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Overview

The KEMET T551 Series Polymer Hermetic Seal (PHS) is a tantalum capacitor with a Ta anode and Ta₂O₅ dielectric. A conductive organic polymer replaces the traditionally used MnO₂ or wet electrolyte as the cathode plate of the capacitor. This results in very low ESR and improved capacitance retention at high frequency and low temperature. The T551 Series PHS also exhibits a benign failure mode which eliminates the case breach that can occur in wet tantalum types. Additionally, this part may be operated at voltages up to 80% of rated voltage with equivalent or better reliability than traditional MnO₂ or wet

tantalum capacitors operated at 50% of rated voltage. T551 Series PHS also offers higher ripple current handling capability and a lower ESR range than wet tantalums. With reduced ESR and enhanced capacitance retention at higher frequencies and low temperatures, the T551 Series PHS provides the highest total capacitance and the most economical solution for high power applications, all within an approximately 25% lighter package than the equivalent wet tantalum capacitor.

Benefits

- Includes F-Tech anode which eliminates hidden defects in the dielectric
- 100% Simulated Breakdown Screening
- Voltage rating of 6 VDC – 60 VDC
- Capacitance: 20 µF to 820 µF
- Maximum operating temperature of +125°C
- Polymer cathode technology
- ≤ 0.0075 CV (µA) at rated voltage after 5 minutes
- Extremely low ESR
- High frequency capacitance retention
- Low temperature capacitance retention
- 100% accelerated steady state aging (240 hours)
- 100% surge current tested, 10 cycles +25°C
- Volumetrically efficient
- Use at up to 80% of rated voltage
- Non-ignition failure mode
- Approximately 25% lighter than equivalent wet tantalum
- Case dimensions equivalent to MIL-PRF-39006/22/25/30/31



Applications

Typical applications include high voltage power management such as buck/boost converters, filtering, hold-up capacitors, and other high ripple current applications.

Ordering Information

| T | 551 | B | 107 | M | 025 | A | T | 4251 | |
|-----------------|-----------------------------|-----------|--|-----------------------|--|---------------|---|--|---|
| Capacitor Class | Series | Case Size | Capacitance Code (pF) | Capacitance Tolerance | Rated Voltage (VDC) | Product Level | Termination Finish | Surge Option | Packaging |
| T = Tantalum | 551 = Polymer Hermetic Seal | B | First two digits represent significant figures. Third digit specifies number of zeros. | K = ±10% M = ±20% | 006 = 6.3 V 008 = 8 V 015 = 15 V 025 = 25 V 040 = 40 V 050 = 50 V 060 = 60 V | A = N/A | T = 100% tin (Sn) plated H = Tin/lead (SnPb) solder coated (5% Pb minimum) | 4251 = Surge current, 10 cycles, -55°C and +85°C | Blank = Sleeved 0100 = Unsleeved 7200 = Tape & Reel 7293 & 7443 = Ammo |

Performance Characteristics

| Item | Performance Characteristics |
|-------------------------|--|
| Operating Temperature | -55°C to 125°C |
| Rated Capacitance Range | 20 µF to 820 µF at 120 Hz/25°C * |
| Capacitance Tolerance | K Tolerance (10%), M Tolerance (20%) |
| Rated Voltage Range | 6 – 60 V |
| DF (120 Hz at 25°C) | Refer to Part Number Electrical Specification Table |
| ESR (100 kHz at 25°C) | Refer to Part Number Electrical Specification Table |
| Leakage Current | Refer to Part Number Electrical Specification Table (at rated voltage up to +85°C and 66% of rated voltage applied at 125°C) |
| Packaging | According MIL-PRF-39006 |

KEMET does not recommend storage above 85°C.

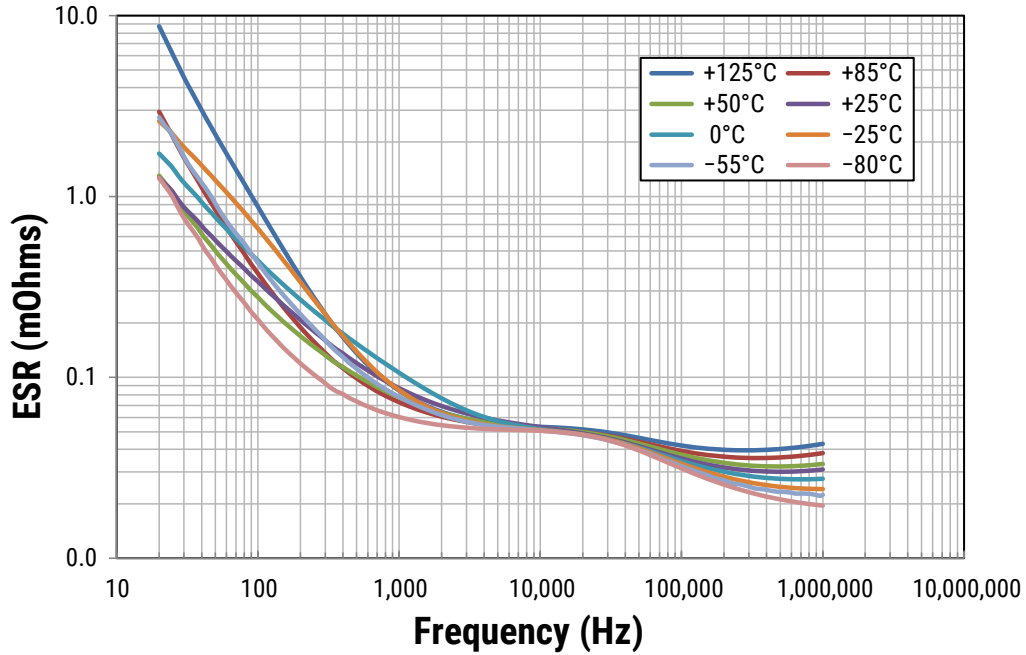
* Additional case sizes and capacitance/voltage are under development.

Qualification

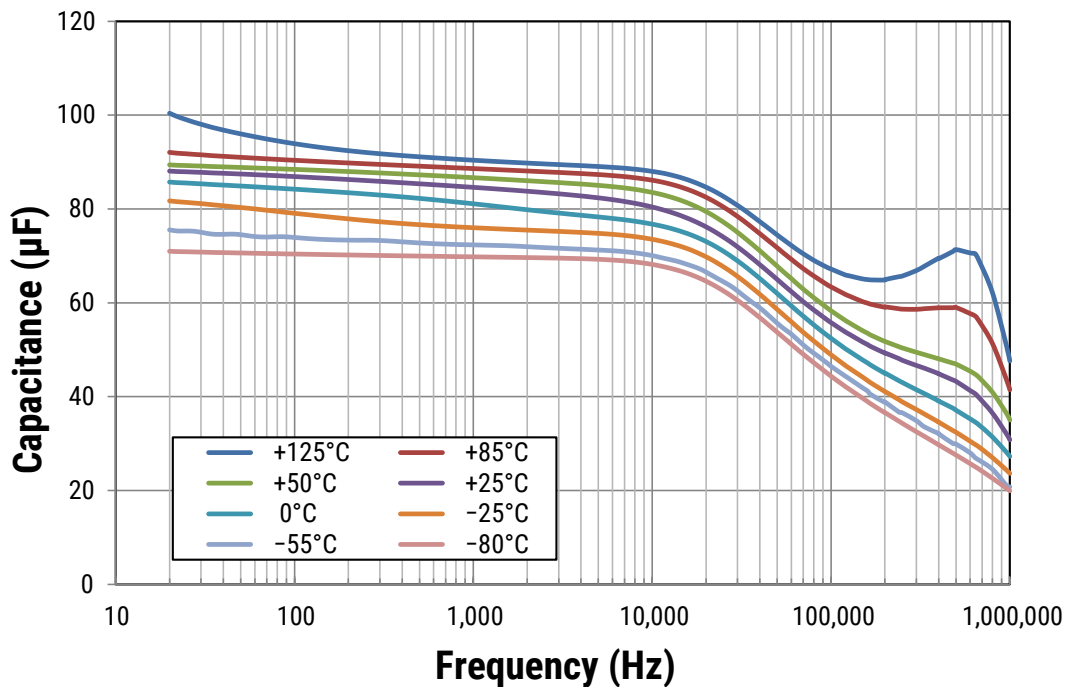
| Test Performed | Method Reference | Test Conditions |
|---|-------------------------------|---|
| Reliability and Environmental Tests | | |
| AC Ripple Life at 85°C | MIL-PRF-39006 | 85°C, 40 kHz ripple current, 2,000 hours |
| 85°C Life | MIL-PRF-39006 | 85°C, rated voltage, 2,000 hours |
| 125°C Life | KEMET Standard | 125°C, 0.66 x rated voltage, 2,000 hours |
| Surge Voltage | MIL-PRF-39006 | 85°C, 1.15 x rated voltage, 1,000 cycles, except delta cap shall be +10%/-20% |
| Surge Current | MIL-PRF-39003 | +25 °C, 10 cycles (Option A), Option B available |
| Low Temperature Storage | MIL-PRF-39006 | -62°C for 72 hours followed by 1 hour at 125°C |
| Reverse Voltage | KEMET Catalog | 1 V for 8 hours maximum at 25°C, 1 V for 2 hours maximum at 70°C |
| Physical, Mechanical and Process Tests | | |
| Visual and Mechanical Examination (Internal and External) | MIL-PRF-39006 | Case dimensions, marking |
| Terminal Strength | MIL-PRF-39006 | Pull test and wire lead bend test |
| Resistance to Solvents | MIL-PRF-39006 | Immersion in (3) solvents |
| Resistance to Soldering Heat | MIL-PRF-39006 | Immersed to within 0.05 inch of capacitor body |
| Solderability | MIL-PRF-39006 | Depth of insertion in flux and solder to within 0.062 inch of welded joint |
| Shock and Vibration | MIL-STD-202, Methods 213, 204 | Shock Method 213, Condition I, 100 g peak, Vibration Method 204, Condition D, 20 g peak |
| Barometric Pressure (Reduced) | MIL-PRF-39006 | 150,000 feet for 5 minutes, voltage applied for 1 minute |
| Salt Atmosphere (Corrosion) | MIL-PRF-39006 | Subjected to fine mist of salt solution |
| Moisture Resistance | MIL-PRF-39006 | 65°C at 6 volts |
| Dielectric Withstanding Voltage | MIL-PRF-39006 | 2,000 VDC, 60 seconds, sleeving examined for evidence of breakdown |
| Insulation Resistance | MIL-PRF-39003 | 500 VDC, 1 minute, insulation resistance not less than 1,000 MΩ |
| Electrical Characterization | | |
| Temperature Stability | Reference MIL-PRF-39006 | -55°C to 125°C |
| Frequency Scan | KEMET Standard | Impedance, ESR and capacitance versus frequency |

Electrical Characteristics

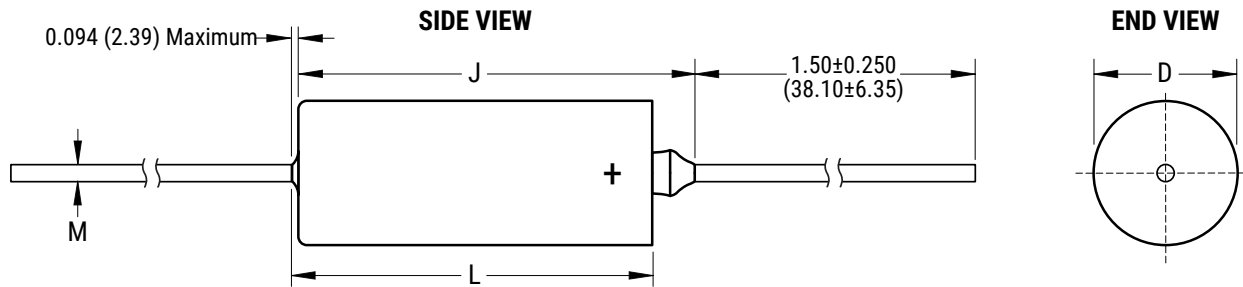
ESR vs. Frequency



Capacitance vs. Frequency



Dimensions – Inches (Millimeters)



| Case Code | Case Size | Uninsulated Case | | | | Insulated Case | |
|-----------|---------------|--------------------|-------------------------------------|--------------------|---------------|-------------------------------------|--------------------|
| | MIL-PRF-39006 | L ±0.031 (0.79) | D +0.016 (0.41) -0.015 (0.38) | M ±0.002 (0.05) | J max | D +0.016 (0.41) -0.015 (0.38) | L ±0.031 (0.79) |
| B | T2 | 0.650 (16.51) | 0.279 (7.09) | 0.025 (0.64) | 0.822 (20.88) | 0.289 (7.34) | 0.686 (17.42) |

Table 1 – Ratings & Part Number Reference

| Rated Voltage | Rated Capacitance | Case Size | KEMET Part Number | DC Leakage | DF | Maximum ESR | Ripple Current |
|---------------|-------------------|-----------|------------------------------|------------------------------|----------------------|--------------------|----------------------|
| (V) 85°C | µF | KEMET/EIA | (See below for part options) | µA at 25°C Maximum/5 Minutes | % at 25°C 120 Hz Max | mΩ at 25°C 100 kHz | mArms at 85°C/40 kHz |
| 6 | 140 | B | T551B147(1)006A(2) | 6.3 | 5.0 | 120 | 1510 |
| 6 | 820 | B | T551B827(1)006A(2) | 36.9 | 5.0 | 90 | 1750 |
| 8 | 220 | B | T551B227(1)008A(2) | 13.2 | 5.0 | 120 | 1510 |
| 8 | 680 | B | T551B687(1)008A(2) | 40.8 | 5.0 | 90 | 1750 |
| 10 | 100 | B | T551B107(1)010A(2) | 7.5 | 5.0 | 140 | 1400 |
| 10 | 180 | B | T551B187(1)010A(2) | 13.5 | 5.0 | 110 | 1580 |
| 10 | 560 | B | T551B567(1)010A(2) | 42.0 | 5.0 | 90 | 1750 |
| 15 | 70 | B | T551B706(1)015A(2) | 7.9 | 5.0 | 140 | 1400 |
| 15 | 120 | B | T551B127(1)015A(2) | 13.5 | 5.0 | 110 | 1580 |
| 15 | 390 | B | T551B397(1)015A(2) | 43.9 | 5.0 | 90 | 1750 |
| 25 | 50 | B | T551B506(1)025A(2) | 9.4 | 5.0 | 170 | 1275 |
| 25 | 100 | B | T551B107(1)025A(2) | 18.8 | 5.0 | 190 | 1200 |
| 30 | 40 | B | T551B406(1)030A(2) | 9.0 | 5.0 | 170 | 1275 |
| 30 | 68 | B | T551B686(1)030A(2) | 15.3 | 5.0 | 140 | 1400 |
| 40 | 100 | B | T551B107(1)040A(2) | 30.0 | 5.0 | 150 | 1350 |
| 40 | 120 | B | T551B127(1)040A(2) | 36.0 | 5.0 | 120 | 1510 |
| 50 | 25 | B | T551B256(1)050A(2) | 9.4 | 5.0 | 170 | 1275 |
| 50 | 47 | B | T551B476(1)050A(2) | 17.6 | 5.0 | 150 | 1350 |
| 50 | 100 | B | T551B107(1)050A(2) | 37.5 | 5.0 | 130 | 1450 |
| 50 | 120 | B | T551B127(1)050A(2) | 45.0 | 5.0 | 90 | 1750 |
| 60 | 20 | B | T551B206(1)060A(2) | 9.0 | 5.0 | 200 | 1175 |
| 60 | 39 | B | T551B396(1)060A(2) | 17.6 | 5.0 | 160 | 1310 |
| 60 | 100 | B | T551B107(1)060A(2) | 45.0 | 5.0 | 100 | 1660 |

(1) To complete KEMET part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.

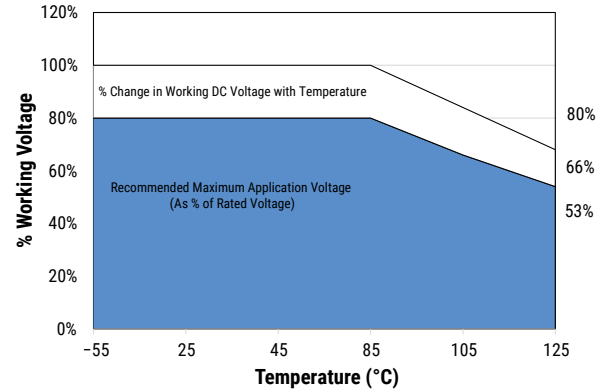
(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, H = Standard Solder coated (SnPb 5% Pb minimum). Designates termination finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating.

Recommended Voltage Derating Guidelines

| | -55°C to 85°C | 85°C to 105°C | 105°C to 125°C |
|---|---------------|---------------|----------------|
| % Change in Working DC Voltage with Temperature | V_R | 78% of V_R | 66% of V_R |
| Recommended Maximum Application Voltage (As % of Rated Voltage) | 80% of V_R | 63% of V_R | 53% of V_R |



Ripple Current/Ripple Voltage

Permissible AC ripple voltage and current are related to equivalent series resistance (ESR) and the power dissipation capabilities of the device. Permissible AC ripple voltage that may be applied is limited by two criteria:

1. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
2. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage.

The maximum power dissipation by case size can be determined using the below left table. The maximum power dissipation rating stated in the table must be reduced with increasing environmental operating temperatures. Refer to the below right table for temperature compensation requirements.

| Case Code | | Maximum Power Dissipation (P_{max}) mWatts at 25°C with +60°C Rise |
|-----------|---|--|
| KEMET | MIL-PRF-39006/22/ 25/30/31 Case Size | |
| B | T2 | 715 |

| Temperature Compensation Multipliers for Maximum Power Dissipation (P_{max}) | | |
|---|--|---|
| $T \leq 45^\circ\text{C}$ | $45^\circ\text{C} < T \leq 85^\circ\text{C}$ | $85^\circ\text{C} < T \leq 125^\circ\text{C}$ |
| 1.00 | 0.70 | 0.10 |

T = Environmental Temperature

Using the P_{max} of the device, the maximum allowable rms ripple current or voltage may be determined.

$$I(max) = \sqrt{P_{max}/R}$$

$$E(max) = Z \sqrt{P_{max}/R}$$

I = rms ripple current (amperes)

E = rms ripple voltage (volts)

P_{max} = maximum power dissipation (watts)

R = ESR at specified frequency (ohms)

Z = Impedance at specified frequency (ohms)

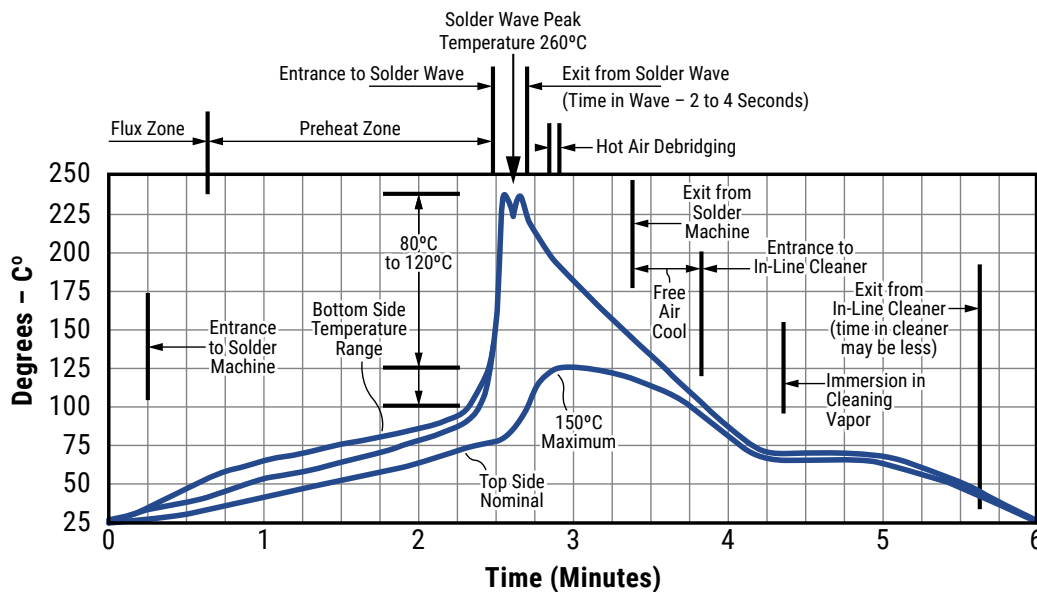
The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

Reverse Voltage

Solid tantalum polymer capacitors are polar devices and may be permanently damaged or destroyed if connected with the wrong polarity. A small reverse voltage is permissible for time periods per the below table. KEMET can offer lower capacitance in this voltage with higher reverse voltage capability. In addition, we continue to improve our capability for this characteristic.

| Temperature | Permissible Reverse Voltage |
|-------------|-----------------------------|
| 25°C | 1 V for 8 hours Maximum |
| 70°C | 1 V for 2 hours Maximum |

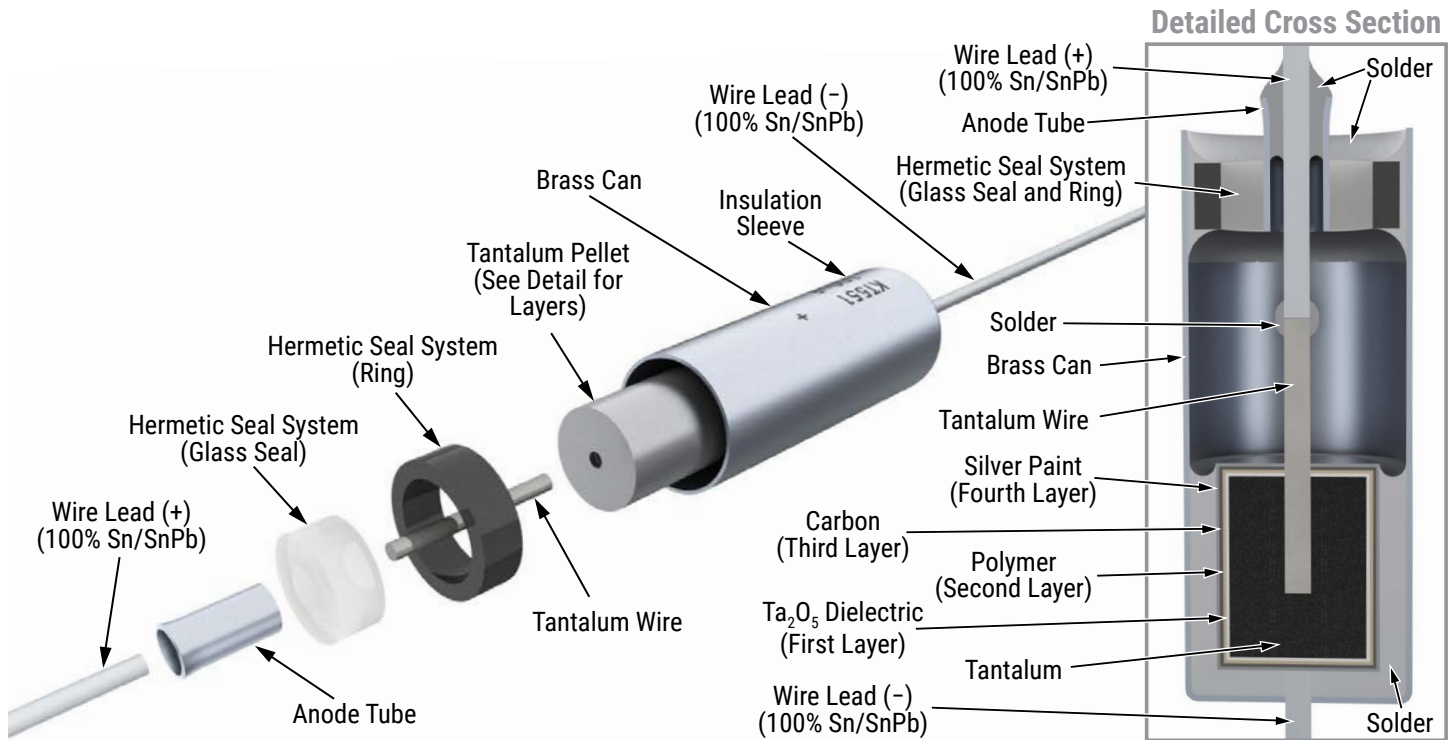
Optimum Solder Wave Profile



Mounting

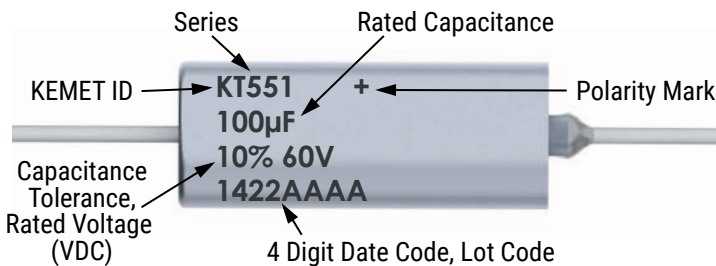
All encased capacitors will pass the Resistance to Soldering Heat Test of MIL-STD-202, Method 210, Condition C. This test simulates wave solder of topside board mount product. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. More severe treatment must be considered reflective of an improper soldering process. The above figure is a recommended solder wave profile for both axial and radial leaded solid tantalum capacitors.

Construction



Capacitor Marking

B Case



| Date Code | 3 Digit | 4 Digit |
|-----------|--|-----------|
| Year | 5 = 2015 | 15 = 2015 |
| | 6 = 2016 | 16 = 2016 |
| | 7 = 2017 | 17 = 2017 |
| | 8 = 2018 | 18 = 2018 |
| | 9 = 2019 | 19 = 2019 |
| Week | 01 = 1 st week of the year to 52 = 52 nd week of the year | |

Storage

Tantalum hermetically sealed capacitors should be stored in normal working environments. While the capacitors themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature – reels may soften or warp and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 60% relative humidity. Temperature fluctuations should be minimized to avoid condensation on the parts and atmospheres should be free of chlorine and sulphur bearing compounds. For optimized solderability capacitors stock should be used promptly, preferably within three years of receipt.

Packaging

| Case Size | | Pieces per Tray |
|-----------|-----|-----------------|
| KEMET | EIA | |
| B | T2 | 20 |

Weight

| Case Size | | Average Weight (grams) |
|-----------|-----|------------------------|
| KEMET | EIA | |
| B | T2 | 3.63 |

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