

Tantalum Surface Mount Capacitors

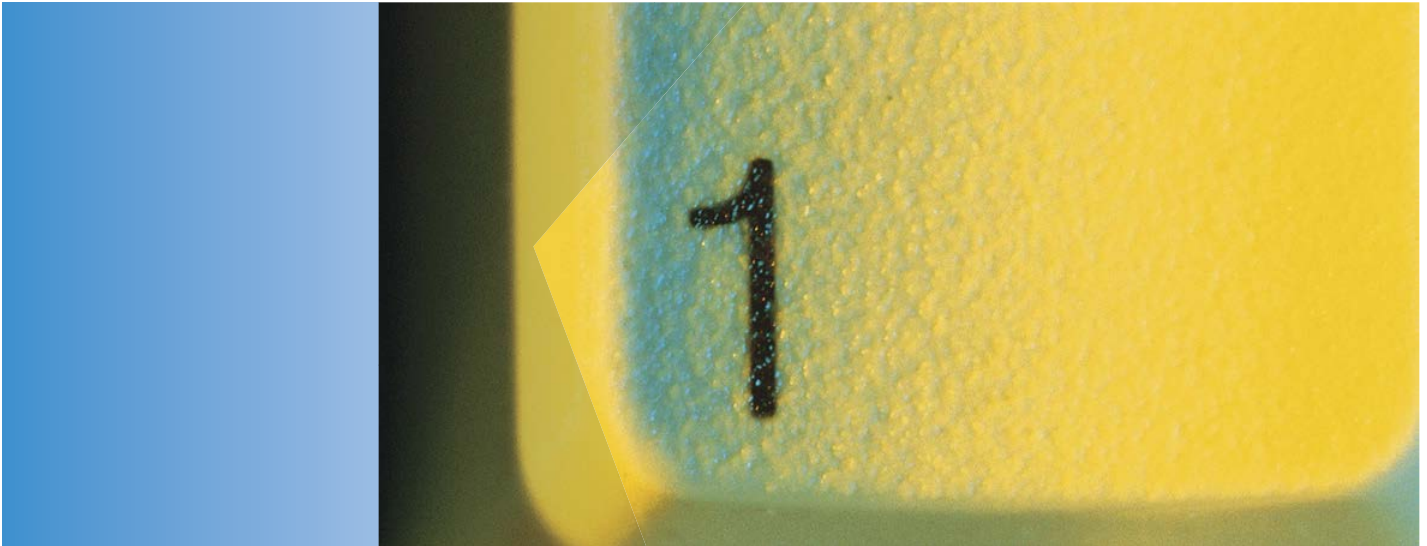
High Temperature



One world. One KEMET.

Electronic Components
KEMET
CHARGED.®

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One world. One source. One KEMET.

When you partner with KEMET, our entire global organization provides you with the coordinated service you need. No bouncing from supplier to supplier. No endless phone calls and web browsing. We're your single, integrated source for electronic component solutions worldwide.

Less hassles. More solutions.

Our commitment to product quality and on-time delivery has helped customers succeed for over 90 years. There's a reason KEMET components can be found in defense and aerospace equipment. Our reputation is built on a history of consistency, reliability and service.

The "Easy-to-Buy-From" company.

KEMET offers a level of responsiveness that far surpasses any other supplier. Our passion for customer service is evident throughout our global sales organization, which offers localized support bolstered by our worldwide logistics capabilities. Whether you need rush samples, technical assistance, in-person consultation, accelerated custom design, design collaboration or prototype services, we have a solution.



Made for you.

When you need custom products delivered on a tight schedule, you can trust KEMET. Get direct design consultation from global experts, who help you get the job done on time and within budget.

Working for a better world.

KEMET is dedicated to economically, environmentally and socially sustainable development. We've adopted the Electronic Industry Code of Conduct (EICC) to address all aspects of corporate responsibility. Our manufacturing facilities have won numerous environmental excellence awards and recognitions, and our supply chain is certified. We believe doing the right thing is in everyone's interest.

About KEMET.

KEMET Corporation is a leading global supplier of electronic components. We offer our customers the broadest selection of capacitor technologies in the industry across multiple dielectrics, along with an expanding range of electromechanical devices, and electromagnetic compatibility solutions. Our vision is to be the preferred supplier of electronic component solutions for customers demanding the highest standards of quality, delivery and service.

Overview

The KEMET T498 Series is a high temperature product that offers optimum performance characteristics in applications with operating temperatures up to 150°C. Advanced materials and testing allow this series to perform with a reliability level of 0.5%/1000 hours at rated voltage and temperature. This series

is classified as MSL (Moisture Sensitivity Level) 1 under J STD 020: unlimited floor life time at ≤30°C / 85% RH. The T498 Series is available in five standard EIA case sizes with ROHS compliant terminations as standard.

Benefits

- Meets or exceeds EIA standard 535BAAC
- Taped and reeled per EIA 481-1
- Symmetrical, compliant terminations
- Optional gold-plated terminations
- Laser-marked case
- 100% surge current testing
- Complies with AEC-Q200
- Capacitance values of 0.47 µF to 220 µF
- Tolerances of ±10% and ±20%
- Voltage rating of 6-50 VDC
- 100% steady-state accelerated aging
- Temperature/voltage derating is 2/3 at 150°C
- RoHS Compliant and lead-free terminations standard
- Operating temperature range of -55°C to +150°C

Applications

Typical applications include decoupling and filtering in industrial and automotive end applications such as DC/DC converters, portable electronics, telecommunications, and control units operating at temperatures up to 150°C.



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	498	X	227	M	010	A	T	E500	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/Design	Lead Material	ESR	Packaging (C-Spec)
T = Tantalum	High Temperature 150°C	A, B, C, D, X	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	006 = 6.3 V 010 = 10 V 015 = 15 V 020 = 20 V 025 = 25 V 035 = 35 V 050 = 50 V	A = N/A	T = 100% Matte Tin (Sn) Plated G = Gold Plated	E = ESR Last three digits specify ESR in mΩ (500 = 500 mΩ)	Blank = 7" Reel 7280 = 13" Reel

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 150°C
Rated Capacitance Range	0.33 – 220 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	150°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		
Storage Life	150°C @ 0 volts, 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	MIL-STD-202, Method 107, Condition B, mounted, -55°C to 150°C, 1,000 cycles	Δ C/C	Within ±5% of initial value		
		DF	Within initial limits		
		DCL	Within 1.25 x initial limit		
		ESR	Within initial limits		
Temperature Stability	Extreme temperature exposure at a succession of continuous steps at +25°C, -55°C, +25°C, +85°C, +150°C, +25°C	+25°C	-55°C	+85°C	+150°C
		Δ C/C	IL*	±10%	±10%
		DF	IL	1.5 x IL	1.5 x IL
		DCL	IL	n/a	10 x IL
Surge Voltage	25°C and 85°C, 1.32 x rated voltage 1,000 cycles (150°C, 1.2 x rated voltage)	Δ C/C	Within ±5% of initial value		
		DF	Within initial limits		
		DCL	Within initial limits		
		ESR	Within initial limits		
Mechanical Shock/Vibration	MIL-STD-202, Method 213, Condition I, 100 G peak 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		

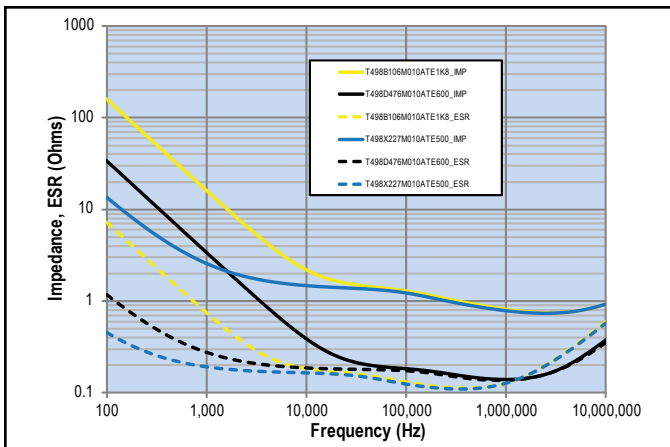
*IL = Initial Limit

Certification

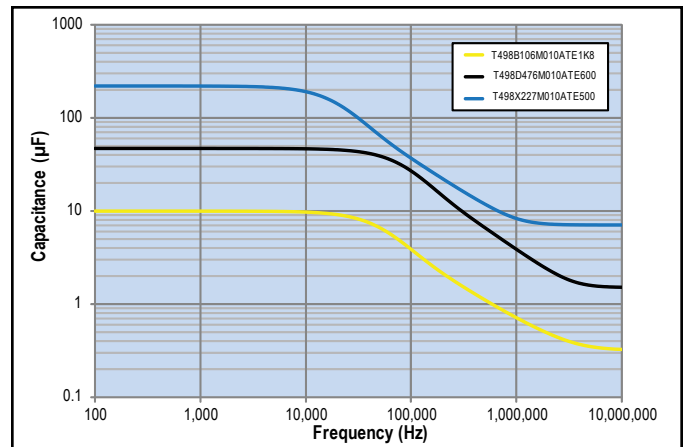
KEMET's Internal Qualification Plan for this Tantalum series of capacitors follows AEC-Q200 guidelines.

Electrical Characteristics

ESR vs. Frequency

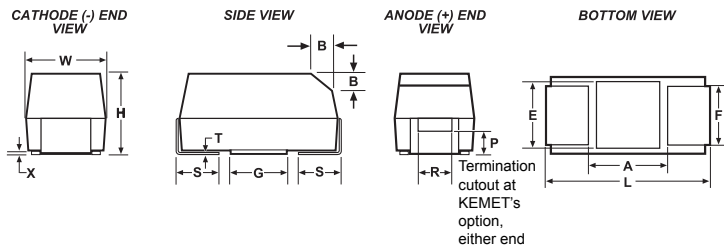


Capacitance vs. Frequency



Dimensions – Millimeters (Inches)

Metric will govern



Case Size		Component												
KEMET	EIA	L*	W*	H*	F* ±0.1 ±(.004)	S* ±0.3 ±(.012)	B* ±0.15 (Ref) ±.006	X (Ref)	P (Ref)	R (Ref)	T (Ref)	A (Min)	G (Ref)	E (Ref)
A	3216-18	3.2 ± 0.2 (.126 ± .008)	1.6 ± 0.2 (.063 ± .008)	1.6 ± 0.2 (.063 ± .008)	1.2 (.047)	0.8 (.031)	0.4 (.016)	0.10 ± 0.10 (.004 ± .004)	0.4 (.016)	0.4 (.016)	0.13 (.005)	0.8 (.31)	1.1 (.043)	1.3 (.051)
B	3528-21	3.5 ± 0.2 (.138 ± .008)	2.8 ± 0.2 (.110 ± .008)	1.9 ± 0.2 (.075 ± .008)	2.2 (.087)	0.8 (.031)	0.4 (.016)	0.10 ± 0.10 (.004 ± .004)	0.5 (.020)	1.0 (.039)	0.13 (.005)	1.1 (0.043)	1.8 (.071)	2.2 (.087)
C	6032-28	6.0 ± 0.3 (.236 ± .03)	3.2 ± 0.3 (.126 ± .012)	2.5 ± 0.3 (.098 ± .012)	2.2 (.087)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	0.9 (.035)	1.0 (.039)	0.13 (.005)	2.5 (.098)	2.8 (.110)	2.4 (.094)
D	7343-31	7.3 ± 0.3 (.287 ± .012)	4.3 ± 0.3 (.169 ± .012)	2.8 ± 0.3 (.110 ± .012)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	0.9 (.035)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)
X	7343-43	7.3 ± 0.3 (.287 ± .012)	4.3 ± 0.3 (.169 ± .012)	4.0 ± 0.3 (.157 ± .012)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	1.7 (.067)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)

Notes: (Ref) – Dimensions provided for reference only. No dimensions provided for B, P or R because low profile cases do not have a bevel or a notch.

* MIL-PRF-55365/8 specified dimensions

Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
4	150	D/7343-31	T498D157(1)004A(2)E600	6.0	6.0	600	500	450	200	1
6.3	2.2	A/3216-18	T498A225(1)006A(2)E6K5	0.5	4.5	6500	107	96	43	1
6.3	3.3	A/3216-18	T498A335(1)006A(2)E4K6	0.5	4.5	4600	128	115	51	1
6.3	4.7	A/3216-18	T498A475(1)006A(2)E3K6	0.5	4.5	3600	144	130	58	1
6.3	6.8	A/3216-18	T498A685(1)006A(2)E2K9	0.5	4.5	2900	161	145	64	1
6.3	6.8	B/3528-21	T498B685(1)006A(2)E2K7	0.5	4.5	2700	177	159	71	1
6.3	10	A/3216-18	T498A106(1)006A(2)E2K7	0.6	4.5	2700	167	150	67	1
6.3	10	B/3528-21	T498B106(1)006A(2)E2K1	0.6	4.5	2100	201	181	80	1
6.3	15	B/3528-21	T498B156(1)006A(2)E1K8	0.9	4.5	1800	217	195	87	1
6.3	15	C/6032-28	T498C156(1)006A(2)E1K7	0.9	4.5	1700	254	229	102	1
6.3	22	B/3528-21	T498B226(1)006A(2)E1K5	1.4	4.5	1500	238	214	95	1
6.3	22	C/6032-28	T498C226(1)006A(2)E1K3	1.4	4.5	1300	291	262	116	1
6.3	33	B/3528-21	T498B336(1)006A(2)E1K7	2.1	6.0	1700	224	202	90	1
6.3	33	C/6032-28	T498C336(1)006A(2)E1K1	2.1	4.5	1100	316	284	126	1
6.3	47	C/6032-28	T498C476(1)006A(2)E800	3.0	4.5	800	371	334	148	1
6.3	47	D/7343-31	T498D476(1)006A(2)E800	3.0	4.5	800	433	390	173	1
6.3	68	C/6032-28	T498C686(1)006A(2)E800	4.3	4.5	800	371	334	148	1
6.3	68	D/7343-31	T498D686(1)006A(2)E600	4.3	4.5	600	500	450	200	1
6.3	100	D/7343-31	T498D107(1)006A(2)E600	6.3	6.0	600	500	450	200	1
6.3	150	D/7343-31	T498D157(1)006A(2)E500	9.5	6.0	500	548	493	219	1
10	1.5	A/3216-18	T498A155(1)010A(2)E6K5	0.5	4.5	6500	107	96	43	1
10	2.2	A/3216-18	T498A225(1)010A(2)E4K6	0.5	4.5	4600	128	115	51	1
10	3.3	A/3216-18	T498A335(1)010A(2)E3K6	0.5	4.5	3600	144	130	58	1
10	4.7	A/3216-18	T498A475(1)010A(2)E2K9	0.5	4.5	2900	161	145	64	1
10	4.7	B/3528-21	T498B475(1)010A(2)E2K7	0.5	4.5	2700	177	159	71	1
10	6.8	A/3216-18	T498A685(1)010A(2)E2K7	0.7	4.5	2700	167	150	67	1
10	6.8	B/3528-21	T498B685(1)010A(2)E2K1	0.7	4.5	2100	201	181	80	1
10	10	B/3528-21	T498B106(1)010A(2)E1K8	1.0	4.5	1800	217	195	87	1
10	10	C/6032-28	T498C106(1)010A(2)E1K7	1.0	4.5	1700	254	229	102	1
10	15	B/3528-21	T498B156(1)010A(2)E1K5	1.5	4.5	1500	238	214	95	1
10	15	C/6032-28	T498C156(1)010A(2)E1K8	1.5	4.5	1800	247	222	99	1
10	22	B/3528-21	T498B226(1)010A(2)E1K5	2.2	6.0	1500	238	214	95	1
10	22	C/6032-28	T498C226(1)010A(2)E1K1	2.2	4.5	1100	316	284	126	1
10	33	C/6032-28	T498C336(1)010A(2)E900	3.3	4.5	900	350	315	140	1
10	33	D/7343-31	T498D336(1)010A(2)E800	3.3	4.5	800	433	390	173	1
10	47	C/6032-28	T498C476(1)010A(2)E800	4.7	4.5	800	371	334	148	1
10	47	D/7343-31	T498D476(1)010A(2)E600	4.7	4.5	600	500	450	200	1
10	68	D/7343-31	T498D686(1)010A(2)E600	6.8	4.5	600	500	450	200	1
10	100	D/7343-31	T498D107(1)010A(2)E600	10.0	6.0	600	500	450	200	1
10	150	X/7343-43	T498X157(1)010A(2)E500	15.0	6.0	500	574	517	230	1
10	220	X/7343-43	T498X227(1)010A(2)E500	22.0	9.0	500	574	517	230	1
16	1	A/3216-18	T498A105(1)016A(2)E6K5	0.5	3.0	6500	107	96	43	1
16	1.5	A/3216-18	T498A155(1)016A(2)E5K2	0.5	4.5	5200	120	108	48	1
16	2.2	A/3216-18	T498A225(1)016A(2)E4K3	0.5	4.5	4300	132	119	53	1
16	3.3	A/3216-18	T498A335(1)016A(2)E3K4	0.5	4.5	3400	149	134	60	1
16	3.3	B/3528-21	T498B335(1)016A(2)E3K0	0.5	4.5	3000	168	151	67	1
16	4.7	A/3216-18	T498A475(1)016A(2)E3K0	0.8	4.5	3000	158	142	63	1
16	4.7	B/3528-21	T498B475(1)016A(2)E2K1	0.8	4.5	2100	201	181	80	1
16	6.8	A/3216-18	T498A685(1)016A(2)E2K6	1.1	4.5	2600	170	153	68	1
16	6.8	B/3528-21	T498B685(1)016A(2)E1K8	1.1	4.5	1800	217	195	87	1
16	6.8	C/6032-28	T498C685(1)016A(2)E1K7	1.1	4.5	1700	254	229	102	1
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity

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

(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated, H = Standard Solder coated (SnPb 5% Pb minimum), N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb). Designates Termination Finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Table 1 – Ratings & Part Number Reference cont'd

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
16	10	B/3528-21	T498B106(1)016A(2)E2K8	1.6	4.5	2800	174	157	70	1
16	10	C/6032-28	T498C106(1)016A(2)E1K4	1.6	4.5	1400	280	252	112	1
16	15	C/6032-28	T498C156(1)016A(2)E1K1	2.4	4.5	1100	316	284	126	1
16	22	C/6032-28	T498C226(1)016A(2)E1K0	3.5	4.5	1000	332	299	133	1
16	22	D/7343-31	T498D226(1)016A(2)E800	3.5	4.5	800	433	390	173	1
16	33	C/6032-28	T498C336(1)016A(2)E900	5.3	4.5	900	350	315	140	1
16	33	D/7343-31	T498D336(1)016A(2)E600	5.3	4.5	600	500	450	200	1
16	47	C/6032-28	T498C476(1)016A(2)E800	7.5	4.5	800	371	334	148	1
16	47	D/7343-31	T498D476(1)016A(2)E600	7.5	4.5	600	500	450	200	1
16	68	D/7343-31	T498D686(1)016A(2)E600	10.9	4.5	600	500	450	200	1
20	0.68	A/3216-18	T498A684(1)020A(2)E7K8	0.5	3.0	7800	98	88	39	1
20	1	A/3216-18	T498A105(1)020A(2)E5K9	0.5	3.0	5900	113	102	45	1
20	1.5	A/3216-18	T498A155(1)020A(2)E5K2	0.5	4.5	5200	120	108	48	1
20	2.2	B/3528-21	T498B225(1)020A(2)E3K6	0.5	4.5	3600	154	139	62	1
20	3.3	B/3528-21	T498B335(1)020A(2)E2K7	0.7	4.5	2700	177	159	71	1
20	4.7	B/3528-21	T498B475(1)020A(2)E1K9	0.9	4.5	1900	212	191	85	1
20	4.7	C/6032-28	T498C475(1)020A(2)E1K7	0.9	4.5	1700	254	229	102	1
20	6.8	C/6032-28	T498C685(1)020A(2)E1K3	1.4	4.5	1300	291	262	116	1
20	10	C/6032-28	T498C106(1)020A(2)E1K1	2.0	4.5	1100	316	284	126	1
20	15	C/6032-28	T498C156(1)020A(2)E1K0	3.0	4.5	1000	332	299	133	1
20	15	D/7343-31	T498D156(1)020A(2)E900	3.0	4.5	900	408	367	163	1
20	22	D/7343-31	T498D226(1)020A(2)E700	4.4	4.5	700	463	417	185	1
20	33	D/7343-31	T498D336(1)020A(2)E600	6.6	4.5	600	500	450	200	1
25	0.47	A/3216-18	T498A474(1)025A(2)E8K5	0.5	3.0	8500	94	85	38	1
25	0.68	A/3216-18	T498A684(1)025A(2)E6K5	0.5	3.0	6500	107	96	43	1
25	1	A/3216-18	T498A105(1)025A(2)E5K2	0.5	3.0	5200	120	108	48	1
25	1.5	B/3528-21	T498B155(1)025A(2)E4K2	0.5	4.5	4200	142	128	57	1
25	2.2	B/3528-21	T498B225(1)025A(2)E3K0	0.6	4.5	3000	168	151	67	1
25	3.3	C/6032-28	T498C335(1)025A(2)E2K0	0.8	4.5	2000	235	212	94	1
25	4.7	C/6032-28	T498C475(1)025A(2)E1K6	1.2	4.5	1600	262	236	105	1
25	6.8	C/6032-28	T498C685(1)025A(2)E1K4	1.7	4.5	1400	280	252	112	1
25	6.8	D/7343-31	T498D685(1)025A(2)E1K1	1.7	4.5	1100	369	332	148	1
25	10	C/6032-28	T498C106(1)025A(2)E1K1	2.5	4.5	1100	316	284	126	1
25	10	D/7343-31	T498D106(1)025A(2)E1K0	2.5	4.5	1000	387	348	155	1
25	15	D/7343-31	T498D156(1)025A(2)E700	3.8	4.5	700	463	417	185	1
25	22	D/7343-31	T498D226(1)025A(2)E600	5.5	4.5	600	500	450	200	1
25	33	D/7343-31	T498D336(1)025A(2)E600	8.3	6.0	600	500	450	200	1
35	0.1	A/3216-18	T498A104(1)035A(2)E28K	0.5	3.0	28000	52	47	21	1
35	0.15	A/3216-18	T498A154(1)035A(2)E23K	0.5	3.0	23000	57	51	23	1
35	0.22	A/3216-18	T498A224(1)035A(2)E15K	0.5	3.0	15000	71	64	28	1
35	0.33	A/3216-18	T498A334(1)035A(2)E11K	0.5	3.0	11000	83	75	33	1
35	0.47	A/3216-18	T498A474(1)035A(2)E10K	0.5	3.0	10000	87	78	35	1
35	0.47	B/3528-21	T498B474(1)035A(2)E8K0	0.5	3.0	8000	103	93	41	1
35	0.68	B/3528-21	T498B684(1)035A(2)E5K5	0.5	3.0	5500	124	112	50	1
35	1	A/3216-18	T498A105(1)035A(2)E10K	0.5	4.0	10000	87	78	35	1
35	1	B/3528-21	T498B105(1)035A(2)E4K4	0.5	3.0	4400	139	125	56	1
35	1.5	C/6032-28	T498C155(1)035A(2)E3K3	0.5	4.5	3300	183	165	73	1
35	2.2	C/6032-28	T498C225(1)035A(2)E2K2	0.8	4.5	2200	224	202	90	1
35	3.3	C/6032-28	T498C335(1)035A(2)E1K7	1.2	4.5	1700	254	229	102	1
35	4.7	C/6032-28	T498C475(1)035A(2)E1K3	1.6	4.5	1300	291	262	116	1
35	4.7	D/7343-31	T498D475(1)035A(2)E1K0	1.6	4.5	1000	387	348	155	1
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity

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

(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated, H = Standard Solder coated (SnPb 5% Pb minimum), N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb). Designates Termination Finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Table 1 – Ratings & Part Number Reference cont'd

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
35	6.8	D/7343-31	T498D685(1)035A(2)E900	2.4	4.5	900	408	367	163	1
35	10	D/7343-31	T498D106(1)035A(2)E700	3.5	4.5	700	463	417	185	1
35	15	D/7343-31	T498D156(1)035A(2)E700	5.3	6.0	700	463	417	185	1
35	15	X/7343-43	T498X156(1)035A(2)E500	5.3	4.5	500	574	517	230	1
35	22	D/7343-31	T498D226(1)035A(2)E700	7.7	6.0	700	463	417	185	1
35	22	X/7343-43	T498X226(1)035A(2)E500	7.7	4.5	500	574	517	230	1
35	33	X/7343-43	T498X336(1)035A(2)E500	11.6	6.0	500	574	517	230	1
35	47	X/7343-43	T498X476(1)035A(2)E500	16.5	6.0	500	574	517	230	1
50	0.1	A/3216-18	T498A104(1)050A(2)E27K	0.5	3.0	27000	53	48	21	1
50	0.15	B/3528-21	T498B154(1)050A(2)E22K	0.5	3.0	22000	62	56	25	1
50	0.22	B/3528-21	T498B224(1)050A(2)E15K	0.5	3.0	15000	75	68	30	1
50	0.33	B/3528-21	T498B334(1)050A(2)E11K	0.5	3.0	11000	88	79	35	1
50	0.47	C/6032-28	T498C474(1)050A(2)E6K5	0.5	3.0	6500	130	117	52	1
50	0.68	C/6032-28	T498C684(1)050A(2)E5K5	0.5	3.0	5500	141	127	56	1
50	1	C/6032-28	T498C105(1)050A(2)E3K3	0.5	3.0	3300	183	165	73	1
50	1.5	D/7343-31	T498D155(1)050A(2)E2K8	0.8	4.5	2800	231	208	92	1
50	2.2	D/7343-31	T498D225(1)050A(2)E2K0	1.1	4.5	2000	274	247	110	1
50	3.3	D/7343-31	T498D335(1)050A(2)E1K1	1.7	4.5	1100	369	332	148	1
50	4.7	D/7343-31	T498D475(1)050A(2)E900	2.4	4.5	900	408	367	163	1
50	6.8	D/7343-31	T498D685(1)050A(2)E700	3.4	6.0	700	463	417	185	1
50	6.8	X/7343-43	T498X685(1)050A(2)E500	3.4	4.5	500	574	517	230	1
50	10	X/7343-43	T498X106(1)050A(2)E1K0	5.0	4.5	1000	406	365	162	1
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity

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

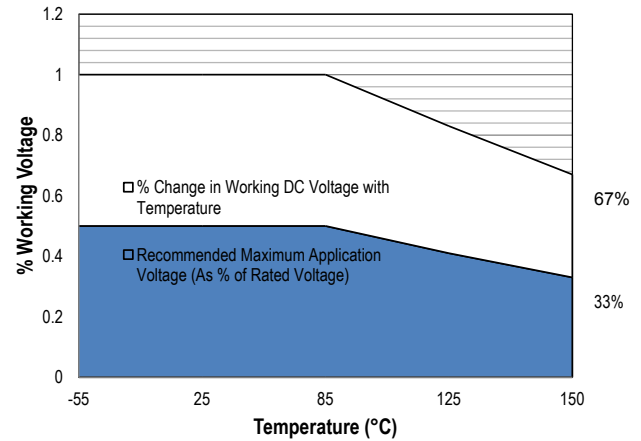
(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated, H = Standard Solder coated (SnPb 5% Pb minimum), N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb). Designates Termination Finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Recommended Voltage Derating Guidelines

Rated Voltage	Working Voltage		Recommended Application Voltage (for maximum reliability)	
	85°C	150°C	85°C	150°C
6.3	6.3	4.22	3.15	2.08
10	10	6.70	5	3.30
16	16	10.72	8	5.28
20	20	13.40	10	6.60
25	25	16.75	12.5	8.25
35	35	23.45	17.5	11.55
50	50	33.50	25	16.50



Ripple Current/Ripple Voltage

Permissible AC ripple voltage and current are related to equivalent series resistance (ESR) and the power dissipation capabilities of the device. Permissible AC ripple voltage which may be applied is limited by two criteria:

1. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
2. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage. See the Reverse Voltage section for allowable limits.

The maximum power dissipation by case size can be determined using the table at right. The maximum power dissipation rating stated in the table must be reduced with increasing environmental operating temperatures. Refer to the table below for temperature compensation requirements.

KEMET Series and Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C with +20°C Rise
A	3216-18	75
B	3528-21	85
C	6032-28	110
D	7343-31	150
X	7343-43	165
E	7360-38	200
S	3216-12	60
T	3528-12	70
U	6032-15	90
V	7343-20	125
T510X	7343-43	270
T510E	7360-38	285

Temperature Compensation Multipliers for Maximum Power Dissipation			
T ≤ 25°C	T ≤ 85°C	T ≤ 125°C	T ≤ 150°C
1.00	0.90	0.40	0.30

T = Environmental Temperature

The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

Using the P max of the device, the maximum allowable rms ripple current or voltage may be determined.

$$I(max) = \sqrt{P_{max}/R}$$

$$E(max) = Z \sqrt{P_{max}/R}$$

I = rms ripple current (amperes)

E = rms ripple voltage (volts)

P max = maximum power dissipation (watts)

R = ESR at specified frequency (ohms)

Z = Impedance at specified frequency (ohms)

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	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
		W	L	S	V1	V2	W	L	S	V1	V2	W	L	S	V1	V2
A	3216-18	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
B	3528-21	2.35	2.21	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
C	6032-25	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
D	7343-31	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
L	6032-19	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
M	3528-15	2.35	2.20	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
H	7360-20	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
E ¹	7360-38	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
Q	7343-12	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
R ²	2012-12	1.05	1.83	0.15	4.82	2.50	0.93	1.50	0.22	3.72	2.00	0.83	1.12	0.38	2.86	1.74
S ²	3216-12	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
T	3528-12	2.35	2.20	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
U	6032-15	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
V	7343-20	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
W	7343-15	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
X ¹	7343-43	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
Y ¹	7343-40	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84

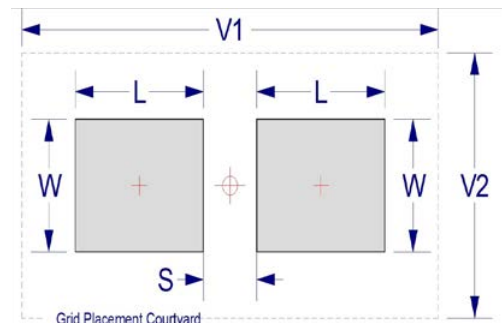
Density Level A: For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.

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 and 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.

² Land pattern geometry is too small for silkscreen outline.



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.

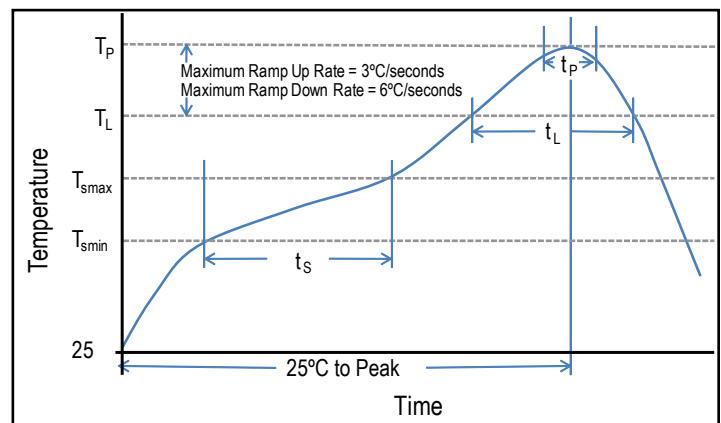
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

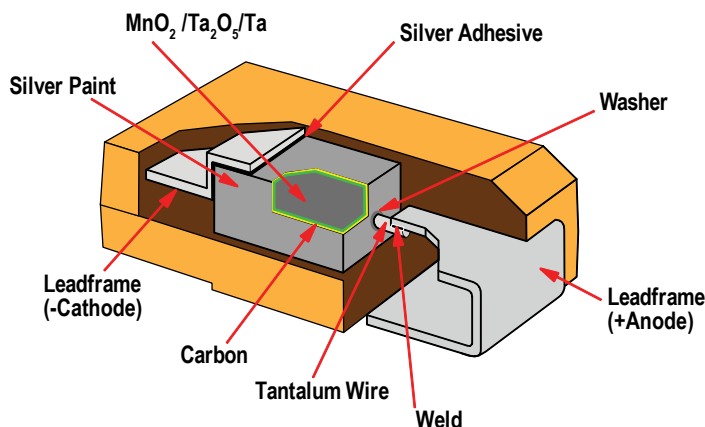
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

*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

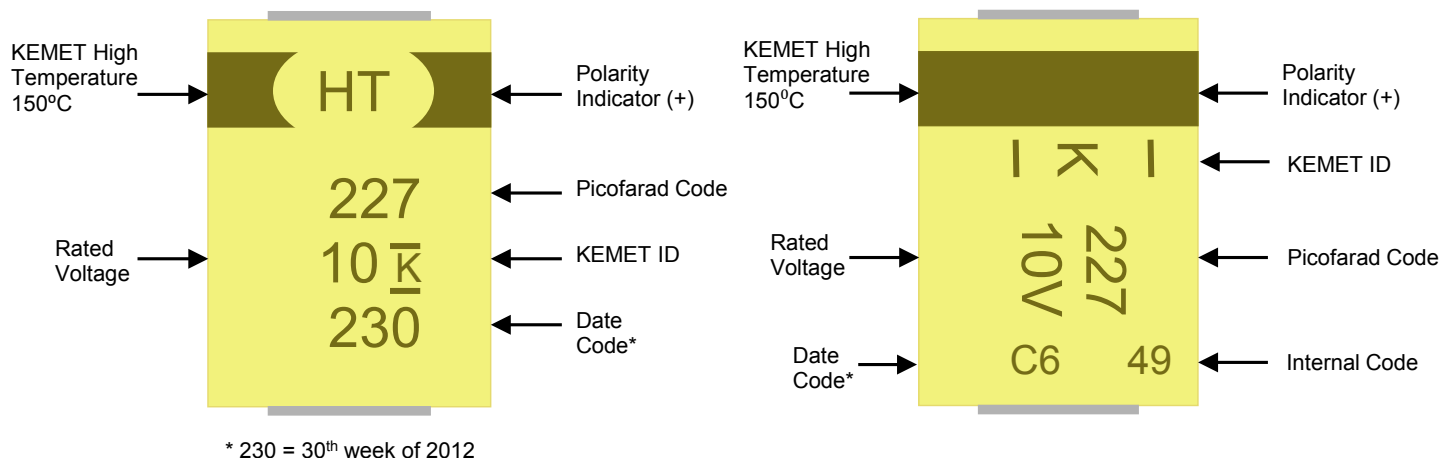


Construction



Capacitor Marking

C, D, X Case Sizes



Date Code *	
1 st digit = Last number of Year	9 = 2009 0 = 2010 1 = 2011 2 = 2012 3 = 2013 4 = 2014
2 nd and 3 rd digit = Week of the Year	01 = 1 st week of the Year to 52 = 52 nd week of the Year

Date Code*		
Year	Month	
X = 2009	1 = Jan	7 = Jul
A = 2010	2 = Feb	8 = Aug
B = 2011	3 = Mar	9 = Spt
C = 2012	4 = Apr	O = Oct
D = 2013	5 = May	N = Nov
E = 2014	6 = Jun	D = Dec

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.

Overview

The KEMET T499 Series is a high-temperature product that offers optimum performance characteristics in applications with operating temperatures up to 175°C. Advanced materials and testing allow this series to perform with a reliability level of 0.5%/1000 hours at rated voltage and temperature. This series

is classified as MSL (Moisture Sensitivity Level) 1 under J STD 020: unlimited floor life time at ≤30°C / 85% RH. This series is available in five standard EIA case sizes with ROHS-compliant terminations as standard.

Benefits

- Meets or exceeds EIA Standard 535BAAC
- Taped and reeled per EIA 481-1
- Symmetrical, compliant terminations
- Optional gold-plated terminations
- Laser-marked case
- 100% surge current testing
- Complies with AEC-Q200
- Capacitance values of 0.15 µF to 220 µF
- Tolerances of ±10% and ±20%
- Voltage rating of 6 to 50 VDC
- 100% steady-state accelerated aging
- Voltage derating is 1/2 at 175°C
- RoHS Compliant and lead-free terminations standard
- Operating temperature range of -55°C to +175°C

Applications

Typical applications include decoupling and filtering in industrial and automotive end applications, such as DC/DC converters, portable electronics, telecommunications, and control units operating at temperatures up to 175°C.



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	499	X	227	M	010	A	T	E500	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/Design	Lead Material	ESR	Packaging (C-Spec)
T = Tantalum	High Temperature 175°C	A, B, C, D, X	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	006 = 6.3 V 010 = 10 V 015 = 15 V 020 = 20 V 025 = 25 V 035 = 35 V 050 = 50 V	A = N/A	T = 100% Matte Tin (Sn) Plated G = Gold Plated	E = ESR Last three digits specify ESR in mΩ (500 = 500 mΩ)	Blank = 7" Reel 7280 = 13" Reel

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 175°C
Rated Capacitance Range	0.15 – 220 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	175°C @ 1/2 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		
Storage Life	175°C @ 0 volts, 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	MIL–STD–202, Method 107, Condition B, mounted, -55°C to 150°C, 1,000 cycles		Δ C/C	Within ±5% of initial value		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Temperature Stability	Extreme temperature exposure at a succession of continuous steps at +25°C, -55°C, +25°C, +85°C, +150°C, +25°C	Δ C/C	+25°C	-55°C	+85°C	+175°C
		IL*	±10%	±10%	±10%	±30%
		DF	IL	IL	1.5 x IL	1.5 x IL
		DCL	IL	n/a	10 x IL	12 x IL
Surge Voltage	25°C and 85°C, 1.32 x rated voltage 1,000 cycles (150°C, 1.2 x rated voltage)		Δ C/C	Within ±5% of initial value		
			DF	Within initial limits		
			DCL	Within initial limits		
			ESR	Within initial limits		
Mechanical Shock/Vibration	MIL–STD–202, Method 213, Condition I, 100 G peak 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		

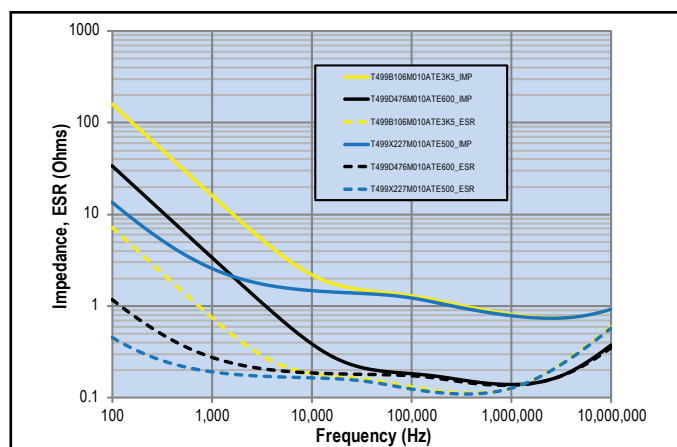
*IL = Initial Limit

Certification

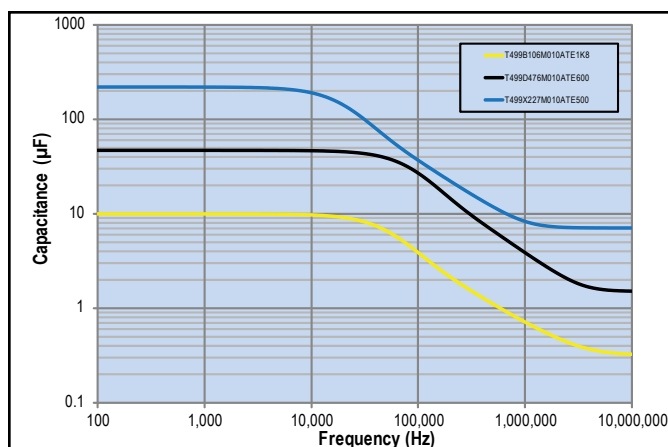
KEMET's Internal Qualification Plan for this Tantalum series of capacitors follows AEC-Q200 guidelines.

Electrical Characteristics

ESR vs. Frequency

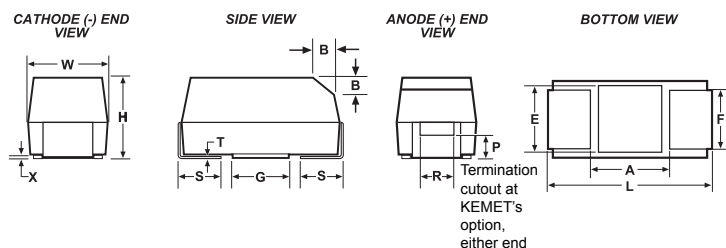


Capacitance vs. Frequency



Dimensions – Millimeters (Inches)

Metric will govern



Case Size		Component												
KEMET	EIA	L*	W*	H*	F* ±0.1 ±(.004)	S* ±0.3 ±(.012)	B* ±0.15 (Ref) ±.006	X (Ref)	P (Ref)	R (Ref)	T (Ref)	A (Min)	G (Ref)	E (Ref)
A	3216-18	3.2 ±0.2 (.126 ± .008)	1.6 ±0.2 (.063 ± .008)	1.6 ±0.2 (.063 ± .008)	1.2 (.047)	0.8 (.031)	0.4 (.016)	0.10 ± 0.10 (.004 ± .004)	0.4 (.016)	0.4 (.016)	0.13 (.005)	0.8 (.31)	1.1 (.043)	1.3 (.051)
B	3528-21	3.5 ±0.2 (.138 ±0.008)	2.8 ±0.2 (.110 ± .008)	1.9 ±0.2 (.075 ± .008)	2.2 (.087)	0.8 (.031)	0.4 (.016)	0.10 ± 0.10 (.004 ± .004)	0.5 (.020)	1.0 (.039)	0.13 (.005)	1.1 (0.043)	1.8 (.071)	2.2 (.087)
C	6032-28	6.0 ±0.3 (.236 ±0.03)	3.2 ±0.3 (.126 ± .012)	2.5 ±0.3 (.098 ± .012)	2.2 (.087)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	0.9 (.035)	1.0 (.039)	0.13 (.005)	2.5 (.098)	2.8 (.110)	2.4 (.094)
D	7343-31	7.3 ±0.3 (.287 ±0.012)	4.3 ±0.3 (.169 ± .012)	2.8 ±0.3 (.110 ± .012)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	0.9 (.035)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)
X	7343-43	7.3 ±0.3 (.287 ±0.012)	4.3 ±0.3 (.169 ± .012)	4.0 ±0.3 (.157 ± .012)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	1.7 (.067)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)

Notes: (Ref) – Dimensions provided for reference only. No dimensions provided for B, P or R because low profile cases do not have a bevel or a notch.

* MIL-PRF-55365/8 specified dimensions

Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
6.3	10	B/3528-21	T499B106(1)006A(2)E3K5	0.6	6	3500	156	140	62	1
6.3	15	B/3528-21	T499B156(1)006A(2)E3K5	0.9	6	3500	156	140	62	1
6.3	22	C/6032-28	T499C226(1)006A(2)E1K8	1.4	6	1800	247	222	99	1
6.3	33	B/3528-21	T499B336(1)006A(2)E3K0	2.1	6	3000	168	151	67	1
6.3	47	C/6032-28	T499C476(1)006A(2)E1K8	3.0	6	1800	247	222	99	1
6.3	100	D/7343-31	T499D107(1)006A(2)E800	6.3	8	800	433	390	173	1
10	1.5	A/3216-18	T499A155(1)010A(2)E8K0	0.5	6	8000	97	87	39	1
10	2.2	A/3216-18	T499A225(1)010A(2)E8K0	0.5	6	8000	97	87	39	1
10	3.3	A/3216-18	T499A335(1)010A(2)E6K0	0.5	6	6000	112	101	45	1
10	4.7	A/3216-18	T499A475(1)010A(2)E6K0	0.5	6	6000	112	101	45	1
10	4.7	B/3528-21	T499B475(1)010A(2)E3K5	0.5	6	3500	156	140	62	1
10	6.8	A/3216-18	T499A685(1)010A(2)E6K0	0.7	6	6000	112	101	45	1
10	6.8	B/3528-21	T499B685(1)010A(2)E3K5	0.7	6	3500	156	140	62	1
10	10	B/3528-21	T499B106(1)010A(2)E3K5	1.0	6	3500	156	140	62	1
10	10	C/6032-28	T499C106(1)010A(2)E1K8	1.0	6	1800	247	222	99	1
10	15	B/3528-21	T499B156(1)010A(2)E3K5	1.5	6	3500	156	140	62	1
10	15	C/6032-28	T499C156(1)010A(2)E1K8	1.5	6	1800	247	222	99	1
10	22	B/3528-21	T499B226(1)010A(2)E3K0	2.2	6	3000	168	151	67	1
10	22	C/6032-28	T499C226(1)010A(2)E1K8	2.2	6	1800	247	222	99	1
10	33	C/6032-28	T499C336(1)010A(2)E1K8	3.3	6	1800	247	222	99	1
10	33	D/7343-31	T499D336(1)010A(2)E1K6	3.3	6	1600	306	275	122	1
10	47	D/7343-31	T499D476(1)010A(2)E800	4.7	6	800	433	390	173	1
10	100	D/7343-31	T499D107(1)010A(2)E700	10.0	8	700	463	417	185	1
10	220	X/7343-43	T499X227(1)010A(2)E500	22.0	8	500	574	517	230	1
16	1	A/3216-18	T499A105(1)016A(2)E10K	0.5	4	10000	87	78	35	1
16	1.5	A/3216-18	T499A155(1)016A(2)E8K0	0.5	6	8000	97	87	39	1
16	2.2	A/3216-18	T499A225(1)016A(2)E6K0	0.5	6	6000	112	101	45	1
16	3.3	A/3216-18	T499A335(1)016A(2)E500	0.5	6	500	387	348	155	1
16	3.3	B/3528-21	T499B335(1)016A(2)E3K5	0.5	6	3500	156	140	62	1
16	4.7	B/3528-21	T499B475(1)016A(2)E6K0	0.8	6	6000	119	107	48	1
16	6.8	A/3216-18	T499A685(1)016A(2)E7K0	1.1	6	7000	104	94	42	1
16	6.8	B/3528-21	T499B685(1)016A(2)E3K5	1.1	6	3500	156	140	62	1
16	6.8	C/6032-28	T499C685(1)016A(2)E1K8	1.1	6	1800	247	222	99	1
16	10	B/3528-21	T499B106(1)016A(2)E3K5	1.6	6	3500	156	140	62	1
16	10	C/6032-28	T499C106(1)016A(2)E1K8	1.6	6	1800	247	222	99	1
16	15	C/6032-28	T499C156(1)016A(2)E1K8	2.4	6	1800	247	222	99	1
16	22	C/6032-28	T499C226(1)016A(2)E1K6	3.5	6	1600	262	236	105	1
16	22	D/7343-31	T499D226(1)016A(2)E800	3.5	6	800	433	390	173	1
16	33	D/7343-31	T499D336(1)016A(2)E800	5.3	6	800	433	390	173	1
16	47	D/7343-31	T499D476(1)016A(2)E800	7.5	6	800	433	390	173	1
16	100	X/7343-43	T499X107(1)016A(2)E300	16.0	6	300	742	668	297	1
20	0.68	A/3216-18	T499A684(1)020A(2)E12K	0.5	4	12000	79	71	32	1
20	1	A/3216-18	T499A105(1)020A(2)E10K	0.5	4	10000	87	78	35	1
20	1.5	A/3216-18	T499A155(1)020A(2)E8K0	0.5	6	8000	97	87	39	1
20	2.2	B/3528-21	T499B225(1)020A(2)E3K5	0.5	6	3500	156	140	62	1
20	3.3	B/3528-21	T499B335(1)020A(2)E3K5	0.7	6	3500	156	140	62	1
20	4.7	B/3528-21	T499B475(1)020A(2)E3K5	0.9	6	3500	156	140	62	1
20	4.7	C/6032-28	T499C475(1)020A(2)E2K4	0.9	6	2400	214	193	86	1
20	6.8	C/6032-28	T499C685(1)020A(2)E1K9	1.4	6	1900	241	217	96	1
20	10	C/6032-28	T499C106(1)020A(2)E1K8	2.0	6	1800	247	222	99	1
20	15	C/6032-28	T499C156(1)020A(2)E1K7	3.0	6	1700	254	229	102	1
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity

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

(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated, H = Standard Solder coated (SnPb 5% Pb minimum), N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb). Designates Termination Finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Table 1 – Ratings & Part Number Reference cont'd

Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
20	15	D/7343-31	T499D156(1)020A(2)E1K0	3.0	6	1000	387	348	155	1
20	22	D/7343-31	T499D226(1)020A(2)E800	4.4	6	800	433	390	173	1
25	0.47	A/3216-18	T499A474(1)025A(2)E14K	0.5	4	14000	73	66	29	1
25	0.68	A/3216-18	T499A684(1)025A(2)E10K	0.5	4	10000	87	78	35	1
25	1	A/3216-18	T499A105(1)025A(2)E8K0	0.5	4	8000	97	87	39	1
25	1.5	A/3216-18	T499A155(1)025A(2)E5K0	0.5	6	5000	122	110	49	1
25	2.2	B/3528-21	T499B225(1)025A(2)E4K5	0.6	6	4500	137	123	55	1
25	3.3	C/6032-28	T499C335(1)025A(2)E2K5	0.8	6	2500	210	189	84	1
25	4.7	C/6032-28	T499C475(1)025A(2)E2K4	1.2	6	2400	214	193	86	1
25	6.8	C/6032-28	T499C685(1)025A(2)E1K9	1.7	6	1900	241	217	96	1
25	6.8	D/7343-31	T499D685(1)025A(2)E1K1	1.7	6	1100	369	332	148	1
25	10	C/6032-28	T499C106(1)025A(2)E1K5	2.5	6	1500	271	244	108	1
25	10	D/7343-31	T499D106(1)025A(2)E1K0	2.5	6	1000	387	348	155	1
25	15	D/7343-31	T499D156(1)025A(2)E1K0	3.8	6	1000	387	348	155	1
25	22	D/7343-31	T499D226(1)025A(2)E800	5.5	6	800	433	390	173	1
25	33	D/7343-31	T499D336(1)025A(2)E700	8.3	6	700	463	417	185	1
35	0.15	A/3216-18	T499A154(1)035A(2)E19K	0.5	4	19000	63	57	25	1
35	0.22	A/3216-18	T499A224(1)035A(2)E18K	0.5	4	18000	65	59	26	1
35	0.33	A/3216-18	T499A334(1)035A(2)E15K	0.5	4	15000	71	64	28	1
35	0.47	B/3528-21	T499B474(1)035A(2)E8K0	0.5	4	8000	103	93	41	1
35	0.68	B/3528-21	T499B684(1)035A(2)E6K5	0.5	4	6000	119	107	48	1
35	1	A/3216-18	T499A105(1)035A(2)E10K	0.5	4	10000	87	78	35	1
35	1	B/3528-21	T499B105(1)035A(2)E5K0	0.5	4	5000	130	117	52	1
35	1.5	C/6032-28	T499C155(1)035A(2)E4K5	0.5	6	4500	156	140	62	1
35	2.2	C/6032-28	T499C225(1)035A(2)E3K5	0.8	6	3500	177	159	71	1
35	3.3	C/6032-28	T499C335(1)035A(2)E2K5	1.2	6	2500	210	189	84	1
35	4.7	C/6032-28	T499C475(1)035A(2)E2K5	1.6	6	2500	210	189	84	1
35	6.8	D/7343-31	T499D685(1)035A(2)E1K3	2.4	6	1300	340	306	136	1
35	10	D/7343-31	T499D106(1)035A(2)E1K0	3.5	6	1000	387	348	155	1
35	22	X/7343-43	T499X226(1)035A(2)E700	7.7	6	700	486	437	194	1
35	33	X/7343-43	T499X336(1)035A(2)E600	11.6	6	600	524	472	210	1
50	3.3	D/7343-31	T499D335(1)050A(2)E2K0	1.7	6	2000	274	247	110	1
VDC	μF	KEMET/EIA	(See below for part options)	μAmps +20°C Max/5 Min	% @ +20°C 120 Hz Max	mΩ @ 20°C 100 kHz Max	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temp ≤ 260°C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Moisture Sensitivity

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

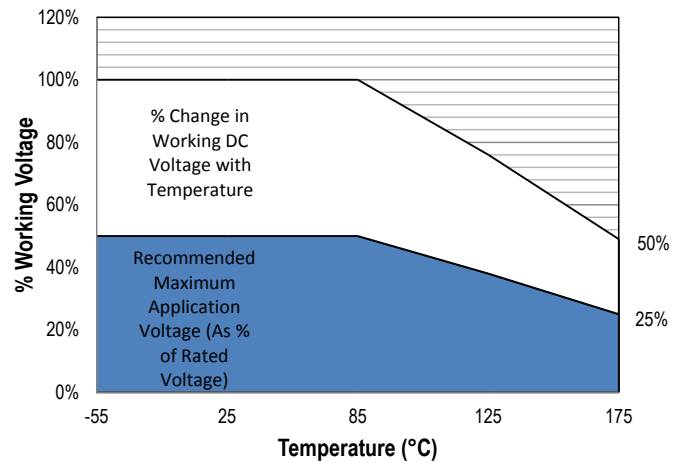
(2) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated, H = Standard Solder coated (SnPb 5% Pb minimum), N = Non-Magnetic 100% Tin (Sn), M = Non-Magnetic (SnPb). Designates Termination Finish.

Refer to Ordering Information for additional detail.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitution will be marked with the higher voltage rating. Substitutions can include better than series.

Recommended Voltage Derating Guidelines

Rated Voltage	Working Voltage		Recommended Application Voltage (for maximum reliability)	
	85°C	175°C	85°C	175°C
6.3	6.3	3.15	3.15	1.58
10	10	5.00	5	2.50
16	16	8.00	8	4.00
20	20	10.00	10	5.00
25	25	12.50	12.5	6.25
35	35	17.50	17.5	8.75
50	50	25.00	25	12.50



Ripple Current/Ripple Voltage

Permissible AC ripple voltage and current are related to equivalent series resistance (ESR) and the power dissipation capabilities of the device. Permissible AC ripple voltage which may be applied is limited by two criteria:

1. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
2. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage. See the Reverse Voltage section for allowable limits.

The maximum power dissipation by case size can be determined using the table at right. The maximum power dissipation rating stated in the table must be reduced with increasing environmental operating temperatures. Refer to the table below for temperature compensation requirements.

Temperature Compensation Multipliers for Maximum Power Dissipation			
T ≤ 25°C	T ≤ 85°C	T ≤ 125°C	T ≤ 175°C
1.00	0.90	0.40	0.20

T = Environmental Temperature

The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

KEMET Series and Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C with +20°C Rise
A	3216-18	75
B	3528-21	85
C	6032-28	110
D	7343-31	150
X	7343-43	165
E	7360-38	200
S	3216-12	60
T	3528-12	70
U	6032-15	90
V	7343-20	125
T510X	7343-43	270
T510E	7360-38	285

Using the P max of the device, the maximum allowable rms ripple current or voltage may be determined.

$$I(max) = \sqrt{P_{max}/R}$$

$$E(max) = Z \sqrt{P_{max}/R}$$

I = rms ripple current (amperes)

E = rms ripple voltage (volts)

P max = maximum power dissipation (watts)

R = ESR at specified frequency (ohms)

Z = Impedance at specified frequency (ohms)

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	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
		W	L	S	V1	V2	W	L	S	V1	V2	W	L	S	V1	V2
A	3216–18	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
B	3528–21	2.35	2.21	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
C	6032–25	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
D	7343–31	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
L	6032-19	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
M	3528-15	2.35	2.20	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
H	7360-20	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
E ¹	7360–38	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
Q	7343-12	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
R ²	2012-12	1.05	1.83	0.15	4.82	2.50	0.93	1.50	0.22	3.72	2.00	0.83	1.12	0.38	2.86	1.74
S ²	3216–12	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
T	3528–12	2.35	2.20	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
U	6032–15	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
V	7343–20	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
W	7343–15	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
X ¹	7343–43	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
Y ¹	7343–40	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84

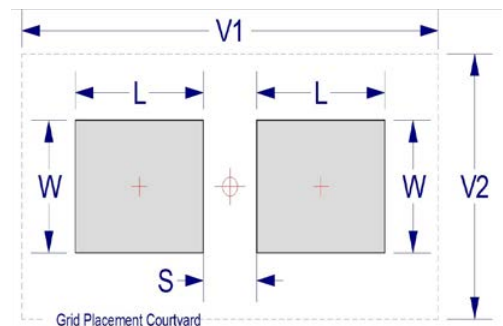
Density Level A: For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.

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.

² Land pattern geometry is too small for silkscreen outline.



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.

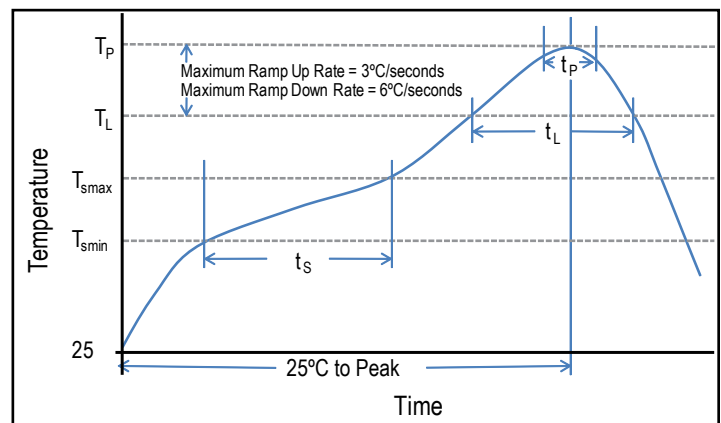
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

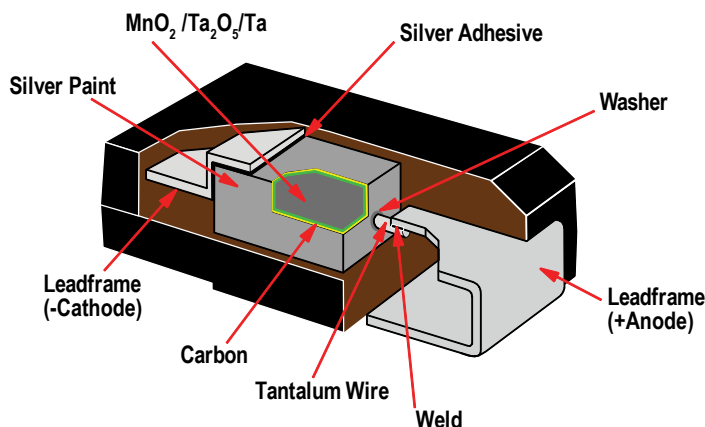
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

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

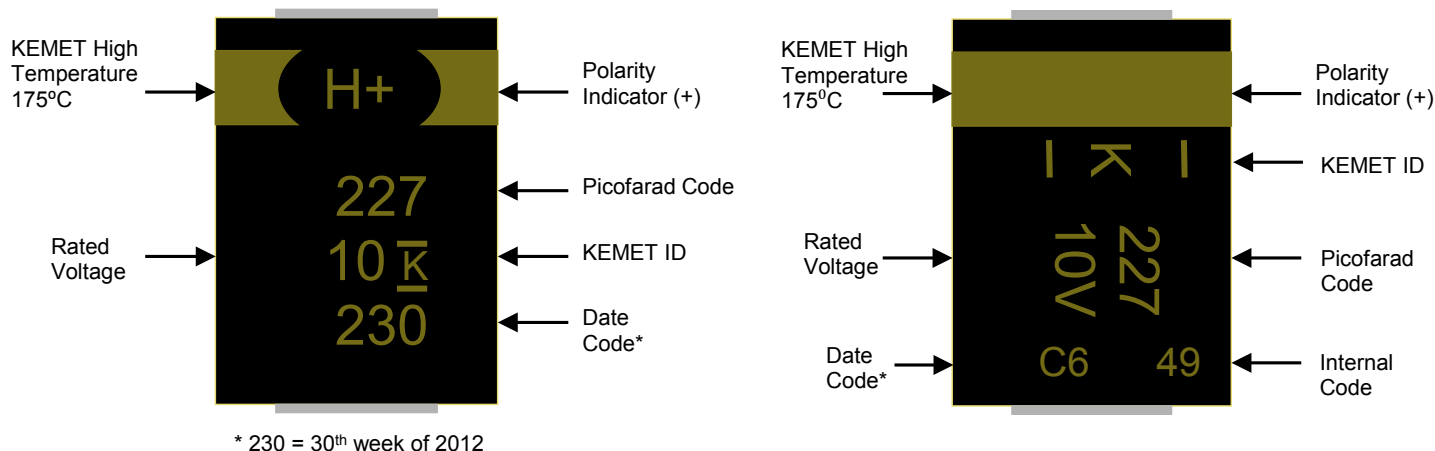
**Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z



Construction



Capacitor Marking



Date Code *	
1 st digit = Last number of Year	9 = 2009 0 = 2010 1 = 2011 2 = 2012 3 = 2013 4 = 2014
2 nd and 3 rd digit = Week of the Year	01 = 1 st week of the Year to 52 = 52 nd week of the Year

Date Code*		
Year	Month	
X = 2009	1 = Jan	7 = Jul
A = 2010	2 = Feb	8 = Aug
B = 2011	3 = Mar	9 = Spt
C = 2012	4 = Apr	O = Oct
D = 2013	5 = May	N = Nov
E = 2014	6 = Jun	D = Dec

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.

Overview

The KEMET T500 Series is a high-temperature product that offers optimum performance characteristics in applications with operating temperatures up to 200°C. This series is classified as MSL (Moisture Sensitivity Level) 1 under J STD 020: unlimited floor life time at ≤30°C / 85% RH.

Applications

Typical applications include decoupling and filtering in down-hole, military and aerospace industries.

Benefits

- Meets or exceeds EIA standard 535BAAC
- Weibull failure rate to B Level Available
- Standard gold-plated termination
- RoHS Compliant
- Operating temperature range of -55°C to +200°C
- 100% steady-state accelerated aging at 200°C
- Voltage derating is 1/3 at 200°C
- Qualified at 1,000 hours of life test at 200°C with 0.33 V_R
- Taped and reeled per EIA 481-1
- Meets MSL 1 requirements for Pb-free assembly according to JEDEC J-STD-020
- Surge current options available



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	500	X	227	M	010	A	G	61	10
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/Design	Lead Material	Performance	ESR
T = Tantalum	High Temperature 200°C	X	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	010 = 10 V 016 = 16 V 035 = 35 V	A = N/A B = 0.1%/1,000 hours	G = Gold Plated	61 = Surge None 62 = Surge @ 25°C after Weibull 63 = Surge -55°C and +85°C after Weibull	10 = Standard ESR

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 200°C
Rated Capacitance Range	33 – 220 µF @ 120 Hz/25°C
Capacitance Tolerance	K Tolerance (10%), M Tolerance (20%)
Rated Voltage Range	10 – 35 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

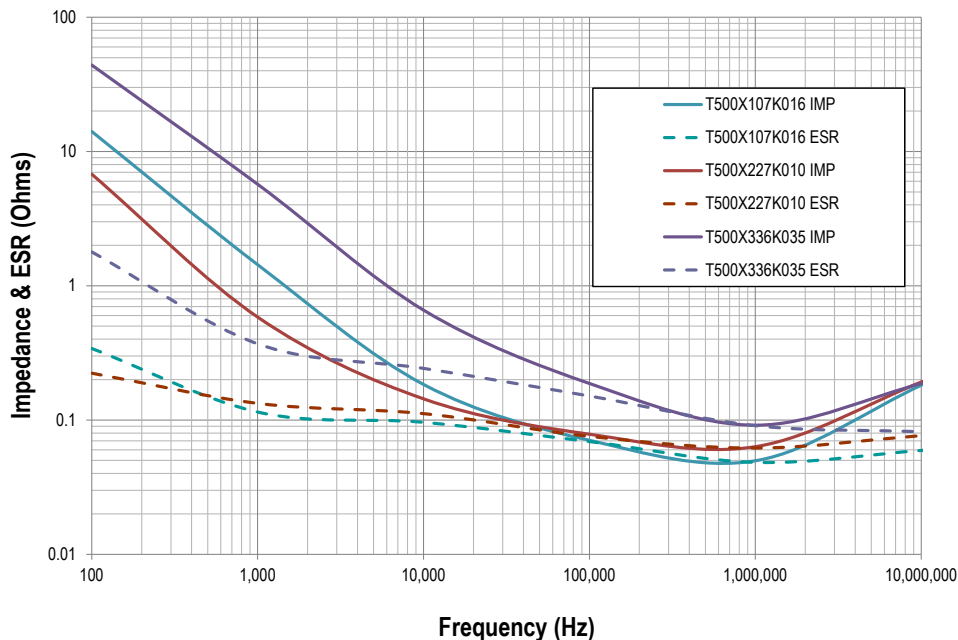
Qualification

Test	Condition	Characteristics			
Endurance	200°C @ 1/3 rated voltage, 1,000 hours	Δ C/C	Within ±10% of initial value		
		DF	Within initial limits		
		DCL	1 mAmp maximum		
		ESR	Within initial limits		
Storage Life	200°C @ 0 volts, 1,000 hours	Δ C/C	Within ±10% of initial value		
		DF	Within initial limits		
		DCL	1 mAmp maximum		
		ESR	Within initial limits		
Humidity	85°C, 85% RH, 0 V, 1,000 hours	Δ C/C	Within ±10% of initial value		
		DF	Within initial limits		
		DCL	Within initial limits		
		ESR	Within initial limits		
Temperature Stability	Extreme temperature exposure at a succession of continuous steps at +25°C, -55°C, +25°C, +85°C, +125°C, +25°C	+25°C	-55°C	+85°C	+150°C
		Δ C/C	IL*	±10%	±10%
		DF	IL	1.5 x IL	1.5 x IL
		DCL	IL	n/a	10 x IL
Mechanical Shock/Vibration	MIL-STD-202, Method 213, Condition I, 100 G peak MIL-STD-202, Method 204, 10 Hz to 2,000 Hz, 5G's for 20 minutes, 12 cycles each of 3 orientations	Δ C/C	Within ±10 of initial value		
		DF	Within initial limits		
		DCL	Within initial limits		

*IL = Initial limit

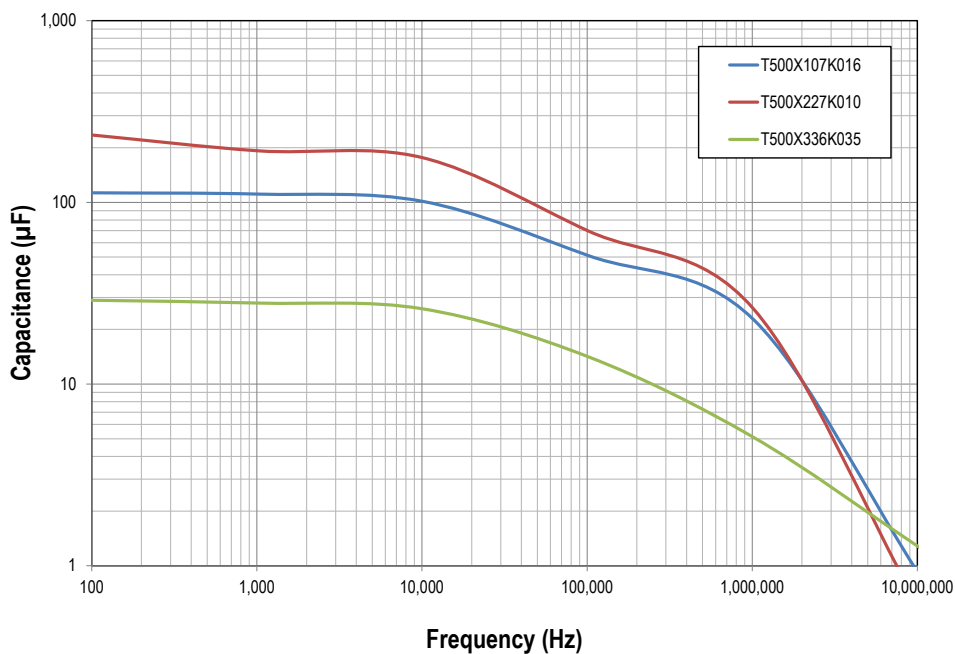
Electrical Characteristics

Impedance & ESR vs. Frequency



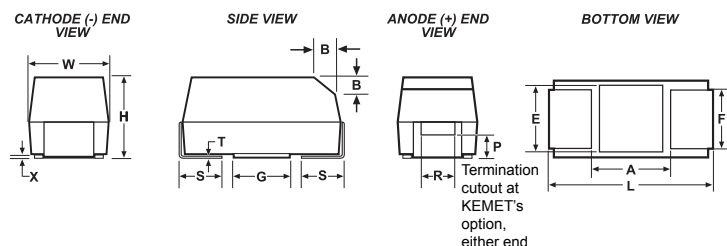
The measurements were taken at room temperature (25°C)

Capacitance vs. Frequency



The measurements were taken at room temperature (25°C)

Dimensions – Millimeters



Case Size		Component												
KEMET	EIA	L*	W*	H*	F* ±0.1 ±(0.004)	S* ±0.3 ±(0.012)	B* ±0.15 (Ref) ±0.006	X (Ref)	P (Ref)	R (Ref)	T (Ref)	A (Min)	G (Ref)	E (Ref)
X	7343-43	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	4.0 ±0.3 (0.157 ±0.012)	2.4 (.095)	1.3 (0.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	1.7 (.067)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)

Notes: (Ref) – Dimensions provided for reference only. No dimensions are provided for B, P or R because low profile cases do not have a bevel or a notch.

* MIL-PRF-55365/8 specified dimensions

Table 1 – Ratings & Part Number Reference

Rated Voltage (V) 85°C	Working Voltage		Rated Cap μF	Case Code/ Case Size	KEMET Part Number (See below for part options)	DC Leakage		DF % @ 20°C 120 Hz Max	ESR mΩ @ 20°C 100 kHz Max	Maximum Allowable Ripple Current		
	@ +125°C	@ +200°C				μA @ 20°C Max/5 Min.	μA @ 200°C, 0.33 V _R Max/5 Min			(mA) 100 kHz, 25°C	(mA) 100 kHz, 125°C	(mA) 100 kHz, 200°C
10	6.6	3.3	220	X/7343-43	T500X227(1)010(2)G(3)10	22	220	10	250	812	325	81
16	10.6	5.3	100	X/7343-43	T500X107(1)016(2)G(3)10	16	160	8	250	812	325	81
35	23.1	11.6	33	X/7343-43	T500X336(1)035(2)G(3)10	11.6	116	8	600	524	210	52

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

(2) To complete KEMET part number, insert B (0.1%/1,000 hours) or A = N/A. Designates reliability level.

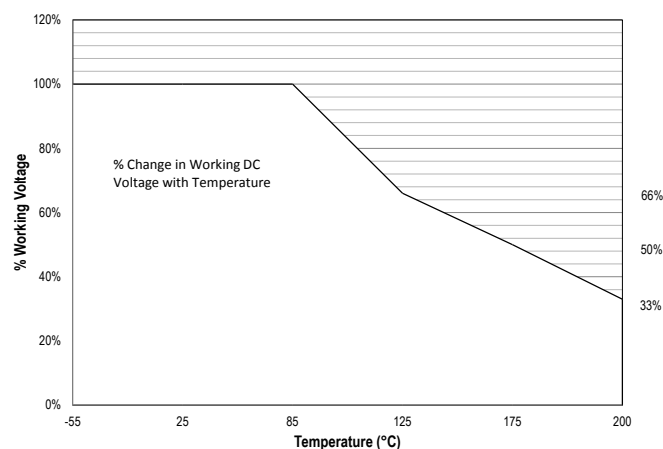
(3) To complete KEMET part number, insert 61 = None, 62 = 10 cycles +25°C after Weibull, 63 = 10 cycles -55°C +85°C after Weibull. Designates surge current option.

Refer to Ordering Information for additional detail.

Recommended Voltage Derating Guidelines

Rated Voltage	Working Voltage			
	+25°C	+85°C	+125°C	+200°C
10	10	10	6.6	3.3
16	16	16	10.6	5.3
35	35	35	23.1	11.6

Note: Additional reliability can be obtained through the derating of voltage



Ripple Current/Ripple Voltage

Permissible AC ripple voltage and current are related to equivalent series resistance (ESR) and the power dissipation capabilities of the device. Permissible AC ripple voltage which may be applied is limited by two criteria:

1. The positive peak AC voltage plus the DC bias voltage, if any, must not exceed the DC voltage rating of the capacitor.
2. The negative peak AC voltage in combination with bias voltage, if any, must not exceed the allowable limits specified for reverse voltage. See the Reverse Voltage section for allowable limits.

The maximum power dissipation by case size can be determined using the table at right. The maximum power dissipation rating stated in the table must be reduced with increasing environmental operating temperatures. Refer to the table below for temperature compensation requirements.

Temperature Compensation Multipliers for Maximum Power Dissipation					
T ≤ 25°C	T ≤ 85°C	T ≤ 125°C	T ≤ 150°C	T ≤ 175°C	T ≤ 200°C
1.00	0.90	0.40	0.30	0.20	0.10

T = Environmental Temperature

KEMET Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C w/+20°C Rise
X	7343-43	165

The maximum power dissipation rating must be reduced with increasing environmental operating temperatures. Refer to the Temperature Compensation Multiplier table for details.

Using the P max of the device, the maximum allowable rms ripple current or voltage may be determined.

$$I(max) = \sqrt{P_{max}/R}$$

$$E(max) = Z \sqrt{P_{max}/R}$$

I = rms ripple current (amperes)

E = rms ripple voltage (volts)

P max = maximum power dissipation (watts)

R = ESR at specified frequency (ohms)

Z = Impedance at specified frequency (ohms)

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 below 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	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
		W	L	S	V1	V2	W	L	S	V1	V2	W	L	S	V1	V2
A	3216-18	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
B	3528-21	2.35	2.21	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
C	6032-25	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
D	7343-31	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
L	6032-19	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
M	3528-15	2.35	2.20	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
H	7360-20	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
E ¹	7360-38	4.25	2.77	3.67	10.22	7.30	4.13	2.37	3.87	9.12	6.80	4.03	1.99	4.03	8.26	6.54
Q	7343-12	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
R ²	2012-12	1.05	1.83	0.15	4.82	2.50	0.93	1.50	0.22	3.72	2.00	0.83	1.12	0.38	2.86	1.74
S ²	3216-12	1.35	2.20	0.62	6.02	2.80	1.23	1.80	0.82	4.92	2.30	1.13	1.42	0.98	4.06	2.04
T	3528-12	2.35	2.20	0.92	6.32	4.00	2.23	1.80	1.12	5.22	3.50	2.13	1.42	1.28	4.36	3.24
U	6032-15	2.35	2.77	2.37	8.92	4.50	2.23	2.37	2.57	7.82	4.00	2.13	1.99	2.73	6.96	3.74
V	7343-20	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
W	7343-15	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
X ¹	7343-43	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84
Y ¹	7343-40	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84

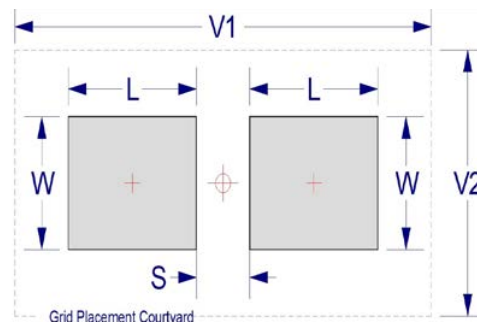
Density Level A: For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.

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.

² Land pattern geometry is too small for silkscreen outline.



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

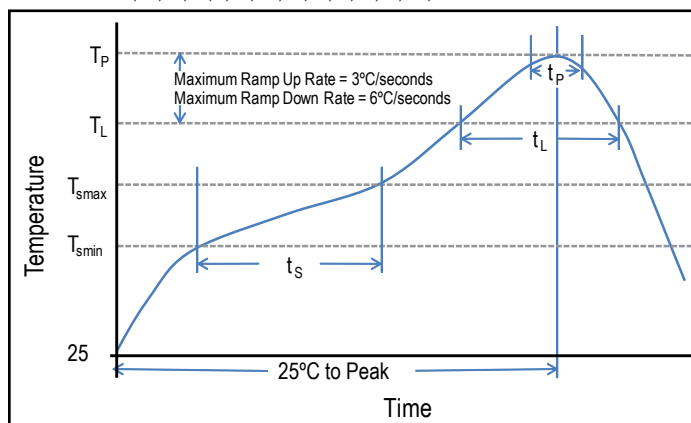
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

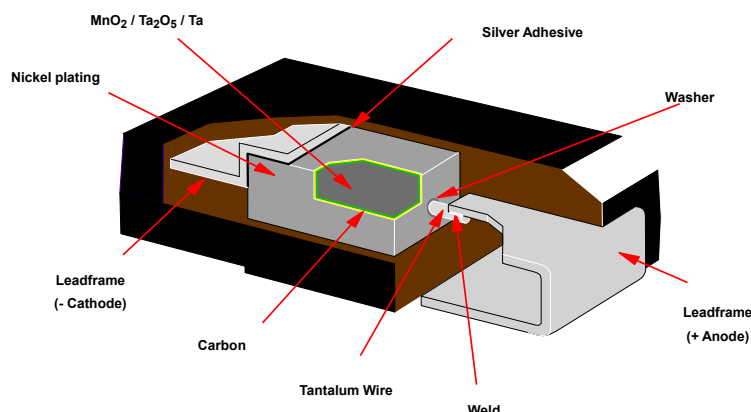
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

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

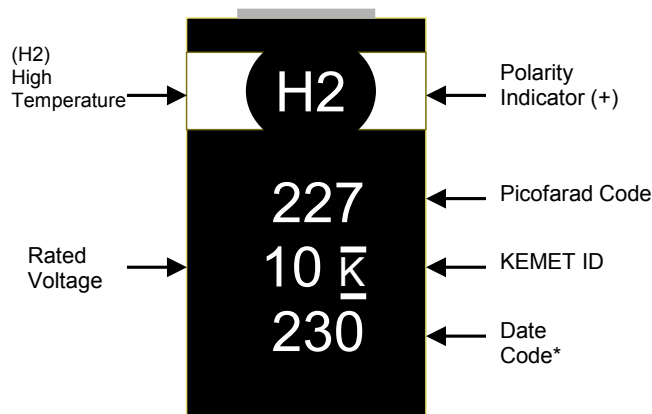
**Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z



Construction



Capacitor Marking



* 230 = 30th week of 2012

Date Code *	
1 st digit = Last number of Year	9 = 2009 0 = 2010 1 = 2011 2 = 2012 3 = 2013 4 = 2014
2 nd and 3 rd digit = Week of the Year	01 = 1 st week of the Year to 52 = 52 nd week of the Year

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.

Tape & Reel Packaging Information

KEMET's molded tantalum and aluminum chip capacitor families are packaged in 8 and 12 mm plastic tape on 7" and 13" reels in accordance with *EIA Standard 481-1: Embossed Carrier Taping of Surface Mount Components for Automatic Handling*. This packaging system is compatible with all tape-fed automatic pick-and-place systems.

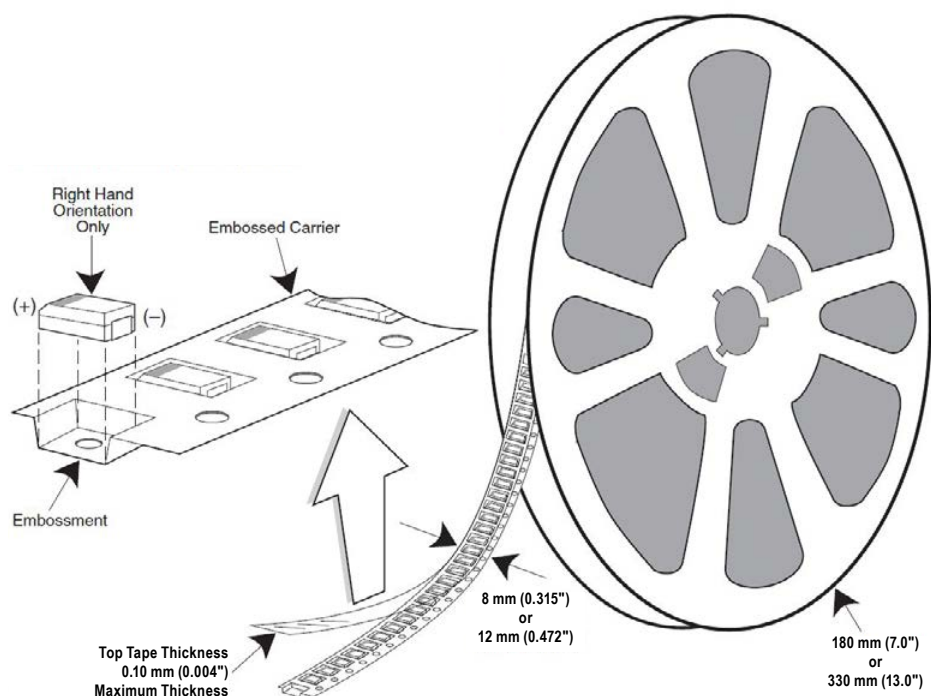
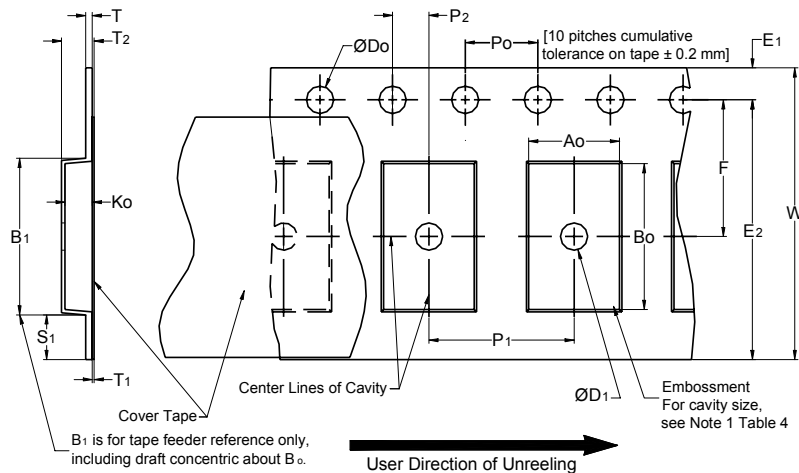


Table 3 – Packaging Quantity

Case Code		Tape Width (mm)	7" Reel*	13" Reel*
KEMET	EIA			
I	3216-10	8	3,000	12,000
S	3216-12	8	2,500	10,000
T	3528-12	8	2,500	10,000
M	3528-15	8	2,000	8,000
U	6032-15	12	1,000	5,000
L	6032-19	12	1,000	5,000
W	7343-15	12	1,000	3,000
Z	7343-17	12	1,000	3,000
V	7343-20	12	1,000	3,000
A	3216-18	8	2,000	9,000
B	3528-21	8	2,000	8,000
C	6032-28	12	500	3,000
D	7343-31	12	500	2,500
Y	7343-40	12	500	2,000
X	7343-43	12	500	2,000
E/T428P	7360-38	12	500	2,000
H	7360-20	12	1,000	2,500

* No C-Spec required for 7" reel packaging. C-7280 required for 13" reel packaging.

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions**Table 4 – Embossed (Plastic) Carrier Tape Dimensions**

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	D ₀	D ₁ Minimum Note 1	E ₁	P ₀	P ₂	R Reference Note 2	S ₁ Minimum Note 3	T Maximum	T ₁ Maximum
8 mm	1.5 +0.10/-0.0 (0.059 +0.004/-0.0)	1.0 (0.039)	1.75 ±0.10 (0.069 ±0.004)	4.0 ±0.10 (0.157 ±0.004)	2.0 ±0.05 (0.079 ±0.002)	25.0 (0.984)	0.600 (0.024)	0.600 (0.024)	0.100 (0.004)
12 mm		1.5 (0.059)				30 (1.181)			
16 mm									
Variable Dimensions — Millimeters (Inches)									
Tape Size	Pitch	B ₁ Maximum Note 4	E ₂ Minimum	F	P ₁	T ₂ Maximum	W Maximum	A ₀ , B ₀ & K ₀	
8 mm	Single (4 mm)	4.35 (0.171)	6.25 (0.246)	3.5 ±0.05 (0.138 ±0.002)	4.0 ±0.10 (0.157 ±0.004)	2.5 (0.098)	8.3 (0.327)	Note 5	
12 mm	Single (4 mm) & Double (8 mm)	8.2 (0.323)	10.25 (0.404)	5.5 ±0.05 (0.217 ±0.002)	8.0 ±0.10 (0.315 ±0.004)	4.6 (0.181)	12.3 (0.484)		
16 mm	Triple (12 mm)	12.1 (0.476)	14.25 (0.561)	5.5 ±0.05 (0.217 ±0.002)	8.0 ±0.10 (0.315 ±0.004)	4.6 (0.181)	16.3 (0.642)		

1. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of embossment location and hole location shall be applied independent of each other.
2. The tape, with or without components, shall pass around R without damage (see Figure 5).
3. If S₁ < 1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481–D, paragraph 4.3, section b).
4. B₁ dimension is a reference dimension for tape feeder clearance only.
5. The cavity defined by A₀, B₀ and K₀ shall surround the component with sufficient clearance that:
 - (a) the component does not protrude above the top surface of the carrier tape.
 - (b) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
 - (c) rotation of the component is limited to 20° maximum for 8 and 12 mm tapes and 10° maximum for 16 mm tapes (see Figure 2).
 - (d) lateral movement of the component is restricted to 0.5 mm maximum for 8 mm and 12 mm wide tape and to 1.0 mm maximum for 16 mm tape (see Figure 3).
 - (e) see Addendum in EIA Standard 481–D for standards relating to more precise taping requirements.

Packaging Information Performance Notes

- 1. Cover Tape Break Force:** 1.0 Kg minimum.
- 2. Cover Tape Peel Strength:** The total peel strength of the cover tape from the carrier tape shall be:

Tape Width	Peel Strength
8 mm	0.1 to 1.0 Newton (10 to 100 gf)
12 and 16 mm	0.1 to 1.3 Newton (10 to 130 gf)

The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ± 10 mm/minute.

- 3. Labeling:** Bar code labeling (standard or custom) shall be on the side of the reel opposite the sprocket holes. Refer to EIA Standards 556 and 624.

Figure 2 – Maximum Component Rotation

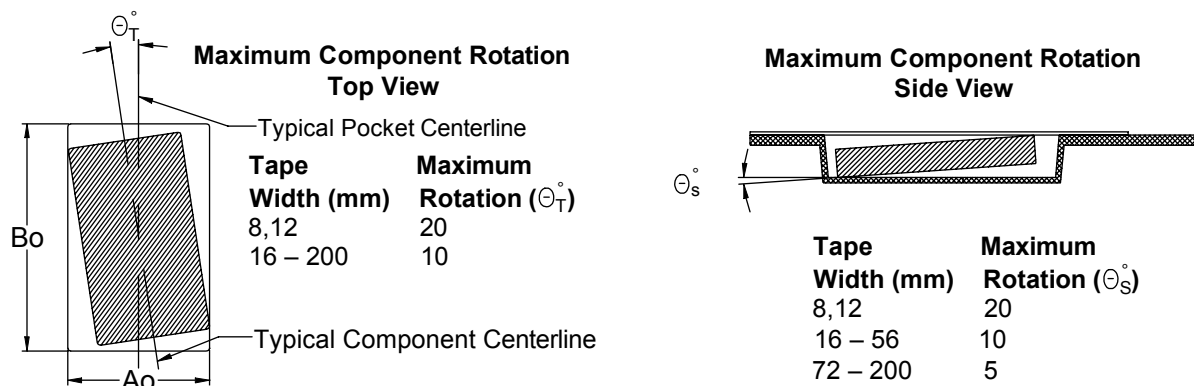


Figure 3 – Maximum Lateral Movement

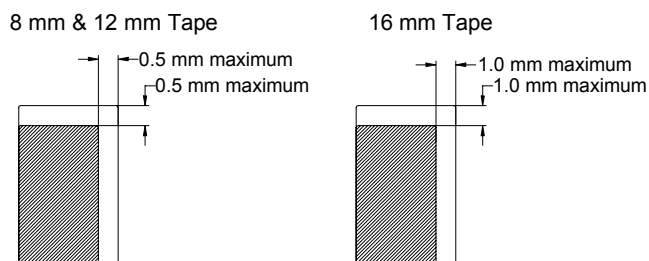


Figure 4 – Bending Radius

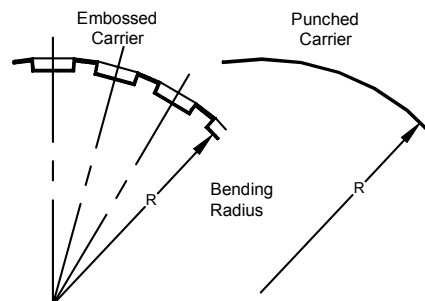
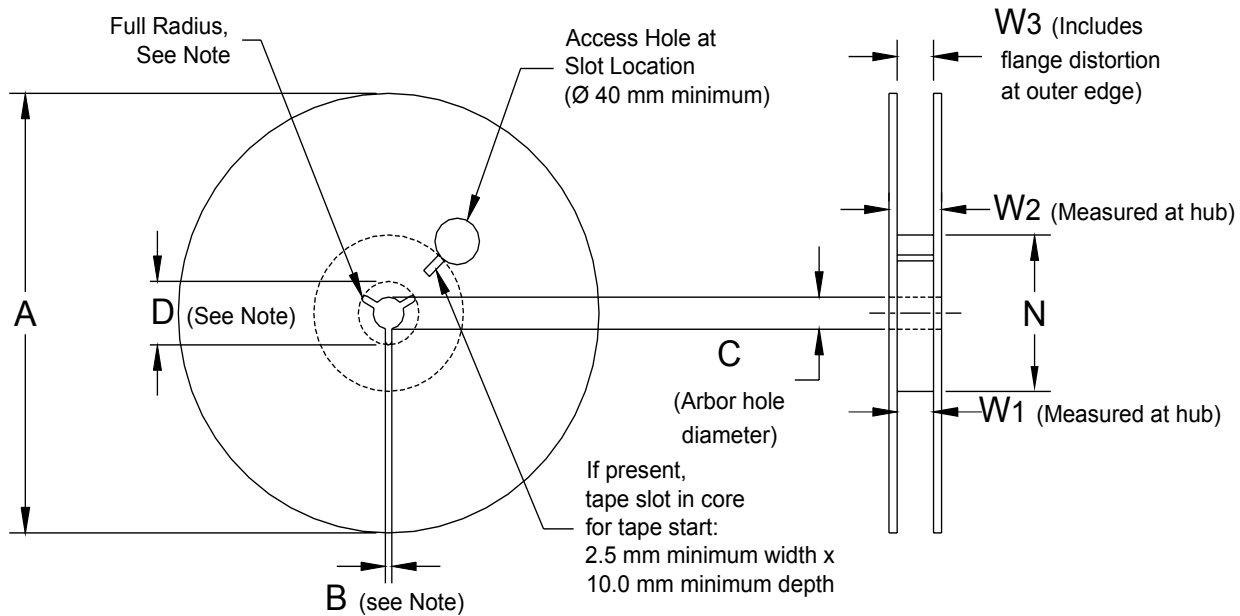


Figure 5 – Reel Dimensions

Note: Drive spokes optional; if used, dimensions B and D shall apply.

Table 5 – Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Minimum	C	D Minimum
8 mm	178 ±0.20 (7.008 ±0.008) or 330 ±0.20 (13.000 ±0.008)	1.5 (0.059)	13.0 +0.5/-0.2 (0.521 +0.02/-0.008)	20.2 (0.795)
12 mm				
16 mm				
Variable Dimensions — Millimeters (Inches)				
Tape Size	N Minimum	W ₁	W ₂ Maximum	W ₃
8 mm	50 (1.969)	8.4 +1.5/-0.0 (0.331 +0.059/-0.0)	14.4 (0.567)	Shall accommodate tape width without interference
12 mm		12.4 +2.0/-0.0 (0.488 +0.078/-0.0)	18.4 (0.724)	
16 mm		16.4 +2.0/-0.0 (0.646 +0.078/-0.0)	22.4 (0.882)	

Figure 6 – Tape Leader & Trailer Dimensions

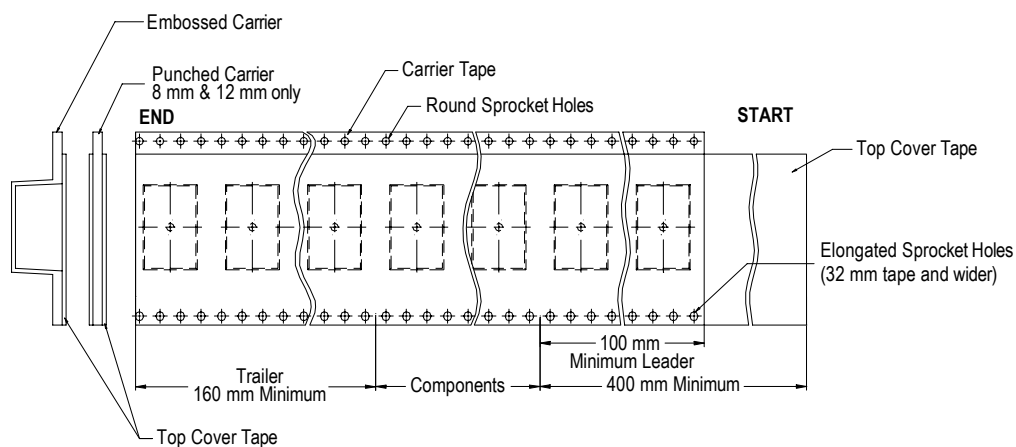
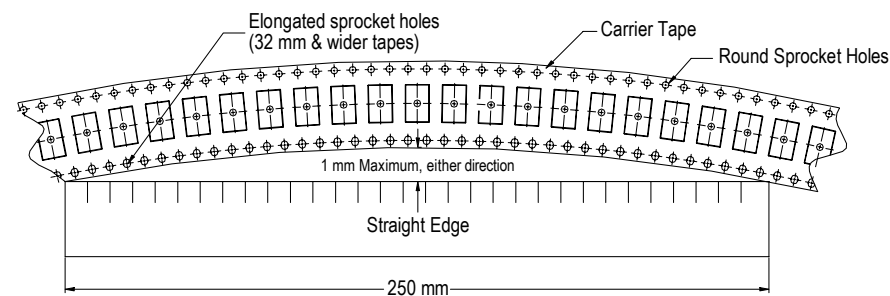


Figure 7 – Maximum Camber



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