

Overview

The KEMET Tantalum Stacks MnO₂ (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 9.4 µF to 1980 µF
- Capacitance can be custom specified
- Voltage ratings of 6 VDC 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.



RoHS Compliant

SPICE

For a detailed analysis of specific part numbers, please visit www.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	C-Spec 2
T = Tantalum	Stacks MnO ₂ 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 = 6.3 V 010 = 10 V 016 = 16 V 020 = 20 V 025 = 25 V 035 = 35 V 050 = 50 V	A = N/A B = 0.1%/1,000 hours C = 0.01%/1,000 hours	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 – 1980 µF @ 120 Hz/25°C
Capacitance Tolerance	K Tolerance (10%), M Tolerance (20%)
Rated Voltage Range	6 – 50 V
DF (120 Hz)	Refer to Part Number Electrical Specification Table
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.01 CV (µA) at rated voltage after 5 minutes

Qualification

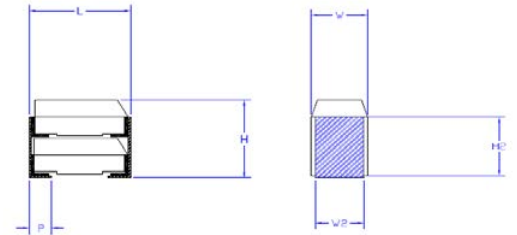
Test	Condition	Characteristics	
Endurance	85°C @ rated voltage, 2,000 hours 125°C @ 2/3 rated voltage, 2,000 hours	Δ C/C	Within ±10% of initial value
		DF	Within initial limits
		DCL	Within 1.25 x initial limit
		ESR	Within initial limits
Thermal Shock	KEMET specified test, mounted, -55°C to 125° C, 5 cycles	Δ C/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 1,000 cycles	Δ C/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 1,000 cycles	Δ C/C	Within ±5% of initial value
		DF	Within initial limits
		DCL	Within initial limits
		ESR	Within initial limits
Mechanical Vibration	MIL-STD-202, Method 204, Condition D, 10 Hz to 2,000 Hz, 20 G peak	Δ C/C	Within ±10% of initial value
		DF	Within initial limits
		DCL	Within initial limits

Dimensions – Millimeters (Inches)

Metric will govern

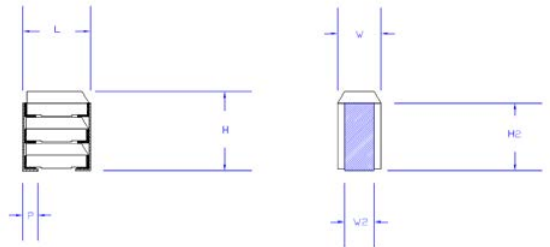
TSM2

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



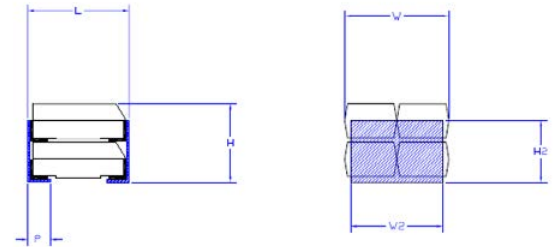
TSM3

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



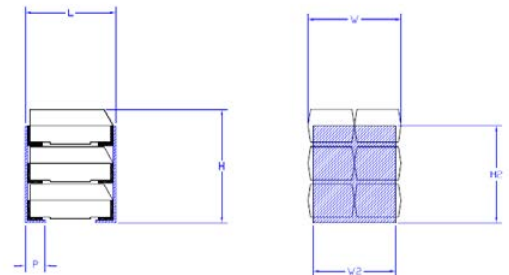
TSM4

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



TSM6

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



Capacitance and Rated Voltage Chart

Capacitance		Rated Voltage						
μF	Code	6 V	10 V	16 V	20 V	25 V	35 V	50 V
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 & 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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 260°C
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	130	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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 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 & 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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 260°C
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	140	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	200	3D	TSM3D207(1)020(2)(3)(4)(5)	40.8	8	0.233	0.067	0.050	1
25	140	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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 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%/1,000 hours), C (0.01%/1,000 hours) 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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 260°C
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	190	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	1300	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	270	4D	TSM4D277(1)020(2)(3)(4)(5)	54.4	8	0.175	0.050	0.038	1
25	180	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	1300	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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 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
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 260°C
6.3	1300	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	280	6C	TSM6C287(1)016(2)(3)(4)(5)	45.0	6	0.200	0.083	0.058	
20	130	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	2000	6D	TSM6D208(1)006(2)(3)(4)(5)	124.8	8	0.083	0.025	0.017	
10	1300	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	410	6D	TSM6D417(1)020(2)(3)(4)(5)	81.6	8	0.117	0.033	0.025	
25	280	6D	TSM6D287(1)025(2)(3)(4)(5)	70.8	10	0.117	0.033	0.020	
35	130	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	2000	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	
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Max/5 Min	% @ +20°C 120 Hz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Ω @ +20°C 100 kHz Max	Temperature ≤ 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%/1,000 hours), C (0.01%/1,000 hours) or A = N/A. Designates Reliability Level.

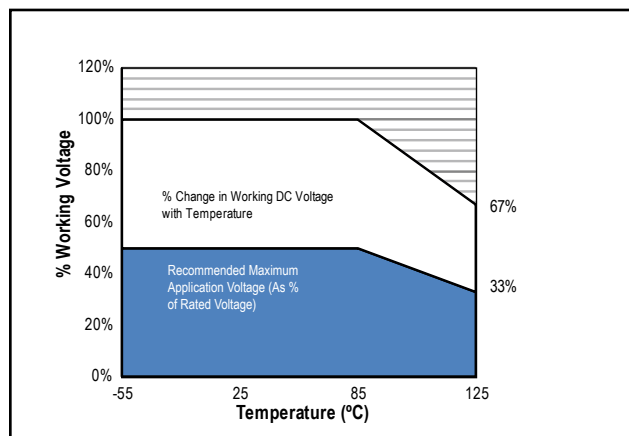
(3) To complete KEMET part number, insert B = Gold Plated, C = Hot solder dipped, H = Solder Plated, or T = 100% Tin (Sn). Designates Termination Finish.

(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

Table 2 – Land Dimensions/Courtyard

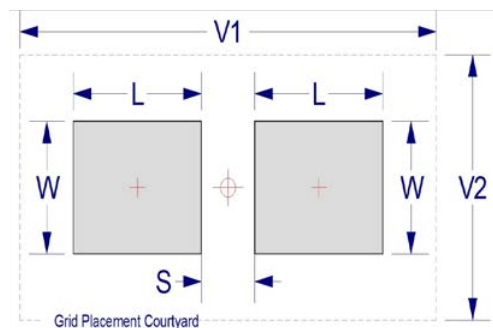
KEMET	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
	Case	L	W	S	V1	V2	L	W	S	V1	V2	L	W	S	V1
TSM2C	2.98	2.74	2.53	9.50	4.50	2.58	2.62	2.73	8.40	4.00	2.20	2.52	2.89	7.54	3.74
TSM2D	3.48	3.24	3.03	11.00	5.60	3.08	3.12	3.23	9.90	5.10	2.70	3.02	3.39	9.04	4.84
TSM2X	3.48	3.24	3.03	11.00	5.60	3.08	3.12	3.23	9.90	5.10	2.70	3.02	3.39	9.04	4.84
TSM3C	2.98	2.74	2.53	9.50	4.50	2.58	2.62	2.73	8.40	4.00	2.20	2.52	2.89	7.54	3.74
TSM3D	3.48	3.24	3.03	11.00	5.60	3.08	3.12	3.23	9.90	5.10	2.70	3.02	3.39	9.04	4.84
TSM3X	3.48	3.24	3.03	11.00	5.60	3.08	3.12	3.23	9.90	5.10	2.70	3.02	3.39	9.04	4.84
TSM4C	2.98	6.04	2.53	9.50	7.80	2.58	5.92	2.73	8.40	7.30	2.20	5.82	2.89	7.54	7.04
TSM4D	3.48	7.64	3.03	11.00	10.10	3.08	7.52	3.23	9.90	9.60	2.70	7.42	3.39	9.04	9.34
TSM4X	3.48	7.64	3.03	11.00	10.10	3.08	7.52	3.23	9.90	9.60	2.70	7.42	3.39	9.04	9.34
TSM6C	2.98	6.04	2.53	9.50	7.80	2.58	5.92	2.73	8.40	7.30	2.20	5.82	2.89	7.54	7.04
TSM6D	3.48	7.64	3.03	11.00	10.10	3.08	7.52	3.23	9.90	9.60	2.70	7.42	3.39	9.04	9.34
TSM6X	3.48	7.64	3.03	11.00	10.10	3.08	7.52	3.23	9.90	9.60	2.70	7.42	3.39	9.04	9.34

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).

¹ Height of these chips may create problems in wave soldering.



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.

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

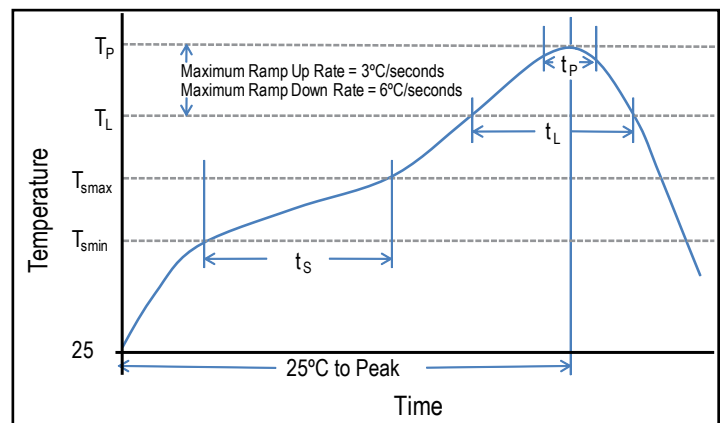
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

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

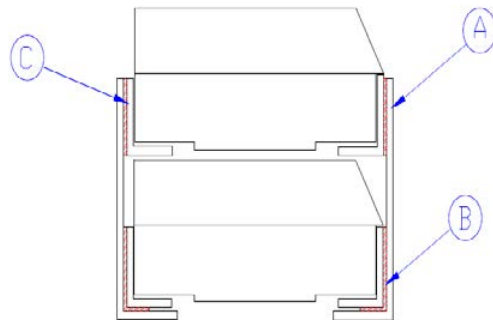
*Case Size D, E, P, Y, and X

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



Construction

Reference	Name	Material
A	Lead frame	BeCu Alloy 190
B	Lead frame Attach	High Temperature Solder
C	Lead Termination	Solder Coated Alloy 752

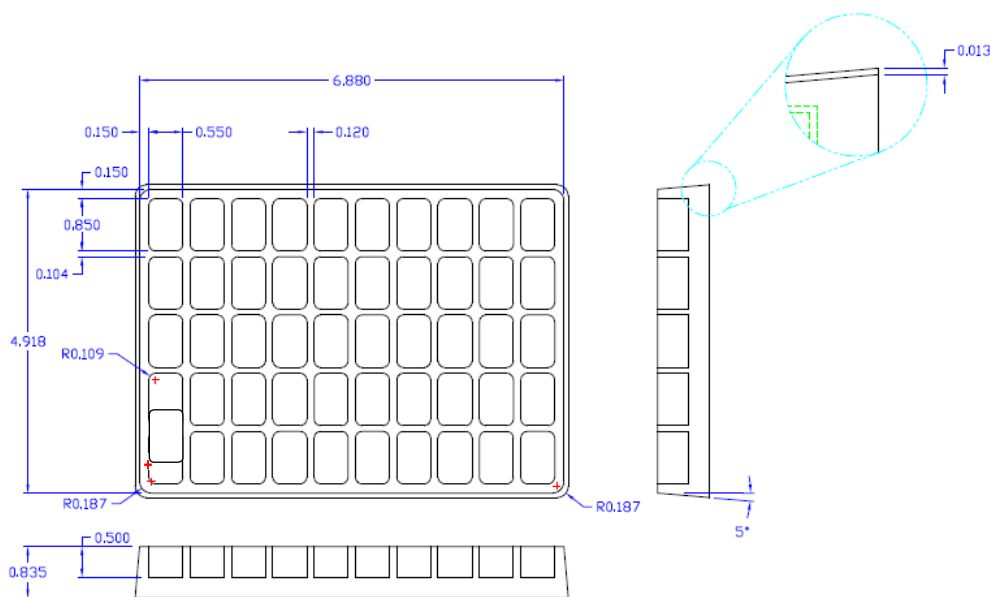


Storage

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. 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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Tel: 49-8191-3350800

Kamen, Germany
Tel: 49-2307-438110

Northern Europe

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Tel: 44-1279-460122

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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	http://capacitoredge.kemet.com
SPICE & FIT Software	http://www.kemet.com/spice
Search Our FAQs: KnowledgeEdge	http://www.kemet.com/keask
Electrolytic LifeCalculator	http://www.kemet.com:8080/elc

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

Product Request	
Resource	Location
Sample Request	http://www.kemet.com/sample
Engineering Kit Request	http://www.kemet.com/kits

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Website	www.kemet.com
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Call Us	1-877-MyKEMET
Twitter	http://twitter.com/kemetcapacitors

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