

## Overview

The KEMET Tantalum Stacks MnO<sub>2</sub> (TSM) Series is designed to provide the highest capacitance/voltage ratings in surface mount configuration. KEMET's T493 COTS Military/Aerospace capacitors are utilized in stacks of 2,3,4,and 6 components to achieve a broad range of capacitance and voltage ratings. The T493 COTS series offers component level Weibull grading options, surge current testing options and standard, low, and ultra-low ESR options. All component level lots of this series are conditioned with MIL-PRF-55365 Group A testing. Stacking configurations offer this high reliability product with custom capacitance/voltage solutions and very low ESR options.



*Note: Custom stacking solutions are available with other KEMET Tantalum Surface Mount Series. Please contact KEMET Product Management for availability.*

## Benefits

- High capacitance
- Surface mountable
- Capacitance values of 9.4µF to 1980µF
- Capacitance can be custom specified
- Voltage ratings of 6 to 50 VDC
- High volumetric efficiency
- Ultra-low ESR
- Surge capability
- Weibull failure options B and C
- Operating temperature range of -55°C to +125°C
- Laser-marked case
- Discrete components EIA standard case sizes (others available)
- High Temperature lead attach material available (>260°C)

## Applications

Typical applications include decoupling and filtering in a variety of market segments. The T493 COTS stack devices can be utilized in military and aerospace applications. Other KEMET series can be utilized in filtering and decoupling applications to service various market segments.

## Environmental Compliance

RoHS Compliant (6/6)\* according to Directive 2002/95/EC

*\*When ordered with 100% Sn Solder*

## SPICE

For a detailed analysis of specific part numbers, please visit [kemet.com](http://kemet.com) for a free download of KEMET's SPICE software. The KEMET SPICE program is freeware intended to aid design engineers in analyzing the performance of these capacitors over frequency, temperature, ripple, and DC bias conditions.

## Ordering Information

T	SM	2D	447	K	10	A	H	61	20	D493
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	Surge	ESR	Cspec 2
T = Tantalum	Stacks MnO <sub>2</sub> Cathode	2C, 3C, 4C, 6C, 2D, 3D, 4D, 6D, 2X, 3X, 4X, 6X	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	006 = 6.3V 010 = 10V 016 = 16V 020 = 20V 025 = 25V 035 = 35V 050 = 50V	A = N/A B = 0.1%/1000 hrs C = .01%/1000 hrs	H = Standard Solder Coated (SnPb 5% Pb minimum) C = Hot Solder Dipped B = Gold Plated T = 100% Tin	61 = None 62 = 10 Cycles 25°C After Weibull 63 = 10 cycles, -55°C and 85°C After Weibull 64 = 10 cycles, -55°C and 85°C Before Weibull Special CSPEC: CECC	10 = ESR - Standard 20 = ESR - Low 30 = ESR - Ultra-low	Designates discrete component series. D493 = T493

Note: These TSM Stacks are specific to T493 COTS.

## Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	9.4 µF–1980 µF @ 120 Hz/25°C
Capacitance Tolerance	K Tolerance (10%), M Tolerance (20%)
Rated Voltage Range	6V–50V
DF(120Hz)	Refer to Part Number Electrical Specification Table
ESR (100kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.01CV (mA) at rated voltage after 5 minutes

## Qualification

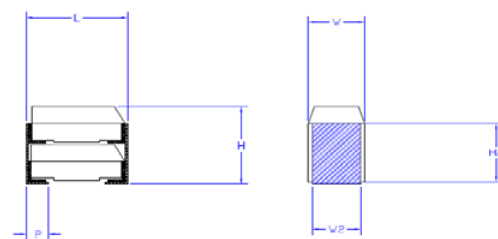
Test	Condition	Characteristics	
Endurance	85°C @ Rated Voltage, 2000 Hours 125°C @ 2/3 Rated Voltage, 2000 Hours	ΔC/C	Within ± 10% of initial value
		DF	Within initial limits
		DCL	Within 1.25 x initial limit
		ESR	Within initial limits
Thermal Shock	KEMET specified test, mounted, -55°C to 125° C, 5 cycles	ΔC/C	Within ± 5% of initial value
		DF	Within initial limits
		DCL	Within 1.25 x initial limit
		ESR	Within initial limits
Surge Voltage	85° C, 1.15 x Rated Voltage 1000 cycles	ΔC/C	Within ± 5% of initial value
		DF	Within initial limits
		DCL	Within initial limits
		ESR	Within initial limits
Surge Voltage	125° C, 0.77 x Rated Voltage 1000 cycles	ΔC/C	Within ± 5% of initial value
		DF	Within initial limits
		DCL	Within initial limits
		ESR	Within initial limits
Mechanical Vibration	MIL-Std-202, Meth. 204, Cond. D, 10Hz to 2000Hz, 20G Peak	ΔC/C	Within ±10% of initial value
		DF	Within initial limits
		DCL	Within initial limits

## Dimensions – Millimeters (Inches)

Metric will govern

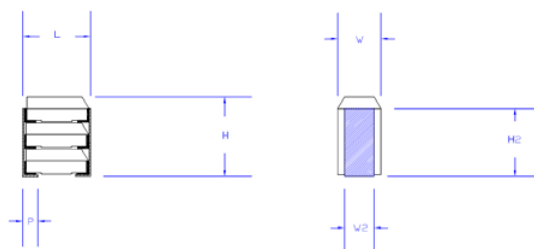
TSM2

KEMET 2 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
2C	6.5 ± 0.38	3.3 ± 0.2	5.3 ± 0.38	2.5 ± 0.2	4.5 ± 0.38	1.4 ± 0.38
	(.258 ± .015)	(.130 ± .008)	(.210 ± .015)	(.100 ± .008)	(.176 ± .015)	(.055 ± .015)
2D	8.0 ± 0.38	4.4 ± 0.2	6.2 ± 0.38	3.0 ± 0.2	4.8 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.174 ± .008)	(.245 ± .015)	(.120 ± .008)	(.192 ± .015)	(.075 ± .015)
2X	8.0 ± 0.38	4.4 ± 0.2	8.9 ± 0.38	3.0 ± 0.2	6.9 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.174 ± .008)	(.352 ± .015)	(.120 ± .008)	(.272 ± .015)	(.075 ± .015)



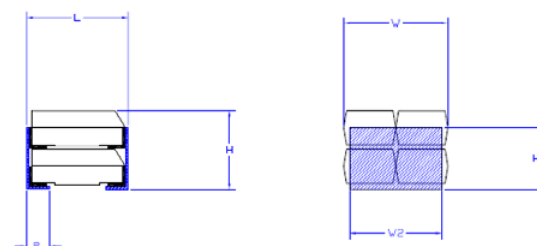
TSM3

KEMET 3 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
3C	6.5 ± 0.38	3.3 ± 0.2	7.8 ± 0.38	2.5 ± 0.2	6.4 ± 0.38	1.4 ± 0.38
	(.258 ± .015)	(.130 ± .008)	(.310 ± .015)	(.100 ± .008)	(.252 ± .015)	(.055 ± .015)
3D	8.0 ± 0.38	4.4 ± 0.2	9.2 ± 0.38	3.0 ± 0.2	7.7 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.174 ± .008)	(.365 ± .015)	(.120 ± .008)	(.304 ± .015)	(.075 ± .015)
3X	8.0 ± 0.38	4.4 ± 0.2	13.3 ± 0.38	3.0 ± 0.2	11.0 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.174 ± .008)	(.525 ± .015)	(.120 ± .008)	(.436 ± .015)	(.075 ± .015)



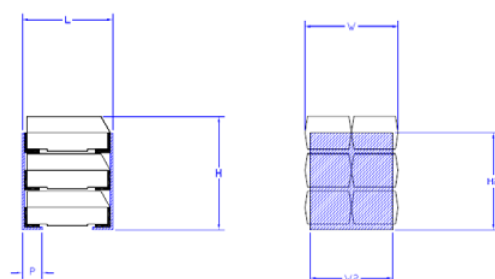
TSM4

KEMET 4 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
4C	6.5 ± 0.38	6.6 ± 0.2	5.3 ± 0.38	5.8 ± 0.2	4.6 ± 0.38	1.4 ± 0.38
	(.258 ± .015)	(.262 ± .008)	(.210 ± .015)	(.230 ± .008)	(.180 ± .015)	(.055 ± .015)
4D	8.0 ± 0.38	8.9 ± 0.2	6.2 ± 0.38	7.4 ± 0.2	4.8 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.350 ± .008)	(.245 ± .015)	(.292 ± .008)	(.192 ± .015)	(.075 ± .015)
4X	8.0 ± 0.38	8.9 ± 0.2	8.9 ± 0.38	7.4 ± 0.2	6.9 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.350 ± .008)	(.352 ± .015)	(.292 ± .008)	(.272 ± .015)	(.075 ± .015)



TSM6

KEMET 6 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
6C	6.5 ± 0.38	6.6 ± 0.2	7.8 ± 0.38	5.8 ± 0.2	6.6 ± 0.38	1.4 ± 0.38
	(.258 ± .015)	(.262 ± .008)	(.310 ± .015)	(.230 ± .008)	(.260 ± .015)	(.055 ± .015)
6D	8.0 ± 0.38	8.9 ± 0.2	9.2 ± 0.38	7.4 ± 0.2	7.7 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.350 ± .008)	(.365 ± .015)	(.292 ± .008)	(.304 ± .015)	(.075 ± .015)
6X	8.0 ± 0.38	8.9 ± 0.2	13.3 ± 0.38	7.4 ± 0.2	11.0 ± 0.38	1.9 ± 0.38
	(.315 ± .015)	(.350 ± .008)	(.525 ± .015)	(.292 ± .008)	(.436 ± .015)	(.075 ± .015)



## Capacitance and Rated Voltage Chart

Capacitance		Rated Voltage						
μF	Code	6V	10V	16V	20V	25V	35V	50V
9.4	945							2D
14	146							3D
19	196							4D
20	206						2C	2X
28	286							6D
30	306					2C	3C	3X
40	406						4C	4X
44	446				2C		2D	
45	456					3C		
60	606					4C	6C	6X
66	666				3C		3D	
88	886				4C		4D	
90	906					6C		
94	946			2C		2D		
132	137				6C		6D	
136	137				2D			
141	147			3C		3D		
188	197			4C		4D		
200	207		2C					
204	207				3D			
272	277				4D			
282	287			6C		6D		
300	307		3C	2D				
400	407		4C					
408	417				6D			
440	447	2C	2D					
450	457			3D				
600	607		6C	4D				
660	667	3C, 2D	3D, 2X					
880	887	4C	4D					
900	907			6D				
990	997	3D	3X					
1320	138	6C, 4D	6D, 4X					
1980	208	6D	6X					

Table 1A – TSM2 Ratings &amp; Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity
85°C	120Hz	KEMET/EIA	(See below for part options)	μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
VDC	μF			max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
6.3	440	2C	TSM2C447(1)006(2)(3)(4)(5)	27.8	10	0.600	0.150	0.115	1
10	200	2C	TSM2C207(1)010(2)(3)(4)(5)	20.0	8	0.600	0.150	NA	1
16	94	2C	TSM2C946(1)016(2)(3)(4)(5)	15.0	6	0.600	0.250	0.175	1
20	44	2C	TSM2C446(1)020(2)(3)(4)(5)	8.8	6	0.600	0.200	NA	1
25	30	2C	TSM2C306(1)025(2)(3)(4)(5)	7.6	6	0.750	0.450	NA	1
35	20	2C	TSM2C206(1)035(2)(3)(4)(5)	7.0	6	1.000	0.600	NA	1
6.3	660	2D	TSM2D667(1)006(2)(3)(4)(5)	41.6	8	0.250	0.075	0.050	1
10	440	2D	TSM2D447(1)010(2)(3)(4)(5)	44.0	8	0.250	0.100	0.040	1
16	300	2D	TSM2D307(1)016(2)(3)(4)(5)	48.0	8	0.350	0.200	0.075	1
20	136	2D	TSM2D137(1)020(2)(3)(4)(5)	27.2	8	0.350	0.100	0.075	1
25	94	2D	TSM2D946(1)025(2)(3)(4)(5)	23.6	10	0.350	0.100	0.060	1
35	44	2D	TSM2D446(1)035(2)(3)(4)(5)	15.4	6	0.350	0.200	0.100	1
50	9.4	2D	TSM2D945(1)050(2)(3)(4)(5)	4.8	6	0.750	0.300	0.140	1
10	660	2X	TSM2X667(1)010(2)(3)(4)(5)	66.0	10	0.250	0.050	0.025	1
50	20	2X	TSM2X206(1)050(2)(3)(4)(5)	10.0	6	0.350	0.200	NA	1
VDC	μF	KEMET/EIA	(See below for part options)	max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
85°C	120Hz			μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity

Table 1B – TSM3 Ratings &amp; Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity
85°C	120Hz	KEMET/EIA	(See below for part options)	μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
VDC	μF			max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
6.3	660	3C	TSM3C667(1)006(2)(3)(4)(5)	41.7	10	0.400	0.100	0.077	1
10	300	3C	TSM3C307(1)010(2)(3)(4)(5)	30.0	8	0.400	0.100	NA	1
16	141	3C	TSM3C147(1)016(2)(3)(4)(5)	22.5	6	0.400	0.167	0.117	1
20	66	3C	TSM3C666(1)020(2)(3)(4)(5)	13.2	6	0.400	0.133	NA	1
25	45	3C	TSM3C456(1)025(2)(3)(4)(5)	11.4	6	0.500	0.300	NA	1
35	30	3C	TSM3C306(1)035(2)(3)(4)(5)	10.5	6	0.667	0.400	NA	1
6.3	990	3D	TSM3D997(1)006(2)(3)(4)(5)	62.4	8	0.167	0.050	0.033	1
10	660	3D	TSM3D667(1)010(2)(3)(4)(5)	66.0	8	0.167	0.067	0.027	1
16	450	3D	TSM3D457(1)016(2)(3)(4)(5)	72.0	8	0.233	0.133	0.050	1
20	204	3D	TSM3D207(1)020(2)(3)(4)(5)	40.8	8	0.233	0.067	0.050	1
25	141	3D	TSM3D147(1)025(2)(3)(4)(5)	35.4	10	0.233	0.067	0.040	1
35	66	3D	TSM3D666(1)035(2)(3)(4)(5)	23.1	6	0.233	0.133	0.067	1
50	14	3D	TSM3D146(1)050(2)(3)(4)(5)	7.2	6	0.500	0.200	0.093	1
10	990	3X	TSM3X997(1)010(2)(3)(4)(5)	99.0	10	0.167	0.033	0.017	1
50	30	3X	TSM3X306(1)050(2)(3)(4)(5)	15.0	6	0.233	0.133	NA	1
VDC	μF	KEMET/EIA	(See below for part options)	max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
85°C	120Hz			μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity

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

(2) To complete KEMET part number, insert B (0.1%/1000Hrs), C (0.01%/1000Hrs) or A = N/A. Designates Reliability Level.

(3) To complete KEMET part number, insert B = Gold Plated, C = Hot solder dipped, H = Solder Plated, or T = 100% Tin (Sn). Designates Termination Finish.

(4) To complete KEMET part number, insert 61 = None, 62 = 10 cycles +25°C, 63 = 10 cycles -55°C +85°C after Weibull or 64 = 10 cycles -55°C +85°C before Weibull. Designates Surge current option.

(5) To complete KEMET part number, insert 10 = Standard ESR, 20 = Low ESR or 30 = Ultra Low ESR. Designates ESR option.

Refer to Ordering Information for additional detail.

**Table 1C – TSM4 Ratings & Part Number Reference**

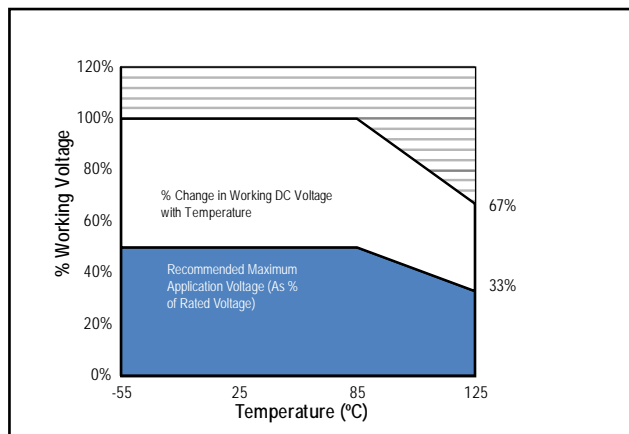
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity
85°C	120Hz	KEMET/EIA	(See below for part options)	μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
VDC	μF			max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
6.3	880	4C	TSM4C887(1)006(2)(3)(4)(5)	55.6	10	0.300	0.075	0.058	1
10	400	4C	TSM4C407(1)010(2)(3)(4)(5)	40.0	8	0.300	0.075	NA	1
16	188	4C	TSM4C197(1)016(2)(3)(4)(5)	30.0	6	0.300	0.125	0.088	1
20	88	4C	TSM4C886(1)020(2)(3)(4)(5)	17.6	6	0.300	0.100	NA	1
25	60	4C	TSM4C606(1)025(2)(3)(4)(5)	15.2	6	0.375	0.225	NA	1
35	40	4C	TSM4C406(1)035(2)(3)(4)(5)	14.0	6	0.500	0.300	NA	1
6.3	1320	4D	TSM4D138(1)006(2)(3)(4)(5)	83.2	8	0.125	0.038	0.025	1
10	880	4D	TSM4D887(1)010(2)(3)(4)(5)	88.0	8	0.125	0.050	0.020	1
16	600	4D	TSM4D607(1)016(2)(3)(4)(5)	96.0	8	0.175	0.100	0.038	1
20	272	4D	TSM4D277(1)020(2)(3)(4)(5)	54.4	8	0.175	0.050	0.038	1
25	188	4D	TSM4D187(1)025(2)(3)(4)(5)	47.2	10	0.175	0.050	0.030	1
35	88	4D	TSM4D886(1)035(2)(3)(4)(5)	30.8	6	0.175	0.100	0.050	1
50	19	4D	TSM4D196(1)050(2)(3)(4)(5)	9.6	6	0.375	0.150	0.070	1
10	1320	4X	TSM4X138(1)010(2)(3)(4)(5)	132.0	10	0.125	0.025	0.013	1
50	40	4X	TSM4X406(1)050(2)(3)(4)(5)	20.0	6	0.175	0.100	NA	1
VDC	μF	KEMET/EIA	(See below for part options)	max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
85°C	120Hz			μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity

**Table 1D – TSM6 Ratings & Part Number Reference**

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity
85°C	120Hz	KEMET/EIA	(See below for part options)	μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
VDC	μF			max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
6.3	1320	6C	TSM6C138(1)006(2)(3)(4)(5)	83.4	10	0.200	0.050	0.038	
10	600	6C	TSM6C607(1)010(2)(3)(4)(5)	60.0	8	0.200	0.050	NA	
16	282	6C	TSM6C287(1)016(2)(3)(4)(5)	45.0	6	0.200	0.083	0.058	
20	132	6C	TSM6C137(1)020(2)(3)(4)(5)	26.4	6	0.200	0.067	NA	
25	90	6C	TSM6C906(1)025(2)(3)(4)(5)	22.8	6	0.250	0.150	NA	
35	60	6C	TSM6C606(1)035(2)(3)(4)(5)	21.0	6	0.333	0.200	NA	
6.3	1980	6D	TSM6D208(1)006(2)(3)(4)(5)	124.8	8	0.083	0.025	0.017	
10	1320	6D	TSM6D138(1)010(2)(3)(4)(5)	132.0	8	0.083	0.033	0.013	
16	900	6D	TSM6D907(1)016(2)(3)(4)(5)	144.0	8	0.117	0.067	0.025	
20	408	6D	TSM6D417(1)020(2)(3)(4)(5)	81.6	8	0.117	0.033	0.025	
25	282	6D	TSM6D287(1)025(2)(3)(4)(5)	70.8	10	0.117	0.033	0.020	
35	132	6D	TSM6D137(1)035(2)(3)(4)(5)	46.2	6	0.117	0.067	0.033	
50	28	6D	TSM6D286(1)050(2)(3)(4)(5)	14.4	6	0.250	0.100	0.047	
10	1980	6X	TSM6X208(1)010(2)(3)(4)(5)	198.0	10	0.083	0.017	0.008	
50	60	6X	TSM6X606(1)050(2)(3)(4)(5)	30.0	6	0.117	0.067	NA	
VDC	μF	KEMET/EIA	(See below for part options)	max/5min	% Max	Ohms	Ohms	Ohms	J-STD-020D
85°C	120Hz			μAmps +20°C	+20°C 120Hz	+20°C 100kHz	+20°C 100kHz	+20°C 100kHz	Temp≤260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR	Ultra-low ESR	Moisture Sensitivity

- 1) To complete KEMET part number, insert M for ± 20%, K for ± 10%. Designates Capacitance tolerance.
  - 2) To complete KEMET part number, insert B (0.1%/1000Hrs), C (0.01%/1000Hrs) or A = N/A. Designates Reliability Level.
  - 3) To complete KEMET part number, insert B = Gold Plated, C = Hot solder dipped, H = Solder Plated, or T = 100% Tin (Sn). Designates Termination Finish.
  - 4) To complete KEMET part number, insert 61 = None, 62 = 10 cycles +25°C, 63 = 10 cycles -55°C +85°C after Weibull or 64 = 10 cycles -55°C +85°C before Weibull. Designates Surge current option.
  - 5) To complete KEMET part number, insert 10 = Standard ESR, 20 = Low ESR or 30 = Ultra Low ESR. Designates ESR option.
- Refer to Ordering Information for additional detail.

## Recommended Voltage Derating Guidelines



## Reverse Voltage

Solid tantalum capacitors are polar devices and may be permanently damaged or destroyed if connected with the wrong polarity. The positive terminal is identified on the capacitor body by a stripe plus in some cases a beveled edge. A small degree of transient reverse voltage is permissible for short periods per the table. The capacitors should not be operated continuously in reverse mode, even within these limits.

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

## Soldering Process

KEMET's families of surface mount capacitors are compatible with wave (single or dual), convection, IR or vapor phase reflow techniques. Preheating of these components is recommended to avoid extreme thermal stress. KEMET's recommended profile conditions for convection and IR reflow reflect the profile conditions of the IPC/J-STD-020D standard for moisture sensitivity testing. The devices can safely withstand a maximum of three reflow passes at these conditions.

Note that although the X/7343-43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

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. Once reflow occurred, the iron should be removed immediately. "Wiping" the edges of a chip and heating the top surface is not recommended.

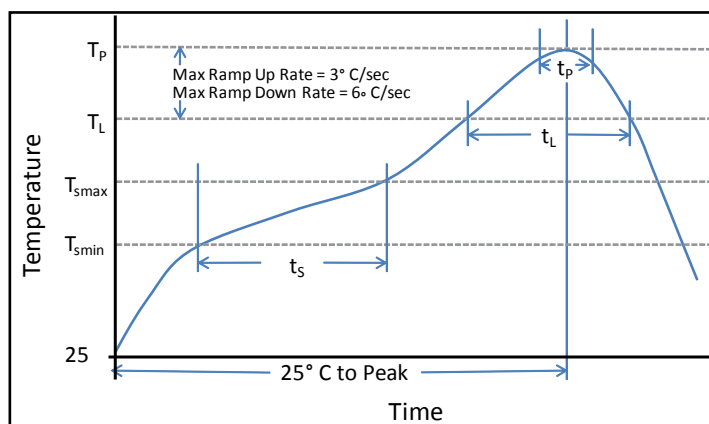
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and is not harmful to the product. Marking permanency is not affected by this change.

Profile Feature	SnPb Assembly	Pb-Free Assembly
<b>Preheat/Soak</b>		
Temperature Min ( $T_{Smin}$ )	100°C	150°C
Temperature Max ( $T_{Smax}$ )	150°C	200°C
Time ( $t_s$ ) from $T_{Smin}$ to $T_{Smax}$	60–120 sec	60–120 sec
Ramp-up Rate ( $T_L$ to $T_p$ )	3°C/sec max	3°C/sec max
Liquidous Temperature ( $T_L$ )	183°C	217°C
Time Above Liquidous ( $t_L$ )	60–150 sec	60–150 sec
Peak Temperature ( $T_p$ )	220°C* 235°C**	250°C* 260°C**
Time within 5°C of Max Peak Temperature ( $t_p$ )	20 sec max	30 sec max
Ramp-down Rate ( $T_p$ to $T_L$ )	6°C/sec max	6°C/sec max
Time 25°C to Peak Temperature	6 minutes max	8 minutes max

Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

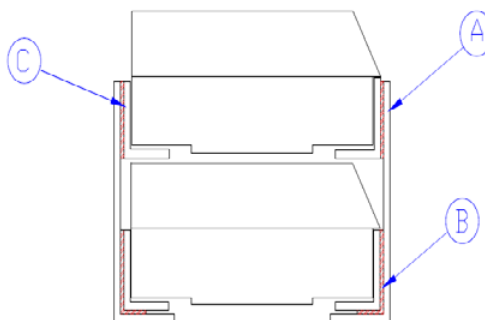
\*Case Size D, E, P, Y and X

\*\*Case Size A, B, C, H, I, K, M, R, S, T, U, V, W and Z



## Construction

Ref	Name	Material
A	Leadframe	BeCu Alloy 190
B	Leadframe Attach	High Temp Solder
C	Lead Termination	Solder Coated Alloy 752

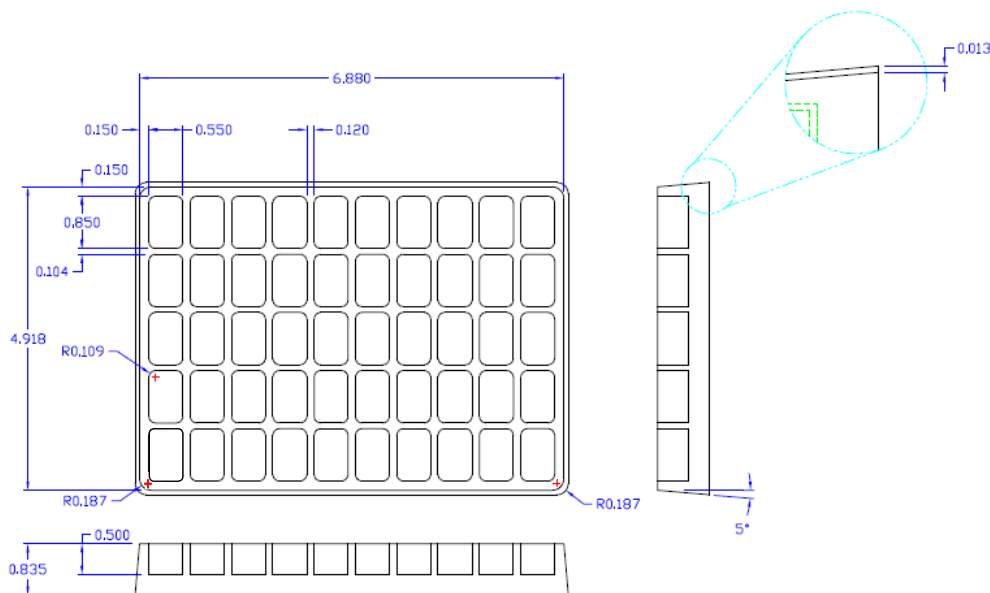


## Storage

Tantalum chip capacitors should be stored in normal working environments. While the chips 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. In addition, 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, chip stock should be used promptly, preferably within three years of receipt.

## Packaging

- Tantalum Stacks Packaging EIA-451 Packaging Material Standards for ESD Sensitive Items
- Antistatic Plastic Trays
- Polyurethane Polyether Foam



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Carmel, IN  
Tel: 317-706-6742

### West

Milpitas, CA  
Tel: 408-433-9950

### Mexico

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

## Europe

### Southern Europe

Geneva, Switzerland  
Tel: 41-22-715-0100

Paris, France  
Tel: 33-1-4646-1009

Sasso Marconi, Italy  
Tel: 39-051-939111

Milan, Italy  
Tel: 39-02-57518176

Rome, Italy  
Tel: 39-06-23231718

Madrid, Spain  
Tel: 34-91-804-4303

### Central Europe

Landsberg, Germany  
Tel: 49-8191-3350800

Dortmund, Germany  
Tel: 49-2307-3619672

Kwidzyn, Poland  
Tel: 48-55-279-7025

### Northern Europe

Bishop's Stortford, United Kingdom  
Tel: 44-1279-757201

Weymouth, United Kingdom  
Tel: 44-1305-830747

Coatbridge, Scotland  
Tel: 44-1236-434455

Färjestaden, Sweden  
Tel: 46-485-563934

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: 86-10-5829-1711

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

Taipei, Taiwan  
Tel: 886-2-27528585

### Southeast Asia

Singapore  
Tel: 65-6586-1900

Penang, Malaysia  
Tel: 60-4-6430200

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

*Note: KEMET reserves the right to modify minor details of internal and external construction at any time in the interest of product improvement. KEMET does not assume any responsibility for infringement that might result from the use of KEMET Capacitors in potential circuit designs. KEMET is a registered trademark of KEMET Electronics Corporation.*

## Other KEMET Resources

Tools	
Resource	Location
Configure A Part: CapEdge	<a href="http://capacitoredge.kemet.com">http://capacitoredge.kemet.com</a>
SPICE & FIT Software	<a href="http://www.kemet.com/spice">http://www.kemet.com/spice</a>
Search Our FAQs: KnowledgeEdge	<a href="http://www.kemet.com/keask">http://www.kemet.com/keask</a>

Product Information	
Resource	Location
Products	<a href="http://www.kemet.com/products">http://www.kemet.com/products</a>
Technical Resources (Including Soldering Techniques)	<a href="http://www.kemet.com/technicalpapers">http://www.kemet.com/technicalpapers</a>
RoHS Statement	<a href="http://www.kemet.com/rohs">http://www.kemet.com/rohs</a>
Quality Documents	<a href="http://www.kemet.com/qualitydocuments">http://www.kemet.com/qualitydocuments</a>

Product Request	
Resource	Location
Sample Request	<a href="http://www.kemet.com/sample">http://www.kemet.com/sample</a>
Engineering Kit Request	<a href="http://www.kemet.com/kits">http://www.kemet.com/kits</a>

Contact	
Resource	Location
Website	<a href="http://www.kemet.com">www.kemet.com</a>
Contact Us	<a href="http://www.kemet.com/contact">http://www.kemet.com/contact</a>
Investor Relations	<a href="http://www.kemet.com/ir">http://www.kemet.com/ir</a>
Call Us	1-877-MyKEMET
Twitter	<a href="http://twitter.com/kemetcapacitors">http://twitter.com/kemetcapacitors</a>

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Although we design and manufacture our 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.

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