

## Overview

The KEMET T551 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 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 MnO<sub>2</sub> 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	Sleeve Option
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.

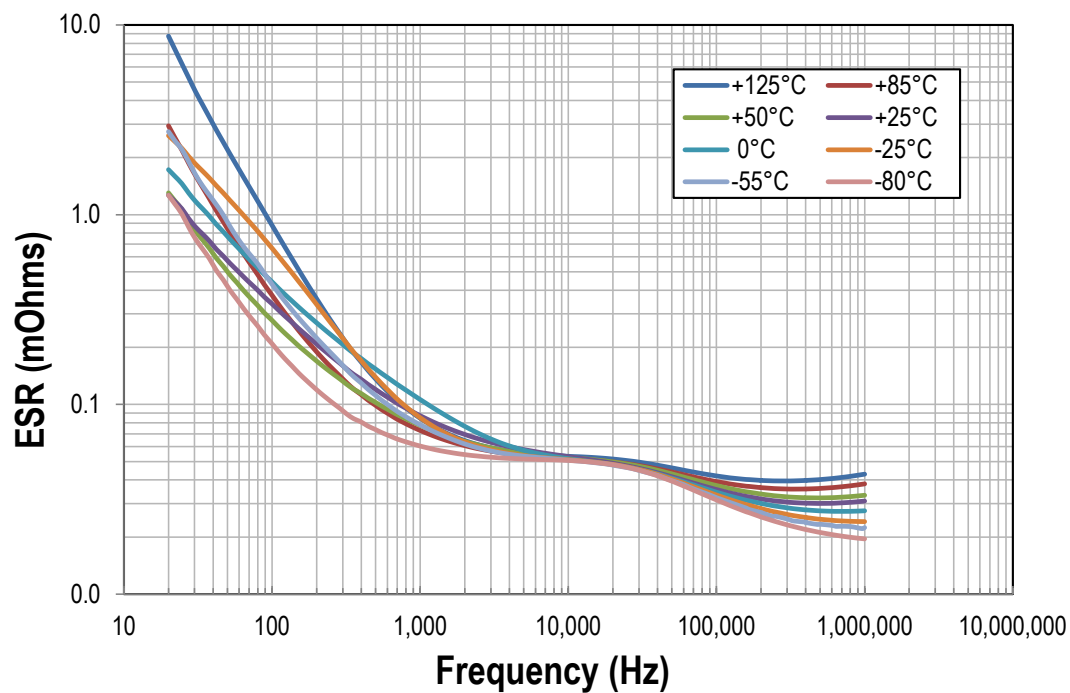
\* Additional case sizes and capacitance/voltage are under development.

## Qualification

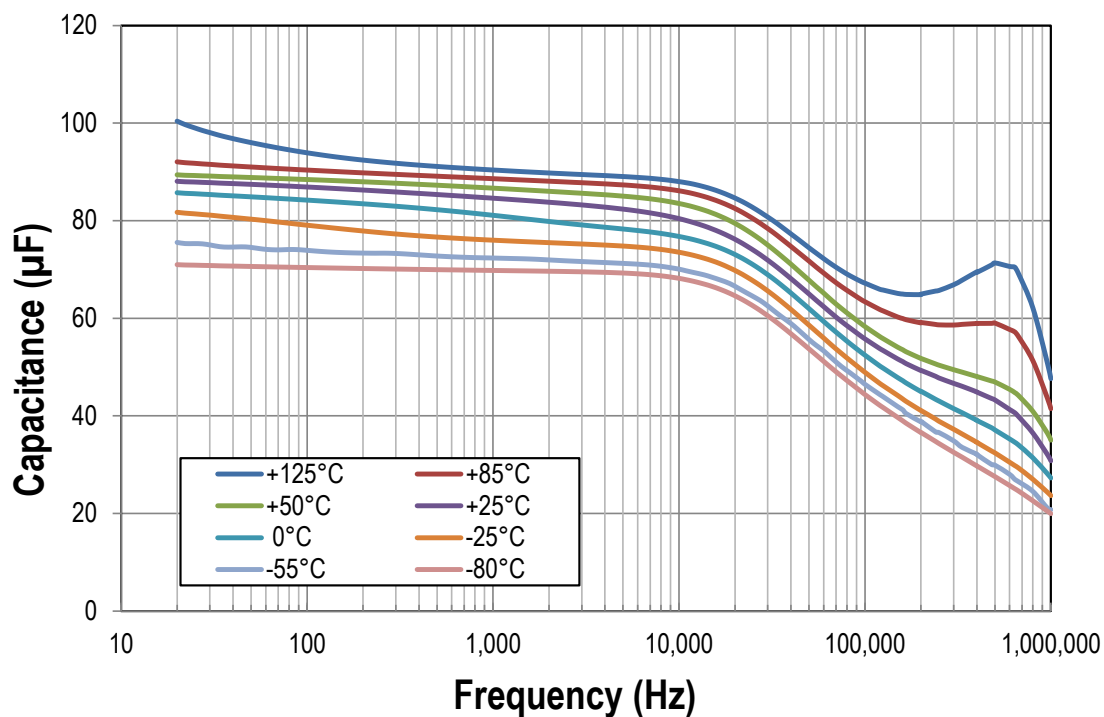
Test Performed	Method Reference	Test Conditions
Reliability and Environmental Tests		
AC Ripple Life at 85°C	MIL-PRF-39006	85°C, 40 kHz ripple current, 2,000 hours
85°C Life	MIL-PRF-39006	85°C, rated voltage, 2,000 hours
125°C Life	KEMET Standard	125°C, 0.66 x rated voltage, 2,000 hours
Surge Voltage	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

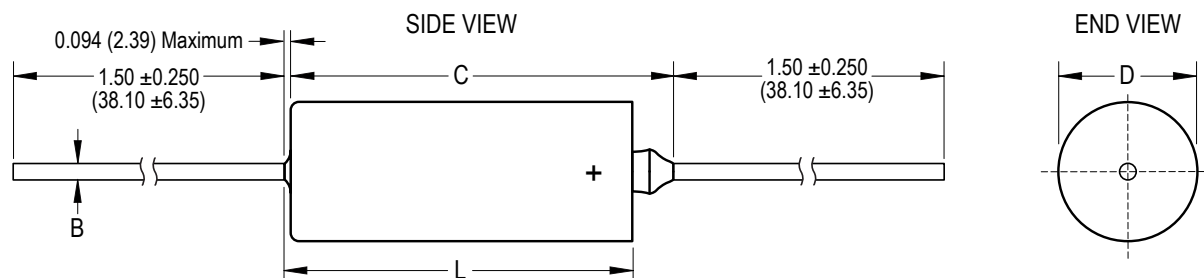
ESR vs. Frequency



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

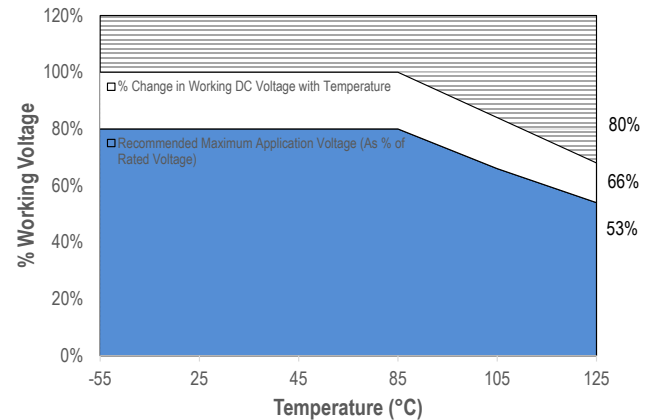
(1) To complete KEMET part number, insert M for ±20% or K for ±10%. Designates capacitance tolerance.

(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	0.50	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)

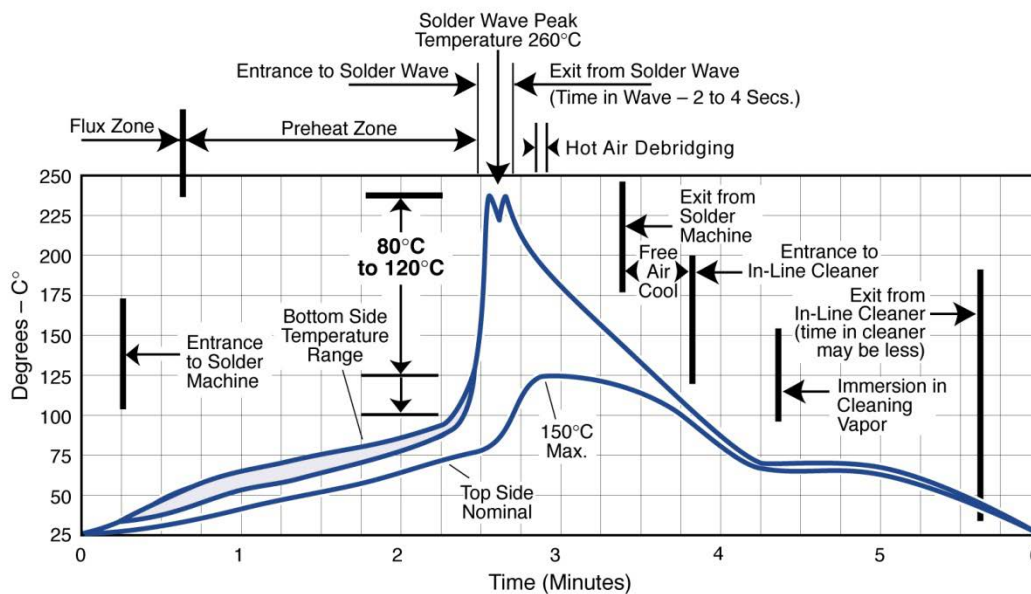
The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

## 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

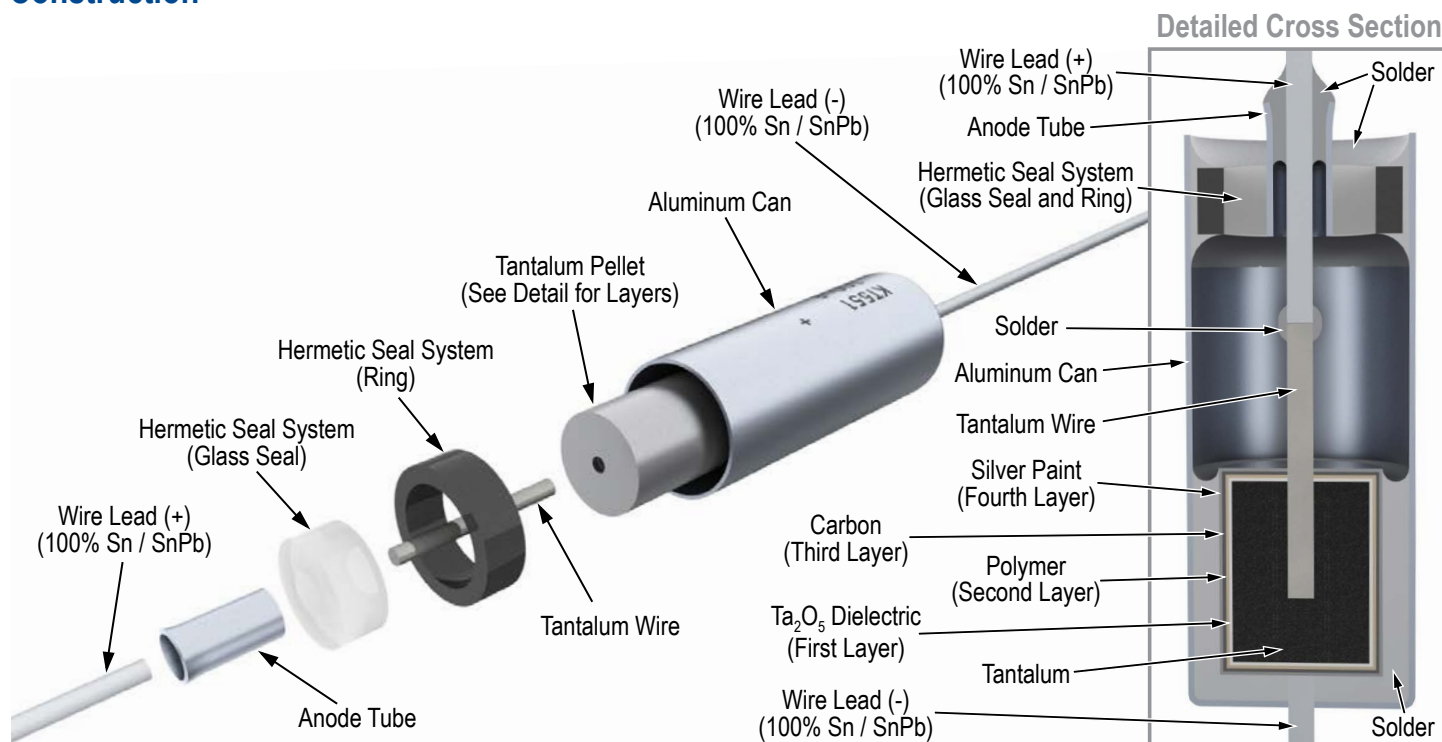
## Optimum Solder Wave Profile



## Mounting

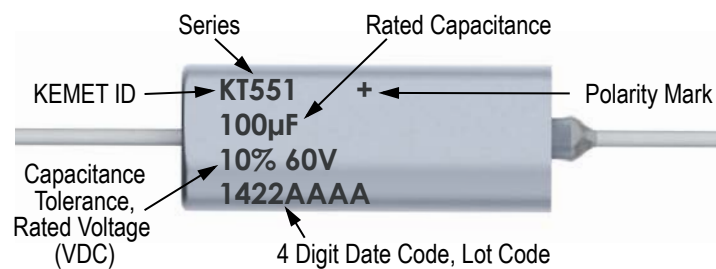
All encased capacitors will pass the Resistance to Soldering Heat Test of MIL-STD-202, Method 210, Condition C. This test simulates wave solder of topside board mount product. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. More severe 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.

## 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 <sup>st</sup> week of the year to 52 = 52 <sup>nd</sup> 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

## KEMET Corporation World Headquarters

2835 KEMET Way  
Simpsonville, SC 29681

Mailing Address:  
P.O. Box 5928  
Greenville, SC 29606

www.kemet.com  
Tel: 864-963-6300  
Fax: 864-963-6521

**Corporate Offices**  
Fort Lauderdale, FL  
Tel: 954-766-2800

## North America

### Northeast

Wilmington, MA  
Tel: 978-658-1663

### Southeast

Lake Mary, FL  
Tel: 407-855-8886

### Central

Novi, MI  
Tel: 248-994-1030

Irving, TX  
Tel: 972-915-6041

### West

Milpitas, CA  
Tel: 408-433-9950

### Mexico

Guadalajara, Jalisco  
Tel: 52-33-3123-2141

## Europe

### Southern Europe

Sasso Marconi, Italy  
Tel: 39-051-939111

Skopje, Macedonia  
Tel: 389-2-55-14-623

### Central Europe

Landsberg, Germany  
Tel: 49-8191-3350800

Kamen, Germany  
Tel: 49-2307-438110

### Northern Europe

Wyboston, United Kingdom  
Tel: 44-1480-273082

Espoo, Finland  
Tel: 358-9-5406-5000

## Asia

### Northeast Asia

Hong Kong  
Tel: 852-2305-1168

Shenzhen, China  
Tel: 86-755-2518-1306

Beijing, China  
Tel: 86-10-5877-1075

Shanghai, China  
Tel: 86-21-6447-0707

Seoul, South Korea  
Tel: 82-2-6294-0550

Taipei, Taiwan  
Tel: 886-2-27528585

### Southeast Asia

Singapore  
Tel: 65-6701-8033

Penang, Malaysia  
Tel: 60-4-6430200

Bangalore, India  
Tel: 91-806-53-76817

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Contact Us :

➤ Address :

401 Building No.5, JiuGe Business Center, Lane 2301, Yishan Rd  
Minhang District, Shanghai , China

➤ Sales :

Direct     +86 (21) 6401-6692  
  
Email       amall@ameya360.com  
  
QQ         800077892  
  
Skype      ameyasales1 ameyasales2

➤ Customer Service :

Email       service@ameya360.com

➤ Partnership :

Tel         +86 (21) 64016692-8333  
  
Email      mkt@ameya360.com