

# Solid Tantalum Surface Mount Chip Capacitors

## TANTAMOUNT<sup>®</sup>, Molded Case, for Medical Instruments



### PERFORMANCE / ELECTRICAL CHARACTERISTICS

[www.vishay.com/doc?40209](http://www.vishay.com/doc?40209)

**Operating Temperature:** -55 °C to +125 °C  
(above 85 °C, voltage derating is required)

**Capacitance Range:** 1 µF to 220 µF

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

**Voltage Rating:** 4 V<sub>DC</sub> to 20 V<sub>DC</sub>

### FEATURES

- **For non-life support medical applications**
- High reliability
- Weibull grading options
- DC leakage at 0.005 CV
- 100 % surge current tested (B, C, D, E cases)
- Terminations: 100 % matte tin and tin / lead
- Standard EIA 535BAAC case sizes (A through E)
- Manufacturing location is certified to medical standard ISO 13485
- Compliant terminations
- Dry pack as per IPC / JEDEC<sup>®</sup> J-STD-033 standard
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS\***  
Available

**HALOGEN  
FREE**  
**GREEN**  
(5-2008)  
Available

### Note

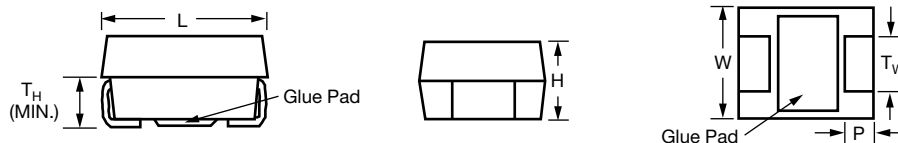
\* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

### ORDERING INFORMATION

| TM3  | C                                 | 226                                                                                                                            | K                        | 6R3                                                                                                                                                    | C                                                                                                                                                                                                                                   | B                                                                                          | A                                                                 |
|------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| TYPE | CASE CODE                         | CAPACITANCE                                                                                                                    | CAPACITANCE TOLERANCE    | DC VOLTAGE RATING AT +85 °C                                                                                                                            | TERMINATION AND PACKAGING                                                                                                                                                                                                           | RELIABILITY LEVEL                                                                          | SURGE CURRENT                                                     |
|      | 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. A decimal point is indicated by an "R" (6R3 = 6.3 V). | C: matte tin, 7" (178 mm) reel<br>H: matte tin, 7" (178 mm) ½ reel<br>E: tin / lead, 7" (178 mm) reel<br>L: tin / lead, 7" (178 mm) ½ reel<br>V: matte tin, 7" (178 mm) reel, dry pack<br>T: tin / lead, 7" (178 mm) reel, dry pack | B = 0.1 % Weibull FRL<br>S = hi-rel std. (40 h burn-in)<br>Z = non-established reliability | A = 10 cycles at +25 °C, 1.1 RV<br>Z = no surge (for A case only) |

### Note

- Dry pack as specified in J-STD-033 for MSL3. Applicable for D and E cases only.

**DIMENSIONS** in inches (millimeters)


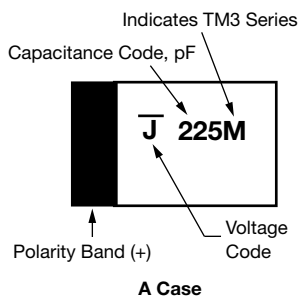
| CASE CODE | EIA SIZE | L                             | W                             | H                             | P                              | T <sub>W</sub>                | T <sub>H</sub> (MIN.) |
|-----------|----------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|-------------------------------|-----------------------|
| A         | 3216-18  | 0.126 ± 0.008<br>[3.2 ± 0.20] | 0.063 ± 0.008<br>[1.6 ± 0.20] | 0.063 ± 0.008<br>[1.6 ± 0.20] | 0.031 ± 0.012<br>[0.80 ± 0.30] | 0.047 ± 0.004<br>[1.2 ± 0.10] | 0.028<br>[0.70]       |
| B         | 3528-21  | 0.138 ± 0.008<br>[3.5 ± 0.20] | 0.110 ± 0.008<br>[2.8 ± 0.20] | 0.075 ± 0.008<br>[1.9 ± 0.20] | 0.031 ± 0.012<br>[0.80 ± 0.30] | 0.087 ± 0.004<br>[2.2 ± 0.10] | 0.028<br>[0.70]       |
| C         | 6032-28  | 0.236 ± 0.012<br>[6.0 ± 0.30] | 0.126 ± 0.012<br>[3.2 ± 0.30] | 0.098 ± 0.012<br>[2.5 ± 0.30] | 0.051 ± 0.012<br>[1.3 ± 0.30]  | 0.087 ± 0.004<br>[2.2 ± 0.10] | 0.039<br>[1.0]        |
| D         | 7343-31  | 0.287 ± 0.012<br>[7.3 ± 0.30] | 0.169 ± 0.012<br>[4.3 ± 0.30] | 0.110 ± 0.012<br>[2.8 ± 0.30] | 0.051 ± 0.012<br>[1.3 ± 0.30]  | 0.094 ± 0.004<br>[2.4 ± 0.10] | 0.039<br>[1.0]        |
| E         | 7343-43  | 0.287 ± 0.012<br>[7.3 ± 0.30] | 0.169 ± 0.012<br>[4.3 ± 0.30] | 0.157 ± 0.012<br>[4.0 ± 0.30] | 0.051 ± 0.012<br>[1.3 ± 0.30]  | 0.094 ± 0.004<br>[2.4 ± 0.10] | 0.039<br>[1.0]        |

**Note**

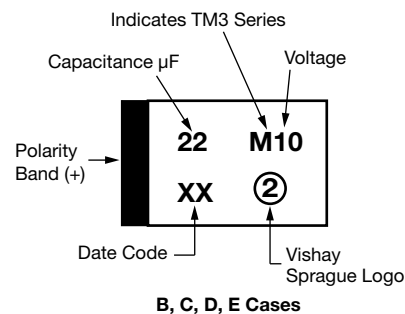
- Glue pad (non-conductive, part of molded case) is dedicated for glue attachment (as user option).

**RATINGS AND CASE CODES**

| μF  | 4 V   | 6.3 V     | 10 V      | 16 V      | 20 V  |
|-----|-------|-----------|-----------|-----------|-------|
| 1.0 |       |           |           | A         |       |
| 1.5 |       |           | A         | A         |       |
| 2.2 |       | A         | A         | A / B     | B     |
| 3.3 |       | A         | A         | A / B     | B     |
| 4.7 |       |           | A / B     | A / B     | C     |
| 6.8 |       | B         | B         | B         | B / C |
| 10  |       | A / B     | A / B     | B / C     | C     |
| 15  |       |           | B / C     | B / C     |       |
| 22  |       | A / B / C | B / C     | B / C / D | C / D |
| 33  |       | B         | B / C / D | D         | D     |
| 47  |       | B / C / D | C / D     | C / D     | E     |
| 68  | B     | D         | D         | D         |       |
| 100 | D     | D         | D         | D / E     |       |
| 150 | D     | D         |           |           |       |
| 220 | D / E | D / E     | E         |           |       |

**MARKING**

**"A" CASE VOLTAGE CODE**

| VOLTS | CODE |
|-------|------|
| 4.0   | G    |
| 6.3   | J    |
| 10    | A    |
| 16    | C    |
| 20    | D    |
| 25    | E    |
| 35    | V    |
| 50    | T    |


**Marking**

Capacitor marking includes an anode (+) polarity band, capacitance in microfarads and the voltage rating. "A" case capacitors use a letter code for the voltage and EIA capacitance code.

The Vishay Sprague® trademark is included if space permits. Capacitors rated at 6.3 V are marked 6 V.

A manufacturing date code is marked on all capacitors.

Call the factory for further explanation.



| 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<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 4 V <sub>DC</sub> AT +85 °C; 2.7 V <sub>DC</sub> AT +125 °C |           |                      |                                     |                                       |                                                  |                                            |
| 68                                                          | B         | TM3B686(1)004(2)(3)A | 1.36                                | 6                                     | 1.90                                             | 0.21                                       |
| 100                                                         | D         | TM3D107(1)004(4)(3)A | 2.00                                | 6                                     | 0.70                                             | 0.46                                       |
| 150                                                         | D         | TM3D157(1)004(4)(3)A | 3.00                                | 8                                     | 0.60                                             | 0.50                                       |
| 220                                                         | D         | TM3D227(1)004(4)(3)A | 4.40                                | 8                                     | 0.60                                             | 0.50                                       |
| 220                                                         | E         | TM3E227(1)004(4)(3)A | 4.40                                | 8                                     | 0.50                                             | 0.57                                       |
| 6.3 V <sub>DC</sub> AT +85 °C; 4 V <sub>DC</sub> AT +125 °C |           |                      |                                     |                                       |                                                  |                                            |
| 2.2                                                         | A         | TM3A225(1)6R3(2)(3)Z | 0.25                                | 6                                     | 7.60                                             | 0.10                                       |
| 3.3                                                         | A         | TM3A335(1)6R3(2)(3)Z | 0.25                                | 6                                     | 6.30                                             | 0.11                                       |
| 6.8                                                         | B         | TM3B685(1)6R3(2)(3)A | 0.25                                | 6                                     | 3.40                                             | 0.16                                       |
| 10                                                          | A         | TM3A106(1)6R3(2)(3)Z | 0.32                                | 6                                     | 3.40                                             | 0.15                                       |
| 10                                                          | B         | TM3B106(1)6R3(2)(3)A | 0.30                                | 6                                     | 2.90                                             | 0.17                                       |
| 22                                                          | A         | TM3A226(1)6R3(2)(3)Z | 0.66                                | 6                                     | 2.90                                             | 0.16                                       |
| 22                                                          | B         | TM3B226(1)6R3(2)(3)A | 0.69                                | 6                                     | 2.00                                             | 0.21                                       |
| 22                                                          | C         | TM3C226(1)6R3(2)(3)A | 0.66                                | 6                                     | 1.80                                             | 0.25                                       |
| 33                                                          | B         | TM3B336(1)6R3(2)(3)A | 0.99                                | 6                                     | 1.90                                             | 0.21                                       |
| 47                                                          | B         | TM3B476(1)6R3(2)(3)A | 1.41                                | 6                                     | 1.90                                             | 0.21                                       |
| 47                                                          | C         | TM3C476(1)6R3(2)(3)A | 1.41                                | 6                                     | 1.40                                             | 0.28                                       |
| 47                                                          | D         | TM3D476(1)6R3(4)(3)A | 1.41                                | 6                                     | 0.80                                             | 0.43                                       |
| 68                                                          | D         | TM3D686(1)6R3(4)(3)A | 2.04                                | 6                                     | 0.70                                             | 0.46                                       |
| 100                                                         | D         | TM3D107(1)6R3(4)(3)A | 3.00                                | 6                                     | 0.14                                             | 1.04                                       |
| 150                                                         | D         | TM3D157(1)6R3(4)(3)A | 4.50                                | 8                                     | 0.60                                             | 0.50                                       |
| 220                                                         | D         | TM3D227(1)6R3(4)(3)A | 6.60                                | 8                                     | 0.60                                             | 0.50                                       |
| 220                                                         | E         | TM3E227(1)6R3(4)(3)A | 6.60                                | 8                                     | 0.50                                             | 0.57                                       |
| 10 V <sub>DC</sub> AT +85 °C; 7 V <sub>DC</sub> AT +125 °C  |           |                      |                                     |                                       |                                                  |                                            |
| 1.5                                                         | A         | TM3A155(1)010(2)(3)Z | 0.25                                | 6                                     | 8.00                                             | 0.10                                       |
| 2.2                                                         | A         | TM3A225(1)010(2)(3)Z | 0.25                                | 6                                     | 6.30                                             | 0.11                                       |
| 3.3                                                         | A         | TM3A335(1)010(2)(3)Z | 0.25                                | 6                                     | 5.50                                             | 0.12                                       |
| 4.7                                                         | A         | TM3A475(1)010(2)(3)Z | 0.25                                | 6                                     | 5.00                                             | 0.12                                       |
| 4.7                                                         | B         | TM3B475(1)010(2)(3)A | 0.25                                | 6                                     | 3.40                                             | 0.16                                       |
| 6.8                                                         | B         | TM3B685(1)010(2)(3)A | 0.34                                | 6                                     | 2.90                                             | 0.17                                       |
| 10                                                          | A         | TM3A106(1)010(2)(3)Z | 0.50                                | 6                                     | 3.40                                             | 0.15                                       |
| 10                                                          | B         | TM3B106(1)010(2)(3)A | 0.50                                | 6                                     | 2.50                                             | 0.18                                       |
| 15                                                          | B         | TM3B156(1)010(2)(3)A | 0.75                                | 6                                     | 2.00                                             | 0.21                                       |
| 15                                                          | C         | TM3C156(1)010(2)(3)A | 0.75                                | 6                                     | 1.80                                             | 0.25                                       |
| 22                                                          | B         | TM3B226(1)010(2)(3)A | 1.10                                | 6                                     | 1.90                                             | 0.21                                       |
| 22                                                          | C         | TM3C226(1)010(2)(3)A | 1.10                                | 6                                     | 0.35                                             | 0.56                                       |
| 33                                                          | B         | TM3B336(1)010(2)(3)A | 1.65                                | 6                                     | 1.90                                             | 0.21                                       |
| 33                                                          | C         | TM3C336(1)010(2)(3)A | 1.65                                | 6                                     | 1.40                                             | 0.28                                       |
| 33                                                          | D         | TM3D336(1)010(4)(3)A | 1.65                                | 6                                     | 0.80                                             | 0.43                                       |
| 47                                                          | C         | TM3C476(1)010(2)(3)A | 2.35                                | 6                                     | 1.10                                             | 0.32                                       |
| 47                                                          | D         | TM3D476(1)010(4)(3)A | 2.35                                | 6                                     | 0.70                                             | 0.46                                       |
| 68                                                          | D         | TM3D686(1)010(4)(3)A | 3.40                                | 6                                     | 0.70                                             | 0.46                                       |
| 100                                                         | D         | TM3D107(1)010(4)(3)A | 5.00                                | 6                                     | 0.60                                             | 0.50                                       |
| 220                                                         | E         | TM3E227(1)010(4)(3)A | 11.00                               | 8                                     | 0.50                                             | 0.57                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance: K, M
  - Termination and packaging: C, E, H, L
  - Reliability level: B, S, Z
  - Termination and packaging: C, E, H, L, V, T



| 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<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>( $\Omega$ ) | MAX. RIPPLE<br>100 kHz<br>$I_{RMS}$<br>(A) |
| 16 V <sub>DC</sub> AT +85 °C; 10 V <sub>DC</sub> AT +125 °C |           |                      |                                     |                                       |                                                  |                                            |
| 1.0                                                         | A         | TM3A105(1)016(2)(3)Z | 0.25                                | 4                                     | 9.30                                             | 0.09                                       |
| 1.5                                                         | A         | TM3A155(1)016(2)(3)Z | 0.25                                | 6                                     | 6.70                                             | 0.11                                       |
| 2.2                                                         | A         | TM3A225(1)016(2)(3)Z | 0.25                                | 6                                     | 4.00                                             | 11.00                                      |
| 2.2                                                         | B         | TM3B225(1)016(2)(3)A | 0.25                                | 6                                     | 4.60                                             | 0.14                                       |
| 3.3                                                         | A         | TM3A335(1)016(2)(3)Z | 0.26                                | 6                                     | 3.50                                             | 0.15                                       |
| 3.3                                                         | B         | TM3B335(1)016(2)(3)A | 0.26                                | 6                                     | 3.50                                             | 0.16                                       |
| 4.7                                                         | A         | TM3A475(1)016(2)(3)Z | 0.38                                | 6                                     | 5.00                                             | 0.12                                       |
| 4.7                                                         | B         | TM3B475(1)016(2)(3)A | 0.38                                | 6                                     | 2.90                                             | 0.17                                       |
| 6.8                                                         | B         | TM3B685(1)016(2)(3)A | 0.54                                | 6                                     | 2.50                                             | 0.18                                       |
| 10                                                          | B         | TM3B106(1)016(2)(3)A | 0.80                                | 6                                     | 2.00                                             | 0.21                                       |
| 10                                                          | C         | TM3C106(1)016(2)(3)A | 0.80                                | 6                                     | 1.80                                             | 0.25                                       |
| 15                                                          | B         | TM3B156(1)016(2)(3)A | 1.20                                | 6                                     | 2.00                                             | 0.21                                       |
| 15                                                          | C         | TM3C156(1)016(2)(3)A | 1.20                                | 6                                     | 0.40                                             | 0.52                                       |
| 22                                                          | B         | TM3B226(1)016(2)(3)A | 1.76                                | 6                                     | 1.90                                             | 0.21                                       |
| 22                                                          | C         | TM3C226(1)016(2)(3)A | 1.76                                | 6                                     | 1.40                                             | 0.28                                       |
| 22                                                          | D         | TM3D226(1)016(4)(3)A | 1.76                                | 6                                     | 0.80                                             | 0.43                                       |
| 33                                                          | D         | TM3D336(1)016(4)(3)A | 2.64                                | 6                                     | 0.70                                             | 0.46                                       |
| 47                                                          | C         | TM3C476(1)016(2)(3)A | 3.76                                | 6                                     | 1.00                                             | 0.33                                       |
| 47                                                          | D         | TM3D476(1)016(4)(3)A | 3.76                                | 6                                     | 0.70                                             | 0.46                                       |
| 68                                                          | D         | TM3D686(1)016(4)(3)A | 5.44                                | 6                                     | 0.60                                             | 0.50                                       |
| 100                                                         | D         | TM3D107(1)016(4)(3)A | 8.00                                | 8                                     | 0.60                                             | 0.50                                       |
| 100                                                         | E         | TM3E107(1)016(4)(3)A | 8.00                                | 8                                     | 0.60                                             | 0.52                                       |
| 20 V <sub>DC</sub> AT +85 °C; 13 V <sub>DC</sub> AT +125 °C |           |                      |                                     |                                       |                                                  |                                            |
| 2.2                                                         | B         | TM3B225(1)020(2)(3)A | 0.25                                | 6                                     | 3.50                                             | 0.16                                       |
| 3.3                                                         | B         | TM3B335(1)020(2)(3)A | 0.33                                | 6                                     | 3.00                                             | 0.17                                       |
| 4.7                                                         | C         | TM3C475(1)020(2)(3)A | 0.47                                | 6                                     | 2.30                                             | 0.22                                       |
| 6.8                                                         | B         | TM3B685(1)020(2)(3)A | 0.68                                | 6                                     | 2.50                                             | 0.18                                       |
| 6.8                                                         | C         | TM3C685(1)020(2)(3)A | 0.68                                | 6                                     | 1.90                                             | 0.24                                       |
| 10                                                          | C         | TM3C106(1)020(2)(3)A | 1.00                                | 6                                     | 1.70                                             | 0.25                                       |
| 22                                                          | C         | TM3C226(1)020(2)(3)A | 2.20                                | 6                                     | 1.10                                             | 0.32                                       |
| 22                                                          | D         | TM3D226(1)020(4)(3)A | 2.20                                | 6                                     | 0.70                                             | 0.46                                       |
| 33                                                          | D         | TM3D336(1)020(4)(3)A | 3.30                                | 6                                     | 0.70                                             | 0.46                                       |
| 47                                                          | E         | TM3E476(1)020(4)(3)A | 4.70                                | 6                                     | 0.60                                             | 0.52                                       |

**Note**

- Part number definitions:
  - Capacitance tolerance: K, M
  - Termination and packaging: C, E, H, L
  - Reliability level: B, S, Z
  - Termination and packaging: C, E, H, L, V, T

**RECOMMENDED VOLTAGE DERATING GUIDELINES** (for temperatures below +85 °C)**STANDARD CONDITIONS. FOR EXAMPLE: OUTPUT FILTERS**

| Capacitor Voltage Rating | Operating Voltage |
|--------------------------|-------------------|
| 4.0                      | 2.5               |
| 6.3                      | 3.3               |
| 10                       | 5.0               |
| 16                       | 8.0               |
| 20                       | 10                |

**SEVERE CONDITIONS. FOR EXAMPLE: INPUT FILTERS**

| Capacitor Voltage Rating | Operating Voltage |
|--------------------------|-------------------|
| 4.0                      | 2.5               |
| 6.3                      | 3.6               |
| 10                       | 6.0               |
| 16                       | 10                |
| 20                       | 12                |

**POWER DISSIPATION**

| CASE CODE | MAXIMUM PERMISSIBLE POWER DISSIPATION AT +25 °C (W) IN FREE AIR |
|-----------|-----------------------------------------------------------------|
| A         | 0.075                                                           |
| B         | 0.085                                                           |
| C         | 0.110                                                           |
| D         | 0.150                                                           |
| E         | 0.165                                                           |

**STANDARD PACKAGING QUANTITY**

| CASE CODE | UNITS PER REEL |              |
|-----------|----------------|--------------|
|           | 7" FULL REEL   | 7" HALF REEL |
| A         | 2000           | 1000         |
| B         | 2000           | 1000         |
| C         | 500            | 250          |
| D         | 500            | 250          |
| E         | 400            | 200          |

**PRODUCT INFORMATION**

|                                      |                                                                        |
|--------------------------------------|------------------------------------------------------------------------|
| Guide for Molded Tantalum Capacitors | <a href="http://www.vishay.com/doc?40074">www.vishay.com/doc?40074</a> |
| Pad Dimensions                       |                                                                        |
| Packaging Dimensions                 |                                                                        |
| Moisture Sensitivity                 | <a href="http://www.vishay.com/doc?40135">www.vishay.com/doc?40135</a> |
| <b>SELECTOR GUIDES</b>               |                                                                        |
| Solid Tantalum Selector Guide        | <a href="http://www.vishay.com/doc?49053">www.vishay.com/doc?49053</a> |
| Solid Tantalum Chip Capacitors       | <a href="http://www.vishay.com/doc?40091">www.vishay.com/doc?40091</a> |
| <b>FAQ</b>                           |                                                                        |
| Frequently Asked Questions           | <a href="http://www.vishay.com/doc?40110">www.vishay.com/doc?40110</a> |

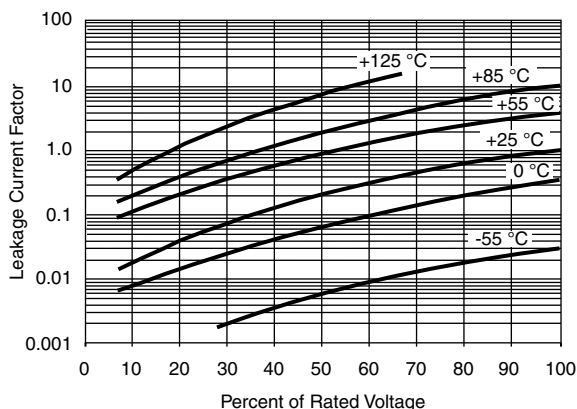


## COTS Tantalum Capacitors

| ELECTRICAL PERFORMANCE CHARACTERISTICS               |                                                                                                                                                                                                                                                                                                                                                                                           |                          |                             |                          |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------|--------------------------|
| ITEM                                                 | PERFORMANCE CHARACTERISTICS                                                                                                                                                                                                                                                                                                                                                               |                          |                             |                          |
| Category temperature range                           | -55 °C to +85 °C (to +125 °C with voltage derating)                                                                                                                                                                                                                                                                                                                                       |                          |                             |                          |
| Capacitance tolerance                                | ± 20 %, ± 10 %, tested via bridge method, at 25 °C, 120 Hz                                                                                                                                                                                                                                                                                                                                |                          |                             |                          |
| Dissipation factor                                   | Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz                                                                                                                                                                                                                                                                                                              |                          |                             |                          |
| ESR                                                  | Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 100 kHz                                                                                                                                                                                                                                                                                                             |                          |                             |                          |
| Leakage current                                      | After application of rated voltage applied to capacitors for 5 min using a steady source of power with 1 kΩ resistor in series with the capacitor under test, leakage current at 25 °C is not more than 0.01 CV or 0.5 μA, whichever is greater. <i>Note that the leakage current varies with temperature and applied voltage. See graph below for the appropriate adjustment factor.</i> |                          |                             |                          |
| Capacitance change by temperature                    | +15 % max. (at +125 °C)<br>+10 % max. (at +85 °C)<br>-10 % max. (at -55 °C)                                                                                                                                                                                                                                                                                                               |                          |                             |                          |
| Reverse voltage                                      | Capacitors are capable of withstanding peak voltages in the reverse direction equal to:<br>10 % of the DC rating at +25 °C<br>5 % of the DC rating at +85 °C<br>1 % of the DC rating at +125 °C<br>Vishay does not recommend intentional or repetitive application of reverse voltage.                                                                                                    |                          |                             |                          |
| Ripple current                                       | For maximum ripple current values (at 25 °C) refer to relevant datasheet. If capacitors are to be used at temperatures above +25 °C, the permissible RMS ripple current (or voltage) shall be calculated using the derating factors:<br>1.0 at +25 °C<br>0.9 at +85 °C<br>0.4 at +125 °C                                                                                                  |                          |                             |                          |
| Maximum operating and surge voltages vs. temperature | +85 °C                                                                                                                                                                                                                                                                                                                                                                                    |                          | +125 °C                     |                          |
|                                                      | <b>RATED VOLTAGE (V)</b>                                                                                                                                                                                                                                                                                                                                                                  | <b>SURGE VOLTAGE (V)</b> | <b>CATEGORY VOLTAGE (V)</b> | <b>SURGE VOLTAGE (V)</b> |
|                                                      | 4.0                                                                                                                                                                                                                                                                                                                                                                                       | 5.2                      | 2.7                         | 3.4                      |
|                                                      | 6.3                                                                                                                                                                                                                                                                                                                                                                                       | 8.0                      | 4.0                         | 5.0                      |
|                                                      | 10                                                                                                                                                                                                                                                                                                                                                                                        | 13                       | 7.0                         | 8.0                      |
|                                                      | 16                                                                                                                                                                                                                                                                                                                                                                                        | 20                       | 10                          | 12                       |
|                                                      | 20                                                                                                                                                                                                                                                                                                                                                                                        | 26                       | 13                          | 16                       |
|                                                      | 25                                                                                                                                                                                                                                                                                                                                                                                        | 32                       | 17                          | 20                       |
|                                                      | 35                                                                                                                                                                                                                                                                                                                                                                                        | 46                       | 23                          | 28                       |
|                                                      | 40                                                                                                                                                                                                                                                                                                                                                                                        | 52                       | 26                          | 31                       |
|                                                      | 50                                                                                                                                                                                                                                                                                                                                                                                        | 65                       | 33                          | 40                       |
|                                                      | 50 <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                         | 60                       | 33                          | 40                       |
|                                                      | 63                                                                                                                                                                                                                                                                                                                                                                                        | 75                       | 42                          | 50                       |
|                                                      | 75                                                                                                                                                                                                                                                                                                                                                                                        | 75                       | 50                          | 50                       |

## Notes

- All information presented in this document reflects typical performance characteristics
- <sup>(1)</sup> Capacitance value 15 μF and higher

**TYPICAL LEAKAGE CURRENT - TEMPERATURE FACTOR****Notes**

- At +25 °C, the leakage current shall not exceed the value listed in the Standard Ratings table.
- At +85 °C, the leakage current shall not exceed 10 times the value listed in the Standard Ratings table.
- At +125 °C, the leakage current shall not exceed 12 times the value listed in the Standard Ratings table.

**ENVIRONMENTAL PERFORMANCE CHARACTERISTICS**

| ITEM                                   | CONDITION                                                                                                                                                                 | POST TEST PERFORMANCE                                                                                                                                                                                                                                                                                                 |                                                                                                                      |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Surge voltage                          | MIL-PRF-55365<br>1000 successive test cycles at 85 °C of surge voltage (as specified in the table above), in series with a 33 Ω resistor at the rate of 30 s ON, 30 s OFF | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                                                                                                                                           | Within ± 10 % of initial value<br>Initial specified limit<br>Initial specified limit                                 |
| Life test at +85 °C                    | MIL-STD-202, method 108<br>1000 h application of rated voltage at 85 °C                                                                                                   | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                                                                                                                                           | Within ± 10 % of initial value<br>Initial specified limit<br>Shall not exceed 125 % of initial limit                 |
| Life test at +125 °C                   | MIL-STD-202, method 108<br>1000 h application 2/3 of rated voltage at 125 °C                                                                                              | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                                                                                                                                           | Within ± 10 % of initial value<br>Initial specified limit<br>Shall not exceed 125 % of initial limit                 |
| Moisture resistance                    | MIL-STD-202, method 106 at rated voltage, 20 cycles                                                                                                                       | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                                                                                                                                           | Within ± 15 % of initial value<br>Shall not exceed 150 % of initial limit<br>Shall not exceed 200 % of initial limit |
| Stability at low and high temperatures | MIL-PRF-55365                                                                                                                                                             | Delta cap limit at -55 °C, 85 °C is ± 10 % of initial value<br>Delta cap limit at 125 °C is ± 15 % of initial value<br>Delta cap at step 3 and final step 25 °C is ± 10 %<br>DCL at 85 °C: 10 x initial specified value<br>DCL at 125 °C: 12 x initial specified value<br>DCL at 25 °C: initial specified value at RV |                                                                                                                      |
| Thermal shock                          | MIL-STD-202, method 107<br>At -55 °C / +125 °C, for 5 cycles, 30 min at each temperature                                                                                  | Capacitance change<br>Dissipation factor<br>Leakage current                                                                                                                                                                                                                                                           | Within ± 10 % of initial value<br>Initial specified limit<br>Initial specified limit                                 |



| MECHANICAL PERFORMANCE CHARACTERISTICS |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                         |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ITEM                                   | CONDITION                                                                                                                                                                                                                                                         | POST TEST PERFORMANCE                                                                                                                                                                                                                                   |
| Terminal strength / Shear force test   | Apply a pressure load of 5 N for 10 s $\pm$ 1 s horizontally to the center of capacitor side body                                                                                                                                                                 | Capacitance change      Within $\pm$ 10 % of initial value<br>Dissipation factor      Initial specified limit<br>Leakage current          Initial specified limit<br><br>There shall be no mechanical or visual damage to capacitors post-conditioning. |
| Vibration                              | MIL-STD-202, method 204, condition D, 10 Hz to 2000 Hz, 20 g peak, 8 h, at rated voltage                                                                                                                                                                          | Electrical measurements are not applicable, since the same parts are used for shock (specified pulse) test.<br><br>There shall be no mechanical or visual damage to capacitors post-conditioning.                                                       |
| Shock (specified pulse)                | MIL-STD-202, method 213, condition I, 100 g peak                                                                                                                                                                                                                  | Capacitance change      Within $\pm$ 10 % of initial value<br>Dissipation factor      Initial specified limit<br>Leakage current          Initial specified limit<br><br>There shall be no mechanical or visual damage to capacitors post-conditioning. |
| Resistance to soldering heat           | MIL-STD-202, method 210, condition J (leadbearing capacitors) and K (lead (Pb)-free capacitors), one heat cycle                                                                                                                                                   | Capacitance change      Within $\pm$ 10 % of initial value<br>Dissipation factor      Initial specified limit<br>Leakage current          Initial specified limit                                                                                       |
| Solderability                          | MIL-STD-202, method 208, ANSI/J-STD-002, test B (leadbearing) and B1 (lead (Pb)-free). Preconditioning per category C (category E - optional). Does not apply to gold terminations. Lead (Pb)-free and leadbearing capacitors are backward and forward compatible | Solder coating of all capacitors shall meet specified requirements.<br><br>There shall be no mechanical or visual damage to capacitors post-conditioning.                                                                                               |
| Resistance to solvents                 | MIL-STD-202, method 215                                                                                                                                                                                                                                           | There shall be no mechanical or visual damage to capacitors post-conditioning. Body marking shall remain legible.                                                                                                                                       |
| Flammability                           | Encapsulation materials meet UL 94 V-0 with an oxygen index of 32 %                                                                                                                                                                                               |                                                                                                                                                                                                                                                         |





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