Tantalum Stack Polymer (TSP) Series

Overview

The KEMET Tantalum Stack Polymer (TSP) Series is designed to provide the highest capacitance/voltage ratings in surface mount configuration. KEMET's T540 Polymer COTS capacitors are utilized in stacks of 2,3,4 and 6 components to achieve a broad range of capacitance and voltage ratings. The T540 COTS series offers component level surge current testing options and standard and low ESR options. As with other KEMET Polymer product, this series may be operated at steady state voltages up to 90% of rated voltage for part types with rated voltages of ≤ 10 volts and up to 80% of rated voltage for part types > 10 volts. Stacking configurations offer this Polymer COTS 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

- Polymer cathode technology
- High capacitance
- Surface mountable
- Capacitance values of 66 µF to 4080 µF
- Capacitance can be custom specified
- Voltage ratings of 3 VDC to 16 VDC
- High volumetric efficiency
- Ultra low ESR
- Surge capability
- Operating temperature range of -55˚C to +125˚C
- Laser-marked case
- Use up to 90% of rated voltage for part types ≤ 10 volts
- Use up to 80% of rated voltage for part types > 10 volts

Applications

Typical applications include decoupling and filtering in a variety of market segments. The T540 Polymer 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	SP	2D	207	M	010	A	H	65	20	D540
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	Surge	ESR	C-Spec 2
T = Tantalum	Stacks Polymer Cathode	2B, 3B, 4B, 6B, 2D, 3D, 4D, 6D	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	003 = 3 V 004 = 4 V 006 = 6.3 V 010 = 10 V 016 = 16 V	A = N/A	H = Standard Solder Coated (SnPb 5% Pb minimum)	65 = No Surge 66 = 10 cycles @ 25°C 67 = 10 cycles -55°C and 85°C	10 = ESR - Standard 20 = ESR-Low	Designates discrete component series. D540 = T540

Note: These TSP Stacks are specific to T540 COTS.

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	66 – 4080 µF @ 120 Hz/25° C
Capacitance Tolerance	M Tolerance (20%)
Rated Voltage Range	3 – 16 V
DF (120 Hz)	Refer to Part Number Electrical Specification Table
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.1 CV (mA) at rated voltage after 5 minutes

Qualification

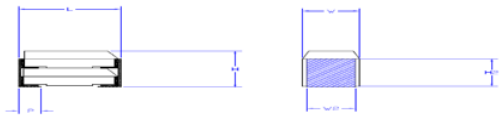
Test	Condition	Characteristics	
Endurance	105°C @ rated voltage, 2,000 hours 125°C @ 2/3 rated voltage, 2,000 hours	Δ C/C	Within -20/+10% of initial value
		DF	≤ initial limit
		DCL	1.25 x IL @125° C
		ESR	2 x initial limit
Thermal Shock	KEMET specified test, mounted, -55C° to 125° C, 5 cycles	Δ C/C	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

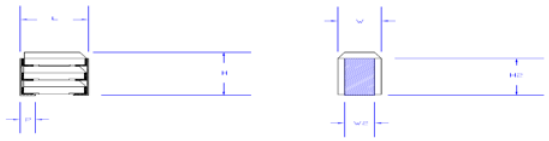
TSP2

KEMET 2 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
2B	4.1 ± 0.38 (.162 ± .015)	3.1 ± 0.2 (.122 ± .008)	4.3 ± 0.38 (.170 ± .015)	2.3 ± 0.2 (.090 ± .008)	3.1 ± 0.38 (.124 ± .015)	0.76 ± 0.38 (.030 ± .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)



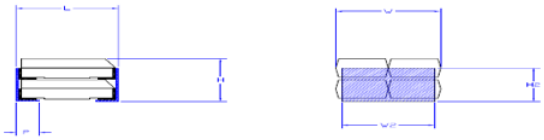
TSP3

KEMET 3 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
3B	4.1 ± 0.38 (.162 ± .015)	3.1 ± 0.2 (.122 ± .008)	6.3 ± 0.38 (.248 ± .015)	2.3 ± 0.2 (.090 ± .008)	5.3 ± 0.38 (.210 ± .015)	0.76 ± 0.38 (.030 ± .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)



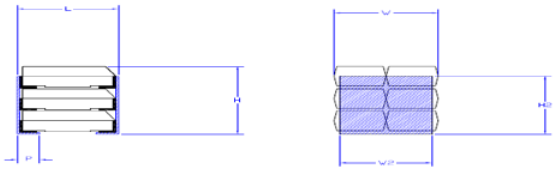
TSP4

KEMET 4 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
4B	4.1 ± 0.38 (.162 ± .015)	6.1 ± 0.2 (.242 ± .008)	4.3 ± 0.38 (.170 ± .015)	5.3 ± 0.2 (.210 ± .008)	3.1 ± 0.38 (.124 ± .015)	0.76 ± 0.38 (.030 ± .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)



TSP6

KEMET 6 Component Stack Dimensions						
Case Code	L	W	H	W2	H2	P
6B	4.1 ± 0.38 (.162 ± .015)	6.1 ± 0.2 (.242 ± .008)	6.3 ± 0.38 (.248 ± .015)	5.3 ± 0.2 (.210 ± .008)	5.3 ± 0.38 (.210 ± .015)	0.76 ± 0.38 (.030 ± .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)



Capacitance and Rated Voltage Chart

Capacitance		Rated Voltage				
µF	Code	3	4	6.3	10	16
66	666				2B	
94	946					2D
99	996				3B	
132	137				4B	
136	137			2B		
141	147					3D
188	197					4D
198	207				6B	
200	207		2B		2D	
204	207			3B		
272	277			4B		
282	287					6D
300	307		3B		2D	
400	407		4B		4D	
408	407			6B		
440	447		2D		2D	
450	457	3B				
600	607	4B	6B			
660	667	2D		2D	3D	
880	887		4D		4D	
900	907	6B			6D	
940	947		2D			
990	997			3D		
1320	138			4D	6D	
1360	148	2D				
1410	148		3D			
1880	198		4D			
1980	208			6D		
2040	208	3D				
2720	278	4D				
2820	288		6D			
4080	418	6D				

Table 1A – TSP2 Ratings & Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR
85°C	120Hz	KEMET/EIA	(See below for part options)	µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
VDC	µF			max/5min	% Max	mOhms	mOhms
4	200	2B	TSP2B207M004AH(1)(2)D540	80	8	40.0	N/A
6.3	136	2B	TSP2B137M006AH(1)(2)D540	86	8	40.0	N/A
10	66	2B	TSP2B666M010AH(1)(2)D540	66	8	40.0	N/A
3	660	2D	TSP2D667M003AH(1)(2)D540	198	10	12.5	N/A
3	1360	2D	TSP2D148M003AH(1)(2)D540	408	10	12.5	N/A
4	440	2D	TSP2D447M004AH(1)(2)D540	176	10	12.5	N/A
4	940	2D	TSP2D947M004AH(1)(2)D540	376	10	20	12.5
6.3	660	2D	TSP2D667M006AH(1)(2)D540	416	10	20	12.5
10	200	2D	TSP2D207M010AH(1)(2)D540	200	10	27.5	12.5
10	300	2D	TSP2D307M010AH(1)(2)D540	300	10	27.5	12.5
10	440	2D	TSP2D447M010AH(1)(2)D540	440	10	12.5	N/A
16	94	2D	TSP2D946M016AH(1)(2)D540	152	10	32.5	17.5
VDC	µF	KEMET/EIA	(See below for part options)	max/5min	% Max	mOhms	mOhms
85°C	120Hz			µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR

Table 1B – TSP3 Ratings & Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR
85°C	120Hz	KEMET/EIA	(See below for part options)	µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
VDC	µF			max/5min	% Max	mOhms	mOhms
3	450	3B	TSP3B457M003AH(1)(2)D540	135	8	26.7	N/A
4	300	3B	TSP3B307M004AH(1)(2)D540	120	8	26.7	N/A
6.3	204	3B	TSP3B207M006AH(1)(2)D540	129	8	26.7	N/A
10	99	3B	TSP3B996M010AH(1)(2)D540	99	8	26.7	N/A
3	2040	3D	TSP3D208M003AH(1)(2)D540	612	10	8.3	N/A
4	1410	3D	TSP3D148M004AH(1)(2)D540	564	10	13.3	8.3
6.3	990	3D	TSP3D997M006AH(1)(2)D540	624	10	13.3	8.3
10	660	3D	TSP3D667M010AH(1)(2)D540	660	10	8.3	N/A
16	141	3D	TSP3D147M016AH(1)(2)D540	226	10	21.7	11.7
VDC	µF	KEMET/EIA	(See below for part options)	max/5min	% Max	mOhms	mOhms
85°C	120Hz			µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR

(1) To complete KEMET part number, insert 65 = None, 66 = 10 cycles +25°C, 67 = 10 cycles -55°C +85°C. Designates surge current option.
(2) To complete KEMET part number, insert 10 = Standard ESR, 20 = Low ESR. Designates ESR option.
Refer to Ordering Information for additional detail.

Roll Over for Order Info.

Table 1C – TSP4 Ratings & Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR
85°C	120Hz	KEMET/EIA	(See below for part options)	µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
VDC	µF			max/5min	% Max	mOhms	mOhms
3	600	4B	TSP4B607M003AH(1)(2)D540	180	8	20.0	N/A
4	400	4B	TSP4B407M004AH(1)(2)D540	160	8	20.0	N/A
6.3	272	4B	TSP4B277M006AH(1)(2)D540	172	8	20.0	N/A
10	132	4B	TSP4B137M010AH(1)(2)D540	132	8	20.0	N/A
3	2720	4D	TSP4D278M003AH(1)(2)D540	816	10	6.25	N/A
4	880	4D	TSP4D887M004AH(1)(2)D540	352	10	6.25	N/A
4	1880	4D	TSP4D198M004AH(1)(2)D540	752	10	10	6.25
6.3	1320	4D	TSP4D138M006AH(1)(2)D540	832	10	10	6.25
10	400	4D	TSP4D407M010AH(1)(2)D540	400	10	13.75	6.25
10	880	4D	TSP4D887M010AH(1)(2)D540	880	10	6.25	N/A
16	188	4D	TSP4D197M016AH(1)(2)D540	301	10	16.25	8.75
VDC	µF	KEMET/EIA	(See below for part options)	max/5min	% Max	mOhms	mOhms
85°C	120Hz			µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR

Table 1D – TSP6 Ratings & Part Number Reference

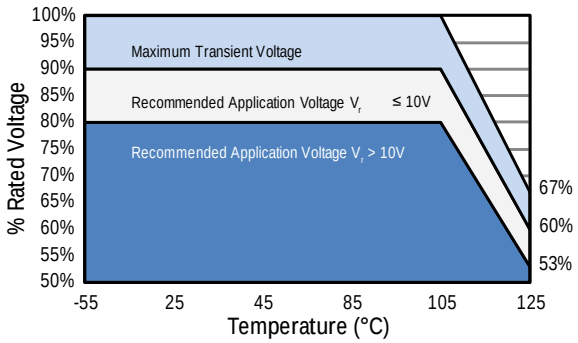
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR
85°C	120Hz	KEMET/EIA	(See below for part options)	µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
VDC	µF			max/5min	% Max	mOhms	mOhms
3	900	6B	TSP6B907M003AH(1)(2)D540	270	8	13.3	N/A
4	600	6B	TSP6B607M004AH(1)(2)D540	240	8	13.3	N/A
6.3	408	6B	TSP6B407M006AH(1)(2)D540	258	8	13.3	N/A
10	198	6B	TSP6B207M010AH(1)(2)D540	198	8	13.3	N/A
3	4080	6D	TSP6D418M003AH(1)(2)D540	1224	10	4.2	N/A
4	2820	6D	TSP6D288M004AH(1)(2)D540	1128	10	6.7	4.2
6.3	1980	6D	TSP6D208M006AH(1)(2)D540	1248	10	6.7	4.2
10	900	6D	TSP6D907M010AH(1)(2)D540	900	10	9.2	4.2
10	1320	6D	TSP6D138M010AH(1)(2)D540	1320	10	4.2	N/A
16	282	6D	TSP6D287M016AH(1)(2)D540	452	10	10.8	5.8
VDC	µF	KEMET/EIA	(See below for part options)	max/5min	% Max	mOhms	mOhms
85°C	120Hz			µAmps +20°C	+20°C 120Hz	+25°C 100kHz	+25°C 100kHz
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR	Low ESR

(1) To complete KEMET part number, insert 65 = None, 66 = 10 cycles +25°C, 67 = 10 cycles -55°C +85°C. Designates surge current option.
(2) To complete KEMET part number, insert 10 = Standard ESR, 20 = Low ESR. Designates ESR option.
Refer to Ordering Information for additional detail.

Derating Guidelines

Voltage Rating	Maximum Recommended Steady State Voltage	Maximum Recommended Transient Voltage (1 ms – 1 µs)
-55°C to 105°C		
2.5 V ≤ V_R ≤ 10 V	90% of V_R	V_R
12.5 V ≤ V_R ≤ 16 V	80% of V_R	V_R

V_R = Rated Voltage



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.

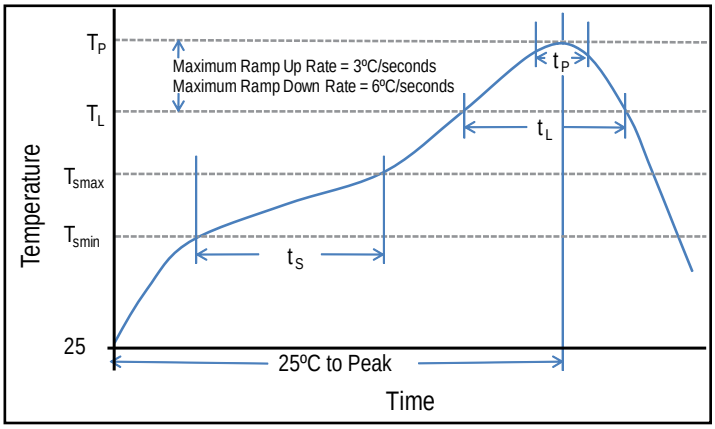
Please note that although the X/7343–43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

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.

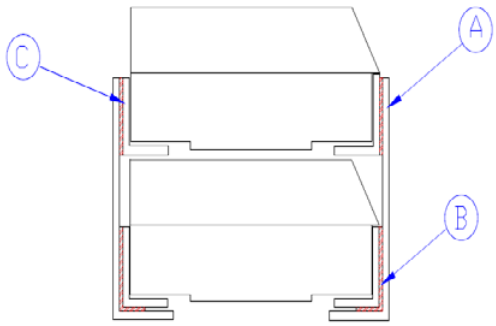
Profile Feature	SnPb Assembly	Pb-Free Assembly
Preheat/Soak		
Temperature Minimum (T_{Smin})	100°C	150°C
Temperature Maximum (T_{Smax})	150°C	200°C
Time (t_s) from T_{smin} to T_{smax})	60 – 120 seconds	60 – 120 seconds
Ramp-up Rate (T_L to T_P)	3°C/seconds maximum	3°C/seconds maximum
Liquidous Temperature (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	Leadframe	BeCu Alloy 190
B	Leadframe Attach	High Temp Solder
C	Lead Termination	Solder Coated Alloy 752

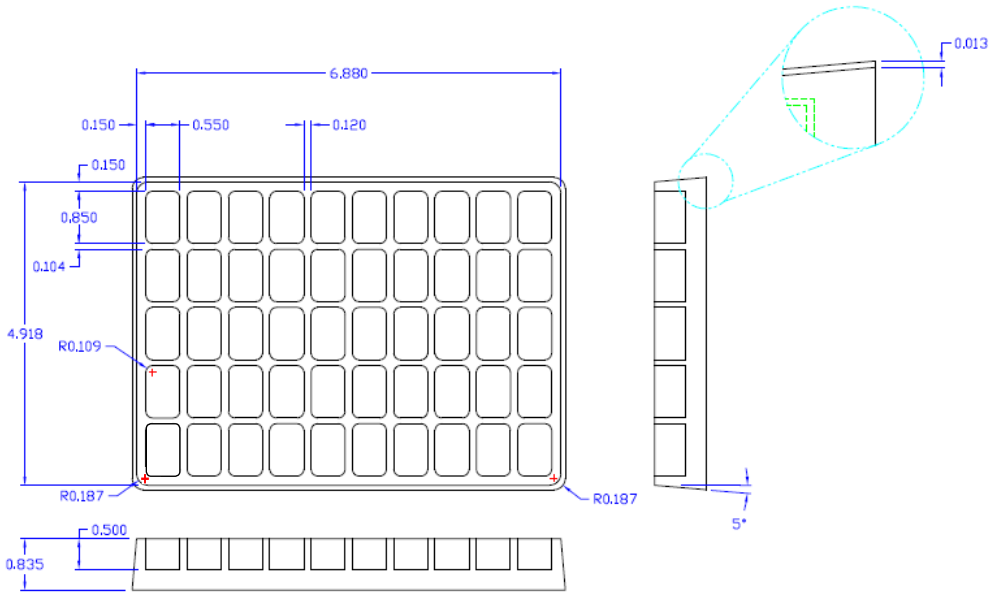


Storage and Handling

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 40ºC and maximum storage humidity not exceed 70% relative humidity. Temperature fluctuations should be minimized to avoid condensation on the parts and atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability chip stock should be used promptly, preferably within 1.5 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: 408-433-9950

Mexico
Zapopan, Jalisco
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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

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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

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

Contact	
Resource	Location
Website	www.kemet.com
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Investor Relations	http://www.kemet.com/ir
Call Us	1-877-MyKEMET
Twitter	http://twitter.com/kemetcapacitors

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Although all product-related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.

Digitally signed by Jeannette Calvo
DN: c=US, st=FL, l=Fort Lauderdale, o=KEMET Corp., ou=Marketing Communications, cn=Jeannette Calvo, email=jeannettecalvo@kemet.com
Date: 2012.09.07 14:26:04 -04'00'

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