

# T550 Axial Polymer Hermetic Seal (PHS) 105°C and DLA Series

## Overview

The KEMET T550 Series Polymer Hermetic Seal (PHS) is a tantalum capacitor with a Ta anode and Ta<sub>2</sub>O<sub>5</sub> dielectric. A conductive organic polymer replaces the traditionally used MnO<sub>2</sub> 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 T550 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 MnO<sub>2</sub> or wet tantalum capacitors operated at 50% of rated voltage.

T550 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 T550 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
- Maximum operating temperature of +105°C
- Meets all requirements of DLA Drawing 13030
- Polymer cathode technology
- 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
- 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               | 550                         | 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                                                                                                                                                                                                            | Sleeve Option                                                                   |
| T = Tantalum    | 550 = Polymer Hermetic Seal | B         | First two digits represent significant figures. Third digit specifies number of zeros. | K = $\pm 10\%$<br>M = $\pm 20\%$ | 006 = 6.3<br>008 = 8<br>015 = 15<br>025 = 25<br>040 = 40<br>050 = 50<br>060 = 60<br>075 = 75<br>100 = 100 | A = N/A<br>B* = DLA<br>13030<br>Standard reliability<br>T* = DLA<br>13030 High reliability | T = 100% tin (Sn) plated<br>H = Tin/lead (SnPb) solder coated (5% Pb minimum) | Blank = 25°C $\pm 5^\circ\text{C}$ , 10 cycles, after constant voltage conditioning (KEMET standard)<br>4251 = 10 cycles, -55°C and +85°C after voltage aging<br>4252 = 10 cycles, -55°C and +85°C before voltage aging | Blank = Sleeved<br>0100 = Unsleeved<br>7200 = Tape & Reel<br>7293 & 7443 = Ammo |

\* Only available on select parts. Refer to part number table for details.

## Ordering Information – DLA Series

| 13030          | -01                   | K                                | A                                                                                                                                                                                                                                                                                                | S                            | L                          | B                                                |
|----------------|-----------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------|--------------------------------------------------|
| Drawing Number | Dash Number           | Capacitance Tolerance            | Surge Current Testing                                                                                                                                                                                                                                                                            | Insulation                   | Lead Length                | Product Level                                    |
|                | See Part Number Table | K = $\pm 10\%$<br>M = $\pm 20\%$ | A = +25°C $\pm 5^\circ\text{C}$ , 10 cycles, after constant voltage conditioning (KEMET standard)<br>B = -55°C -5°C, +0°C and +85°C $\pm 5^\circ\text{C}$ ; after constant voltage conditioning.<br>C = -55°C -5°C, +0°C and +85°C $\pm 5^\circ\text{C}$ ; before constant voltage conditioning. | S = Sleeved<br>U = Unsleeved | L = 1.50 inches (standard) | B = Standard reliability<br>T = High reliability |

\* Standard terminations for DLA PN's is "H" (SnPb)

## Performance Characteristics

| Item                    | Performance Characteristics                                                                                                  |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Operating Temperature   | -55°C to 105°C                                                                                                               |
| Rated Capacitance Range | 20 $\mu\text{F}$ to 820 $\mu\text{F}$ at 120 Hz/25°C *                                                                       |
| Capacitance Tolerance   | K Tolerance (10%), M Tolerance (20%)                                                                                         |
| Rated Voltage Range     | 6 – 100 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 78% of rated voltage applied at 105°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                                                        |
| 105°C Life                                                | KEMET Standard                | 105°C, 0.78 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 105°C                                                                          |
| Frequency Scan                                            | KEMET Standard                | Impedance, ESR and capacitance versus frequency                                         |

## Qualification – DLA Approval Inspection

| Inspection | Test Name                              | DLA Requirement Paragraph | SS/Lot           |
|------------|----------------------------------------|---------------------------|------------------|
| Group I    | Shock (Specified Pulse) <sup>1</sup>   | 3.3.4                     | 6 per case size  |
|            | Vibration, High Frequency <sup>1</sup> | 3.3.5                     |                  |
|            | Thermal Shock                          | 3.3.6                     |                  |
|            | Salt Atmosphere                        | 3.3.7                     |                  |
| Group II   | Solderability                          | 3.3.8                     | 12               |
|            | Terminal Strength                      | 3.3.9                     |                  |
|            | Surge Voltage <sup>2</sup>             | 3.3.10                    |                  |
|            | Moisture Resistance                    | 3.3.11                    |                  |
|            | Dielectric Withstanding Voltage        | 3.3.12                    |                  |
|            | Insulation Resistance                  | 3.3.13                    |                  |
|            | Low Temperature (Storage)              | 3.3.14                    |                  |
| Group III  | Stability at Low and High Temperatures | 3.3.15                    | 13               |
|            | Reverse Voltage                        | 3.3.23                    | 12 per condition |
| Group IV   | Life at 85°C                           | 3.3.16                    | 102              |
| Group V    | AC Ripple Life at 85°C                 | 3.3.18                    | 8 per case size  |
| Group VI   | Life at 105°C                          | 3.3.17                    | 40               |
|            | Barometric Pressure                    | 3.3.20                    |                  |
| Group VII  | Resistance to Solvents                 | 3.3.21                    | 6                |
|            | Resistance to Soldering Heat           | 3.3.22                    |                  |

<sup>1</sup> No failures for mechanical shock or vibration tests shall be permitted.

<sup>2</sup> Surge voltage change in capacitance limits are wider than those in some subsequent tests.

It may be necessary to perform initial measurements again, prior to the individual tests of Group II.

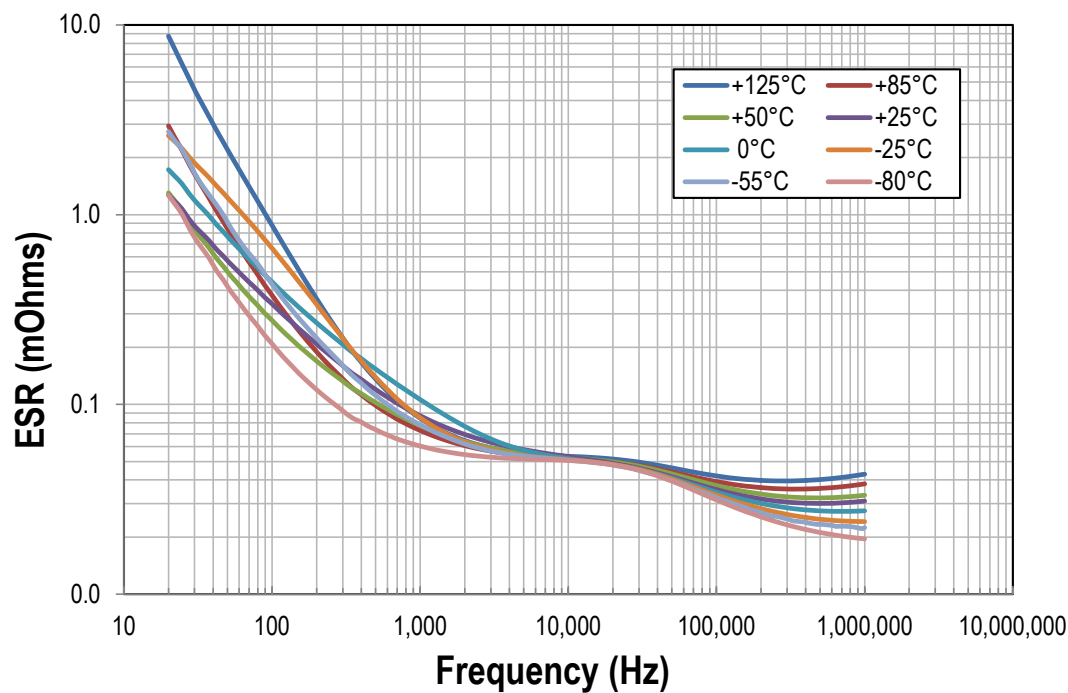
### Product Level:

Inspection of product for delivery shall consist of:

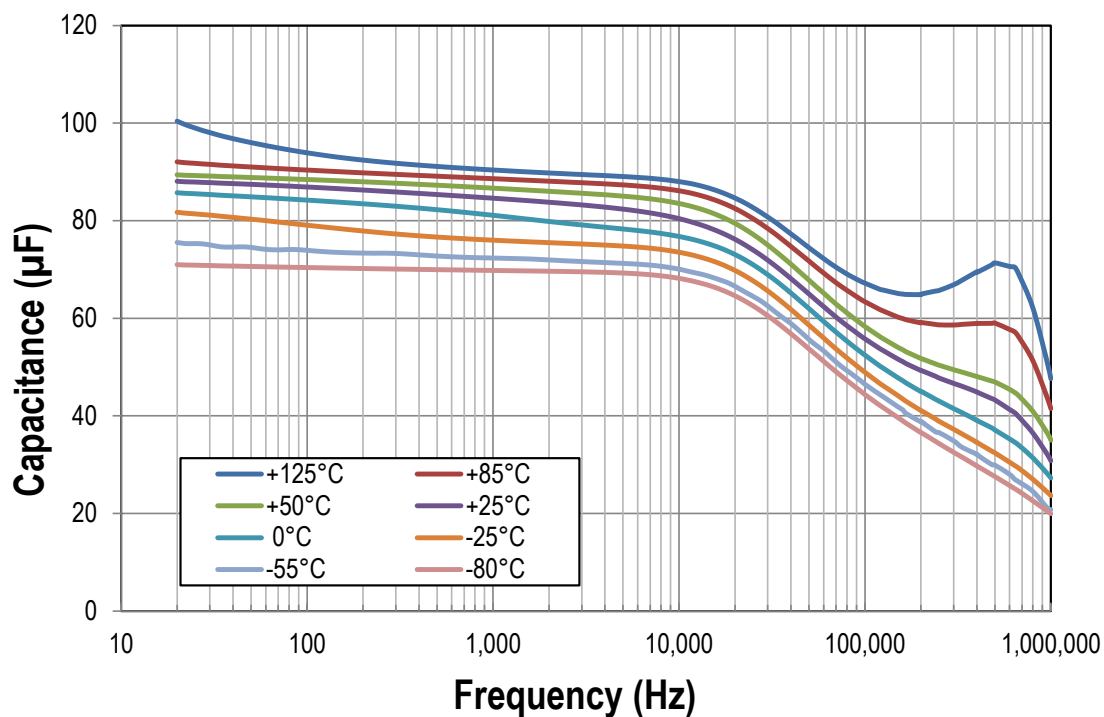
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|---------|------------------------------------------------------------|
| B level | Group A inspection specified in Drawing 13030              |
| T level | Group A and group B inspections specified in Drawing 13030 |

## Electrical Characteristics

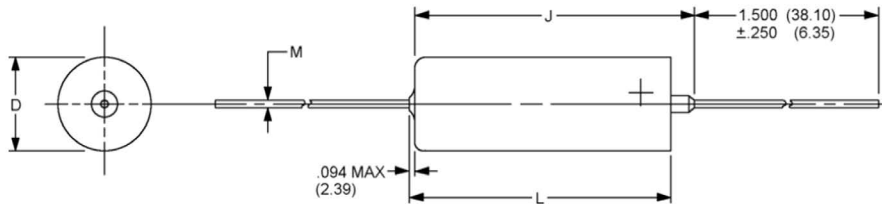
ESR vs. Frequency



Capacitance vs. Frequency



## Dimensions – Inches (Millimeters)



| Case Code | Case Size     | Uninsulated Case   |                                     |                    |              | Insulated Case                      |                     |
|-----------|---------------|--------------------|-------------------------------------|--------------------|--------------|-------------------------------------|---------------------|
|           | MIL-PRF-39006 | L<br>±0.031 (0.79) | D<br>+0.016 (0.41)<br>-0.015 (0.38) | M<br>±0.002 (0.05) | J<br>max     | D<br>+0.016 (0.41)<br>-0.015 (0.38) | L<br>± 0.031 (0.79) |
| B         | T2            | 0.650 (16.51)      | 0.279 (7.09)                        | .025 (0.64)        | .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            | DLA Drawing Number           | DC Leakage                      | DF                      | Maximum ESR           | Ripple Current          |
|---------------|-------------------|-----------|------------------------------|------------------------------|---------------------------------|-------------------------|-----------------------|-------------------------|
| (V) 85°C      | µF                | KEMET/EIA | (See below for part options) | (See below for part options) | µA at 25°C<br>Maximum/5 Minutes | % at 25°C<br>120 Hz Max | mΩ at 25°C<br>100 kHz | mArms at<br>85°C/40 kHz |
| 6             | 140               | B         | T550B147(1)006A(3)           | N/A                          | 6.3                             | 5.0                     | 120                   | 1510                    |
| 6             | 820               | B         | T550B827(1)006A(3)           | N/A                          | 36.9                            | 5.0                     | 90                    | 1750                    |
| 8             | 220               | B         | T550B227(1)008A(3)           | N/A                          | 13.2                            | 5.0                     | 120                   | 1510                    |
| 8             | 680               | B         | T550B687(1)008A(3)           | N/A                          | 40.8                            | 5.0                     | 90                    | 1750                    |
| 10            | 100               | B         | T550B107(1)010A(3)           | N/A                          | 7.5                             | 5.0                     | 140                   | 1400                    |
| 10            | 180               | B         | T550B187(1)010A(3)           | N/A                          | 13.5                            | 5.0                     | 110                   | 1580                    |
| 10            | 560               | B         | T550B567(1)010A(3)           | N/A                          | 42.0                            | 5.0                     | 90                    | 1750                    |
| 15            | 70                | B         | T550B706(1)015A(3)           | N/A                          | 7.9                             | 5.0                     | 140                   | 1400                    |
| 15            | 120               | B         | T550B127(1)015A(3)           | N/A                          | 13.5                            | 5.0                     | 110                   | 1580                    |
| 15            | 390               | B         | T550B397(1)015A(3)           | N/A                          | 43.9                            | 5.0                     | 90                    | 1750                    |
| 25            | 50                | B         | T550B506(1)025A(3)           | N/A                          | 9.4                             | 5.0                     | 170                   | 1275                    |
| 25            | 100               | B         | T550B107(1)025(2)(3)         | 13030-01(1)(4)(5)L(6)        | 18.8                            | 5.0                     | 190                   | 1200                    |
| 30            | 40                | B         | T550B406(1)030A(3)           | N/A                          | 9.0                             | 5.0                     | 170                   | 1275                    |
| 30            | 68                | B         | T550B686(1)030A(3)           | N/A                          | 15.3                            | 5.0                     | 140                   | 1400                    |
| 40            | 100               | B         | T550B107(1)040(2)(3)         | 13030-02(1)(4)(5)L(6)        | 30.0                            | 5.0                     | 150                   | 1350                    |
| 40            | 120               | B         | T550B127(1)040(2)(3)         | 13030-03(1)(4)(5)L(6)        | 36.0                            | 5.0                     | 120                   | 1510                    |
| 50            | 25                | B         | T550B256(1)050A(3)           | N/A                          | 9.4                             | 5.0                     | 170                   | 1275                    |
| 50            | 47                | B         | T550B476(1)050A(3)           | N/A                          | 17.6                            | 5.0                     | 150                   | 1350                    |
| 50            | 100               | B         | T550B107(1)050(2)(3)         | 13030-04(1)(4)(5)L(6)        | 37.5                            | 5.0                     | 130                   | 1450                    |
| 50            | 120               | B         | T550B127(1)050(2)(3)         | 13030-05(1)(4)(5)L(6)        | 45.0                            | 5.0                     | 90                    | 1750                    |
| 60            | 20                | B         | T550B206(1)060A(3)           | N/A                          | 9.0                             | 5.0                     | 200                   | 1175                    |
| 60            | 39                | B         | T550B396(1)060A(3)           | N/A                          | 17.6                            | 5.0                     | 160                   | 1310                    |
| 60            | 100               | B         | T550B107(1)060(2)(3)         | 13030-06(1)(4)(5)L(6)        | 45.0                            | 5.0                     | 100                   | 1660                    |
| 75            | 75                | B         | T550B756(1)075(2)(3)         | 13030-07(1)(4)(5)L(6)        | 42.2                            | 5.0                     | 110                   | 1580                    |
| 100           | 25                | B         | T550B256(1)100(2)(3)         | 13030-08(1)(4)(5)L(6)        | 18.8                            | 5.0                     | 190                   | 1200                    |

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

(2) To complete KEMET part number, insert A = N/A, B = standard reliability, or T = high reliability.

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

(4) To complete the DLA PIN number, insert the surge current testing option, A = 25°C after voltage aging, B = -55°C +0°C and +85°C after voltage aging or C = -55°C +0°C and +85°C before voltage aging

(5) To complete the DLA PIN number, insert the insulation option. S = Sleeved, U = Unseleaved.

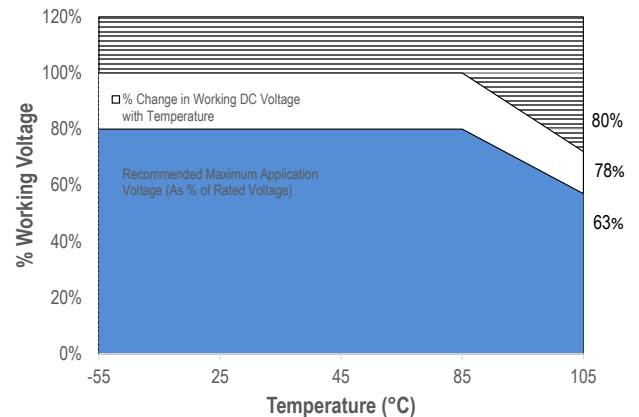
(6) To complete the DLA PIN number, insert the product level option. B = standard reliability or T = high reliability.

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 |
|-----------------------------------------------------------------|---------------|---------------|
| % Change in Working DC Voltage with Temperature                 | $V_R$         | 78% of $V_R$  |
| Recommended Maximum Application Voltage (As % of Rated Voltage) | 80% of $V_R$  | 63% 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 ( $P_{max}$ )<br>mWatts at 25°C<br>with +60°C Rise |
|-----------|-----------------------------------------|------------------------------------------------------------------------------|
| KEMET     | MIL-PRF-39006/22/<br>25/30/31 Case Size |                                                                              |
| B         | T2                                      | 715                                                                          |

| Temperature Compensation Multipliers for<br>Maximum Power Dissipation ( $P_{max}$ ) |                                              |                                               |
|-------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------------|
| $T \leq 45^\circ\text{C}$                                                           | $45^\circ\text{C} < T \leq 85^\circ\text{C}$ | $85^\circ\text{C} < T \leq 105^\circ\text{C}$ |
| 1.00                                                                                | 0.50                                         | 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)

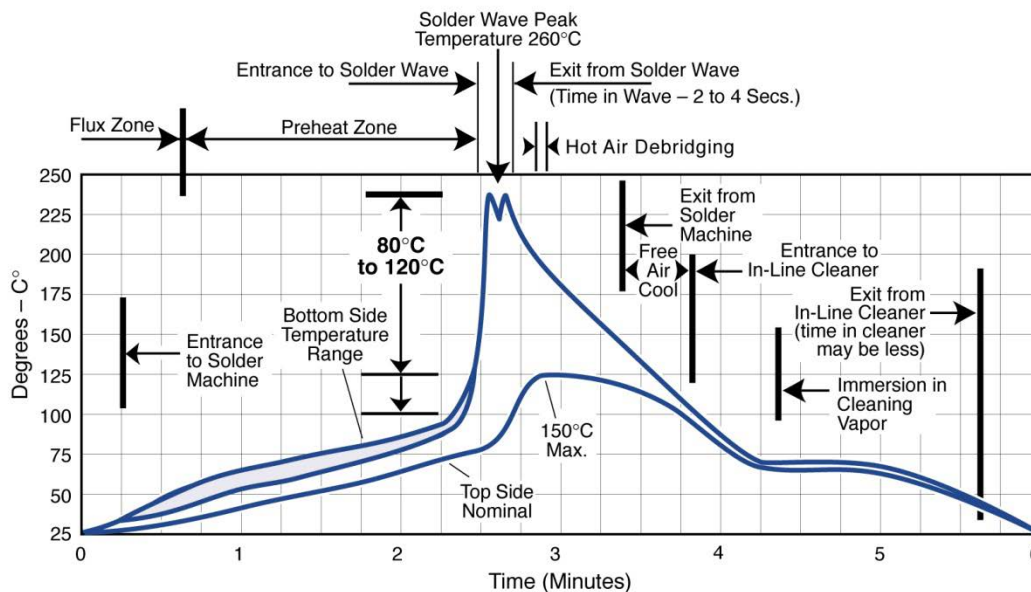
The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

## 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.

## Capacitor Marking

|                 |          |                                                       |
|-----------------|----------|-------------------------------------------------------|
| <b>KT550</b>    | <b>+</b> | Manufacturer's Identification, Series, Polarity       |
| <b>100μf</b>    |          | Nominal Capacitance in Microfarads (μf) ("R"=Decimal) |
| <b>10% 60V</b>  | <b>+</b> | Capacitance Tolerance, Voltage                        |
| <b>1202AAAA</b> |          | Date*/Lot Code (Year, Week, Lot Code)                 |

\* 1st & 2nd digit = Year  
3rd & 4th digit = Week

## 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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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product-related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.