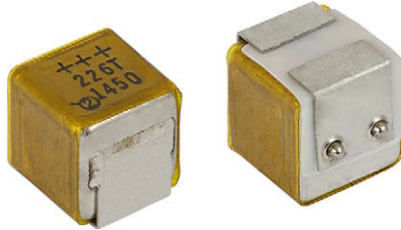


## Solid Tantalum SMD Capacitors TANTAMOUNT™, Hi-Rel COTS, Low ESR, Metal Case



### PERFORMANCE CHARACTERISTICS

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

**Capacitance Range:** 22 µF to 330 µF

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

**Voltage Rating:** 16 V<sub>DC</sub> to 50 V<sub>DC</sub>

### FEATURES

- High reliability; burn-in at a minimum of rated DC voltage for a minimum of 40 h
- Surge current testing per MIL-PRF-55365 option available
- Low ESR
- Lead (Pb)-free terminations available (tin / lead terminations are under development)
- Mounting: surface mount
- 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 |                                  |  |                          |  |   |                                |   |
|----------------------|----------------------------------|--|--------------------------|--|---|--------------------------------|---|
| T25                  | D                                | 226  | K                        | 050  | E   | S                              | A   |
| TYPE                 | CASE CODE                        | CAPACITANCE  | CAPACITANCE TOLERANCE    | DC VOLTAGE RATING AT +85 °C  | TERMINATION / PACKAGING<br>(available options are series dependent)   | RELIABILITY GRADE              | SURGE CURRENT OPTION  |
|                      | See Ratings and Case Codes table | This is expressed in pF. 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 = 100 % tin / 7" (178 mm), reel<br>H = 100 % tin / 7" (178 mm), 1/2 reel<br>E = Sn / Pb solder / 7" (178 mm) reel<br>L = Sn / Pb solder / 7" (178 mm), 1/2 reel | S = 40 h burn-in<br>Z = non ER | A = 10 cycles at +25 °C<br>B = 10 cycles at -55 °C / +85 °C<br>C = 10 cycles at -55 °C / +85 °C (before burn-in)<br>S = 3 cycles at 25 °C<br>Z = no surge current |

| DIMENSIONS in inches [millimeters] |                |                              |                              |                              |                              |                              |                    |
|------------------------------------|----------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------------------|
|                                    |                |                              |                              |                              |                              |                              |                    |
| CASE CODE                          | L (MAX.)       | L1                           | W                            | H                            | P                            | T <sub>w</sub>               | WEIGHT g (AVERAGE) |
| D                                  | 0.326<br>[8.5] | 0.283 ± 0.008<br>[7.2 ± 0.2] | 0.275 ± 0.008<br>[7.0 ± 0.2] | 0.291 ± 0.008<br>[7.4 ± 0.2] | 0.098 ± 0.008<br>[2.5 ± 0.2] | 0.197 ± 0.008<br>[5.0 ± 0.2] | 1.80               |

| RATINGS AND CASE CODES |      |                  |                  |                  |      |
|------------------------|------|------------------|------------------|------------------|------|
| μF                     | 16 V | 20 V             | 25 V             | 35 V             | 50 V |
| 22                     |      |                  |                  |                  | D    |
| 33                     |      |                  |                  |                  |      |
| 47                     |      |                  |                  |                  |      |
| 68                     |      |                  |                  | D <sup>(1)</sup> |      |
| 100                    |      |                  | D <sup>(1)</sup> |                  |      |
| 150                    |      |                  |                  |                  |      |
| 220                    |      | D <sup>(1)</sup> |                  |                  |      |
| 330                    | D    |                  |                  |                  |      |

**Note**

<sup>(1)</sup> Preliminary values, contact factory for availability

| MARKING |              |      |
|---------|--------------|------|
|         | VOLTAGE CODE |      |
|         | V            | CODE |
|         | 16           | C    |
|         | 20           | D    |
|         | 25           | E    |
|         | 35           | V    |
| 50      | T            |      |

| STANDARD RATINGS   |                  |                        |                         |                       |                                 |  |
|--|------------------|------------------------|-------------------------|-----------------------|---------------------------------|--|
| CAPACITANCE (μF)   | CASE CODE        | PART NUMBER            | MAX. DCL AT +25 °C (μA) | MAX. DF AT +25 °C (%) | MAX. ESR AT +25 °C 100 kHz (mΩ) | MAX. RIPPLE 100 kHz I <sub>RMS</sub> (A) |
| <b>16 V<sub>DC</sub> AT +85 °C; 10 V<sub>DC</sub> AT +125 °C</b> |                  |                        |                         |                       |                                 |  |
| 330  | D                | T25D337(1)016(2)(3)(4) | 52.8                    | 14                    | 180                             | 1.5                                      |
| <b>20 V<sub>DC</sub> AT +85 °C; 13 V<sub>DC</sub> AT +125 °C</b> |                  |                        |                         |                       |                                 |  |
| 220  | D <sup>(1)</sup> | T25D227(1)020(2)(3)(4) |                         | In development        |                                 |  |
| <b>25 V<sub>DC</sub> AT +85 °C; 17 V<sub>DC</sub> AT +125 °C</b> |                  |                        |                         |                       |                                 |  |
| 100  | D <sup>(1)</sup> | T25D107(1)025(2)(3)(4) |                         | In development        |                                 |  |
| <b>35 V<sub>DC</sub> AT +85 °C; 23 V<sub>DC</sub> AT +125 °C</b> |                  |                        |                         |                       |                                 |  |
| 68   | D <sup>(1)</sup> | T25D686(1)035(2)(3)(4) |                         | In development        |                                 |  |
| <b>50 V<sub>DC</sub> AT +85 °C; 33 V<sub>DC</sub> AT +125 °C</b> |                  |                        |                         |                       |                                 |  |
| 22   | D                | T25D226(1)050(2)(3)(4) | 11                      | 6                     | 500                             | 0.9                                      |

**Notes**

- Part number definitions:
  - Capacitance tolerance: K, M
  - Termination and packaging: C, H, E, L
  - Reliability level: S, Z
  - Surge current: A, B, S, C, Z
- <sup>(1)</sup> Rating in development, contact factory for availability



| VOLTAGE DERATING GUIDELINES (below +85 °C) |                             |
|--|-----------------------------|
| VOLTAGE RAIL (V)                           | CAPACITOR RATED VOLTAGE (V) |
| 3.3  | 6.3                         |
| 5  | 10                          |
| 10   | 20                          |
| 12   | 25                          |
| 15   | 35                          |
| ≥ 24                                       | 50 or series configuration  |

**Note**

- For more information about recommended voltage derating see technical note [www.vishay.com/doc?40246](http://www.vishay.com/doc?40246)

| CARRIER TAPE DIMENSIONS in inches [millimeters] |           |                   |                               |                     |                     |
|---|-----------|-------------------|-------------------------------|---------------------|---------------------|
| TYPE  | CASE CODE | TAPE WIDTH W (mm) | P <sub>1</sub>                | K <sub>0</sub> MAX. | B <sub>1</sub> MAX. |
| T25   | D         | 16                | 0.476 ± 0.004<br>[12.0 ± 0.1] | 0.3<br>[7.86]       | 0.45<br>[11.3]      |

| POWER DISSIPATION |   |
|-------------------|---|
| CASE CODE         | MAXIMUM PERMISSIBLE POWER DISSIPATION AT +25 °C (W) IN FREE AIR |
| D                 | 0.408   |

| STANDARD PACKAGING QUANTITY |                |              |
|-----------------------------|----------------|--------------|
| CASE CODE                   | UNITS PER REEL |              |
|                             | 7" FULL REEL   | 7" HALF REEL |
| D                           | 100            | 50           |

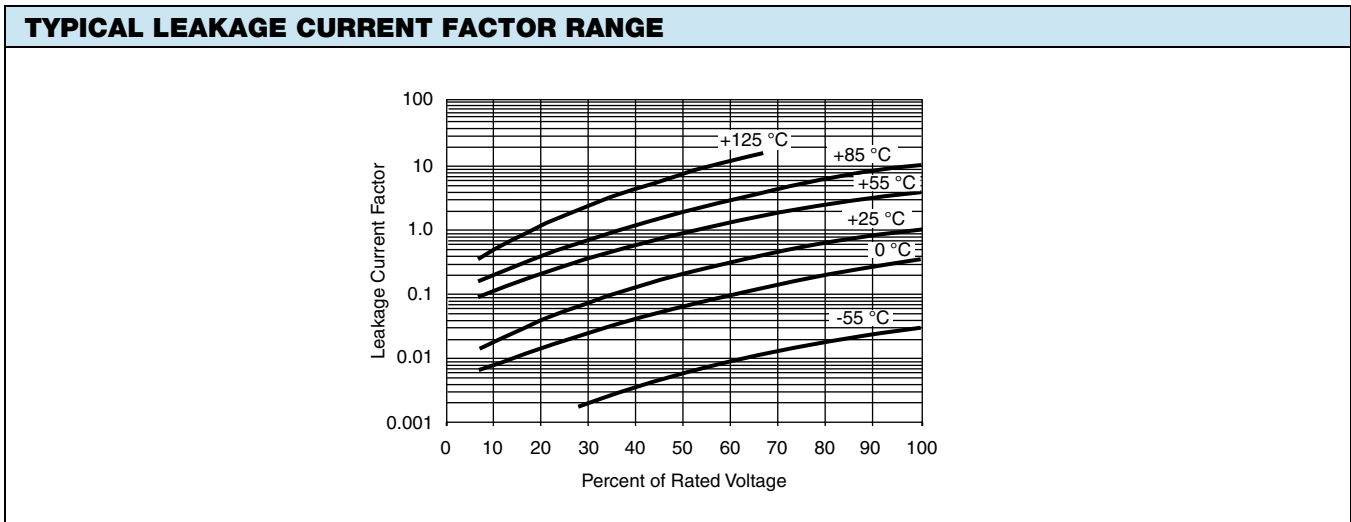
| CAPACITOR ELECTRICAL PERFORMANCE CHARACTERISTICS |   |                         |                                |                        |                         |                        |                        |  |                        |
|--|---|-------------------------|--------------------------------|------------------------|-------------------------|------------------------|------------------------|--|------------------------|
| 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 described in Standard Ratings table. <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                | <table border="0"> <tr> <td>+12 % max. (at +125 °C)</td> <td>For capacitance value &gt; 300 μF</td> </tr> <tr> <td>+10 % max. (at +85 °C)</td> <td>+20 % max. (at +125 °C)</td> </tr> <tr> <td>-10 % max. (at -55 °C)</td> <td>+15 % max. (at +85 °C)</td> </tr> <tr> <td></td> <td>-15 % max. (at -55 °C)</td> </tr> </table>  | +12 % max. (at +125 °C) | For capacitance value > 300 μF | +10 % max. (at +85 °C) | +20 % max. (at +125 °C) | -10 % max. (at -55 °C) | +15 % max. (at +85 °C) |  | -15 % max. (at -55 °C) |
| +12 % max. (at +125 °C)                          | For capacitance value > 300 μF  |                         |                                |                        |                         |                        |                        |  |                        |
| +10 % max. (at +85 °C)                           | +20 % max. (at +125 °C)   |                         |                                |                        |                         |                        |                        |  |                        |
| -10 % max. (at -55 °C)                           | +15 % max. (at +85 °C)  |                         |                                |                        |                         |                        |                        |  |                        |
|  | -15 % 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>Vishay does not recommend intentional or repetitive application of reverse voltage.   |                         |                                |                        |                         |                        |                        |  |                        |
| Ripple current and temperature derating          | For maximum permissible ripple current (I <sub>RMS</sub> ) or / and voltage (V <sub>RMS</sub> ) please refer to product datasheet and Guide to Application. 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              |                         |                                |                        |                         |                        |                        |  |                        |



| CAPACITOR ELECTRICAL PERFORMANCE CHARACTERISTICS |                             |                   |                   |                   |
|--|-----------------------------|-------------------|-------------------|-------------------|
| ITEM   | PERFORMANCE CHARACTERISTICS |                   |                   |                   |
| Maximum operating voltage                        | OPERATING TEMPERATURE       |                   |                   |                   |
|  | +85 °C                      |                   | +125 °C           |                   |
|  | RATED VOLTAGE (V)           | SURGE VOLTAGE (V) | RATED VOLTAGE (V) | SURGE VOLTAGE (V) |
|  | 16                          | 20                | 10                | 12                |
|  | 20                          | 26                | 13                | 16                |
|  | 25                          | 32                | 17                | 20                |
|  | 35                          | 46                | 23                | 28                |
| 50   | 65                          | 33                | 40                |                   |

**Note**

- All information presented in this document reflects typical performance characteristics



**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

| CAPACITOR PERFORMANCE CHARACTERISTICS |   |                       |                                |
|---------------------------------------|---|-----------------------|--------------------------------|
| ITEM                                  | CONDITION   | POST TEST PERFORMANCE |                                |
| Surge voltage                         | 85 °C, 1000 successive test cycles at 1.3 of rated voltage in series with a 1 kΩ resistor at the rate of 30 s ON, 30 s OFF, MIL-PRF-55365 | Capacitance change    | Within ± 10 % of initial       |
|                                       |   | Dissipation factor    | Not to exceed initial          |
|                                       |   | Leakage current       | Not to exceed initial          |
| Life test at +85 °C                   | 2000 h application of rated voltage at 85 °C, MIL-STD-202 method 108  | Capacitance change    | Within ± 10 % of initial       |
|                                       |   | Leakage current       | Not to exceed 125 % of initial |
| Life test at +125 °C                  | 1000 h application of 2/3 rated voltage at 125 °C, MIL-STD-202 method 108   | Capacitance change    | Within ± 20 % of initial       |
|                                       |   | Leakage current       | Not to exceed 125 % of initial |

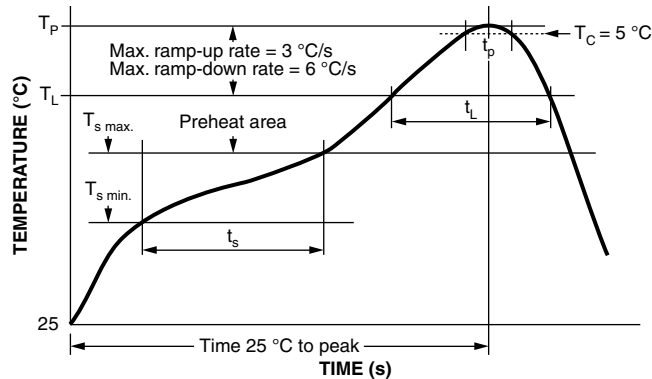


| CAPACITOR ENVIRONMENTAL CHARACTERISTICS |  |  |
|---|--|--|
| ITEM                                    | CONDITION  | POST TEST PERFORMANCE  |
| Moisture resistance                     | MIL-STD-202, method 106, at rated voltage.   | Capacitance change<br>Cap. $\leq$ 600 $\mu$ F      Within $\pm$ 10 % of initial value<br>Cap. $>$ 600 $\mu$ F      Within $\pm$ 20 % of initial value<br>Dissipation factor      Initial specified value or less<br>Leakage current      Initial specified value or less |
| Thermal shock                           | Capacitors are subjected to 6 cycles per MIL-STD-202 method 107 of the following:<br>-55 °C (+0 °C, -6 °C) for 30 min, then<br>+25 °C (+3 °C, -3 °C) for 5 min, then<br>+85 °C (+4 °C, -5 °C) for 40 min, then<br>+125 °C (+4 °C, -0 °C) for 30 min, then<br>+25 °C (+3 °C, -3 °C) for 5 min | Capacitance change<br>Cap.      Within $\pm$ 15 % of initial<br>Dissipation factor      Initial specified value or less<br>Leakage current      Initial specified value multiplied by 12 or less   |
| Salt atmosphere (corrosion)             | Test per MIL-202, method 101, condition B (48 h).<br>5 % salt solution applying.   | No harmful or extensive corrosion, = 90 % protection of exposed metallic surfaces by finish, markings legible, = 10 % corrosion of the terminal hardware or mounting.  |

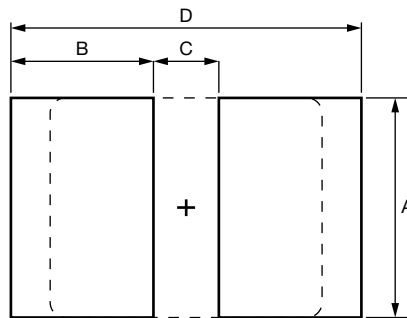
| MECHANICAL PERFORMANCE CHARACTERISTICS |   |   |
|--|---|---|
| TEST CONDITION                         | CONDITION   | POST TEST PERFORMANCE   |
| Shear test                             | Apply a pressure load of 5 N for 10 s $\pm$ 1 s horizontally to the center of capacitor side body.<br>AEC-Q200-006                              | There shall be no visual damage when viewed at 20 x magnification and the component shall meet the original electrical requirements.  |
| Vibration                              | MIL-STD-202, method 204, condition D,<br>10 Hz to 2000 Hz, 20 g peak  | There shall be no mechanical or visual damage to capacitors post-conditioning.  |
| Shock (specified pulse)                | MIL-STD-202, method 213, condition I,<br>100 g peak   | Capacitance change      Within $\pm$ 10 % of initial<br>Dissipation factor      Initial specified value or less<br>Leakage current      Initial specified value or less<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,<br>except with only one heat cycle.   | Capacitance change      Within $\pm$ 10 % of initial<br>Dissipation factor      Initial specified value or less<br>Leakage current      Initial specified value or less<br><br>There shall be no mechanical or visual damage to capacitors post-conditioning. |
| Solderability                          | MIL-STD-202, method 208, ANSI/J-STD-002, test B.<br>Applies only to solder and tin plated terminations.<br>Does not apply to gold terminations. | All terminations shall exhibit a continuous solder coating free from defects for a minimum of 95 % of the critical area of any individual lead.   |
| Resistance to solvent                  | MIL-STD-202, method 215   | Marking has to remain legible, no degradation of the can material.  |
| Sleeving                               | MIL-PRF-39003, paragraph 3.22:<br>apply a DC potential of 2000 V.   | Maximum leakage of 20 $\mu$ A is allowed between the capacitor case and the fixture.  |
| Seal                                   | MIL-STD-202, method 112, condition A or D   | There shall be no visual leakage.   |

**RECOMMENDED REFLOW PROFILES**

Capacitors should withstand reflow profile as per J-STD-020 standard



| PROFILE FEATURE  | SnPb EUTECTIC ASSEMBLY | LEAD (Pb)-FREE ASSEMBLY |
|--|------------------------|-------------------------|
| <b>Preheat / soak</b>  |                        |                         |
| Temperature min. ( $T_{s \text{ min.}}$ )  | 100 °C                 | 150 °C                  |
| Temperature max. ( $T_{s \text{ max.}}$ )  | 150 °C                 | 200 °C                  |
| Time ( $t_s$ ) from ( $T_{s \text{ min.}}$ to $T_{s \text{ max.}}$ )             | 60 s to 120 s          | 60 s to 120 s           |
| <b>Ramp-up</b>   |                        |                         |
| Ramp-up rate ( $T_L$ to $T_P$ )  | 3 °C/s max.            | 3 °C/s max.             |
| Liquidus temperature ( $T_L$ )   | 183 °C                 | 217 °C                  |
| Time ( $t_L$ ) maintained above $T_L$  | 60 s to 150 s          | 60 s to 150 s           |
| Peak package body temperature ( $T_P$ )  | 220                    | 250                     |
| Time ( $t_p$ ) within 5 °C of the specified classification temperature ( $T_C$ ) | 20 s                   | 30 s                    |
| Time 25 °C to peak temperature   | 6 min max.             | 8 min max.              |
| <b>Ramp-down</b>   |                        |                         |
| Ramp-down rate ( $T_P$ to $T_L$ )  | 6 °C/s max.            | 6 °C/s max.             |
| Time 25 °C to peak temperature   | 6 min max.             | 8 min max.              |

**PAD DIMENSIONS** in inches [millimeters]


| CASE CODE | A (MIN.)  | B (NOM.)    | C (NOM.)  | D (NOM.)   |
|-----------|-----------|-------------|-----------|------------|
| D         | 0.276 [7] | 0.178 [4.5] | 0.079 [2] | 0.433 [11] |



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