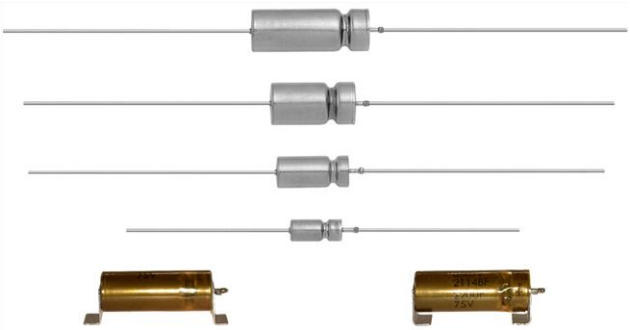
# Wet Tantalum Capacitors, Extended Capacitance, Tantalum Case With Glass-to-Tantalum Hermetic Seal for -55 °C to +125 °C



## LINKS TO ADDITIONAL RESOURCES

3D Models

## PERFORMANCE CHARACTERISTICS

Refer to: Typical Performance Characteristics

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

**Capacitance Tolerance:** ± 10 %, ± 20 % standard

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

## FEATURES

- Enhanced performance, high reliability design
- Terminations: axial, standard tin / lead (Sn / Pb), 100 % tin (RoHS-compliant) available
- Model T16 tantalum-case electrolytic capacitors provide all the advantages of Vishay's SuperTan® series devices, while offering improved reverse voltage and vibration capability
- Increased thermal shock capability of 300 cycles
- Designed for the avionics and aerospace applications
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free Available

RoHS* Available

HALOGEN FREE GREEN (5-2008) Available

**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

## ORDERING INFORMATION

| T16 | D | 227 | M | 100 | E (1) | Z | S (2) | S |
|---|---|---|---|---|---|---|---|---|
| MODEL | CASE CODE | CAPACITANCE | CAPACITANCE TOLERANCE | DC VOLTAGE RATING AT +85 °C | TERMINATION AND PACKAGING | RELIABILITY / SHOCK / VIBRATION LEVEL | INSULATING SLEEVE | ESR |
| | See Ratings and Case Codes Table. | This is expressed in picofarads. The first two digits are the significant figures. The third is the number of zeros to follow. | K = ± 10 %<br>M = ± 20 % | This is expressed in volts. To complete the three-digit block, zeros precede the voltage rating. | E = axial, tin / lead, bulk<br>C = axial, 100 % tin, bulk<br>J = SMD, outside bend, tin / lead<br>K = SMD, outside bend, 100 % tin<br>L = SMD, inside bend, tin / lead<br>M = SMD, inside bend, 100 % tin | Z = standard<br>H = high | S = sleeved<br>U = unsleeved | S = standard |

**Notes**

- Packaging: the use of formed plastic trays for packaging these axial lead components is standard. Tape and reel is not available due to the unit weight

(1) J, K, L, M are available in T4. For all other case sizes, check with marketing

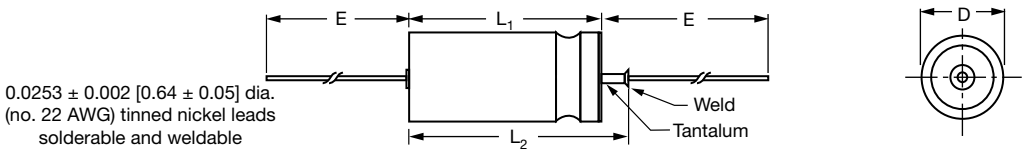
(2) Sleeve on J, K, L, M terminations shall be Kapton only



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## AXIAL DIMENSIONS in inches [millimeters]




| CASE CODE | | D | $L_1$ | $L_2$ (max.) | E | WEIGHT (g) (max.) |
|---|---|---|---|---|---|---|
| TYPE T16 | ST | | | | | |
| A | T1 | 0.188 ± 0.016 [4.78 ± 0.41] | 0.453 + 0.031 / - 0.016 [11.51 + 0.79 / - 0.41] | 0.734 [18.64] | 1.500 ± 0.250 [38.10 ± 6.35] | 2.6 |
| B | T2 | 0.281 ± 0.016 [7.14 ± 0.41] | 0.641 + 0.031 / - 0.016 [16.28 + 0.79 / - 0.41] | 0.922 [23.42] | 2.250 ± 0.250 [57.15 ± 6.35] | 6.2 |
| E | L2 | 0.281 ± 0.016 [7.14 ± 0.41] | 1.008 + 0.031 / - 0.016 [25.60 + 0.79 / - 0.41] | 1.171 [29.75] | 2.250 [57.15] | 7.84 |
| C | T3 | 0.375 ± 0.016 [9.52 ± 0.41] | 0.766 + 0.031 / - 0.016 [19.46 + 0.79 / - 0.41] | 1.047 [26.59] | 2.250 ± 0.250 [57.15 ± 6.35] | 11.6 |
| D | T4 | 0.375 ± 0.016 [9.52 ± 0.41] | 1.062 + 0.031 / - 0.016 [26.97 + 0.79 / - 0.41] | 1.343 [34.11] | 2.250 ± 0.250 [57.15 ± 6.35] | 17.7 |

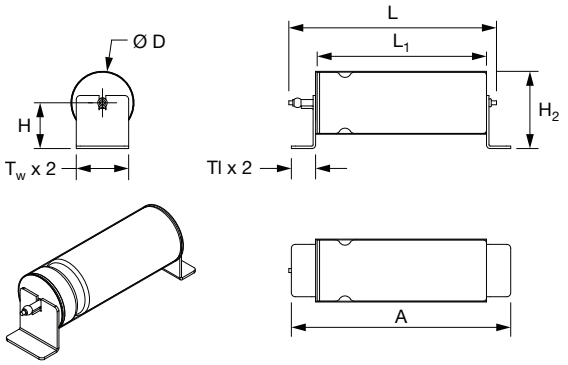
**Note**

- For insulated parts, add 0.015" [0.38 mm] to the diameter. The insulation shall lap over the ends of the capacitor body

## SMD PRODUCT DIMENSIONS in inches [millimeters]

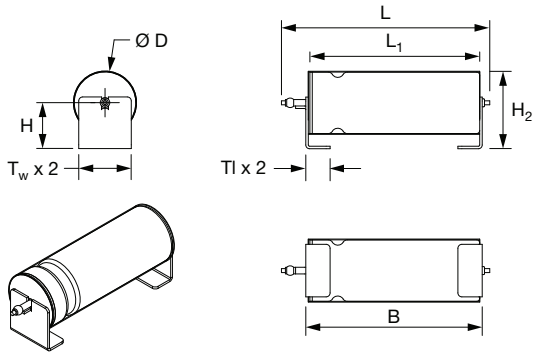
**Styles J, K**

| Term. code | Solder type |
|---|---|
| J | SnPb |
| K | 100 % tin (RoHS-compliant) |




**Styles L, M**

| Term. code | Solder type |
|---|---|
| L | SnPb |
| M | 100 % tin (RoHS-compliant) |




| CASE CODE | | A (max.) | B (max.) | Tl (max.) | H (max.) | $T_w$ ± 0.005 | $H_2$ (max.) | L (max.) | $L_1$ | D (max.) |
|---|---|---|---|---|---|---|---|---|---|---|
| TYPE T16 | ST | | | | | | | | | |
| A | T1 | 0.773 [19.6] | 0.513 [13.0] | 0.157 [4.0] | 0.177 [4.5] | 0.158 [4.0] | 0.296 [7.5] | 0.705 [17.9] | 0.469 + 0.031 / -0.016 [11.91 + 0.79 / -0.41] | 0.228 [5.8] |
| D | T4 | 1.432 [36.4] | 1.140 [29.0] | 0.157 [4.0] | 0.295 [7.5] | 0.331 [8.4] | 0.492 [12.5] | 1.343 [34.1] | 1.062 + 0.031 / - 0.016 [26.97 + 0.79 / - 0.41] | 0.397 [10.1] |

**Note**

- Use appropriate adhesive between capacitor body and the board for improved mechanical strength



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| RATINGS AND CASE CODES | | | | | | | |
|---|---|---|---|---|---|---|---|
| **µF** | **25 V** | **30 V** | **50 V** | **60 V** | **75 V** | **100 V** | **125 V** |
| 10 | | | | | | | A |
| 15 | | | | | | A | |
| 33 | | | | | A | | |
| 47 | | | | A | | | B |
| 68 | | | A | | | B | |
| 82 | | | | | | | C |
| 90 | | | | | | | E |
| 100 | | A | | | | | C |
| 110 | | | | | B | | |
| 120 | A | | | | | E | |
| 150 | | | | B | | C | D |
| 220 | | | B | | E | D | |
| 250 | | | | | E | | |
| 330 | | | | | C | | |
| 370 | | | | E | | | |
| 390 | | | | C | | | |
| 450 | | | E | | | | |
| 470 | | B | C | | D | | |
| 560 | B | | | D | | | |
| 680 | | D | D | | | | |
| 950 | | E | | | | | |
| 1000 | | C | | | | | |
| 1100 | E | | | | | | |
| 1200 | C | | | | | | |
| 1500 | | D | | | | | |
| 1800 | D | | | | | | |


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## STANDARD RATINGS

| CAPACITANCE AT +25 °C 120 Hz (µF) | CASE CODE | PART NUMBER | MAX. ESR AT +25 °C 120 Hz (Ω) | MAX. IMP. AT -55 °C 120 Hz (Ω) | MAX. DCL (µA) AT | | MAX. CAPACITANCE CHANGE (%) | | | AC RIPPLE +85 °C 40 kHz ($mA_{RMS}$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | +25 °C | +85 °C AND +125 °C | -55 °C | +85 °C | +125 °C | |
| **25 $V_{DC}$ AT 85 °C, 15 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 120 | A | T16A127(1)025(2)(3)(4)(5) | 1.30 | 25 | 1 | 5 | -42 | 8 | 12 | 1250 |
| 560 | B | T16B567(1)025(2)(3)(4)(5) | 0.83 | 12 | 2 | 10 | -65 | 14 | 18 | 2000 |
| 1100 | E | T16E118(1)025(2)(3)(4)(5) | 0.50 | 7 | 3 | 25 | -60 | 20 | 45 | 3200 |
| 1200 | C | T16C128(1)025(2)(3)(4)(5) | 0.65 | 7 | 5 | 20 | -70 | 15 | 20 | 2400 |
| 1800 | D | T16D188(1)025(2)(3)(4)(5) | 0.50 | 7 | 6 | 25 | -72 | 15 | 20 | 3000 |
| **30 $V_{DC}$ AT 85 °C, 20 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 100 | A | T16A107(1)030(2)(3)(4)(5) | 1.30 | 25 | 1 | 5 | -38 | 8 | 12 | 1200 |
| 470 | B | T16B477(1)030(2)(3)(4)(5) | 0.85 | 15 | 2 | 10 | -65 | 14 | 18 | 1800 |
| 680 | D | T16D687(1)030(2)(3)(4)(5) | 0.70 | 8 | 5 | 40 | -58 | 10 | 20 | 2700 |
| 950 | E | T16E957(1)030(2)(3)(4)(5) | 0.50 | 7 | 5 | 30 | -55 | 18 | 35 | 3200 |
| 1000 | C | T16C108(1)030(2)(3)(4)(5) | 0.70 | 7 | 7 | 25 | -70 | 15 | 25 | 2200 |
| 1500 | D | T16D158(1)030(2)(3)(4)(5) | 0.60 | 6 | 12 | 35 | -72 | 15 | 25 | 2900 |
| **50 $V_{DC}$ AT 85 °C, 30 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 68 | A | T16A686(1)050(2)(3)(4)(5) | 1.50 | 35 | 1 | 5 | -25 | 8 | 15 | 1050 |
| 220 | B | T16B227(1)050(2)(3)(4)(5) | 0.90 | 17.5 | 2 | 10 | -50 | 8 | 15 | 1800 |
| 450 | E | T16E457(1)050(2)(3)(4)(5) | 0.60 | 9 | 3 | 25 | -45 | 12 | 30 | 2900 |
| 470 | C | T16C477(1)050(2)(3)(4)(5) | 0.75 | 10 | 3 | 25 | -45 | 8 | 15 | 2100 |
| 680 | D | T16D687(1)050(2)(3)(4)(5) | 0.70 | 8 | 5 | 40 | -58 | 10 | 20 | 2700 |
| **60 $V_{DC}$ AT 85 °C, 40 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 47 | A | T16A476(1)060(2)(3)(4)(5) | 2.00 | 44 | 1 | 5 | -25 | 8 | 12 | 1050 |
| 150 | B | T16B157(1)060(2)(3)(4)(5) | 1.10 | 20 | 2 | 10 | -40 | 8 | 15 | 1800 |
| 370 | E | T16E377(1)060(2)(3)(4)(5) | 0.60 | 9 | 3 | 25 | -33 | 9 | 20 | 2900 |
| 390 | C | T16C397(1)060(2)(3)(4)(5) | 0.90 | 15 | 3 | 25 | -45 | 8 | 15 | 2100 |
| 560 | D | T16D567(1)060(2)(3)(4)(5) | 0.80 | 10 | 5 | 40 | -58 | 8 | 15 | 2700 |
| **75 $V_{DC}$ AT 85 °C, 50 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 33 | A | T16A336(1)075(2)(3)(4)(5) | 2.50 | 66 | 1 | 5 | -25 | 5 | 9 | 1050 |
| 110 | B | T16B117(1)075(2)(3)(4)(5) | 1.30 | 24 | 2 | 10 | -35 | 6 | 10 | 1650 |
| 220 | E | T16E227(1)075(2)(3)(4)(5) | 0.80 | 12 | 5 | 30 | -30 | 6 | 15 | 2500 |
| 250 | E | T16E257(1)075(2)(3)(4)(5) | 0.80 | 12 | 5 | 30 | -30 | 6 | 15 | 2500 |
| 330 | C | T16C337(1)075(2)(3)(4)(5) | 1.00 | 12 | 3 | 30 | -45 | 6 | 10 | 2100 |
| 470 | D | T16D477(1)075(2)(3)(4)(5) | 0.90 | 12 | 5 | 50 | -50 | 6 | 10 | 2700 |
| **100 $V_{DC}$ AT 85 °C, 65 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 15 | A | T16A156(1)100(2)(3)(4)(5) | 3.50 | 125 | 1 | 5 | -18 | 3 | 10 | 1050 |
| 68 | B | T16B686(1)100(2)(3)(4)(5) | 2.10 | 37 | 2 | 10 | -30 | 4 | 12 | 1650 |
| 120 | E | T16E127(1)100(2)(3)(4)(5) | 1.00 | 20.5 | 3 | 25 | -30 | 4 | 12 | 2200 |
| 150 | C | T16C157(1)100(2)(3)(4)(5) | 1.60 | 22 | 3 | 25 | -35 | 6 | 12 | 2100 |
| 220 | D | T16D227(1)100(2)(3)(4)(5) | 1.20 | 15 | 5 | 50 | -40 | 6 | 12 | 2700 |
| **125 $V_{DC}$ AT 85 °C, 85 $V_{DC}$ AT 125 °C** | | | | | | | | | | |
| 10 | A | T16A106(1)125(2)(3)(4)(5) | 5.50 | 175 | 1 | 5 | -15 | 3 | 10 | 1050 |
| 47 | B | T16B476(1)125(2)(3)(4)(5) | 2.30 | 47 | 2 | 10 | -25 | 5 | 12 | 1650 |
| 82 | C | T16C826(1)125(2)(3)(4)(5) | 1.80 | 40 | 3 | 25 | -35 | 5 | 12 | 1950 |
| 90 | E | T16E906(1)125(2)(3)(4)(5) | 1.30 | 25 | 5 | 25 | -25 | 4 | 15 | 2000 |
| 100 | C | T16C107(1)125(2)(3)(4)(5) | 1.80 | 35 | 3 | 25 | -35 | 5 | 12 | 2100 |
| 150 | D | T16D157(1)125(2)(3)(4)(5) | 1.60 | 20 | 5 | 50 | -35 | 6 | 12 | 2700 |

**Note**

- Part number definitions:
  (1) Capacitance tolerance: K, M
  (2) Termination / packaging: C = 100 % tin, bulk; E = standard, tin / lead, bulk; J = SMD, outside bend, tin / lead; K = SMD, outside bend, 100 % tin; L = SMD, inside bend, tin / lead; M = SMD, inside bend, 100 % tin
  (3) Reliability level: Z = standard (non-ER / 500 *g* / 50 *g* / 53.79 *g*); H = high (non-ER / 500 *g* / 80 *g* / 53.79 *g*)
  (4) Insulating sleeve: S = sleeved; U = unsleeved
  (5) ESR: S = standard


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## TYPICAL PERFORMANCE CHARACTERISTICS OF T16 CAPACITORS

| ELECTRICAL CHARACTERISTICS | |
|---|---|
| **ITEM** | **PERFORMANCE CHARACTERISTICS** |
| 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 | Reverse voltage shall be in accordance with MIL-PRF-39006, paragraphs 3.23 and 4.8.19. |
| Surge voltage | Surge voltage shall be in accordance with MIL-PRF-39006 and Table II of DLA 13017.<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.<br>After the test, the capacitors shall meet the following requirements:<br>a) DC leakage shall not exceed the specified value in catalog<br>b) Capacitance shall be within +5 %, -20 % of initial value<br>c) ESR shall not exceed the specified value in catalog |

| PERFORMANCE CHARACTERISTICS | |
|---|---|
| **ITEM** | **PERFORMANCE CHARACTERISTICS** |
| 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 |

| ENVIRONMENTAL CHARACTERISTICS | | |
|---|---|---|
| **ITEM** | **CONDITION** | **COMMENTS** |
| 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. Number of cycles: 10 continuous cycles |
| Barometric pressure (reduced) | MIL-STD-202, method 105, condition E | Altitude 150 000 feet |


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| MECHANICAL CHARACTERISTICS | | |
|---|---|---|
| **ITEM** | **CONDITION** | **COMMENTS** |
| Shock (specified pulse) | MIL-STD-202, method 213,<br>codes Z and H = test condition D (500 *g*) | The capacitors shall meet the requirements of MIL-PRF-39006. |
| Vibration, high frequency | MIL-STD-202, method 204,<br>code Z = test condition E (50 *g* peak)<br>code H = test condition H (80 *g* peak) | The capacitors shall meet the requirements of MIL-PRF-39006. |
| Random vibration | MIL-STD-202, method 214,<br>test condition II-K (53.79 *g* RMS) | 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 300 cycles. |
| Solderability | MIL-STD-202, method 208,<br>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 µF), capacitance tolerance letter, rated voltage, date code, lot symbol and Vishay trademark. |

| SELECTOR GUIDES | |
|---|---|
| Tantalum Selector Guide | www.vishay.com/doc?49054 |
| Parameter Comparison Guide | www.vishay.com/doc?42088 |


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