T551 Axial & T556 Surface Mount 125°C

Overview

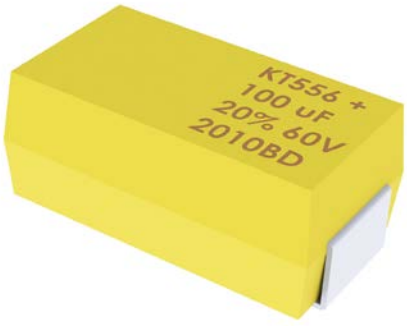
The T551 axial leaded and T556 surface mount polymer hermetically sealed (PHS) devices are tantalum capacitors with a Ta anode and Ta_2O_5 dielectric. A conductive, organic polymer replaces the traditionally used MnO_2 or wet electrolyte as the cathode plate of the capacitor. The result is very low ESR and improved capacitance retention at high frequency and low temperature. The PHS device also exhibits a benign failure mode, which eliminates the case breach that can occur in wet tantalum capacitors. Additionally, the part may be operated at voltages up to 80% of rated voltage, with equivalent or better reliability than traditional MnO_2 or wet tantalum capacitors operated at 50% of rated voltage.

PHS capacitors molded also offer 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, these parts provide 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 +125°C
- Polymer cathode technology
- ≤ 0.0075 CV (µA) at rated voltage after 5 minutes
- Extremely low ESR
- High frequency and low temperature capacitance retention
- 100% constant voltage conditioning (240 hours)
- 100% surge current tested
- Volumetrically efficient
- Use at up to 80% of rated voltage
- Non-ignition failure mode
- Approximately 25% lighter than equivalent wet tantalum
- T551 case dimensions equivalent to MIL-PRF-39006/22/25/30/31
- T556 surface mount design (see dimensions diagram)





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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 = Axial Leaded PHS 556 = Surface Mount PHS	B	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	006 = 6.3 008 = 8 010 = 10 015 = 15 025 = 25 030 = 30 040 = 40 050 = 50 060 = 60 075 = 75	A = N/A	T = 100% tin (Sn)-plated H = Tin/lead (SnPb) solder coated (5% Pb minimum)	Blank = 25°C ±5°C, 10 cycles, after constant voltage conditioning (KEMET standard) 4251 = Surge current, 10 cycles, –55°C and +85°C 4252 = 10 cycles, –55°C and +85°C before constant voltage conditioning	Blank = Bulk/Sleeved 0100 = Bulk/Unsleeved 7200 = Tape & Reel/Sleeved 7293 = Ammo/Sleeved 7443 = Ammo/Sleeved

** Only for T551 (Surge options/packaging)*

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	–55°C to 125°C
Rated Capacitance Range	20 – 680 µF at 120 Hz/25°C *
Capacitance Tolerance	K tolerance (10%), M tolerance (20%)
Rated Voltage Range	6.3 – 75 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 (rated voltage up to +85°C and 66% of rated voltage applied at 125°C)
Packaging	T551 according to MIL-PRF-39006, T556 bulk

KEMET does not recommend storage above 85°C.
** Additional case sizes and capacitance/voltage are under development.*

Qualification - T551

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 105°C
Frequency Scan	KEMET Standard	Impedance, ESR and capacitance versus frequency

Qualification - T556

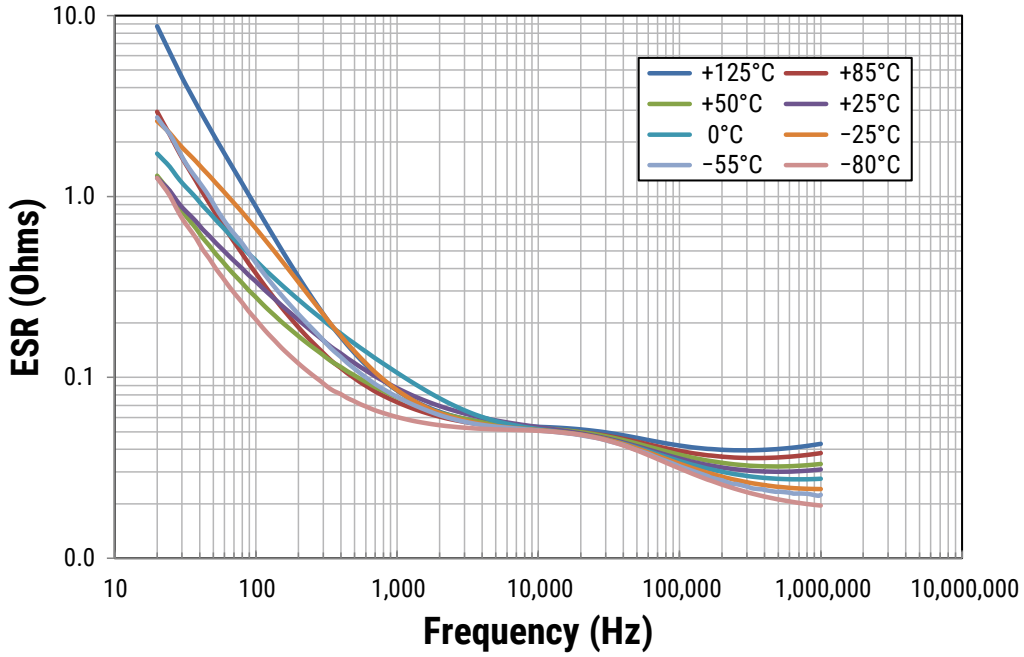
Test Performed	Method Reference	Test Conditions
Reliability and Environmental Tests		
105°C Life	KEMET Standard	105°C, 0.78 x rated voltage, 2,000 hours
Surge Voltage	MIL-PRF-39006	85°C, 1.15 x rated voltage, 1,000 cycles, except delta cap shall be +10%/–20%
Physical, Mechanical and Process Tests		
Visual and Mechanical Examination (Internal and External)	MIL-PRF-39003	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
Electrical Characterization		
Temperature Stability	Reference MIL-PRF-39006	–55°C to 105°C

Environmental Compliance

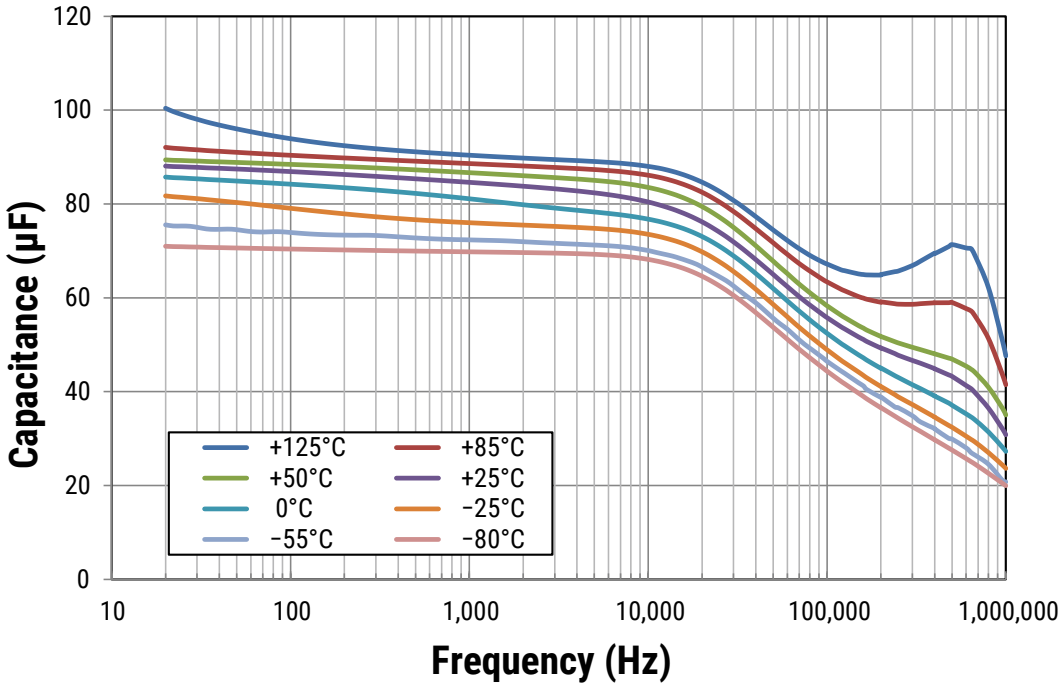
Epoxy compliant with UL 94 V–0.

Electrical Characteristics

ESR vs. Frequency

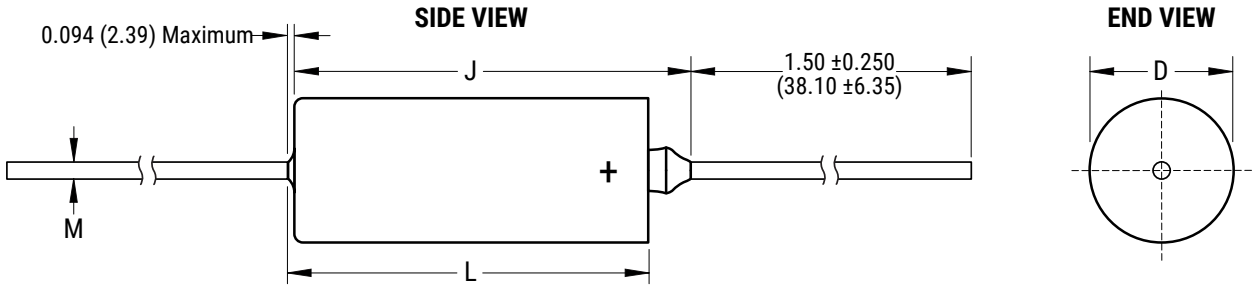


Capacitance vs. Frequency



Dimensions – Inches (Millimeters)

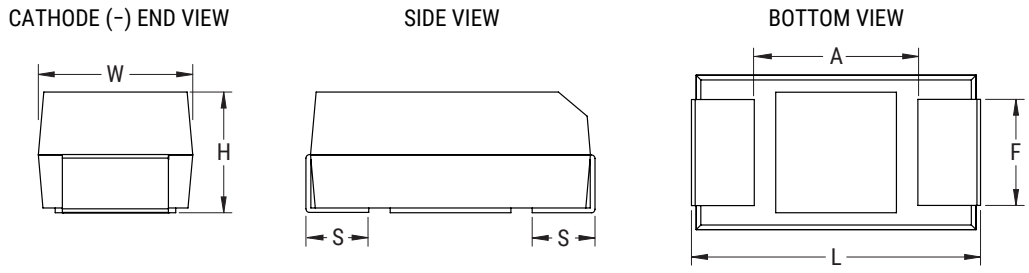
T551



Case Code	Case Size	Unsleeved Case				Sleeved Case	
	MIL-PRF-39006	L ±0.031 (0.79)	D +0.016 (0.41) −0.015 (0.38)	M ±0.002 (0.05)	J maximum	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)

Dimensions – Millimeters

T556



Case Code						Weight (g)
	L ±0.5	W ±0.5	H ±0.5	F ±0.5	S minimum	Average
B Surface mount	24.5	8.5	9.1	4.2	3.0	5.54

Table 1A – 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		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
6.3	140	B	T551B147(1)006A(2)	6.3	5.0	120	1,510
8	220	B	T551B227(1)008A(2)	13.2	5.0	120	1,510
8	680	B	T551B687(1)008A(2)	40.8	5.0	90	1,750
10	100	B	T551B107(1)010A(2)	7.5	5.0	140	1,400
10	180	B	T551B187(1)010A(2)	13.5	5.0	110	1,580
10	560	B	T551B567(1)010A(2)	42.0	5.0	90	1,750
15	70	B	T551B706(1)015A(2)	7.9	5.0	140	1,400
15	120	B	T551B127(1)015A(2)	13.5	5.0	110	1,580
15	390	B	T551B397(1)015A(2)	43.9	5.0	90	1,750
25	50	B	T551B506(1)025A(2)	9.4	5.0	170	1,275
25	100	B	T551B107(1)025A(2)	18.8	5.0	190	1,200
30	40	B	T551B406(1)030A(2)	9.0	5.0	170	1,275
30	68	B	T551B686(1)030A(2)	15.3	5.0	140	1,400
40	100	B	T551B107(1)040A(2)	30.0	5.0	150	1,350
40	120	B	T551B127(1)040A(2)	36.0	5.0	120	1,510
50	25	B	T551B256(1)050A(2)	9.4	5.0	170	1,275
50	47	B	T551B476(1)050A(2)	17.6	5.0	150	1,350
50	100	B	T551B107(1)050A(2)	37.5	5.0	130	1,450
50	120	B	T551B127(1)050A(2)	45.0	5.0	90	1,750
60	20	B	T551B206(1)060A(2)	9.0	5.0	200	1,175
60	39	B	T551B396(1)060A(2)	17.6	5.0	160	1,310
60	100	B	T551B107(1)060A(2)	45.0	5.0	100	1,660
75	75	B	T551B756(1)075A(2)	42.2	5.0	110	1,580

(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. The 85°C 40 kHz ripple limit is based on the maximum allowed power at 85°C and the maximum expected ESR at 40 kHz. For this calculation, the 100 kHz ESR limit is multiplied by a factor of 1.3 to account for the frequency dependence of ESR.

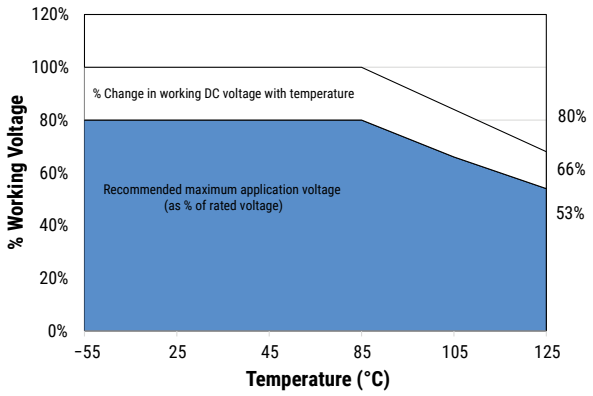
Table 1B – Ratings & Part Number Reference

Rated Voltage	Rated Capacitance	Case Size	KEMET Part Number	DC Leakage	DF	Maximum ESR	Ripple Current
(V) 85°C	µF	KEMET/EIA		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
6.3	140	B	T556B147(1)006A(2)	6.3	5.0	120	1,510
8	220	B	T556B227(1)008A(2)	13.2	5.0	120	1,510
8	680	B	T556B687(1)008A(2)	40.8	5.0	90	1,750
10	100	B	T556B107(1)010A(2)	7.5	5.0	140	1,400
10	180	B	T556B187(1)010A(2)	13.5	5.0	110	1,580
10	560	B	T556B567(1)010A(2)	42.0	5.0	90	1,750
15	70	B	T556B706(1)015A(2)	7.9	5.0	140	1,400
15	120	B	T556B127(1)015A(2)	13.5	5.0	110	1,580
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30	40	B	T556B406(1)030A(2)	9.0	5.0	170	1,275
30	68	B	T556B686(1)030A(2)	15.3	5.0	140	1,400
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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

** Applies to TH and SMD*

Temperature Compensation Multipliers for Maximum Power Dissipation (P_{max})		
T ≤ 45°C	45°C < T ≤ 85°C	85°C < T ≤ 125°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

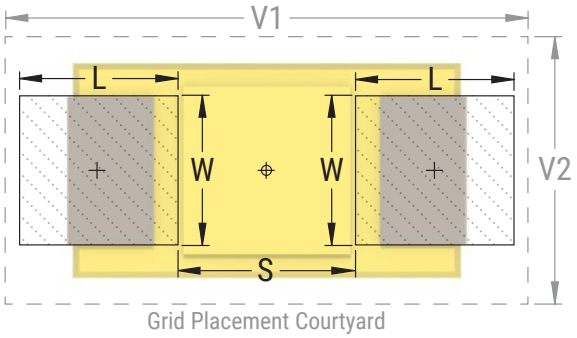
Solid tantalum polymer capacitors are polar devices and may be permanently damaged or destroyed if connected with the wrong polarity. A small reverse voltage is permissible for time periods per the below table. KEMET can offer lower capacitance in this voltage with higher reverse voltage capability.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

Table 2 – Land Dimensions/Courtyard

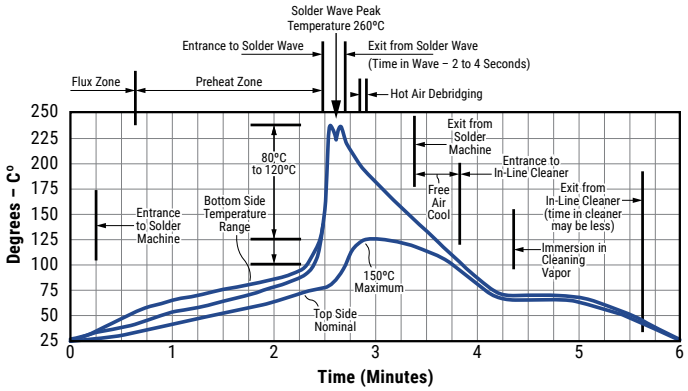
KEMET	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
Case	EIA	W	L	S	V1	V2	W	L	S	V1	V2	W	L	S	V1	V2
B	3528–21	4.73	4.86	17.015	27.62	10	4.61	4.46	17.215	26.52	9.5	4.51	4.08	17.375	25.81	9.24

Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.*
Density Level B: *For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.*
Density Level C: *For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC standard 7351 (IPC–7351).*

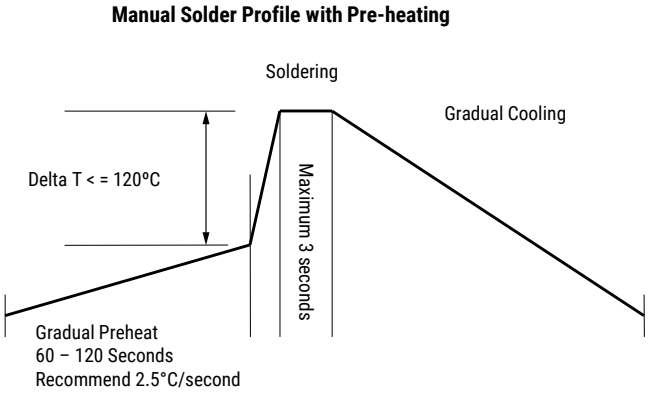


Soldering Process

Optimum Solder Wave Profile



Hand Soldering (Manual)*



T555 MUST be hand soldered only.

Mounting

WARNING: T555/T556 MUST BE HAND SOLDERED. THE USE OF STANDARD SMD PROCESSES FOR BOARD MOUNT WILL CAUSE IRREVERSIBLE DAMAGE TO THIS PRODUCT.

T555 SMD

In hand-soldering tantalum polymer SMT capacitors, a manufacturer can utilize two (2) soldering methodologies that include pre-heating or not pre-heating the capacitors. KEMET recommends utilizing a pre-heating technique. However, due to the large temperature gradient between the capacitors and the tip of the soldering iron, take extreme caution in this process. The thermal stresses from the large thermal gradients and the propensity of the operator touching the tip of the soldering iron to the device can lead to mechanical and/or electrical damage.

When manually soldering, it is important the soldering process be carefully monitored and carried out so that the temperature gradient falls within the recommended conditions above (profile).

Mounting (cont'd.)

Process 1 (with preheating)

1) Utilize 1.0 mm thread eutectic solder with soldering flux in the core. Either a rosin-based or non-activated flux is recommended.
2) The capacitors shall be pre-heated so that the temperature gradient between the devices and the tip of the soldering iron is Delta T < = 120°C or below.
3) The temperature of the solder iron tip should not exceed 270°C.
4) The required amount of solder shall be melted in advance on the soldering tip.
5) After soldering, the capacitors shall be cooled gradually at room ambient temperature. Forced air cooling is not recommended.

Process 2 (without preheating)

1) Soldering iron tip shall never directly touch the termination egress or the case body of the capacitors.
2) Lands are sufficiently pre-heated with a soldering iron tip before sliding the soldering iron tip to the terminal electrode of the capacitor for soldering.

Reference	Condition
Case Size	All
Temperature of soldering iron	270°C
Wattage	20 W maximum
Shape of soldering iron	3 mm maximum
Soldering time with soldering iron	3 seconds maximum

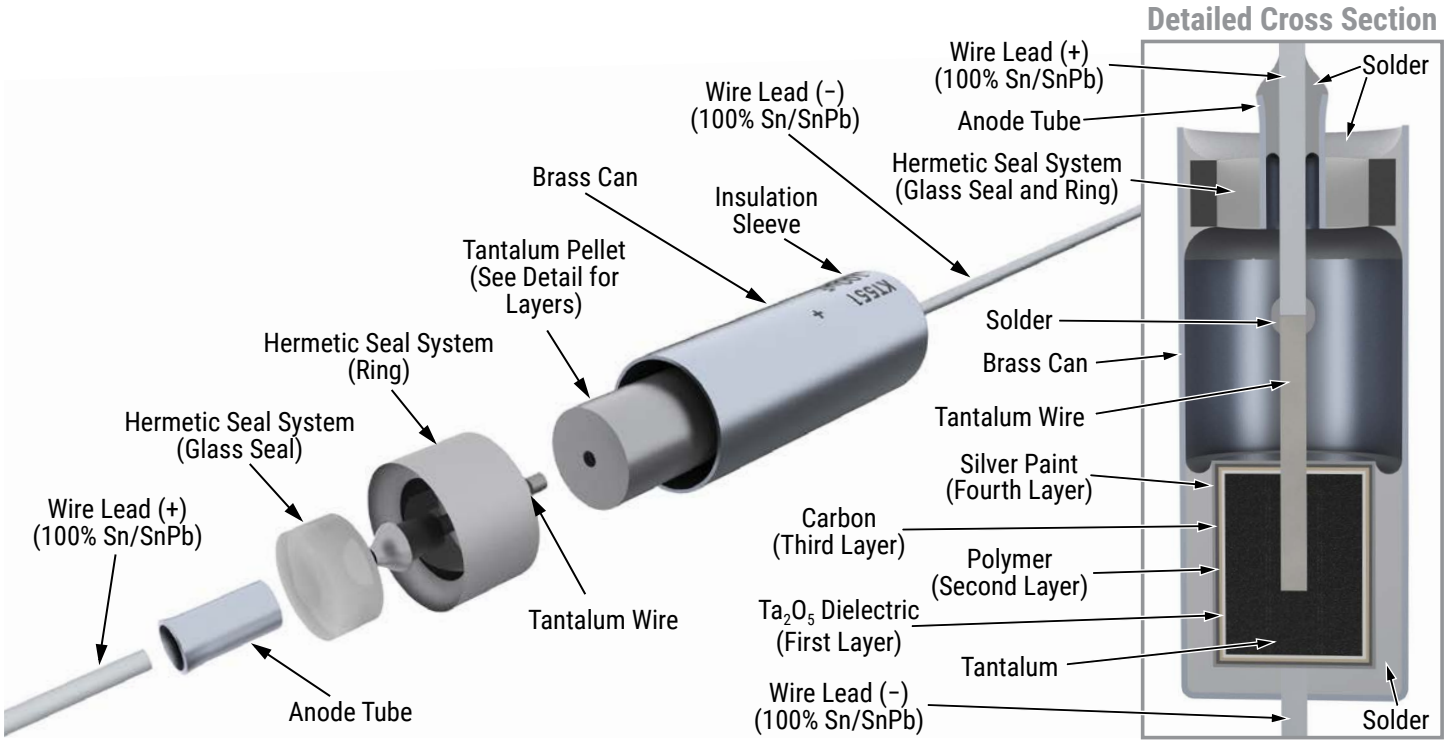
T551 Through-Hole
All encased capacitors will pass the resistance to soldering heat test of MIL-STD-202, Method 210, Condition C. This test simulates wave solder of topside board mount product. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. 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.

Additional mounting recommendations (SMD and Through-Hole):

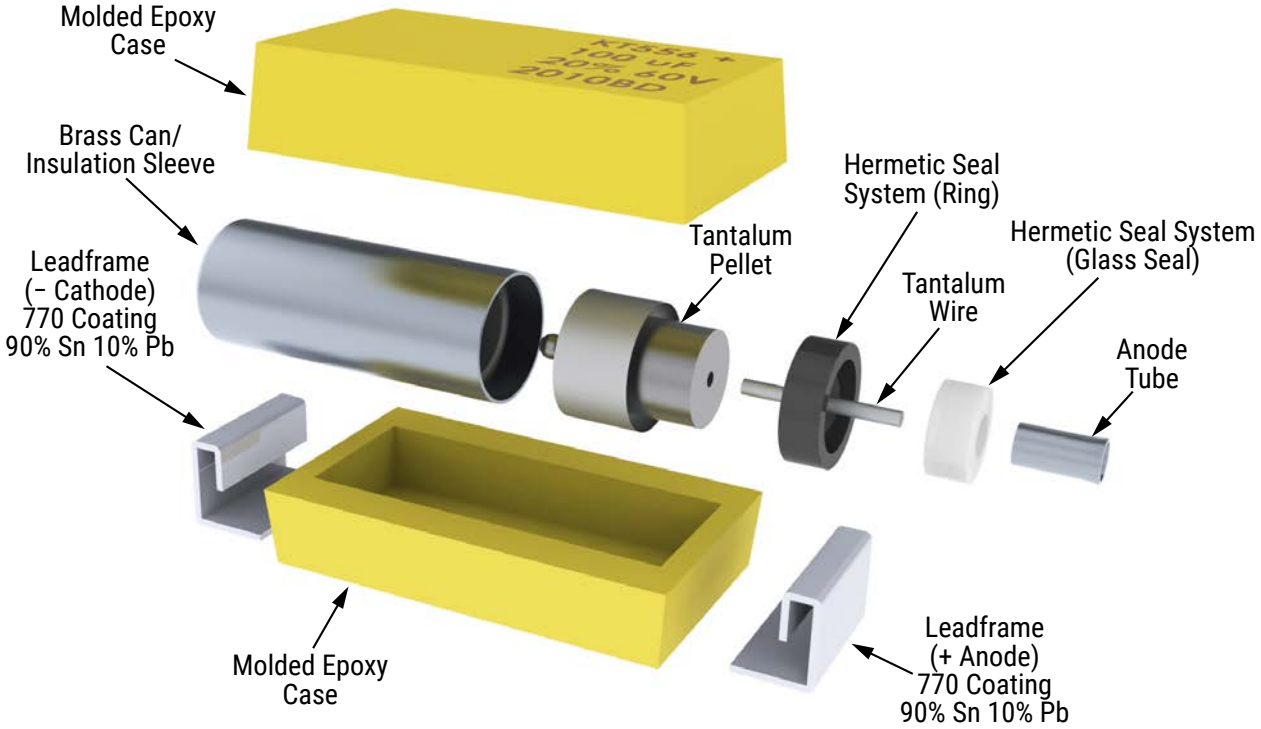
In order to increase the board mount integrity of KEMET's Polymer Hermetic Sealed (SMD or TH version) relative to mechanical shock and vibration, KEMET recommends the use of an adhesive between the component and the PCB. This is defined in the Space Application Electronic Hardware Addendum to J-STD-001 (Requirements for Solder Electrical and Electronic Assemblies.)

Construction

T551



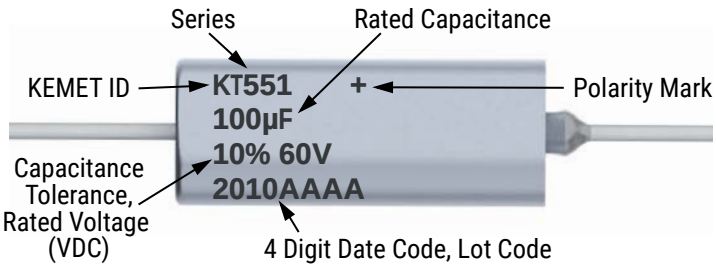
T556



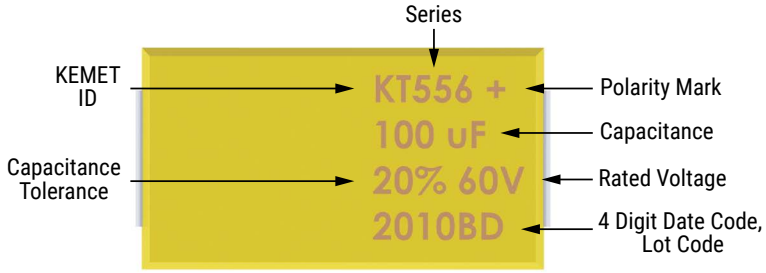
Capacitor Marking

T551

B Case



T556



Storage

Tantalum hermetically sealed and SMD 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		Bulk	8.5" Reel*	Ammo Pack
	C-Spec	Blank	7200	7443
B Through-hole	–	20 per tray	150	250
B Surface mount	–	100 per box	N/A	

** For orders greater than 150 pieces, a 12" reel (500 pieces/reel) will be sent.*

Weight

Case Size		Average Weight (grams)
KEMET	EIA	
B Through-hole	T2	3.63
B Surface mount	–	5.54

KEMET Electronics Corporation Sales Offices

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