Current (DCL Max.):** at +25 °C and above: leakage current shall not exceed the values listed in the Standard Ratings tables.

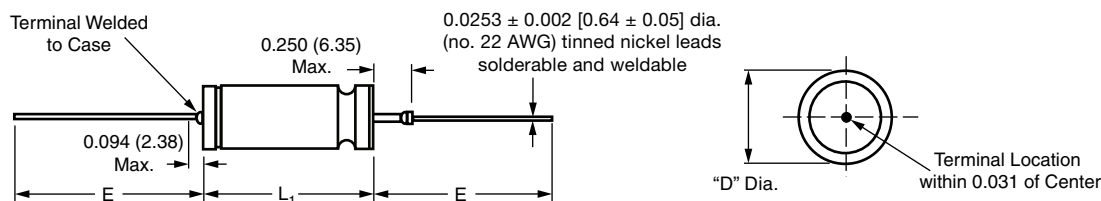
**Life Test:** capacitors are capable of withstanding a 2000 h life test at a temperature of +85 °C at the applicable rated DC working voltage.

## ORDERING INFORMATION

| STE  | 6000              | 16                             | T4        | M                        | I                                | E3                                                                                              |
|------|-------------------|--------------------------------|-----------|--------------------------|----------------------------------|-------------------------------------------------------------------------------------------------|
| TYPE | CAPACITANCE<br>μF | DC VOLTAGE RATING<br>AT +85 °C | CASE SIZE | CAPACITANCE<br>TOLERANCE | INSULATING<br>SLEEVE             | RoHS COMPLIANT                                                                                  |
|      |                   |                                |           | M = ± 20 %<br>K = ± 10 % | I = insulated<br>X = uninsulated | E3 = 100 % tin termination<br>(RoHS compliant)<br>Blank = SnPb termination<br>(standard design) |

### Note

- Packaging: the use of formed plastic trays for packaging this type of axial lead component is standard. Tape and reel is not recommended due to the unit weight.

**DIMENSIONS** in inches [millimeters]


| CASE CODE | D ± 0.016 [0.41] | MAX. INSULATED (DIA.) | L <sub>1</sub> + 0.031 / - 0.016 [+ 0.79 / - 0.41] UNINSULATED | E ± 0.250 [6.35] MAX. |
|-----------|------------------|-----------------------|----------------------------------------------------------------|-----------------------|
| T1        | 0.188 [4.78]     | 0.219 [5.56]          | 0.453 [11.51]                                                  | 1.500 [38.10]         |
| T2        | 0.281 [7.14]     | 0.312 [7.92]          | 0.641 [16.28]                                                  | 2.250 [57.15]         |
| T3        | 0.375 [9.52]     | 0.406 [10.31]         | 0.766 [19.46]                                                  | 2.250 [57.15]         |
| T4        | 0.375 [9.52]     | 0.406 [10.31]         | 1.062 [26.97]                                                  | 2.250 [57.15]         |

**Notes**

- Material at egress is tantalum
- Insulation sleeving will lap over the ends of the capacitor case
- Approx. weight:  
T1: 2.3 g, T2: 5.7 g  
T3: 9.4 g, T4: 14.8 g

**STANDARD RATINGS**

| CAPACITANCE (μF)                                                 | VOLTAGE   | CASE CODE | PART NUMBER <sup>(1)</sup>                  | MAX. ESR AT +25 °C 120 Hz (Ω) | TYP. ESR AT +25 °C 1 kHz (Ω) | MAX. DCL AT +25 °C (μA) | MAX. DCL AT +85 °C / +125 °C (μA) | MAX. CAPACITANCE CHANGE AT -55 °C (%) | MAX. CAPACITANCE CHANGE AT +85 °C (%) | MAX. CAPACITANCE CHANGE AT +125 °C (%) | MAX. IMP. AT -55 °C 120 Hz (Ω) | AC RIPPLE 85 °C 40 kHz mA RMS |
|------------------------------------------------------------------|-----------|-----------|---------------------------------------------|-------------------------------|------------------------------|-------------------------|-----------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|--------------------------------|-------------------------------|
| <b>10 V<sub>DC</sub> AT +85 °C; 7 V<sub>DC</sub> AT +125 °C</b>  |           |           |                                             |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>680</b>                                                       | <b>10</b> | <b>T1</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>2000</b>                                                      | <b>10</b> | <b>T2</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 4700                                                             | 10        | T3        | STE4700-10T3MI                              | 0.35                          | < 0.200                      | 16                      | 100                               | -80                                   | 10                                    | 20                                     | 3.50                           | 4000                          |
| 10 000                                                           | 10        | T4        | STE10000-10T4MI                             | 0.25                          | < 0.100                      | 25                      | 150                               | -85                                   | 20                                    | 35                                     | 3.00                           | 5000                          |
| <b>16 V<sub>DC</sub> AT +85 °C; 11 V<sub>DC</sub> AT +125 °C</b> |           |           |                                             |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>430</b>                                                       | <b>16</b> | <b>T1</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>1200</b>                                                      | <b>16</b> | <b>T2</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 3300                                                             | 16        | T3        | STE3300-16T3MI                              | 0.35                          | < 0.200                      | 16                      | 100                               | -80                                   | 10                                    | 15                                     | 3.50                           | 4000                          |
| 6000                                                             | 16        | T4        | STE6000-16T4MI                              | 0.30                          | < 0.150                      | 25                      | 150                               | -80                                   | 15                                    | 20                                     | 3.00                           | 4500                          |
| <b>25 V<sub>DC</sub> AT +85 °C; 15 V<sub>DC</sub> AT +125 °C</b> |           |           |                                             |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>270</b>                                                       | <b>25</b> | <b>T1</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>1000</b>                                                      | <b>25</b> | <b>T2</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>2200</b>                                                      | <b>25</b> | <b>T3</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 4000                                                             | 25        | T4        | STE4000-25T4MI                              | 0.35                          | < 0.150                      | 25                      | 125                               | -80                                   | 15                                    | 20                                     | 5.00                           | 4250                          |
| <b>30 V<sub>DC</sub> AT +85 °C; 20 V<sub>DC</sub> AT +125 °C</b> |           |           |                                             |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>220</b>                                                       | <b>30</b> | <b>T1</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 820                                                              | 30        | T2        | STE820-30T2MI                               | 1.00                          | < 0.600                      | 3.5                     | 18                                | -75                                   | 12                                    | 20                                     | 20.00                          | 1650                          |
| <b>1800</b>                                                      | <b>30</b> | <b>T3</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 3300                                                             | 30        | T4        | STE3300-30T4MI                              | 0.35                          | < 0.200                      | 25                      | 125                               | -80                                   | 20                                    | 25                                     | 4.00                           | 2750                          |
| <b>35 V<sub>DC</sub> AT +85 °C; 22 V<sub>DC</sub> AT +125 °C</b> |           |           |                                             |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| <b>180</b>                                                       | <b>35</b> | <b>T1</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 680                                                              | 35        | T2        | STE680-35T2MI                               | 0.95                          | < 0.500                      | 5                       | 25                                | -75                                   | 16                                    | 20                                     | 16.00                          | 2500                          |
| <b>1500</b>                                                      | <b>35</b> | <b>T3</b> | <i>Preliminary value, contact marketing</i> |                               |                              |                         |                                   |                                       |                                       |                                        |                                |                               |
| 2800                                                             | 35        | T4        | STE2800-35T4MI                              | 0.35                          | < 0.200                      | 25                      | 125                               | -80                                   | 20                                    | 30                                     | 4.50                           | 4000                          |

**Notes**

- Part numbers shown are for units with ± 20 % capacitance tolerance and insulated capacitors. For units with ± 10 % capacitance tolerance change the letter "M" to "K". For units without insulation, substitute "X" with "I" at the end of the part number. For RoHS-compliant add the "E3" for suffix
- Requires export license for shipments outside the US. Contact marketing for availability



| STANDARD RATINGS                                             |            |                   |                                             |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
|--------------------------------------------------------------|------------|-------------------|---------------------------------------------|-------------------------------------------------------|---------------------------------------------------|----------------------|-----------------------------------|-------------------------------|---------------|----------------|-----------------------------------------------------|-------------------------------------------|
| CAPACITANCE<br>( $\mu$ F)                                    | VOLTAGE    | CASE<br>CODE      | PART NUMBER <sup>(1)</sup>                  | MAX.<br>ESR<br>AT<br>+25 °C<br>120 Hz<br>( $\Omega$ ) | TYP.<br>ESR AT<br>+25 °C<br>1 kHz<br>( $\Omega$ ) | MAX. DCL AT          |                                   | MAX. CAPACITANCE<br>CHANGE AT |               |                | MAX.<br>IMP. AT<br>-55 °C<br>120 Hz<br>( $\Omega$ ) | AC<br>RIPPLE<br>85 °C<br>40 kHz<br>mA RMS |
|                                                              |            |                   |                                             |                                                       |                                                   | +25 °C<br>( $\mu$ A) | +85 °C /<br>+125 °C<br>( $\mu$ A) | -55 °C<br>(%)                 | +85 °C<br>(%) | +125 °C<br>(%) |                                                     |                                           |
| 50 V <sub>DC</sub> AT +85 °C; 30 V <sub>DC</sub> AT +125 °C  |            |                   |                                             |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 110                                                          | 50         | T1                | STE110-50T1MI                               | 1.60                                                  | < 1.000                                           | 2                    | 7.5                               | -40                           | 10            | 15             | 40.00                                               | 1500                                      |
| 470                                                          | 50         | T2                | STE470-50T2MI                               | 0.90                                                  | < 0.600                                           | 5                    | 50                                | -60                           | 8             | 12             | 12.00                                               | 2000                                      |
| 520                                                          | 50         | T2                | STE520-50T2MI                               | 1.00                                                  | < 0.600                                           | 3                    | 15                                | -80                           | 12            | 18             | 20.00                                               | 1700                                      |
| 900                                                          | 50         | T3                | STE900-50T3MI                               | 0.90                                                  | < 0.300                                           | 15                   | 125                               | -75                           | 20            | 20             | 10.00                                               | 2500                                      |
| 1500                                                         | 50         | T3                | STE1500-50T3MI                              | 1.00                                                  | < 0.300                                           | 25                   | 130                               | -85                           | 25            | 30             | 8.00                                                | 2400                                      |
| 1500                                                         | 50         | T4                | STE1500-50T4MI                              | 0.35                                                  | < 0.215                                           | 15                   | 110                               | -70                           | 20            | 20             | 6.00                                                | 3500                                      |
| 2200                                                         | 50         | T4                | STE2200-50T4MI                              | 0.60                                                  | < 0.400                                           | 25                   | 125                               | -80                           | 25            | 30             | 4.50                                                | 3000                                      |
| 60 V <sub>DC</sub> AT +85 °C; 40 V <sub>DC</sub> AT +125 °C  |            |                   |                                             |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 68                                                           | 60         | T1                | STE68-60T1MI                                | 1.50                                                  | < 0.600                                           | 1.5                  | 7.5                               | -30                           | 10            | 12             | 40.00                                               | 1400                                      |
| <b>220</b>                                                   | <b>60</b>  | <b>T2</b>         | <i>Preliminary value, contact marketing</i> |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 560                                                          | 60         | T3                | STE560-60T3MI                               | 0.90                                                  | < 0.300                                           | 20                   | 120                               | -70                           | 12            | 15             | 10.00                                               | 2500                                      |
| 1000                                                         | 60         | T4                | STE1000-60T4MI                              | 0.50                                                  | < 0.300                                           | 20                   | 120                               | -40                           | 10            | 15             | 5.50                                                | 3500                                      |
| 1800                                                         | 60         | T4 <sup>(2)</sup> | STE1800-60T4MI                              | 0.50                                                  | < 0.300                                           | 25                   | 250                               | -75                           | 25            | 25             | 6.00                                                | 3000                                      |
| 75 V <sub>DC</sub> AT +85 °C; 50 V <sub>DC</sub> AT +125 °C  |            |                   |                                             |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 56                                                           | 75         | T1                | STE56-75T1MI                                | 1.60                                                  | < 0.800                                           | 1.5                  | 7.5                               | -30                           | 8             | 10             | 40.00                                               | 1750                                      |
| 180                                                          | 75         | T2                | STE180-75T2MI                               | 1.50                                                  | < 0.500                                           | 5                    | 25                                | -35                           | 15            | 20             | 30.00                                               | 2000                                      |
| 470                                                          | 75         | T3                | STE470-75T3MI                               | 0.60                                                  | < 0.325                                           | 25                   | 100                               | -45                           | 10            | 25             | 10.00                                               | 3000                                      |
| 750                                                          | 75         | T4                | STE750-75T4MI                               | 0.50                                                  | < 0.400                                           | 20                   | 120                               | -35                           | 10            | 15             | 6.50                                                | 3500                                      |
| 1200                                                         | 75         | T4 <sup>(2)</sup> | STE1200-75T4MI                              | 0.80                                                  | < 0.350                                           | 25                   | 250                               | -75                           | 25            | 35             | 8.00                                                | 2750                                      |
| 100 V <sub>DC</sub> AT +85 °C; 65 V <sub>DC</sub> AT +125 °C |            |                   |                                             |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 22                                                           | 100        | T1                | STE22-100T1MI                               | 3.00                                                  | < 1.500                                           | 1                    | 5                                 | -15                           | 4             | 10             | 100.00                                              | 1200                                      |
| <b>86</b>                                                    | <b>100</b> | <b>T2</b>         | <i>Preliminary value, contact marketing</i> |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 220                                                          | 100        | T3                | STE220-100T3MI                              | 1.40                                                  | < 0.200                                           | 5                    | 25                                | -55                           | 10            | 15             | 18.00                                               | 2500                                      |
| 400                                                          | 100        | T4                | STE400-100T4MI                              | 0.70                                                  | < 0.400                                           | 10                   | 120                               | -40                           | 6             | 12             | 15.00                                               | 3000                                      |
| 125 V <sub>DC</sub> AT +85 °C; 85 V <sub>DC</sub> AT +125 °C |            |                   |                                             |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| <b>18</b>                                                    | <b>125</b> | <b>T1</b>         | <i>Preliminary value, contact marketing</i> |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| <b>56</b>                                                    | <b>125</b> | <b>T2</b>         | <i>Preliminary value, contact marketing</i> |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| <b>150</b>                                                   | <b>125</b> | <b>T3</b>         | <i>Preliminary value, contact marketing</i> |                                                       |                                                   |                      |                                   |                               |               |                |                                                     |                                           |
| 240                                                          | 125        | T4                | STE240-125T4MI                              | 0.80                                                  | < 0.600                                           | 15                   | 150                               | -35                           | 6             | 12             | 20.00                                               | 2500                                      |

**Notes**

- <sup>(1)</sup> Part numbers shown are for units with  $\pm 20$  % capacitance tolerance and insulated capacitors.  
 For units with  $\pm 10$  % capacitance tolerance change the letter "M" to "K".  
 For units without insulation, substitute "X" with "I" at the end of the part number.  
 For RoHS-compliant add the "E3" for suffix
- <sup>(2)</sup> Requires export license for shipments outside the US. Contact marketing for availability

**TYPICAL PERFORMANCE CHARACTERISTICS OF STE CAPACITORS**

| <b>ELECTRICAL CHARACTERISTICS</b> |                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ITEM</b>                       | <b>PERFORMANCE CHARACTERISTICS</b>                                                                                                                                                                                                                                                                                                                                        |
| Operating temperature range       | -55 °C to +85 °C (to +125 °C with voltage derating)                                                                                                                                                                                                                                                                                                                       |
| Capacitor tolerance               | ± 20 %, ± 10 % at 120 Hz, at +25 °C                                                                                                                                                                                                                                                                                                                                       |
| Capacitor change by temperature   | Limit per Standard Ratings table                                                                                                                                                                                                                                                                                                                                          |
| ESR                               | Limit per Standard Ratings table, at +25 °C, 120 Hz                                                                                                                                                                                                                                                                                                                       |
| Impedance                         | Limit per Standard Ratings table, at -55 °C, 120 Hz                                                                                                                                                                                                                                                                                                                       |
| DCL (leakage current)             | Limit per Standard Ratings table                                                                                                                                                                                                                                                                                                                                          |
| AC ripple current                 | Limit per Standard Ratings table, at +85 °C and 40 kHz                                                                                                                                                                                                                                                                                                                    |
| Reverse voltage                   | There shall be no continuous reverse voltage. Transient reverse voltage surges are acceptable under the following conditions:<br>a) The peak reverse voltage is equal to or less than 1.5 V and the product of the peak current times the duration of the reverse transient is 0.05 As or less<br>b) The repetition rate of the reverse voltage surges is less than 10 Hz |
| Surge voltage                     | Surge voltage shall be in accordance with MIL-PRF-39006 and Table I of DLA 10004.<br>The DC rated surge voltage is the maximum voltage to which the capacitors can be subjected under any conditions including transients and peak ripple at the highest line voltage.<br>The DC surge voltage is 115 % of rated DC voltage.                                              |

| <b>PERFORMANCE CHARACTERISTICS</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ITEM</b>                        | <b>PERFORMANCE CHARACTERISTICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Life testing                       | Capacitors shall be capable of withstanding a 2000 h life test at a temperature +85 °C at rated voltage, or a 2000 h life test at 125 °C test at derated voltage.<br>After the test, the capacitors shall meet the following requirements:<br>a) DC leakage at 85 °C and 125 °C shall not exceed 125 % of the specified value<br>b) DC leakage at 25 °C shall not exceed the specified value<br>c) Capacitance shall be within +10 %, -20 % of initial value<br>d) ESR shall not exceed 200 % of the specified value |

| <b>ENVIRONMENTAL CHARACTERISTICS</b> |                                      |                                                                                                          |
|--------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>ITEM</b>                          | <b>CONDITION</b>                     | <b>COMMENTS</b>                                                                                          |
| Seal                                 | MIL-PRF-39006                        | When the capacitors are tested as specified in MIL-PRF-39006, there shall be no evidence of leakage.     |
| Moisture resistance                  | MIL-PRF-39006                        | Moisture resistance shall be in accordance with MIL-PRF-39006.<br>Number of cycles: 10 continuous cycles |
| Barometric pressure (reduced)        | MIL-STD-202, method 105, condition E | Altitude 150 000 feet                                                                                    |

**MECHANICAL CHARACTERISTICS**

| ITEM                      | CONDITION                                        | COMMENTS                                                                                                                                                                                                                                                       |
|---------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shock (specified pulse)   | MIL-STD-202, method 213, condition I (100 g)     | The capacitors shall meet the requirements of MIL-PRF-39006.                                                                                                                                                                                                   |
| Vibration, high frequency | MIL-STD-202, method 204, condition D (20 g peak) | The capacitors shall meet the requirements of MIL-PRF-39006.                                                                                                                                                                                                   |
| Thermal shock             | MIL-STD-202, method 107, condition A             | Thermal shock shall be in accordance with MIL-PRF-39006 when tested for 30 cycles.                                                                                                                                                                             |
| Solderability             | MIL-STD-202, method 208, ANSI/J-STD-002, test A  | Solderability shall be in accordance with MIL-PRF-39006.                                                                                                                                                                                                       |
| Terminal strength         | MIL-STD-202, method 211                          | Terminal strength shall be in accordance with MIL-PRF-39006.                                                                                                                                                                                                   |
| Resistance to solder heat | MIL-STD-202, method 210, condition C             | The capacitors shall meet the requirements of MIL-PRF-39006.                                                                                                                                                                                                   |
| Terminals                 | MIL-STD-1276                                     | Terminals shall be as specified in MIL-STD-1276. The length and diameter of the terminals shall be as specified in Dimensions table. All terminals shall be permanently secured internally and externally, as applicable. All external joints shall be welded. |
| Marking                   | MIL-STD-1285                                     | Marking of capacitors conforms to method I of MIL-STD-1285 and include capacitance (in $\mu\text{F}$ ), capacitance tolerance letter, rated voltage, date code, lot symbol and Vishay trademark.                                                               |

**SELECTOR GUIDES**

|                            |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Tantalum Selector Guide    | <a href="http://www.vishay.com/doc?49054">www.vishay.com/doc?49054</a> |
| Parameter Comparison Guide | <a href="http://www.vishay.com/doc?42088">www.vishay.com/doc?42088</a> |



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