PRODUCT DESCRIPTION

KEMET's family of solid tantalum chip capacitors is designed and manufactured with the demanding requirements of surface mount technology in mind.

These devices extend the advantages of solid tantalum technology to today's surface mount circuit applications. Complimenting multilayer ceramic chip convenience with capacitance ratings through 150μF, tantalum chip capacitors permit circuit designers to take full advantage of the benefits of surface mount technology.

Molded T491 Series

The leading choice in today's surface mount designs is the KEMET T491 Series. This product is qualified to IEC QC300801/US0001 and meets or exceeds the requirements of EIA standard 535BAAC. The physical outline and dimensions of this Series conform to both global standards.

This product was designed specifically for today's highly automated surface mount processes and equipment. This Series uses the same proven solid tantalum KEMET technology acclaimed and respected throughout the world. Added to this is the latest in materials, processes and automation which result in a component unsurpassed worldwide in total performance and value.

The solder coated terminations provide excellent wetting characteristics and compatibility with today's surface mount solder systems. The symmetrical terminations offer total compliancy to provide the thermal and mechanical stress relief required in today's technology. Lead frame attachments to the tantalum pellet are made via a microprocessor controlled welding operation, and a high temperature silver epoxy adhesive system.

Standard packaging of these devices is tape and reel in accordance with EIA 481. Standard quantities by case size and reel size are offered per Amendment Number 1 of IEC QC300801/US0001 (see page 19 for details). This system provides perfect compatibility with all tape fed placement units.

Unencapsulated T411/T421 Series

Originally designed for use on both thick-film and thin-film alumina substrates, these devices offer excellent performance on all types of printed circuit boards commonly used in today's surface mount technology. With the use of a unique high temperature counter-electrode system, this product has unparalleled resistance to degradation from extreme soldering and operating temperature conditions.

Substrate attachment is achieved typically with the use of the standard 60/40 Sn/Pb terminations, which are compatible with all conventional solder systems. Epoxy or thermo-compression bonding techniques are also possible with this Series to satisfy your specialized requirements.

With almost two decades of manufacturing experience to date, this surface mount device offers the industry the ultimate in performance and reliability. Testing to Mil-C-55365 and beyond is available to satisfy your most demanding specialized needs.

SUMMARY

This family of solid tantalum surface mount capacitors all benefit from KEMET's total commitment to Statistical Process Control (SPC) techniques and Just-in-Time (JIT) scheduling systems. This qualifies these products to be available with KEMET's globally recognized Certification Program. This program enables the user to accept shipment of this product right at the assembly line, without the time, cost and inconvenience of receiving inspection procedures. Data is shipped with this product demonstrating that all critical parameters have been monitored and are in control.

FEATURES

Molded T491 Series

- Qualified to IEC Standard QC300801/US0001
- Meets or exceeds EIA Standard 535BAAC
- Taped and Reeled per EIA 481
- Symmetrical, Compliant Terminations
- Laser Marked Case
- Capacitance: 0.1μF to 150μF
- Tolerance: ±10%, ±20%
- Voltage: 4-50 VDC

Unencapsulated T411/T421 Series

- High Temperature Capabilities
- Reflow/Wave Soldering
- Epoxy Bonding
- Thermocompression Bonding
- Military Equivalent Product
- Capacitance: 0.1μF to 100μF
- Tolerance: ±5%, ±10%, ±20%
- Voltage: 4-50 VDC

COMPONENT PERFORMANCE CHARACTERISTICS

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

ELECTRICAL

1. Operating Temperature Range

- ***−55°C to +125°C***

Voltage derating is specified in Section 5. Performance characteristics over this temperature range are presented within the following sections.

For operation at temperatures above +125°C, contact KEMET for derating and performance information.

2. Storage Temperature Range

- ***−55°C to +125°C***

For storage at temperatures above +125°C, contact KEMET for additional information.

3. Capacitance Range

- ***.1μF to 150μF***

A complete listing of available capacitance values is presented on pages 14 (T491) and 16 (T411/T421).

Capacitance is measured at 120Hz, up to 1.0 volt rms maximum and up to 2.0 volts DC maximum, at +25°C. The typical effect of frequency upon capacitance is shown in Figure 1.

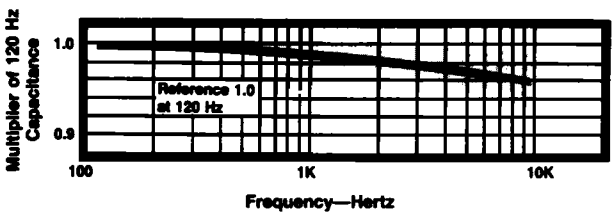


FIGURE 1 Typical Effect of Frequency upon Capacitance

Maximum allowable change in capacitance from initial +25°C value:

Series	Ambient Temperature		
	−55°C	+85°C	+125°C
T491	−10%	+10%	+12%
T411/T421	−10%	+8%	+12%

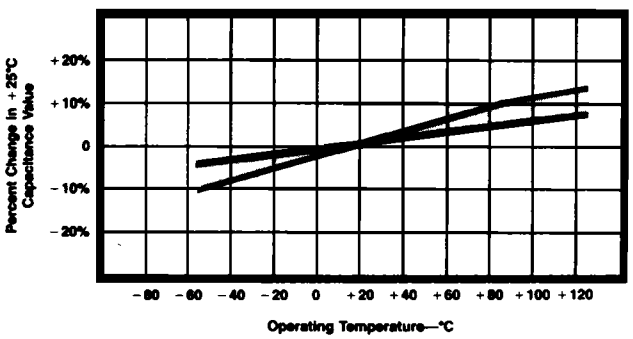


FIGURE 2 Typical Effect of Temperature upon Capacitance

4. Capacitance Tolerance

- ***M − ±20%; K − ±10%***
- ***(J − ±5% tolerance available with T411/T421 Series only.)***

5. Working DC Voltage (WVDC)

- ***4 to 50 volts***

A complete listing of available voltage ratings is presented on pages 14 (T491) and 16 (T411/T421).

These voltages are the maximum recommended peak DC operating voltages from −55°C to +85°C for continuous duty. These voltages are derated linearly above +85°C to ⅔ rated voltage for operation at +125°C (See Figure 3).

Surge voltage capabilities are presented in Section 11, page 6. Reverse voltage capabilities are presented in Section 12, page 7. Contact KEMET for voltage derating factors for operation above +125°C.

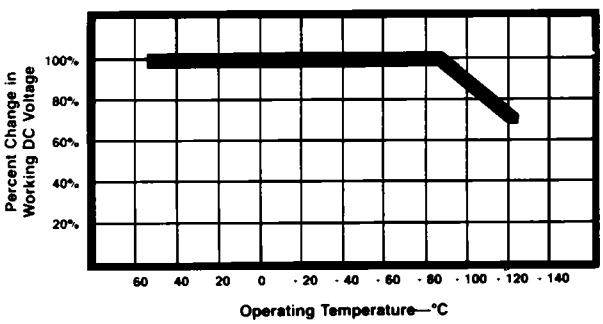


FIGURE 3 Working DC Voltage Change with Temperature

6. DC Leakage Current (DCL)

- ***.01 μA/CV, or .5 μA, whichever is greater (T491 Series)***

A complete listing of maximum leakage ratings is presented on pages 14 (T491) and 16 (T411/T421).

DC leakage current is the current that, after a one to five-minute charging period, flows through a capacitor when voltage is applied. Leakage is measured at +25°C with full rated DC voltage applied to the capacitor through a 1000 ohm resistor in series with the capacitor.

The following multipliers represent the maximum allowable increase in DC leakage at elevated temperatures from initial +25°C limit:

COMPONENT PERFORMANCE CHARACTERISTICS (con't)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

Ambient Temperature		
−55°C	+85°C	+125°C
N/A	10X	12X

See Figure 4 for typical leakage performance vs. temperature.

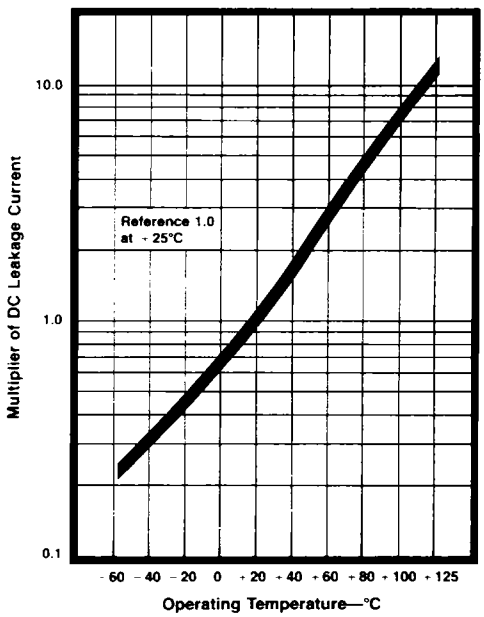


FIGURE 4 Typical Effect of Temperature upon DC Leakage Current

DC leakage is affected by applied voltage as shown in Figure 5.

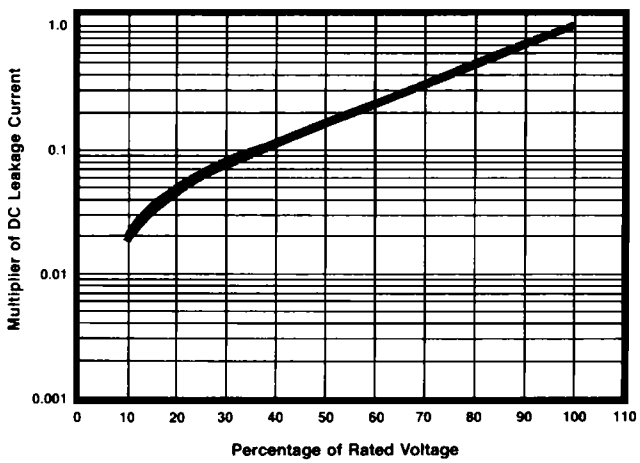


FIGURE 5 Typical Range of DC Leakage Current as a Function of Applied Voltage

7. Dissipation Factor (DF)

- ***4%*** − ≤ ***1.0μF (T491 Series)***
  6% − > ***1.0μF,*** < ***100μF (T491 Series)***
  8% ≥ ***100μF (T491 Series)***

A complete listing of maximum dissipation factor ratings is presented on pages 14 (T491)and 16 (T411/T421).

Dissipation factor is measured at 120Hz, up to 1.0 volt rms maximum, and up to 2.0 volts DC maximum at +25°C. The normal effect of frequency upon dissipiation factor is shown on Figure 6.

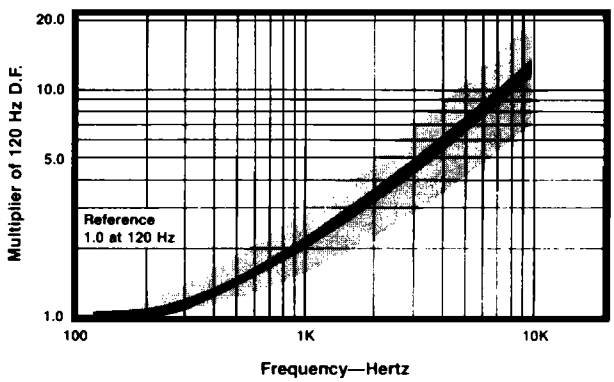


FIGURE 6 Normal Effect of Frequency upon Dissipation Factor

Dissipation factor is a very useful low frequency (120 Hz) measurement of the reactance component of a capacitor. It is defined as the ratio of the equivalent series resistance (ESR) and the capacitive reactance, (Xc) and is usually expressed as a percentage. It is directly proportional to both capacitance and frequency. Dissipation factor loses its importance at higher frequencies, where impedance (Z) and equivalent series resistance (ESR) are the normal parameters of concern.

$$DF = \frac{R}{Xc} = 2\pi fCR$$

DF = Dissipation Factor
R = Equivalent Series Resistance (Ohms)
Xc = Capacitive Reactance (Ohms)
f = Frequency (Hertz)
C = Series Capacitance (Farads)

DF is also referred to an tan θ or "loss tangent". The "Quality Factor", "Q", is the reciprocal of DF.

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

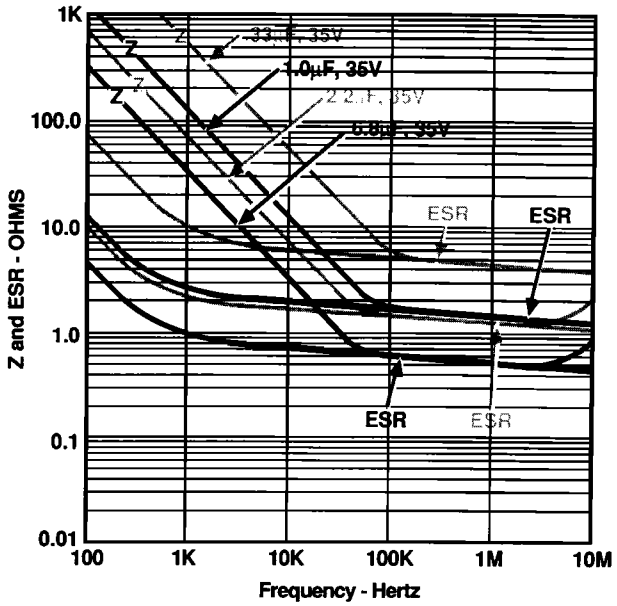


FIGURE 7a ESR & Impedance (Z) vs Frequency
Typical T491

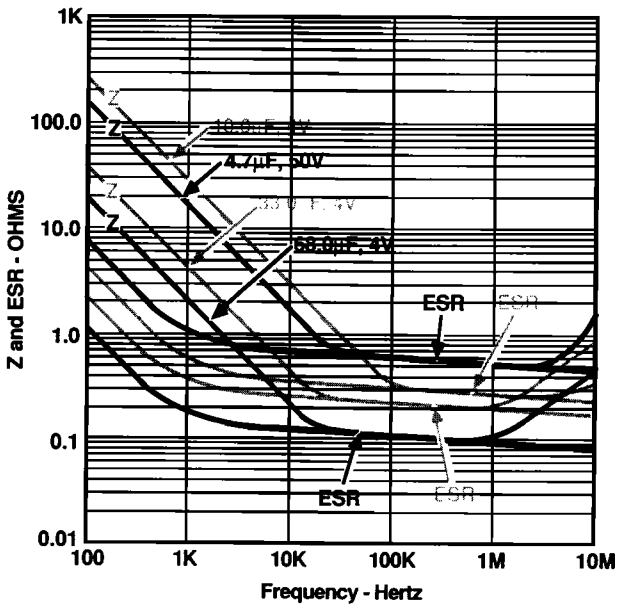


FIGURE 7c ESR & Impedance (Z) vs Frequency
Typical T411/T421

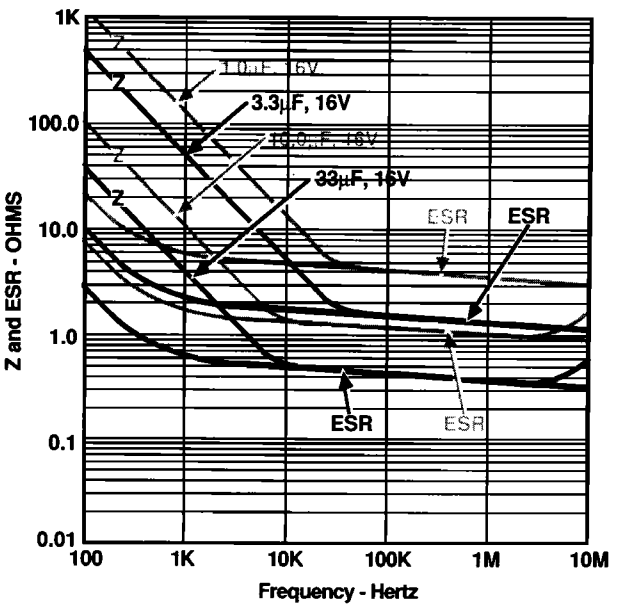


FIGURE 7b ESR & Impedance (Z) vs Frequency
Typical T491

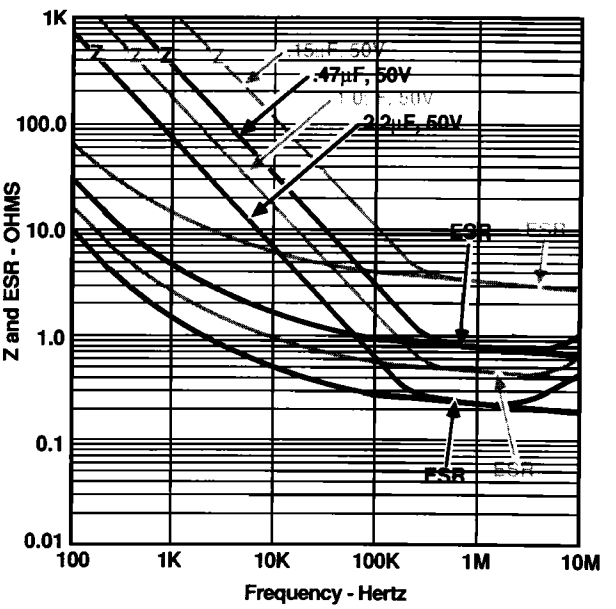


FIGURE 7d ESR & Impedance (Z) vs Frequency
Typical T411/T421

8. Equivalent Series Resistance (ESR)

ESR is frequency dependent and typical performance is depicted in Figures 7a and 7b (T491), and Figures 7c and 7d (T411/T421). Contact KEMET for typical and maximum ESR limits by individual part type.

9. Impedance (Z)

Total impedance of the capacitor is the vector sum of capacitive reactance (Xc) and ESR, below resonance; above resonance total impedance is the vector sum of inductive reactance (X_L)and ESR. This is illustrated in Figures 8a and 8b.

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

$$X_c = \frac{1}{2\pi fC}, \text{ ohm,}$$

where:
f = frequency, Hertz
C = capacitance, Farad

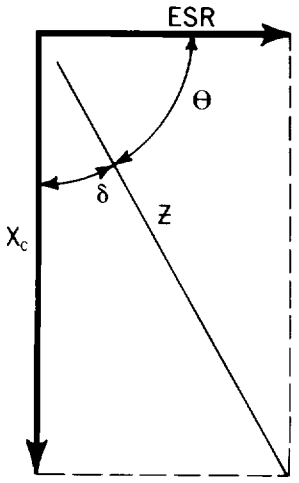


FIGURE 8a Total Impedance of the Capacitor Below Resonance

$$X_L = 2\pi fL$$

where:
f = frequency, Hertz
L = inductance, Henries

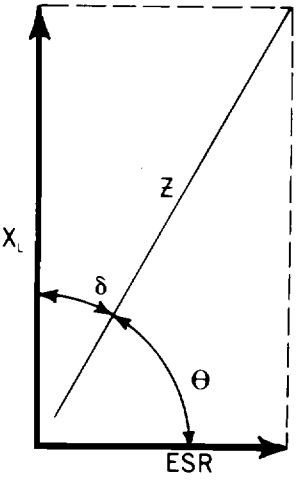


FIGURE 8b Total Impedance of the Capacitor Above Resonance

Typical impedance versus frequency curves are shown in Figures 7a to 7d. Impedance versus temperature is superior to other types of electrolytics, and is shown in Figure 9.

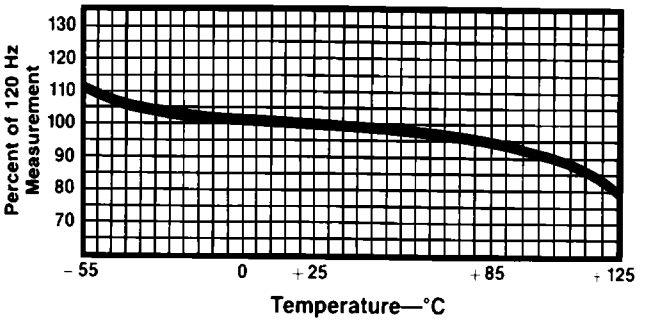


FIGURE 9 Typical Impedance as a Reaction of Temperature

10. Surge Current: Capacitors are capable of withstanding a 4 ± 1 second charge of rated voltage (± 2%) through a total circuit resistance (excluding the capacitor) of 1 ± 0.2 ohms at + 25°C, followed by a 4 ± 1 second discharge to a voltage below 1% of the rated voltage. This cycle is repeated consecutively three (3) times. Post test performance:

a. Capacitance - within ± 5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

11. Surge Voltage

TABLE 1 Surge Voltage Ratings at + 25°C, +85° & + 125°C

Rated DC Working Volts @ +25°C & +85°C	Surge Voltage @ +25°C & +85°C	Derated DC Volts @ +125°C	Surge Voltage @ +125°C
4	5.7	2.7	3.25
6	8	4	5
10	13	7	8
16	20	10	12
20	26	13	16
25	33	17	20
35	46	23	28
50	65	33	40

Surge voltage is the maximum voltage to which the capacitor can be subjected under transient conditions, including the sum of peak AC ripple, DC bias and any transients.

Surge voltage tests are performed at +25°C, +85°C and +125°C with the applicable surge voltage. The surge voltage is applied for 1000 cycles of 30 seconds at voltage through a 33 ohm series resistor and 30 seconds off voltage with the capacitor discharged through a 33 ohm resistor. Upon completing the test, the capacitors are allowed to stabilize at room temperature. Capacitance, DCL and DF are then tested:

a. Capacitance - within ± 5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

12. Reverse Voltage

Table 2 Reverse Voltage Ratings

Temperature	Permissible Reverse Voltage
+25°C	15% of Rated Voltage
+85°C	5% of Rated Voltage
+125°C	1% of Rated Voltage

Solid tantalum capacitors are polarized devices. It is not recommended that they be used where reverse bias is present. A small degree of reverse voltage is permissible, however, for short periods per Table 2.

13. AC Ripple Voltage: Permissible AC ripple voltage is related to equivalent series resistance (ESR) and power dissipation capability. Maximum power dissipation for each case size is listed in Table 3.

Permissible AC ripple voltage which may be applied is limited by three criteria:

a. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.

b. The negative peak AC voltage, in combination with the bias voltage, if any, must not exceed the permissible reverse voltage ratings presented in Table 2.

c. The power dissipated in the ESR of the capacitor must not exceed the appropriate value specified in Tables 3a and 3b. Actual power dissipated may be calculated from the following:

$P = I^2 R$

Substituting $I = \frac{E}{Z}$

$P = \frac{E^2 R}{Z^2}$

where:

I = rms ripple current (amperes)
E = rms ripple voltage (volts)
P = power (watts)
Z = impedance at specified frequency (ohms)
R = equivalent series resistance at specified frequency (ohms)

13. AC Ripple Voltage (con't)

Maximum allowable rms ripple voltage may be determined as follows:

$$E(max) @ 25°C = Z\sqrt{\frac{Pmax}{R}}$$

E(max) @ 85°C = 0.9 E(max) @ 25°C
E(max) @ 125°C = 0.4 E(max) @ 25°C
P(max) = maximum watts from Tables 3a and 3b.

Case Code		Maximum Power Dissipation (Watts)
KEMET	EIA/ECQ	+25°C
A	3216	.075
B	3528	.085
C	6032	.110
D	7343	.150

Table 3a. T491 Maximum Power Dissipation Capability

Case Code	Maximum Power Dissipation (watts) @ + 25°C
A	0.03
B	0.05
C	0.08
D	0.09
E	0.10

Table 3b. T411/T421 Maximum Power Dissipation Capability

ENVIRONMENTAL

14. Temperature Stability

- ***T491 Series***

Step No.	Temp.	Δ Capacitance	Leakage Current	Dissipation Factor
1	+ 25°C	within specified tolerance	within original limit	within original limit
2	− 55°C	within ±10% of initial value	N/A	within original limit
3	+ 25°C	within ±5% of initial value	within original limit	within original limit
4	+ 85°C	within ±10% of initial value	within 10X original limit	within original limit
5	+ 125°C	within ±12% of initial value	within 12X original limit	within original limit
6	+ 25°C	within ±5% of initial value	within original limit	within original limit

TABLE 4a T491 Temperature Stability Limits

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

14. Temperature Stability (con't.)

- ***T411/T421 Series***

Step No.	Temp.	Δ Capacitance	Leakage Current	Dissipation Factor
1	+ 25°C	within specified tolerance	within original limit	within original limit
2	−55°C	within ±10% of initial value	N/A	per Mil-C-55365
3	+ 25°C	within ±5% of initial value	within original limit	within original limit
4	+ 85°C	within ±8% of initial value	within 10X original limit	per Mil-C-55365
5	+ 125°C	within ±12% of initial value	within 12X original limit	per Mil-C-55365
6	+ 25°C	within ±5% of initial value	within original limit	within original limit

Table 4b T411/T421 Temperature Stability Limits

Mounted capacitors withstand extreme temperature testing at a succession of continuous steps at +25°C, −55°C, +25°C, +85°C, +125°C, +25°C, in the order stated. Capacitors shall be brought to thermal stability at each test temperature. Capacitance, DF and DCL are measured at each test temperature except that DCL is not measured at −55°C.

15. Thermal Shock

- ***Mil-Std-202, method 107, Condition B***

Minimum temperature −55°C, mounted

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

16. Moisture Resistance

- ***Mil-Std-202, Method 106***

Steps 7a and 7b excluded, rated voltage, 42 cycles, mounted

Post Test Performance:

a. Capacitance - within ±10% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

17. Electrostatic Discharge (ESD)

- ***2,000 ±50 volts, 1,500 ±5% Ohms, 40 nanosecond pulse each polarity, 1 pulse each polarity, 5 seconds between pulses, +25°C.***
- ***200 ±5 volts, 0 Ohms, 40 nanosecond pulse, each polarity, 9 pulses each polarity, 5 seconds between pulses, +25°C.***

Product subjected to above test conditions demonstrate no sensitivity to electrostatic discharge.

17. Electrostatic Discharge (ESD) (con't.)

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

MECHANICAL

18. Resistance to Solvents

- ***Mil-Std-202, Method 215***

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit
d. Physical - no degradation of case, terminals or marking.

19. Fungus

- ***Mil-Std-810, Method 508***

20. Flammability

- ***UL94 VO classification***

T491 encapsulant materials meet this classification.

21. Resistance to Soldering Heat

- ***Wave solder***
  +260±5°C, 10 seconds
- ***Infrared Reflow***
  +230±5°C, 30 seconds - T491 Series
  +300±5°C, 5 seconds - T411/T421 Series
- ***Vapor Phase Reflow***
  +215±5°C, 2 minutes

Post Test Performance:

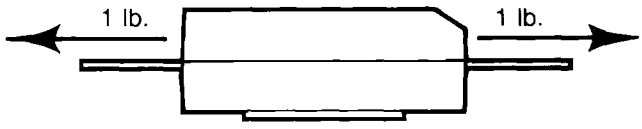
a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

22. Solderability

- ***Mil-Std-202, Method 208***

23. Terminal Strength - Pull Force

- ***One pound (454 grams), 30 seconds (T491 Series)***



Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

Contact KEMET for information regarding T411/T421 Series.

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

24. Terminal Strength - Tensile Force

- ***Four pounds (1.8 kilograms), 60 seconds (T491 Series)***

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

Contact KEMET for information regarding T411/T421 Series.

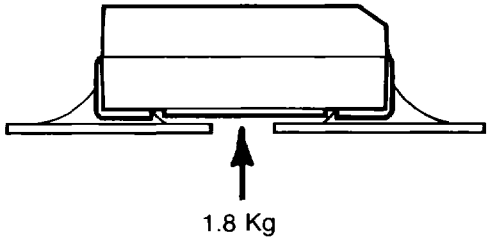


FIGURE 10 Tensile Test

25. Shear Test

- ***T491 Series***

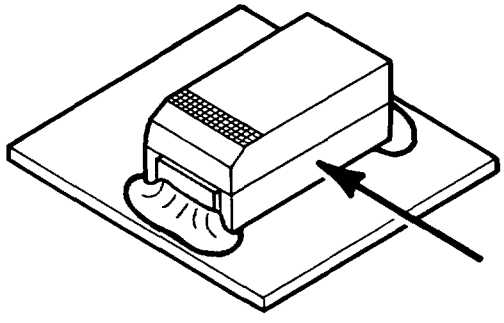


FIGURE 11 Shear Test

Case Code		Maximum Shear Loads	
KEMET	EIA/IECQ	Kilograms	Pounds
A	3216	3.2	7.0
B	3528	3.6	8.0
C	6032	4.5	10.0
D	7343	5.0	11.0

Table 5 Maximum Shear Loads

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

Contact KEMET for information regarding T411/T421 Series.

26. Vibration

- ***Mil-Std-202, Method 204, Condition D***

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

27. Shock

- ***Mil-Std-202, Method 213, Condition I***

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit

RELIABILITY

Solid tantalum capacitors exhibit no degradation failure mode during shelf storage and show a constantly decreasing failure rate (i.e. absence of wearout mechanism) during life tests. This failure rate is dependent upon three important application conditions; DC voltage, temperature, and circuit impedance. Estimates of these respective effects are provided by the Reliability Nomograph (Figure 12) and the Circuit Impedance Reliability Factor Table (Table 6) following. The nomograph relates failure rate to voltage and temperature while the table relates failure rate to impedance. These estimates apply to steady-state DC conditions, and they assume usage within all other rated conditions.

Standard conditions, which produce a unity failure rate factor are rated voltage, +85°C, and 0.1 ohm-per-volt circuit impedance. While voltage and temperature are straight-forward, there is sometimes difficulty in determining impedance. What is required is the circuit impedance *seen by the capacitor.* If several capacitors are connected in parallel, the impedance seen by each is lowered by the source of energy stored in the other capacitors. Energy is similarly stored in series inductors.

Failure rate is conventionally expressed in units of percent per thousand hours. As a sample calculation, suppose a particular batch of capacitors has a failure rate of 0.5% / Khr under standard conditons. What would be the predicted failure rate at 0.7 times rated voltage, 60°C and 0.8 Ω/V? The nomograph gives a factor of 7×10^{-4} and the table gives a factor of 0.3. The failure rate estimate is then:

$0.5 \times 7 \times 10^{-4} \times 0.3 = 1.05 \times 10^{-4}$, or 0.0001%/Khr

TABLE 6 Circuit Impedance Reliability Factors

Circuit Impedance (ohms/volt)	Failure Rate Improvement (multiplying factors)
0.1	1.0
0.2	.8
0.4	.6
0.6	.4
0.8	.3
1.0	.2
2.0	.1
3 or greater	.07

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

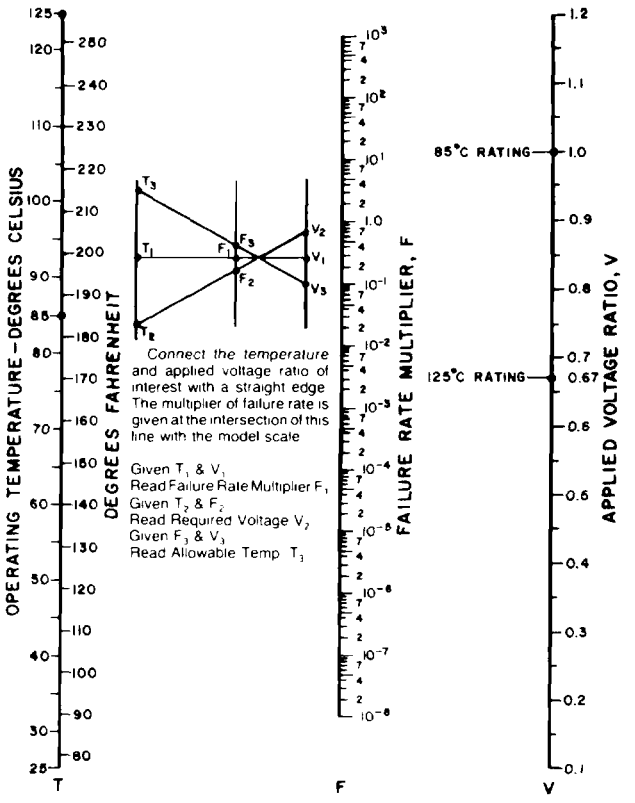


FIGURE 12 Reliability Nomograph

28. Storage Life Test

- ***2,000 hours, +125°C, unbiased, mounted***

Post Test Performance:

a. Capacitance - within ±5% of initial value
b. DC Leakage - within initial limit
c. Dissipation Factor - within initial limit
d. Physical - no degradation of function

29. Standard Life Test

- ***2,000 hours, +85°C, rated voltage, mounted***

Post Test Performance:

a. Capacitance - within ±10% of initial value
b. DC Leakage - within 125% of initial limit
c. Dissipation Factor - within initial limit
d. Physical - no degradation of function

30. High Temperature Life Test

- ***2,000 hours, +125°C, ⅔ rated voltage, mounted***

Post Test Performance:

a. Capacitance - within ±10% of initial value
b. DC Leakage - within 125% of initial limit
c. Dissipation Factor - within initial limit
d. Physical - no degradation of function

APPLICATIONS

31. Handling

- ***T491 Series***

Automatic handling of the T491 components is enhanced by the molded case which provides compatability with all types of high speed pick and place equipment. Manual handling of these devices presents no unique problems. Care should be taken with your fingers, however, to avoid touching the solder coated terminations as body oils, acids and salts will degrade the solderability of these terminations. Finger cots should be used whenever manually handling all solderable surfaces.

- ***T411/T421 Series***

Due to the configuration fo the T411/T421 Series tantalum chips, these components require reasonable care in handling. The preferred method is the application of a vacuum pencil to the body of the capacitor. Plastic tweezers may also be used when gently grasping the body of the capacitor. Care should be taken to avoid contact with the tantalum riser wire which exits from the body of the capacitor, as well as the non-solder coated surfaces of the body. These components should not be picked up by the positive "T-Bar" or "Moustache" since electrical damage may result. Handling of these components with your fingers is not recommended. If handled this way, finger cots should be used. Figure 13 illustrates proper and improper handling techniques.

These components are packaged in special plastic fluroware trays - one part to a cavity. Each cavity has convenient "tweezer slots" which enable easy removal of these devices from their cavities with plastic tweezers.

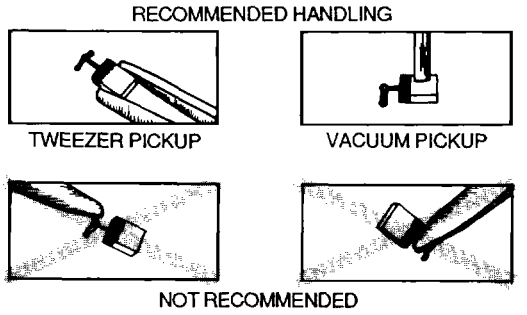


FIGURE 13 T411/T421 Handling Techniques

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

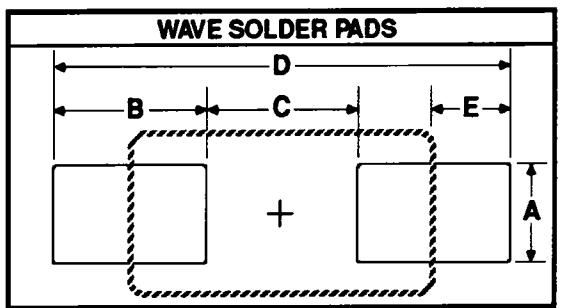
32. Recommended Mounting Pad Geometries

• ***T491 Series***

Proper mounting pad geometries are essential for successful solder connections. These dimensions are highly process sensitive and should be designed to maximize the integrity of the solder joint, and to minimize component rework due to unacceptable solder joints.

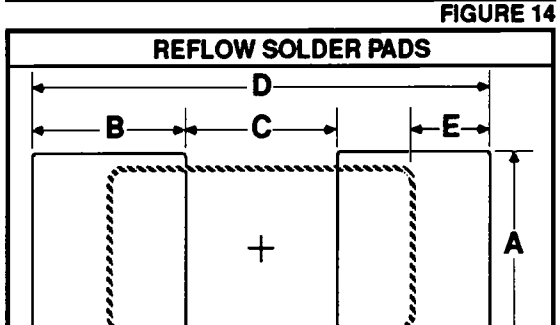
The following figures set forth recommended pad geometries for both wave and reflow soldering techniques. These dimensions are intended to be a starting point for circuit board designers, to be fine tuned if necessary based upon the peculiarities of the soldering process and/or circuit board design.

Contact KEMET for Engineering Bulletin Number F-2100 entitled "Surface Mount Mounting Pad Dimensions and Considerations" for further details on this subject.



PAD DIMENSIONS					
Case Size	A (min)	B (nom)	C (nom)	D (nom)	E (nom)
A	0.87	2.15	1.35	5.65	1.23
B	1.54	2.15	1.65	5.95	1.23
C	1.54	2.70	3.15	8.55	1.28
D	1.68	2.70	4.45	9.85	1.28

FIGURE 14



PAD DIMENSIONS					
Case Size	A (min)	B (nom)	C (nom)	D (nom)	E (nom)
A	1.80	2.15	1.35	5.65	1.23
B	2.80	2.15	1.65	5.95	1.23
C	2.80	2.70	3.15	8.55	1.28
D	3.00	2.70	4.45	9.85	1.28

FIGURE 15

• ***T411/T421 Series***

Figure 16 provides a guide for a pad layout which ensures proper fit of these tantalum chips. All dimensional designations correspond to the dimensions shown and listed in the T411/T421 Outline Drawings and Dimension Tables.

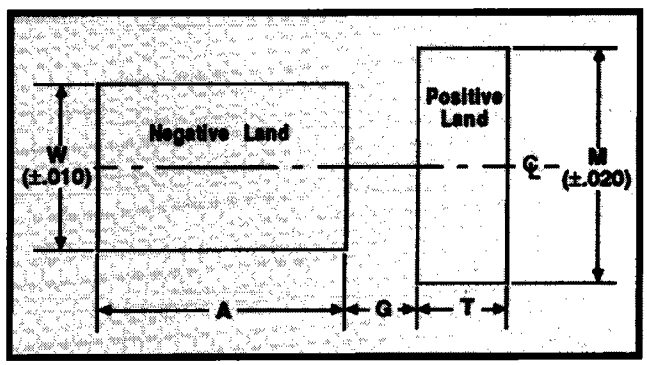


FIGURE 16 Recommended T411/T421 Pad Designs

33. Soldering

KEMET's family of surface mount tantalum capacitors are compatible with wave (single or dual) soldering and IR or vapor phase reflow techniques. All terminations are solder coated and have excellent wetting characteristics for high integrity solder Fillets. Preheating of these components is recommended to avoid extreme thermal stress. The maximum recommended preheat rate is 2°C per second. Figure 17 represents recommended maximum solder temperature / time combinations for these devices.

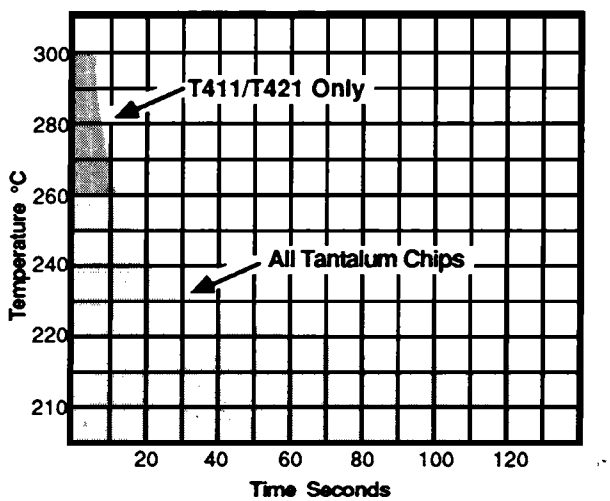


FIGURE 17 Time/Temperature Soldering Profile

COMPONENT PERFORMANCE CHARACTERISTICS (con't.)

(Applies to both T491 and T411/T421 Series, unless otherwise noted.)

Hand soldering should be performed with care due to the difficulty in process control. If performed, care should be taken to avoid contact of the soldering iron to the molded case. The iron should be used to heat the solder pad, applying solder between the pad and the termination, until reflow occurs. The iron should be removed. "Wiping" the edges of a chip and heating the top surface is not recommended.

During typical reflow operations a slight darkening of the T491's gold colored epoxy may be observed. This slight darkening is normal and is not harmful to the product. Marking permanency is not affected by this change.

34. Washing

Standard washing techniques and solvents are compatable with all KEMET surface mount tantalum capacitors. Solvents such as Freon TMC and TMS, Trichlorethane, methylene chloride, prelete, and isopropyl alcohol are not harmful to these components.

35. Encapsulations

Under normal circumstances, potting or encapsulation of KEMET tantalum chips is not required. If, however, severe environmental conditions such as high-level shock, vibration or humidity are expected, potting or conformal coating of T411/T421 style chips should be considered. Since these tantalum chips have been manufactured with terminations which are entirely inorganic, the composition of encapsulating materials is not critical. The selected material should be somewhat resilient to minimize thermal stresses and should be free of ionic contaminants to avoid electrical conductivity within the encapsulant.

36. Termination Solder Coating

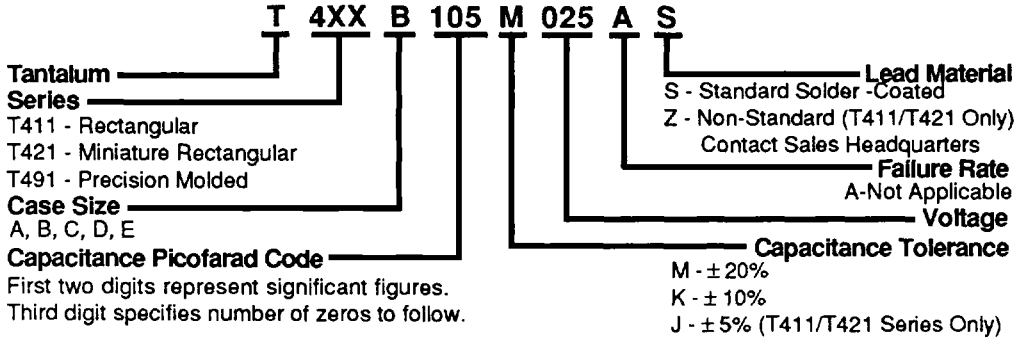
The standard solder coating for the T491 Series is 90/10 Sn/Pb solder. The standard solder coating for the T411/T421 Series is 60/40 Sn/Pb solder.

Alternate termination finishes are available with the T411/T421 Series which are suitable for epoxy and thermocompression bonding at additional cost. These include:

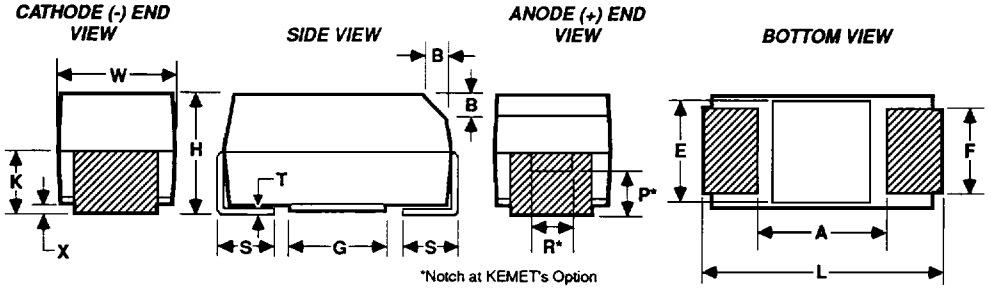
Anode: Sn96 solder coated nickel wire
Gold plated nickel wire
Gold plated Kovar ribbon

Cathode: Sn96 solder coating
Silver loaded epoxy coating
Bare copper coating

ORDERING INFORMATION



T491 SERIES — PRECISION MOLDED CHIP
OUTLINE DRAWING

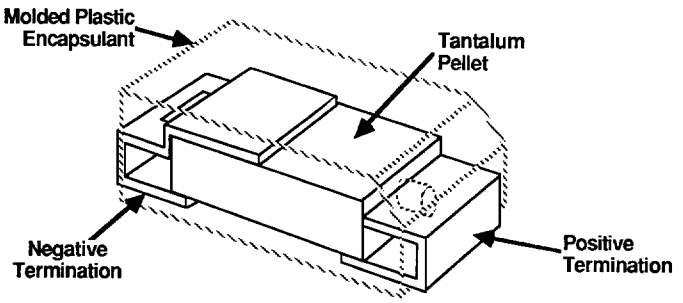


DIMENSIONS
Millimeters (inches)

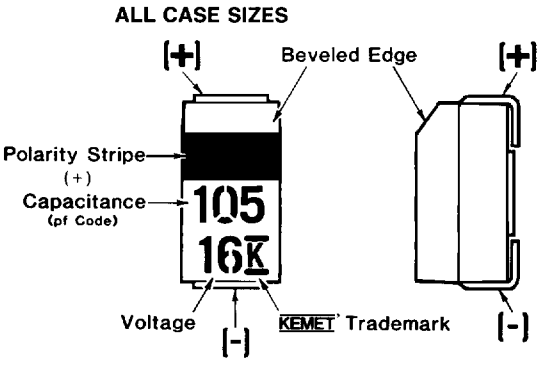
CASE SIZE		COMPONENT													
KEMET	EIA/IECQ	L	W	H	X	F ±0.1 ±(.004)	S ±0.3 ±(.012)	B ±0.15 ±(.006)	K ±0.20 ±(.008)	P (Ref)	R (Ref)	T (Ref)	A (Min)	G (Ref)	E (Ref)
A	3216	3.2±0.2 (.126±.008)	1.6±0.2 (.063±.008)	1.6±0.2 (.063±.008)	0.05±0.05 (.002±.002)	1.2 (.047)	0.8 (.031)	0.4 (.016)	0.9 (.035)	0.4 (.016)	0.4 (.016)	0.13 (.005)	0.8 (.031)	1.4 (.055)	1.3 (.051)
B	3528	3.5±0.2 (.138±.008)	2.8±0.2 (.110±.008)	1.9±0.2 (.075±.008)	0.05±0.05 (.002±.002)	2.2 (.087)	0.8 (.031)	0.4 (.016)	1.1 (.043)	0.5 (.020)	1.0 (.039)	0.13 (.005)	1.1 (.043)	1.8 (.071)	2.5 (.098)
C	6032	6.0±0.3 (.236±.012)	3.2±0.3 (.126±.012)	2.5±0.3 (.098±.012)	0.10±0.10 (.004±.004)	2.2 (.087)	1.3 (.051)	0.5 (.020)	1.4 (.055)	0.9 (.035)	1.0 (.039)	0.13 (.005)	2.5 (.098)	2.8 (.110)	2.9 (.114)
D	7343	7.3±0.3 (.287±.012)	4.3±0.3 (.169±.012)	2.8±0.3 (.110±.012)	0.10±0.10 (.004±.004)	2.4 (.094)	1.3 (.051)	0.5 (.020)	1.5 (.059)	0.9 (.035)	1.0 (.039)	0.13 (.005)	3.8 (.150)	4.0 (.157)	3.9 (.154)

Notes: 1. Metric dimensions govern.
2. (Ref) - Dimensions provided for reference only.

CONSTRUCTION



CAPACITOR MARKINGS



T491 RATINGS & PART NUMBER REFERENCE

Capacitance µF	Case Size	Kemet Part Number	DC Leakage µA @ +25°C Max	DF % @ +25°C 120 Hz Max
4 Volt Rating at +85°C (2.7 Volt Rating at +125°C)				
2.2	A	T491A225(1)004AS	0.5	6.0
3.3	A	T491A335(1)004AS	0.5	6.0
4.7	A	T491A475(1)004AS	0.5	6.0
6.8	B	T491B685(1)004AS	0.5	6.0
10.0	B	T491B106(1)004AS	0.5	6.0
15.0	B	T491B156(1)004AS	0.9	6.0
22.0	C	T491C226(1)004AS	0.9	6.0
33.0	C	T491C336(1)004AS	1.3	6.0
*47.0	C	T491C476(1)004AS	1.9	6.0
68.0	D	T491D686(1)004AS	2.7	6.0
100.0	D	T491D107(1)004AS	4.0	8.0
*150.0	D	T471D157(1)004AS	6.0	8.0
6 Volt Rating at +85°C (4 Volt Rating at +125°C)				
1.5	A	T491A155(1)006AS	0.5	6.0
2.2	A	T491A225(1)004AS	0.5	6.0
3.3	A	T491A335(1)006AS	0.5	6.0
4.7	B	T491B475(1)006AS	0.5	6.0
6.8	B	T491B685(1)006AS	0.5	6.0
10.0	B	T491B106(1)006AS	0.6	6.0
15.0	C	T491C156(1)006AS	0.9	6.0
22.0	C	T491C226(1)006AS	1.4	6.0
*33.0	C	T491C336(1)006AS	2.0	6.0
47.0	D	T491D476(1)006AS	2.9	6.0
68.0	D	T491D686(1)006AS	4.1	6.0
100.0	D	T491D107(1)006AS	6.0	8.0
10 Volt Rating at +85°C (7 Volt Rating at +125°C)				
1.0	A	T491A105(1)010AS	0.5	4.0
1.5	A	T491A155(1)010AS	0.5	6.0
2.2	A	T491A225(1)010AS	0.5	6.0
3.3	B	T491B335(1)010AS	0.5	6.0
4.7	B	T491B475(1)010AS	0.5	6.0
6.8	B	T491B685(1)010AS	0.7	6.0
10.0	C	T491C106(1)010AS	1.0	6.0
15.0	C	T491C156(1)010AS	1.5	6.0
*22.0	C	T491C226(1)010AS	2.2	6.0
33.0	D	T491D336(1)010AS	3.3	6.0
47.0	D	T491D476(1)010AS	4.7	6.0
*68.0	D	T491D686(1)010AS	6.8	6.0
16 Volt Rating at +85°C (10 Volt Rating at +125°C)				
0.68	A	T491A684(1)016AS	0.5	4.0
1.0	A	T491A105(1)016AS	0.5	4.0
1.5	A	T491A155(1)016AS	0.5	6.0
2.2	B	T491B225(1)016AS	0.5	6.0
3.3	B	T491B335(1)016AS	0.5	6.0
4.7	B	T491B475(1)016AS	0.8	6.0
6.8	C	T491C685(1)016AS	1.1	6.0
10.0	C	T491C106(1)016AS	1.6	6.0
*15.0	C	T491C156(1)016AS	2.4	6.0
22.0	D	T491D226(1)016AS	3.6	6.0
33.0	D	T491D336(1)016AS	5.3	6.0
*47.0	D	T491D476(1)016AS	7.5	6.0

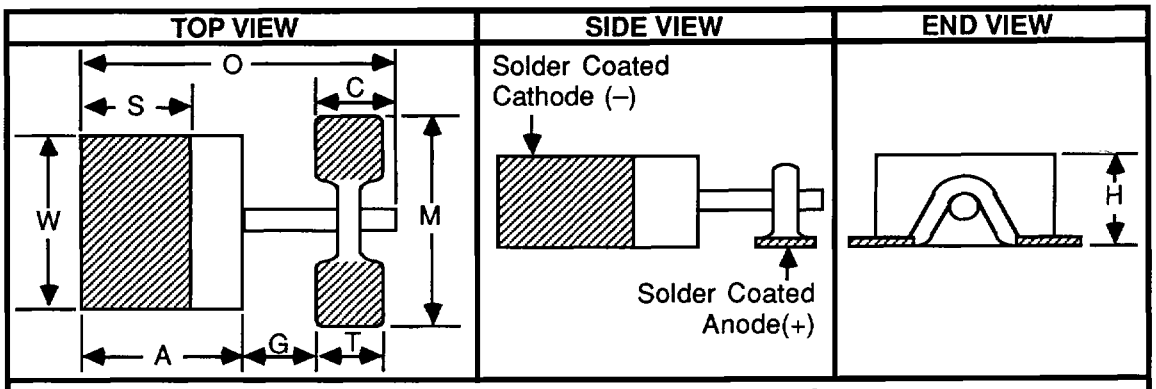
Capacitance µF	Case Size	Kemet Part Number	DC Leakage µA @ +25°C Max	DF % @ +25°C 120 Hz Max
20 Volt Rating at +85°C (13 Volt Rating at +125°C)				
0.47	A	T491A474(1)020AS	0.5	4.0
0.68	A	T491A684(1)020AS	0.5	4.0
1.0	A	T491A105(1)020AS	0.5	4.0
1.5	B	T491B155(1)020AS	0.5	6.0
2.2	B	T491B225(1)020AS	0.5	6.0
3.3	B	T491B335(1)020AS	0.7	6.0
4.7	C	T491C475(1)020AS	1.0	6.0
6.8	C	T491C685(1)020AS	1.4	6.0
*10.0	C	T491C106(1)020AS	2.0	6.0
15.0	D	T491D156(1)020AS	3.0	6.0
22.0	D	T491D226(1)020AS	4.4	6.0
*33.0	D	T491D336(1)020AS	6.6	6.0
25 Volt Rating at +85°C (17 Volt Rating at +125°C)				
0.33	A	T491A334(1)025AS	0.5	4.0
0.47	A	T491A474(1)025AS	0.5	4.0
0.68	B	T491B684(1)025AS	0.5	4.0
1.0	B	T491B105(1)025AS	0.5	4.0
1.5	B	T491B155(1)025AS	0.5	6.0
2.2	C	T491C225(1)025AS	0.6	6.0
3.3	C	T491C335(1)025AS	0.9	6.0
4.7	C	T491C475(1)025AS	1.2	6.0
*6.8	C	T491C685(1)025AS	1.7	6.0
10.0	D	T491D106(1)025AS	2.5	6.0
15.0	D	T491D156(1)025AS	3.8	6.0
*22.0	D	T491D226(1)025AS	5.5	6.0
35 Volt Rating at +85°C (23 Volt Rating at +125°C)				
0.10	A	T491A104(1)035AS	0.5	4.0
0.15	A	T491A154(1)035AS	0.5	4.0
0.22	A	T491A224(1)035AS	0.5	4.0
0.33	A	T491A334(1)035AS	0.5	4.0
0.47	B	T491B474(1)035AS	0.5	4.0
0.68	B	T491B684(1)035AS	0.5	4.0
1.0	B	T491B105(1)035AS	0.5	4.0
1.5	C	T491C155(1)035AS	0.5	6.0
2.2	C	T491C225(1)035AS	0.8	6.0
3.3	C	T491C335(1)035AS	1.2	6.0
4.7	D	T491D475(1)035AS	1.7	6.0
6.8	D	T491D685(1)035AS	2.4	6.0
10.0	D	T491D106(1)035AS	3.5	6.0
50 Volt Rating at +85°C (33 Volt Rating at +125°C)				
0.10	A	T491A104(1)050AS	0.5	4.0
0.15	B	T491B154(1)050AS	0.5	4.0
0.22	B	T491B224(1)050AS	0.5	4.0
0.33	B	T491B334(1)050AS	0.5	4.0
0.47	C	T491C474(1)050AS	0.5	4.0
0.68	C	T491C684(1)050AS	0.5	4.0
1.0	C	T491C105(1)050AS	0.5	4.0
*1.5	C	T491C155(1)050AS	0.8	6.0
2.2	D	T491D225(1)050AS	1.1	6.0
3.3	D	T491D335(1)050AS	1.7	6.0
4.7	D	T491D475(1)050AS	2.4	6.0

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

Higher voltage ratings and tighter capacitance tolerance product may be substituted within the same size at KEMET's option.

Voltage substitutions will be marked with the higher voltage rating. ***NEW EXTENDED VALUES**

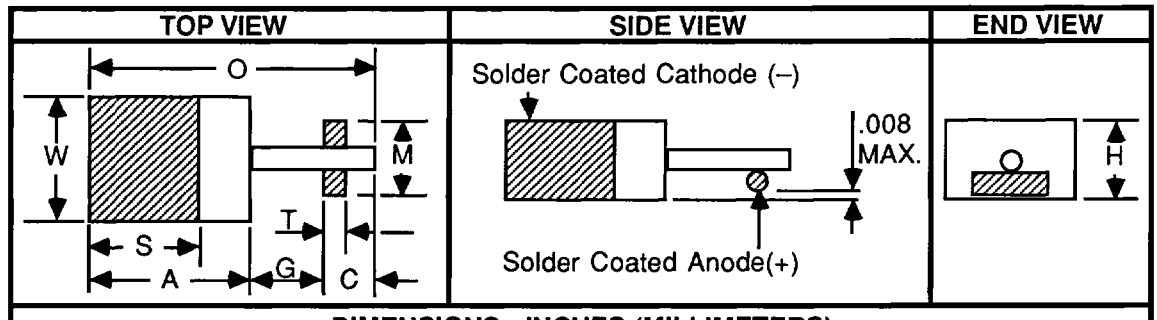
T411 SERIES OUTLINE DRAWINGS



DIMENSIONS - INCHES (MILLIMETERS)

CASE SIZE	O	W	A	S	G	T	C	M	H
A	.160 ± .025 (4.06 ± .64)	.090 ± .010 (2.29 ± .25)	.065 ± .015 (1.65 ± .38)	.045 ± .020 (1.14 ± .51)	.080 ± .025 (2.03 ± .64)	.035 ± .010 (.89 ± .25)	.040 ± .010 (1.02 ± .25)	.090 ± .010 (2.29 ± .25)	.055 ± .015 (1.40 ± .38)
B	.200 ± .030 (5.08 ± .76)	.115 ± .015 (2.29 ± .38)	.105 ± .020 (2.67 ± .51)	.085 ± .030 (2.16 ± .76)	.075 ± .035 (1.90 ± .89)	.040 ± .015 (1.02 ± .38)	.045 ± .015 (1.14 ± .38)	.140 ± .010 (3.56 ± .25)	.055 ± .015 (1.40 ± .38)
C	.235 ± .035 (5.97 ± .89)	.145 ± .015 (3.68 ± .38)	.145 ± .020 (3.68 ± .51)	.110 ± .045 (2.79 ±1.14)	.075 ± .035 (1.90 ± .89)	.040 ± .020 (1.02 ± .51)	.045 ± .015 (1.14 ± .38)	.140 ± .010 (3.56 ± .25)	.055 ± .015 (1.40 ± .38)
D	.295 ± .040 (7.49 ±1.02)	.155 ± .015 (3.94 ± .38)	.195 ± .020 (4.95 ± .51)	.155 ± .050 (3.94 ±1.27)	.080 ± .040 (2.03 ±1.02)	.045 ± .020 (1.14 ± .51)	.050 ± .020 (1.27 ± .51)	.140 ± .010 (3.56 ± .25)	.080 ± .020 (2.03 ± .51)
E	.300 ± .040 (7.62 ±1.02)	.160 ± .020 (4.06 ± .51)	.200 ± .020 (5.08 ± .51)	.160 ± .050 (4.06 ±1.27)	.080 ± .045 (2.03 ±1.14)	.045 ± .020 (1.14 ± .51)	.050 ± .020 (1.27 ± .51)	.140 ± .010 (3.56 ± .25)	.130 ± .020 (3.30 ± .51)

T421 SERIES OUTLINE DRAWINGS



DIMENSIONS - INCHES (MILLIMETERS)

CASE SIZE	O	W	A	S	G	T	C	M	H
A	.165 ± .025 (4.19 ± .64)	.060 ± .010 (1.52 ± .25)	.085 ± .015 (2.16 ± .38)	.065 ± .025 (1.65 ± .64)	.050 ± .025 (1.27 ± .64)	.040 ± .015 (1.02 ± .38)	.045 ± .015 (1.14 ± .38)	.060 ± .010 (1.52 ± .25)	.050 ± .010 (1.27 ± .25)
B	.180 ± .025 (4.57 ± .64)	.110 ± .010 (2.79 ± .25)	.105 ± .015 (2.67 ± .38)	.080 ± .030 (2.03 ± .76)	.050 ± .025 (1.27 ± .64)	.035 ± .010 (.89 ± .25)	.040 ± .010 (1.02 ± .25)	.060 ± .010 (1.52 ± .25)	.050 ± .010 (1.27 ± .25)
C	.225 ± .025 (5.72 ± .64)	.150 ± .010 (3.81 ± .25)	.150 ± .015 (3.81 ± .38)	.110 ± .050 (2.79 ±1.27)	.050 ± .025 (1.27 ± .64)	.035 ± .010 (.89 ± .25)	.040 ± .010 (1.02 ± .25)	.070 ± .020 (1.78 ± .51)	.065 ± .015 (1.65 ± .38)
D	.280 ± .025 (7.11 ± .64)	.160 ± .010 (4.06 ± .25)	.200 ± .015 (5.08 ± .38)	.150 ± .060 (3.81 ±1.52)	.050 ± .025 (1.27 ± .64)	.040 ± .015 (1.02 ± .38)	.045 ± .015 (1.14 ± .38)	.070 ± .020 (1.78 ± .51)	.095 ± .015 (2.41 ± .38)
E	.290 ± .025 (7.37 ± .64)	.160 ± .015 (4.06 ± .38)	.205 ± .015 (5.21 ± .38)	.150 ± .060 (3.81 ±1.52)	.050 ± .025 (1.27 ± .64)	.045 ± .015 (1.14 ± .38)	.050 ± .015 (1.27 ± .38)	.070 ± .020 (1.78 ± .51)	.135 ± .015 (3.43 ± .38)

T411 SERIES RATINGS & PART NUMBER REFERENCE

Capacitance µF	Case Size	KEMET Part Number	DC Leakage µA @ +25°C Max	Max. Dissipation Factor % @ 25° 120 Hz
4 Volt Rating at 85° C (2.7 Volt Rating at 125°C)				
3.3	A	T411A335(1)004AS	0.5	6.0
6.8	B	T411B685(1)004AS	1.0	6.0
15.0	C	T411C156(1)004AS	1.0	6.0
33.0	D	T411D336(1)004AS	2.0	6.0
68.0	E	T411E686(1)004AS	3.0	6.0
6 Volt Rating at 85° C (4.0 Volt Rating at 125°C)				
2.2	A	T411A225(1)006AS	0.5	6.0
4.7	B	T411B475(1)006AS	1.0	6.0
10.0	C	T411C106(1)006AS	1.0	6.0
22.0	D	T411D226(1)006AS	2.0	6.0
47.0	E	T411E476(1)006AS	3.0	6.0
10 Volt Rating at 85° C (7.0 Volt Rating at 125°C)				
1.5	A	T411A155(1)010AS	0.5	6.0
3.3	B	T411B335(1)010AS	1.0	6.0
6.8	C	T411C685(1)010AS	1.0	6.0
15.0	D	T411D156(1)010AS	2.0	6.0
33.0	E	T411E336(1)010AS	3.0	6.0
15 Volt Rating at 85° C (10 Volt Rating at 125°C)				
1.0	A	T411A105(1)015AS	0.5	4.0
2.2	B	T411B225(1)015AS	1.0	6.0
4.7	C	T411C475(1)015AS	1.0	6.0
10.0	D	T411D106(1)015AS	2.0	6.0
22.0	E	T411E226(1)015AS	3.0	6.0
20 Volt Rating at 85° C (13 Volt Rating at 125°C)				
.68	A	T411A684(1)020AS	0.5	4.0
1.5	B	T411B155(1)020AS	1.0	6.0
3.3	C	T411C335(1)020AS	1.0	6.0
6.8	D	T411D685(1)020AS	2.0	6.0
15.0	E	T411E156(1)020AS	3.0	6.0

Capacitance µF	Case Size	KEMET Part Number	DC Leakage µA @ +25°C Max	Max. Dissipation Factor % @ 25° 120 Hz
25 Volt Rating at 85° C (17 Volt Rating at 125°C)				
.47	A	T411A474(1)025AS	0.5	4.0
1.0	B	T411B105(1)025AS	1.0	4.0
2.2	C	T411C225(1)025AS	1.0	6.0
4.7	D	T411D475(1)025AS	2.0	6.0
10.0	E	T411E106(1)025AS	3.0	6.0
30 Volt Rating at 85° C (23 Volt Rating at 125°C)				
.68	B	T411B684(1)030AS	1.0	4.0
1.5	C	T411C155(1)030AS	1.0	6.0
3.3	D	T411D335(1)030AS	2.0	6.0
6.8	E	T411E685(1)020AS	3.0	6.0
35 Volt Rating at 85° C (23 Volt Rating at 125°C)				
.22	A	T411A224(1)035AS	0.5	4.0
.33	A	T411A334(1)035AS	0.5	4.0
.47	B	T411B474(1)035AS	1.0	4.0
1.0	C	T411C105(1)035AS	1.0	4.0
2.2	D	T411D225(1)035AS	2.0	6.0
4.7	E	T411E475(1)035AS	2.0	6.0
50 Volt Rating at 85° C (33 Volt Rating at 125°C)				
.10	A	T411A104(1)050AS	0.5	4.0
.15	A	T411A154(1)050AS	0.5	4.0
.22	B	T411B224(1)050AS	1.0	4.0
.33	B	T411B334(1)050AS	1.0	4.0
.47	C	T411C474(1)050AS	1.0	4.0
.68	C	T411C684(1)050AS	1.0	4.0
1.0	D	T411D105(1)020AS	2.0	4.0
1.5	D	T411D155(1)050AS	2.0	6.0
2.2	E	T411E225(1)050AS	3.0	6.0
3.3	E	T411E335(1)050AS	3.0	6.0

T421 SERIES RATINGS & PART NUMBER REFERENCE

Capacitance µF	Case Size	Kemet Part Number	DC Leakage µA @ +25°C Max	Max. Dissipation Factor % @ 25° 120 Hz
4 Volt Rating at 85° C (2.7 Volt Rating at 125°C)				
4.7	A	T421A475(1)004AS	0.5	6.0
10.0	B	T421B106(1)004AS	1.0	6.0
33.0	C	T421C336(1)004AS	2.0	6.0
68.0	D	T421D686(1)004AS	3.0	6.0
100.0	E	T421E107(1)004AS	3.0	6.0
6 Volt Rating at 85° C (4.0 Volt Rating at 125°C)				
3.3	A	T421A335(1)006AS	0.5	4.0
6.8	B	T421B685(1)006AS	1.0	6.0
22.0	C	T421C226(1)006AS	2.0	6.0
47.0	D	T421D476(1)006AS	3.0	6.0
68.0	E	T421E686(1)006AS	3.0	6.0
10 Volt Rating at 85° C (7.0 Volt Rating at 125°C)				
2.2	A	T421A225(1)010AS	0.5	4.0
4.7	B	T421B475(1)010AS	1.0	6.0
15.0	C	T421C156(1)010AS	2.0	6.0
33.0	D	T421D336(1)010AS	3.0	6.0
47.0	E	T421E476(1)010AS	3.0	6.0
15 Volt Rating at 85° C (10 Volt Rating at 125°C)				
1.5	A	T421A155(1)015AS	0.5	6.0
3.3	B	T421B335(1)015AS	1.0	6.0
10.0	C	T421C106(1)015AS	2.0	6.0
22.0	D	T421D226(1)015AS	3.0	6.0
33.0	E	T421E336(1)015AS	3.0	6.0
20 Volt Rating at 85° C (13 Volt Rating at 125°C)				
1.0	A	T421A105(1)020AS	0.5	4.0
2.2	B	T421B225(1)020AS	1.0	4.0
6.8	C	T421C685(1)020AS	2.0	6.0
10.0	D	T421D106(1)020AS	3.0	6.0
15.0	D	T421D156(1)020AS	3.0	6.0
22.0	E	T421E226(1)020AS	3.0	6.0

Capacitance µF	Case Size	Kemet Part Number	DC Leakage µA @ +25°C Max	Max. Dissipation Factor % @ 25° 120 Hz
25 Volt Rating at 85° C (17 Volt Rating at 125°C)				
.47	A	T421A474(1)025AS	0.5	4.0
.68	A	T421A684(1)025AS	0.5	4.0
1.0	B	T421B105(1)025AS	1.0	4.0
1.5	B	T421B155(1)025AS	1.0	6.0
3.3	C	T421C335(1)025AS	2.0	6.0
4.7	C	T421C475(1)025AS	2.0	6.0
6.8	D	T421D685(1)025AS	3.0	6.0
10.0	E	T421E106(1)025AS	3.0	6.0
35 Volt Rating at 20° C (23 Volt Rating at 125°C)				
.33	A	T421A334(1)035AS	0.5	4.0
.68	B	T421B684(1)035AS	1.0	4.0
2.2	C	T421C225(1)035AS	2.0	6.0
4.7	D	T421D475(1)035AS	3.0	6.0
6.8	E	T421E685(1)035AS	3.0	6.0
50 Volt Rating at 85° C (33 Volt Rating at 125°C)				
.10	A	T421A104(1)050AS	0.5	4.0
.15	A	T421A154(1)050AS	0.5	4.0
.22	A	T421A224(1)050AS	0.5	4.0
.33	B	T421B334(1)050AS	1.0	4.0
.47	B	T421B474(1)050AS	1.0	4.0
.68	C	T421C684(1)050AS	2.0	4.0
1.0	C	T421C105(1)020AS	2.0	4.0
1.5	C	T421C155(1)050AS	2.0	6.0
2.2	D	T421D225(1)050AS	3.0	6.0
3.3	D	T421D335(1)050AS	3.0	6.0
4.7	E	T421E475(1)050AS	3.0	6.0

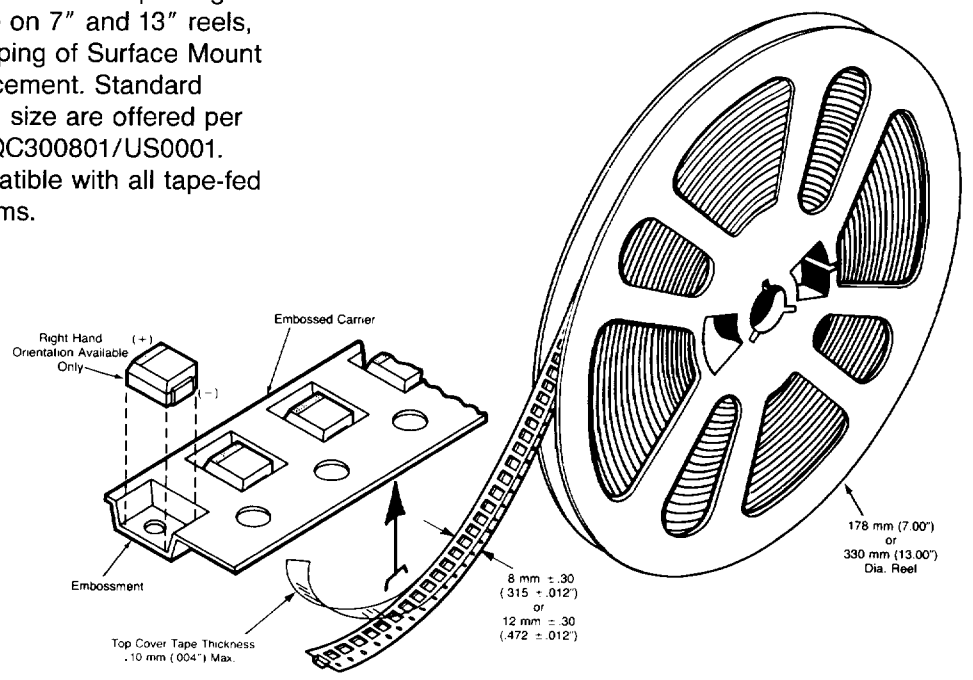
(1) To complete KEMET part number, insert M for ±20% tolerance or K for ±10% tolerance.

See page 13 for KEMET ordering information.

PACKAGING

T491

KEMET T491 tantalum chip capacitors are packaged in 8mm and 12 mm plastic tape on 7″ and 13″ reels, in accordance with EIA 481: Taping of Surface Mount Components for Automatic Placement. Standard quantities by case size and reel size are offered per Amendment Number 1 of IEC QC300801/US0001. This packaging system is compatible with all tape-fed automatic pick and place systems.



T491 TAPE INFORMATION: OUTLINE DRAWINGS

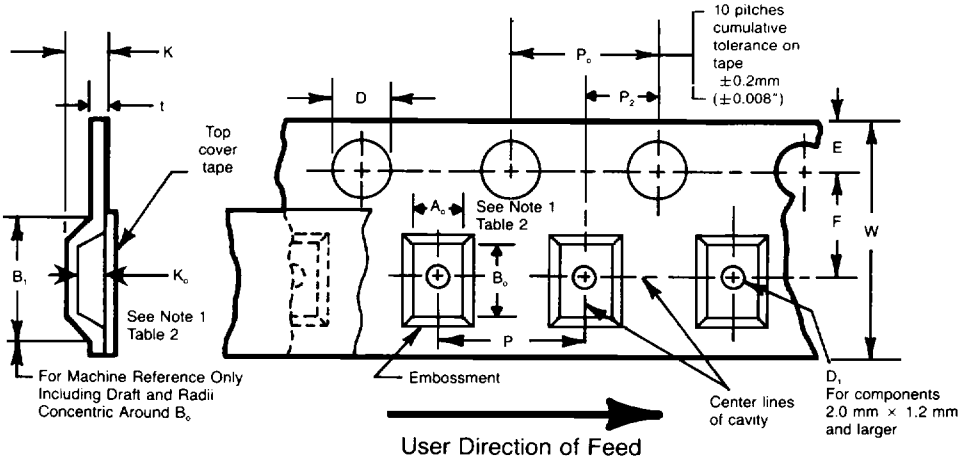


FIGURE 18 Carrier Tape

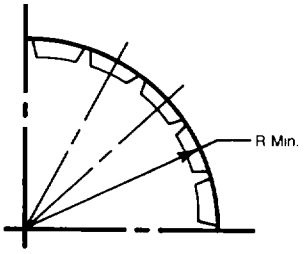


FIGURE 19 Tape Bend Radius

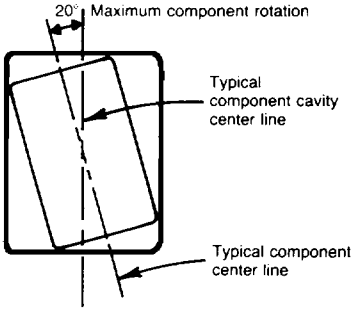
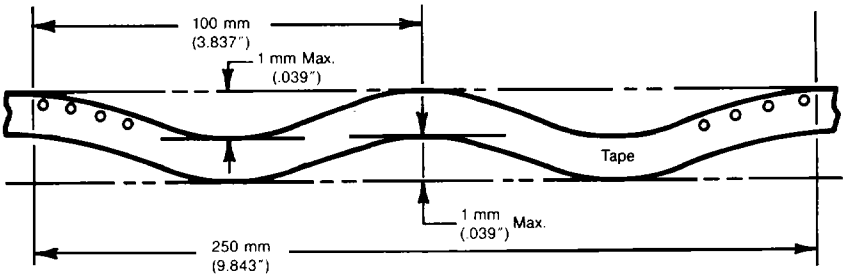


FIGURE 20 Component Rotation

T491 TAPE INFORMATION (CON'T)

OUTLINE DRAWING



Camber (Top View)
Allowable camber to be 1 mm/100 mm nonaccumulative over 250 mm

FIGURE 21 Tape Camber (Top View)

TAPE DIMENSIONS

Millimeters (inches)

FIXED (Refer to Figure 18)

Tape Size	D	E	P_0	t (max)
8 mm, 12 mm	1.5 +0.1 −0.0 (.059 +.004 −0.0)	1.75 ±0.1 (.069 ±.004)	4.0 ±0.1 (.157 ±.004	0.4 (.016)

COMPONENT RELATED (Refer to Figure 18)

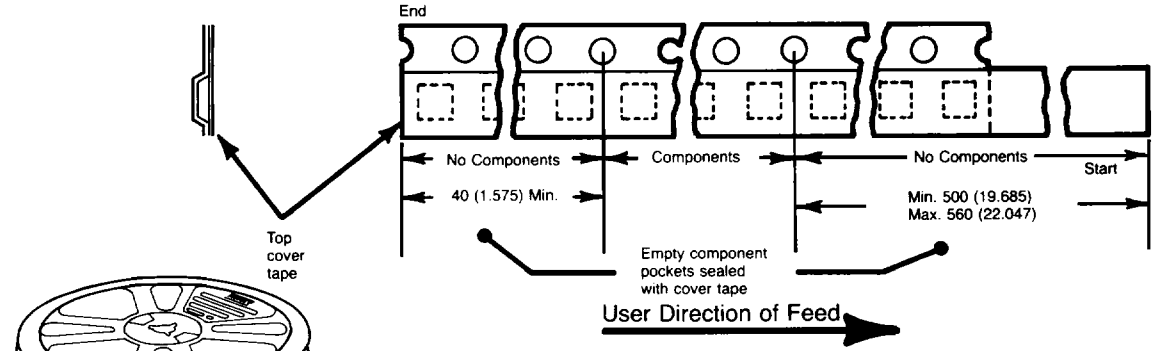
Case Code		Tape		A_0	B_0	K_0
KEMET	EIA/IECQ	Width	Pitch			
A	3216	8 mm	4 mm	1.9 ± .1 (.075 ± .004)	3.5 ± .1 (.138 ± .004)	1.9 ± .1 (.075 ± .004)
B	3528	8 mm	4 mm	3.1 ± .1 (.122 ± .004)	3.7 ± .1 (.146 ± .004)	2.2 ± .1 (.087 ± .004)
C	6032	12 mm	8 mm	3.5 ± .1 (.138 ± .004)	6.4 ± .1 (.252 ± .004)	2.8 ± .1 (.110 ± .004)
D	7343	12 mm	8 mm	4.6 ± .1 (.181 ± .004)	7.55 ± .1 (.297 ± .004)	3.1 ± .1 (.122 ± .004)

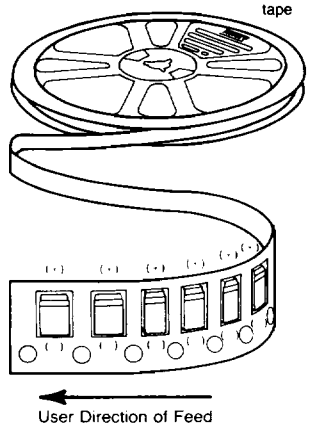
VARIABLE (Refer to Figures 18 & 19)

Tape Size	B_1 (max)	D_1 (min)	F	K (max)	P_2	R (min)	W	P
8 mm	4.2 (.165)	1.0 (.039)	3.5 ±0.05 (.138 ±.002)	2.4 (.094)	2.0 ±0.05 (.079 ±.002)	25.0 (.984)	8.0 ±0.3 (.315 ±.012)	4.0 ±0.1 (.157 ±.004)
12 mm	8.2 (.323)	1.5 (.069)	5.5 ±0.05 (.217 ±.002)	4.5 (.177)	2.0 ±0.1 (.079±.004)	30.0 (1.181)	12.0 ±.3 (.472 ±.012)	8.0 ±0.1 (.315 ±.004)

LEADER AND TRAILER

Millimeters (inches)





Note (-) denotes positive (anode) termination
( ) denotes negative (cathode) termination

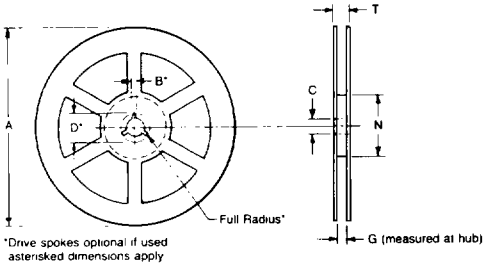


FIGURE 22 Reel Outline Drawing

TAPE PERFORMANCE CHARACTERISTICS

The KEMET T491 tape packaging system is per the guidelines of EIA-481, with the following characteristics:

1. **COVER TAPE BREAK FORCE:**—1.0 Kg minimum.
2. **COVER TAPE PEEL STRENGTH**—0.4 ±0.3 newtons measured between 175°-180° with respect to the component carrier along the longitudinal axis of the carrier tape. The peel-off speed shall be 120± 5 mm/min.
3. **CUMULATIVE PITCH TOLERANCE**—for sprocket holes and chip pockets this shall not exceed 0.2 mm over any 10 sprocket hole or 40 mm span.
4. **TAPE RADIUS**—tape and components shall pass around radius "R" without damage (refer to Figure 19).
5. **COMPONENT ROTATION**—component will not rotate more than 20° within cavity (refer to Figure 20).
6. **TAPE MATERIAL**—the T491 Series surface mount capacitors are packaged in a clear plastic tape (right-hand orientation only) suitable for use on all types of tape fed surface mount placement equipment.

T411/T421

Standard packaging for KEMET's T411/T421 Series tantalum chips is bulk packaging in plastic fluroware trays. These trays have individual cavities which securely contain one device each. Bulk packaging of any other method (i.e. bag, box, etc.) is not acceptable and may cause electrical and/or mechanical damage to the product.

Standard quantities per tray and the number per plastic box are tabulated in table at right.

KEMET's T421 tantalum chip capacitors are also available packaged in plastic embossed carrier tape by special request. Tape and reel packaging permits this product to be used with today's high speed pick-and-place equipment. Contact the factory for further information and engineering support.

REEL DIMENSIONS Millimeters (inches)

FIXED (Refer to Figure 22)

Tape Size	B* (min)	C	D* (min)	N (min)
8 mm, 12 mm	1.5 (.059)	13.0 ±0.2 (.512 ±.008)	20.2 (.795)	50.0 (1.969)

*Dimension applies only if drive spokes used

VARIABLE (Refer to Figure 23)

Tape Size	G	T (max)
8 mm	8.4 + 1.5 −0.0 (.331 + .078 −0.0)	14.4 (.567)
12 mm	12.4 + 2.0 −0.0 (.488 + .078 −0.0)	18.4 (.724)

Reel Size	A (max)
7"	178.0 (7.008)
13"	330.0 (12.992)

QUANTITIES PACKAGED PER REEL Per IECQ QC300801/US0001 Amendment No. 1

Case Code		7" Reel*	13" Reel*
KEMET	EIA/IECQ		
A	3216	2,000	9,000
B	3528	2,000	8,000
C	6032	500	3,000
D	7343	500	2,500

* No c-spec required for 7" reel packaging, C-7280 required for 13" reel packaging.

T411/T421 Packaging Quantities

KEMET Number	Case Size	Chips Per Trays	Trays Per Box	Standard Reel Quantity	Reel Size
T411	A	300	3	N/A	N/A
	B	200	3		
	C	150	3		
	D	150	2		
	E	150	2		
T421	A	300	3	Contact Factory	
	B	200	3		
	C	150	3		
	D	150	2		
	E	150	2		