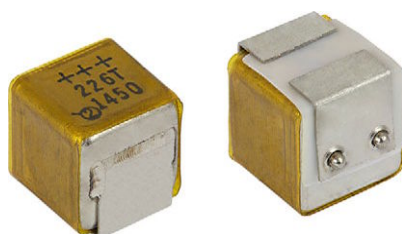


# Solid Tantalum SMD Capacitors TANTAMOUNT™, Hi-Rel COTS, Low ESR, Metal Case



## 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

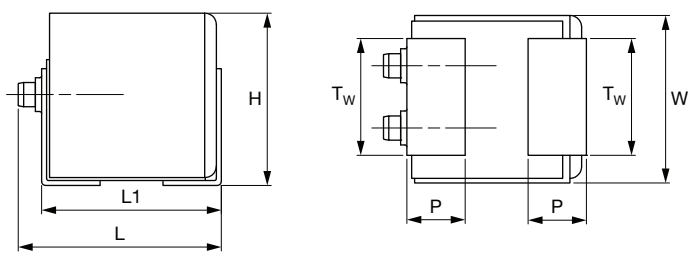
## Note

\* 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                         | Tw                        | WEIGHT g (AVERAGE) |
| D  | 0.326 [8.5] | 0.283 ± 0.008 [7.2 ± 0.2] | 0.275 ± 0.008 [7.0 ± 0.2] | 0.291 ± 0.008 [7.4 ± 0.2] | 0.098 ± 0.008 [2.5 ± 0.2] | 0.197 ± 0.008 [5.0 ± 0.2] | 1.80               |

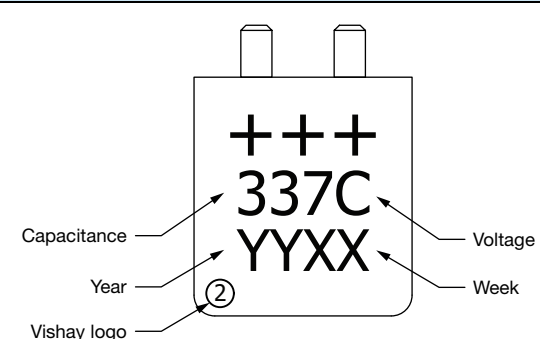
**RATINGS AND CASE CODES**

| $\mu\text{F}$ | 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<br>( $\mu\text{F}$ )                                 | CASE CODE        | PART NUMBER            | MAX. DCL<br>AT +25 °C<br>( $\mu\text{A}$ ) | MAX. DF<br>AT +25 °C<br>(%) | MAX. ESR<br>AT +25 °C<br>100 kHz<br>(m $\Omega$ ) | MAX.<br>RIPPLE<br>100 kHz<br>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
- Rating in development, contact factory for availability

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

| Capacitor Voltage Rating | Operating Voltage |
|--------------------------|-------------------|
| 16                       | 10                |
| 20                       | 12                |
| 25                       | 15                |
| 35                       | 24                |
| 50                       | 28                |

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

| Capacitor Voltage Rating | Operating Voltage |
|--------------------------|-------------------|
| 16                       | 8.0               |
| 20                       | 10                |
| 25                       | 12                |
| 35                       | 15                |
| 50                       | 24                |

**CARRIER TAPE DIMENSIONS** in inches [millimeters]

| TYPE | CASE CODE | TAPE WIDTH W<br>(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           |

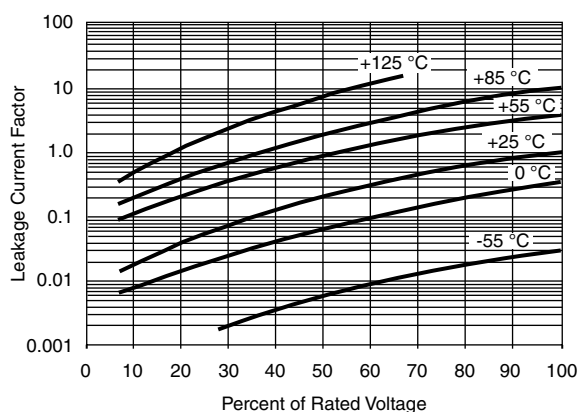
# CAPACITOR ELECTRICAL PERFORMANCE CHARACTERISTICS

| 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       | +12 % max. (at +125 °C)<br>+10 % max. (at +85 °C)<br>-10 % max. (at -55 °C)   | For capacitance value > 300 μF<br>+20 % max. (at +125 °C)<br>+15 % max. (at +85 °C)<br>-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              |   |                   |                   |
| 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.

# TYPICAL LEAKAGE CURRENT FACTOR RANGE



## 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 k $\Omega$ resistor at the rate of 30 s ON, 30 s OFF, MIL-PRF-55365 | Capacitance change<br>Dissipation factor<br>Leakage current | Within $\pm$ 10 % of initial<br>Not to exceed initial<br>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<br>Leakage current                       | Within $\pm$ 10 % of initial<br>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<br>Leakage current                       | Within $\pm$ 20 % of initial<br>Not to exceed 125 % of initial                 |

**CAPACITOR ENVIRONMENTAL CHARACTERISTICS**

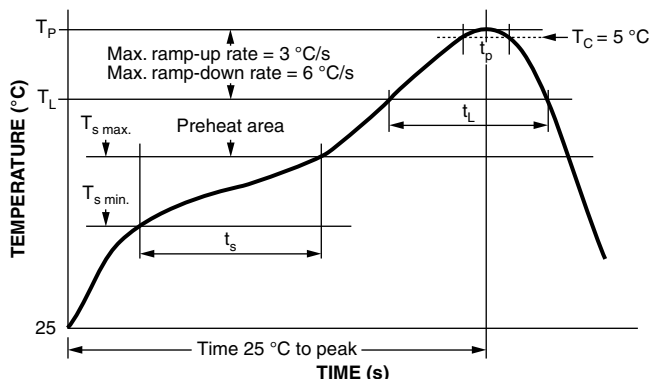
| ITEM                        | CONDITION  | POST TEST PERFORMANCE   |  |
|-----------------------------|--|---|--|
| Moisture resistance         | MIL-STD-202, method 106, at rated voltage.   | Capacitance change<br>Cap. $\leq$ 600 $\mu$ F<br>Cap. $>$ 600 $\mu$ F<br>Dissipation factor<br>Leakage current  | Within $\pm$ 10 % of initial value<br>Within $\pm$ 20 % of initial value<br>Initial specified value or less<br>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.<br>Dissipation factor<br>Leakage current   | Within $\pm$ 15 % of initial<br>Initial specified value or less<br>Initial specified value multiplied by 12 or less                            |
| Salt atmosphere (corrosion) | Test per MIL-202, method 101, condition B (48 h). 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. 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, 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, 100 g peak  | Capacitance change<br>Dissipation factor<br>Leakage current   | Within $\pm$ 10 % of initial<br>Initial specified value or less<br>Initial specified value or less |
| Resistance to soldering heat | MIL-STD-202, method 210, condition J, except with only one heat cycle.  | Capacitance change<br>Dissipation factor<br>Leakage current   | Within $\pm$ 10 % of initial<br>Initial specified value or less<br>Initial specified value or less |
| Solderability                | MIL-STD-202, method 208, ANSI/J-STD-002, test B. Applies only to solder and tin plated terminations. 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: 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.   |  |

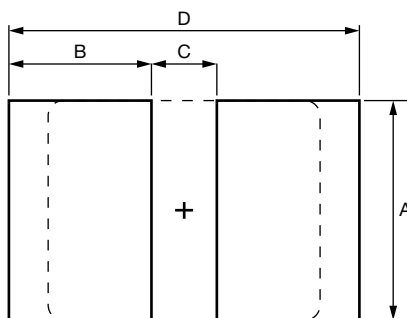
## RECOMMENDED REFLOW PROFILES

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. ( $T_{s \min.}$ )   | 100 °C                 | 150 °C                  |
| Temperature max. ( $T_{s \max.}$ )   | 150 °C                 | 200 °C                  |
| Time ( $t_s$ ) from ( $T_{s \min.}$ to $T_{s \max.}$ )                           | 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<br>(MIN.) | B<br>(NOM.) | C<br>(NOM.) | D<br>(NOM.) |
|-----------|-------------|-------------|-------------|-------------|
| D         | 0.276 [7]   | 0.178 [4.5] | 0.079 [2]   | 0.433 [11]  |



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| <a href="#"><u>T25D226K050ESA</u></a> | <a href="#"><u>T25D337K016ESA</u></a> |                                       |                                       |                                       |