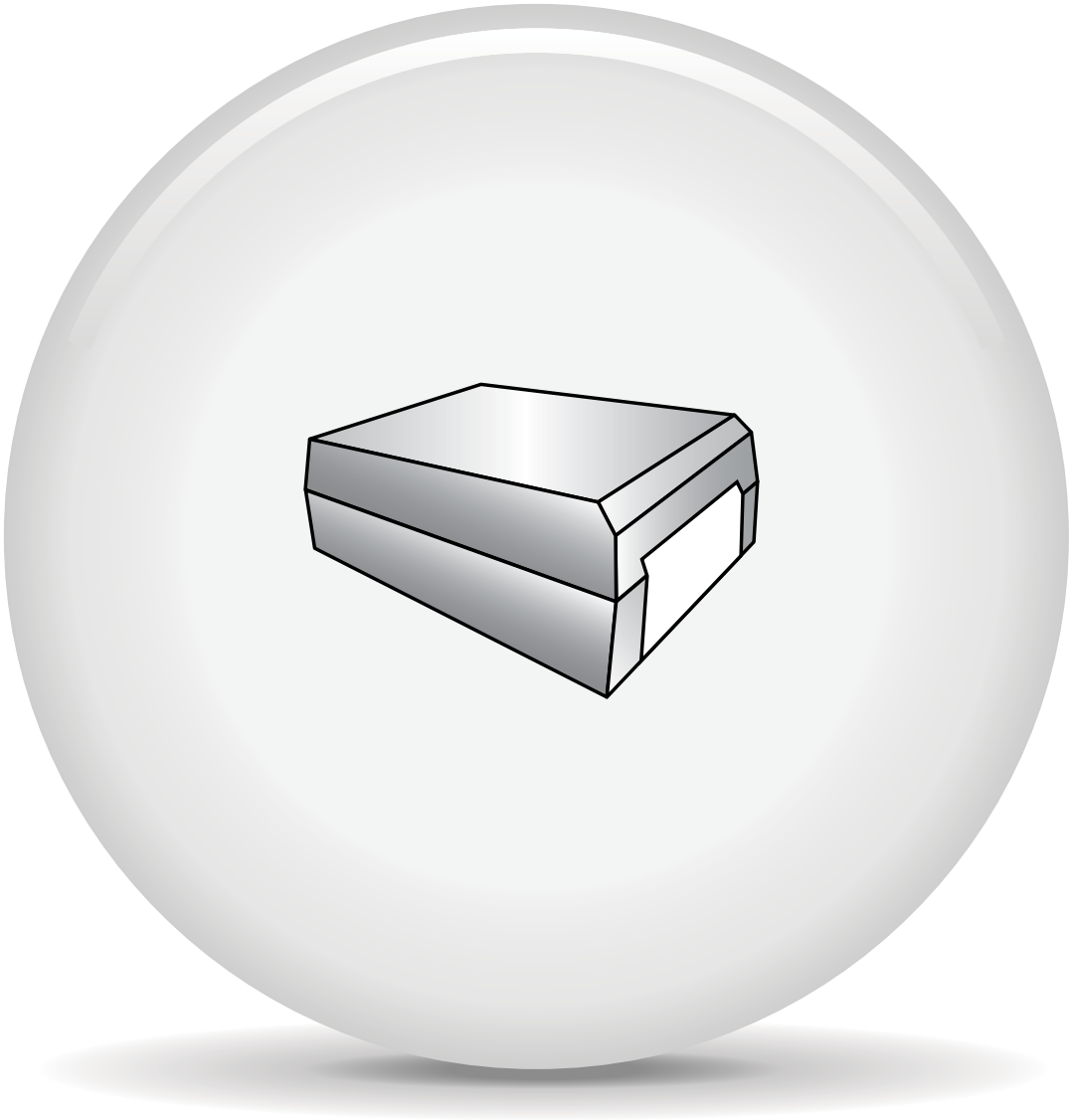
Tantalum Surface Mount Capacitors

Standard Tantalum



One world. One KEMET.

Electronic Components
KEMET
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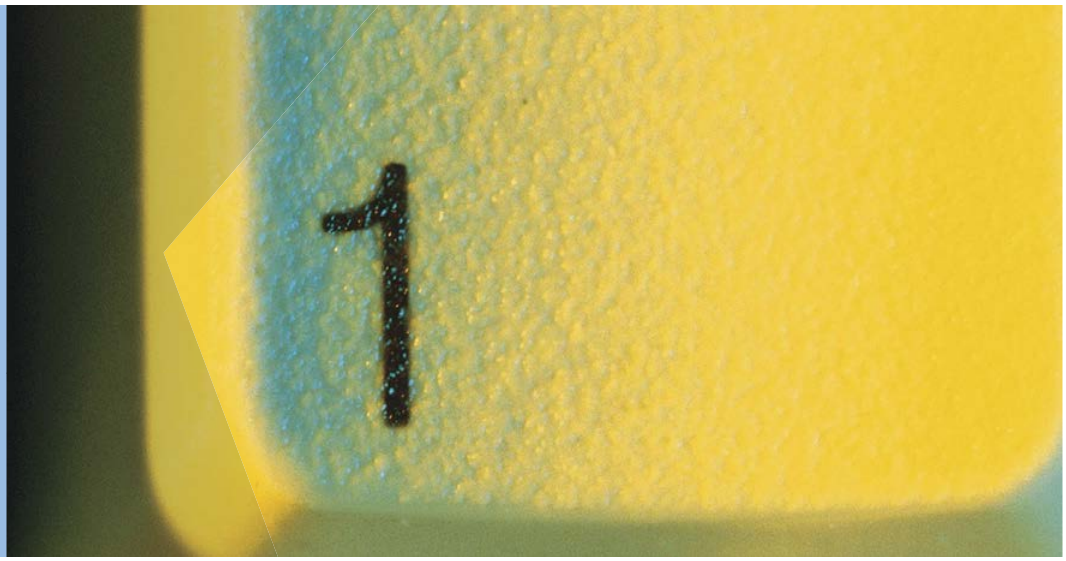


One world. One source. One KEMET.

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.

T491 Industrial Grade MnO_2 Series

Overview

The KEMET T491 Series, designed specifically for today's highly automated surface mount processes and equipment, is the leading choice for surface mount designs. The T491 combines KEMET's proven solid tantalum technology, acclaimed and respected throughout the world, with the latest in materials, processes and automation, resulting in unsurpassed total performance and value. This product meets or exceeds the requirements of EIA standard 535BAAC. This series is classified as MSL (Mositure Sensitivity Level) 1 under J STD 020: unlimited floor life time at ≤30°C / 85% RH. The T491 standard terminations are available in 100% matte tin and provide excellent wetting characteristics and compatibility with today's surface mount solder systems. Tin/lead (Sn/Pb) terminations are available upon request for any part number. Gold-plated terminations are also available for use with conductive epoxy attachment processes. Standard packaging of these devices is tape and reel in accordance with EIA 481-1. This system provides perfect compatibility with all tape-fed placement units.

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 test on C, D, E, U, V, X sizes
- Halogen free epoxy
- Capacitance 0.1 µF to 1,000 µF
- Tolerance ±10%, ±20%
- Voltage 2.5 – 50 VDC
- Extended range values
- Low profile case sizes
- RoHS Compliant and lead-free terminations (See www.kemet.com for transition information)
- Operating temperature: -55ºC to +125ºC

Applications

Typical applications include decoupling and filtering in industrial and automotive end applications such as DC/DC converters, portable electronics, telecommunications, and control units.

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	491	X	157	K	020	A	T	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	Packaging (C-Spec)
T = Tantalum	Industrial	A, B, C, D, E, S, T, U, V, X	First two digits represent significant figures. Third digit specifies number of zeros.	K = ±10% M = ±20%	2R5 = 2.5 V 003 = 3 V 004 = 4 V 006 = 6.3 V 010 = 10 V 016 = 16 V 020 = 20 V 025 = 25 V 035 = 35 V 050 = 50 V	A = N/A	T = 100% Matte Tin (Sn) Plated* H = Standard Solder Coated (SnPb 5% Pb minimum) G = Gold Plated (A, B, C, D, X only) N = Non-Magnetic 100% Tin (Sn) M = Non-Magnetic (SnPb)	Blank = 7" Reel 7280 = 13" Reel

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	0.1 – 1,000 µF @ 120 Hz/25°C
Capacitance Tolerance	K Tolerance (10%), M Tolerance (20%)
Rated Voltage Range	2.5 – 50 V
DF (120 Hz)	Refer to Part Number Electrical Specification Table
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.01 CV (µA) at rated voltage after 5 minutes

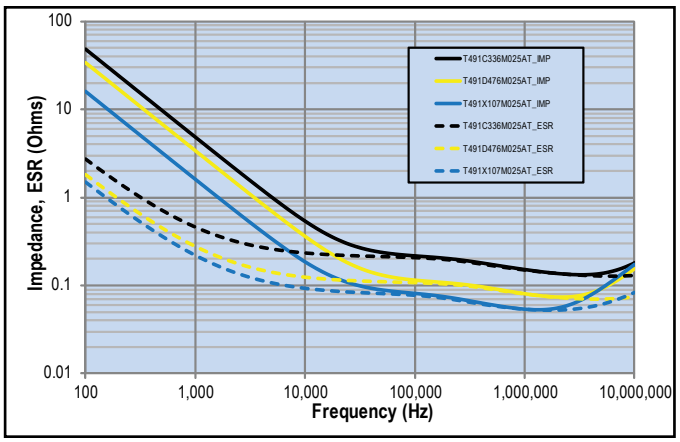
Qualification

Test	Condition		Characteristics			
Endurance	85°C @ rated voltage, 2,000 hours 125°C @ 2/3 rated voltage, 2,000 hours		Δ C/C	Within ±10% of initial value		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Storage Life	125°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, -55C° to 125° 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, +125°C, +25°C.			+25°C	-55°C	+85°C	+125°C
		Δ C/C		IL*	±10%	±10%	±20%
		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 (125°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		

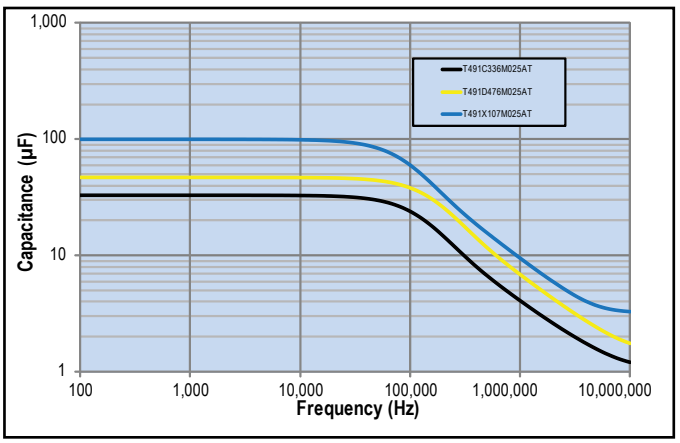
**IL = Initial limit*

Electrical Characteristics

ESR vs. Frequency

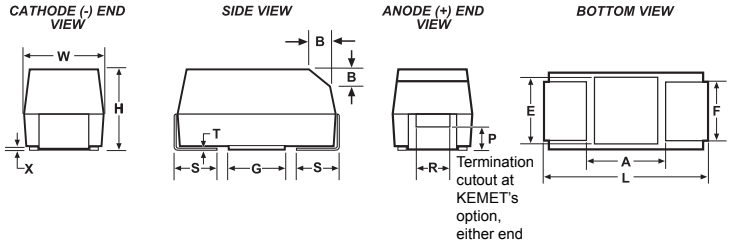


Capacitance vs. Frequency



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 (0.126 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.2 (.047)	0.8 (.031)	0.4 (.016)	0.10 ±0.10 (0.004 ±0.004)	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 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.9 ±0.2 (0.075 ±0.008)	2.2 (.087)	0.8 (.031)	0.4 (.016)	0.10 ±0.10 (0.004 ±0.004)	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 (0.236 ±0.03)	3.2 ±0.3 (0.126 ±0.012)	2.5 ±0.3 (0.098 ±0.012)	2.2 (.087)	1.3 (.051)	0.5 (.020)	0.10 ±0.10 (0.004 ±0.004)	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 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	2.8 ±0.3 (0.110 ±0.012)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ±0.10 (0.004 ±0.004)	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 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	4.0 ±0.3 (0.157 ±0.012)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ±0.10 (0.004 ±0.004)	1.7 (.067)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)
E	7360-38	7.3 ±0.3 (0.287 ±0.012)	6.0± 0.3 (0.236 ±0.012)	3.6 ± 0.2 (0.142 ±0.008)	4.1 (.161)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	n/a	n/a	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)
S	3216–12	3.2 ±0.2 (0.126 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.2 (.047)	1.2 (.047)	0.8 (.031)	n/a	0.05 (.002)	n/a	n/a	0.13 (.005)	0.8 (.031)	1.1 (.043)	1.3 (.051)
T	3528–12	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.2 (.047)	2.2 (.087)	0.8 (.031)	n/a	0.05 (.002)	n/a	n/a	0.13 (.005)	1.1 (.043)	1.8 (.071)	2.2 (.087)
U	6032–15	6.0 ±0.3 (0.236 ±0.012)	3.2 ±0.2 (0.110 ±0.008)	1.5 (.059)	2.2 (.087)	1.3 (.051)	n/a	0.05 (.002)	n/a	n/a	0.13 (.005)	2.5(.098)	2.8 (.110)	2.4 (.094)
V	7343–20	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	2.0 (.079)	2.4 (.094)	1.3 (.051)	n/a	0.05 (.002)	n/a	n/a	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	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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
6.3	47	D/7343-31	T491D476(1)006A(2)	3.0	6.0	0.8	433	390	173	1
6.3	47	C/6032-28	T491C476(1)006A(2)	3.0	6.0	1.5	262	236	105	1
6.3	47	U/6032-15	T491U476(1)006A(2)	3.0	6.0	1.8	224	202	90	1
6.3	47	V/7343-20	T491V476(1)006AT	3.0	6.0	0.7	423	381	169	1
6.3	47	B/3528-21	T491B476(1)006A(2)	3.0	6.0	2.0	206	185	82	1
6.3	47	A/3216-18	T491A476(M)006A(2)	3.0	12.0	3.5	146	131	58	1
6.3	47	T/3528-12	T491T476(1)006A(2)	3.0	24.0	4.4	126	113	50	1
6.3	68	D/7343-31	T491D686(1)006A(2)	4.3	6.0	0.8	433	390	173	1
6.3	68	C/6032-28	T491C686(1)006A(2)	4.3	6.0	1.2	303	273	121	1
6.3	68	U/6032-15	T491U686(1)006A(2)	4.3	10.0	1.8	224	202	90	1
6.3	68	V/7343-20	T491V686(1)006AT	4.3	6.0	0.7	423	381	169	1
6.3	68	B/3528-21	T491B686(1)006A(2)	4.3	8.0	0.9	307	276	123	1
6.3	68	A/3216-18	T491A686(1)006A(2)	4.3	30.0	4.0	137	123	55	1
6.3	100	D/7343-31	T491D107(1)006A(2)	6.3	8.0	0.8	433	390	173	1
6.3	100	V/7343-20	T491V107(1)006A(2)	6.3	8.0	0.7	423	381	169	1
6.3	100	C/6032-28	T491C107(1)006A(2)	6.3	8.0	0.9	350	315	140	1
6.3	100	U/6032-15	T491U107(1)006A(2)	6.3	10.0	1.8	224	202	90	1
6.3	100	B/3528-21	T491B107(1)006A(2)	6.3	15.0	3.0	168	151	67	1
6.3	150	B/3528-21	T491B157M006A(2)	9.5	15.0	3.0	168	151	67	1
6.3	150	D/7343-31	T491D157(1)006A(2)	9.5	8.0	0.7	463	417	185	1
6.3	150	C/6032-28	T491C157(1)006A(2)	9.5	8.0	1.2	303	273	121	1
6.3	150	V/7343-20	T491V157(1)006A(2)	9.5	8.0	0.7	423	381	169	1
6.3	150	U/6032-15	T491U157(1)006AT	9.5	8.0	0.6	387	348	155	1
6.3	150	W/7343-15	T491W157(1)006AT	9.5	8.0	0.8	474	427	190	1
6.3	220	X/7343-43	T491X227(1)006A(2)	13.9	8.0	0.7	486	437	194	1
6.3	220	D/7343-31	T491D227(1)006A(2)	13.9	8.0	0.7	463	417	185	1
6.3	220	C/6032-28	T491C227(M)006A(2)	13.9	10.0	1.0	332	299	133	1
6.3	220	V/7343-20	T491V227(1)006A(2)	13.9	8.0	0.7	423	381	169	1
6.3	220	W/7343-15	T491W227(1)006AT	13.9	8.0	0.8	474	427	190	1
6.3	330	C/6032-28	T491C337(1)006A(2)	20.8	12.0	1.2	303	273	121	1
6.3	330	V/7343-20	T491V337(1)006AT	20.8	8.0	0.7	423	381	169	1
6.3	330	X/7343-43	T491X337(1)006A(2)	20.8	8.0	0.4	642	578	257	1
6.3	330	D/7343-31	T491D337(1)006A(2)	20.8	8.0	0.4	612	551	245	1
6.3	330	E/7360-38	T491E337(1)006A(2)	20.8	8.0	0.5	632	569	253	1
6.3	470	X/7343-43	T491X477(1)006A(2)	29.6	10.0	0.4	642	578	257	1
6.3	470	D/7343-31	T491D477(M)006A(2)	29.6	12.0	0.4	612	551	245	1
6.3	470	E/7360-38	T491E477(1)006A(2)	29.6	10.0	0.4	707	636	283	1
6.3	680	X/7343-43	T491X687(1)006A(2)	42.8	15.0	0.6	524	472	210	1
6.3	680	E/7360-38	T491E687(M)006A(2)	42.8	12.0	0.5	632	569	253	1
6.3	1000	X/7343-43	T491X108(1)006AT	63.0	15.0	0.6	524	472	210	1
10	1	A/3216-18	T491A105(1)010A(2)	0.5	4.0	10.0	87	78	35	1
10	1.5	A/3216-18	T491A155(1)010A(2)	0.5	6.0	8.0	97	87	39	1
10	2.2	B/3528-21	T491B225(1)010A(2)	0.5	6.0	3.5	156	140	62	1
10	2.2	A/3216-18	T491A225(1)010A(2)	0.5	6.0	7.0	97	87	39	1
10	3.3	A/3216-18	T491A335(1)010A(2)	0.5	6.0	5.5	117	105	47	1
10	3.3	S/3216-12	T491S335(1)010A(2)	0.5	6.0	15.0	63	57	25	1
10	4.7	B/3528-21	T491B475(1)010A(2)	0.5	6.0	3.5	156	140	62	1
10	4.7	A/3216-18	T491A475(1)010A(2)	0.5	6.0	5.0	122	110	49	1
10	4.7	S/3216-12	T491S475(1)010A(2)	0.5	6.0	15.0	63	57	25	1
10	6.8	B/3528-21	T491B685(1)010A(2)	0.7	6.0	3.5	156	140	62	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
10	6.8	A/3216-18	T491A685(1)010A(2)	0.7	6.0	4.0	137	123	55	1
10	6.8	T/3528-12	T491T685(1)010A(2)	0.7	6.0	5.0	118	106	47	1
10	6.8	S/3216-12	T491S685(1)010A(2)	0.7	10.0	15.0	63	57	25	1
10	10	C/6032-28	T491C106(1)010A(2)	1.0	6.0	1.8	247	222	99	1
10	10	B/3528-21	T491B106(1)010A(2)	1.0	6.0	3.0	156	140	62	1
10	10	A/3216-18	T491A106(1)010A(2)	1.0	6.0	3.8	137	123	55	1
10	10	T/3528-12	T491T106(1)010A(2)	1.0	6.0	5.0	118	106	47	1
10	10	S/3216-12	T491S106(1)010A(2)	1.0	10.0	15.0	63	57	25	1
10	15	C/6032-28	T491C156(1)010A(2)	1.5	6.0	1.8	247	222	99	1
10	15	U/6032-15	T491U156(1)010A(2)	1.5	6.0	1.8	224	202	90	1
10	15	B/3528-21	T491B156(1)010A(2)	1.5	6.0	2.5	174	157	70	1
10	15	A/3216-18	T491A156(1)010A(2)	1.5	8.0	6.0	112	101	45	1
10	15	T/3528-12	T491T156(1)010A(2)	1.5	8.0	5.0	118	106	47	1
10	22	D/7343-31	T491D226(1)010A(2)	2.2	6.0	0.8	433	390	173	1
10	22	C/6032-28	T491C226(1)010A(2)	2.2	6.0	1.6	247	222	99	1
10	22	U/6032-15	T491U226(1)010A(2)	2.2	6.0	1.8	224	202	90	1
10	22	B/3528-21	T491B226(1)010A(2)	2.2	6.0	2.3	192	173	77	1
10	22	A/3216-18	T491A226(1)010A(2)	2.2	8.0	3.2	112	101	45	1
10	22	T/3528-12	T491T226(1)010A(2)	2.2	12.0	8.0	94	85	38	1
10	33	D/7343-31	T491D336(1)010A(2)	3.3	6.0	0.8	433	390	173	1
10	33	V/7343-20	T491V336(1)010A(2)	3.3	6.0	0.7	423	381	169	1
10	33	C/6032-28	T491C336(1)010A(2)	3.3	6.0	1.5	271	244	108	1
10	33	U/6032-15	T491U336(1)010A(2)	3.3	6.0	1.8	224	202	90	1
10	33	B/3528-21	T491B336(1)010A(2)	3.3	6.0	1.8	217	195	87	1
10	33	T/3528-12	T491T336(1)010A(2)	3.3	24.0	5.0	118	106	47	1
10	33	A/3216-18	T491A336(1)010A(2)	3.3	15.0	6.0	112	101	45	1
10	47	D/7343-31	T491D476(1)010A(2)	4.7	6.0	0.8	433	390	173	1
10	47	V/7343-20	T491V476(1)010A(2)	4.7	6.0	0.7	423	381	169	1
10	47	C/6032-28	T491C476(1)010A(2)	4.7	6.0	1.2	303	273	121	1
10	47	U/6032-15	T491U476(1)010A(2)	4.7	10.0	2.2	202	182	81	1
10	47	B/3528-21	T491B476(1)010A(2)	4.7	8.0	1.0	292	263	117	1
10	68	D/7343-31	T491D686(1)010A(2)	6.8	6.0	0.8	433	390	173	1
10	68	V/7343-20	T491V686(1)010A(2)	6.8	6.0	0.7	423	381	169	1
10	68	C/6032-28	T491C686(1)010A(2)	6.8	6.0	1.2	303	273	121	1
10	68	W/7343-15	T491W686(1)010AT	6.8	6.0	1.2	387	348	155	1
10	68	U/6032-15	T491U686(1)010A(2)	6.8	10.0	1.8	224	202	90	1
10	68	B/3528-21	T491B686(M)010A(2)	6.8	8.0	1.0	292	263	117	1
10	100	B/3528-21	T491B107(M)010A(2)	10.0	15.0	3.0	168	151	67	1
10	100	D/7343-31	T491D107(1)010A(2)	10.0	8.0	0.7	463	417	185	1
10	100	U/6032-15	T491U107(1)010AT	10.0	8.0	0.7	359	323	144	1
10	100	W/7343-15	T491W107(1)010AT	10.0	8.0	0.8	474	427	190	1
10	100	C/6032-28	T491C107(1)010A(2)	10.0	8.0	1.2	303	273	121	1
10	100	V/7343-20	T491V107(1)010A(2)	10.0	8.0	0.7	423	381	169	1
10	150	X/7343-43	T491X157(1)010A(2)	15.0	8.0	0.7	486	437	194	1
10	150	D/7343-31	T491D157(1)010A(2)	15.0	8.0	0.7	463	417	185	1
10	150	C/6032-28	T491C157(1)010A(2)	15.0	10.0	0.9	350	315	140	1
10	150	V/7343-20	T491V157(1)010A(2)	15.0	8.0	0.7	423	381	169	1
10	220	X/7343-43	T491X227(1)010A(2)	22.0	8.0	0.5	574	517	230	1
10	220	D/7343-31	T491D227(1)010A(2)	22.0	8.0	0.5	548	493	219	1
10	330	D/7343-31	T491D337(1)010A(2)	33.0	10.0	0.5	548	493	219	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
10	330	X/7343-43	T491X337(1)010A(2)	33.0	10.0	0.5	574	517	230	1
10	330	E/7360-38	T491E337(1)010A(2)	33.0	10.0	0.5	632	569	253	1
10	470	X/7343-43	T491X477(1)010A(2)	47	10	0.2	908	817.2	363.2	1
10	470	E/7360-38	T491E477(M)010A(2)	47.0	12.0	0.5	632	569	253	1
16	1	A/3216-18	T491A105(1)016A(2)	0.5	4.0	10.0	87	78	35	1
16	1.5	A/3216-18	T491A155(1)016A(2)	0.5	6.0	8.0	97	87	39	1
16	2.2	A/3216-18	T491A225(1)016A(2)	0.5	6.0	6.0	112	101	45	1
16	2.2	S/3216-12	T491S225(1)016A(2)	0.5	6.0	15.0	63	57	25	1
16	3.3	B/3528-21	T491B335(1)016A(2)	0.5	6.0	3.5	156	140	62	1
16	3.3	A/3216-18	T491A335(1)016A(2)	0.5	6.0	5.0	122	110	49	1
16	4.7	C/6032-28	T491C475(1)016A(2)	0.8	6.0	2.4	214	193	86	1
16	4.7	B/3528-21	T491B475(1)016A(2)	0.8	6.0	3.5	156	140	62	1
16	4.7	A/3216-18	T491A475(1)016A(2)	0.8	6.0	4.0	137	123	55	1
16	4.7	T/3528-12	T491T475(1)016A(2)	0.8	6.0	5.0	118	106	47	1
16	6.8	C/6032-28	T491C685(1)016A(2)	1.1	6.0	1.9	241	217	96	1
16	6.8	B/3528-21	T491B685(1)016A(2)	1.1	6.0	2.5	184	166	74	1
16	6.8	A/3216-18	T491A685(1)016A(2)	1.1	6.0	3.5	146	131	58	1
16	10	C/6032-28	T491C106(1)016A(2)	1.6	6.0	1.8	247	222	99	1
16	10	U/6032-15	T491U106(1)016A(2)	1.6	6.0	1.8	224	202	90	1
16	10	B/3528-21	T491B106(1)016A(2)	1.6	6.0	2.5	174	157	70	1
16	10	A/3216-18	T491A106(1)016A(2)	1.6	8.0	7.0	104	94	42	1
16	10	T/3528-12	T491T106(1)016A(2)	1.6	8.0	8.0	94	85	38	1
16	15	C/6032-28	T491C156(1)016A(2)	2.4	6.0	1.6	247	222	99	1
16	15	U/6032-15	T491U156(1)016A(2)	2.4	6.0	1.8	224	202	90	1
16	15	B/3528-21	T491B156(1)016A(2)	2.4	6.0	2.0	192	173	77	1
16	15	A/3216-18	T491A156(1)016A(2)	2.4	8.0	3.5	146	131	58	1
16	22	D/7343-31	T491D226(1)016A(2)	3.5	6.0	0.8	433	390	173	1
16	22	C/6032-28	T491C226(1)016A(2)	3.5	6.0	1.5	262	236	105	1
16	22	U/6032-15	T491U226(1)016A(2)	3.5	10.0	3.0	173	156	69	1
16	22	B/3528-21	T491B226(1)016A(2)	3.5	6.0	2.2	197	177	79	1
16	33	D/7343-31	T491D336(1)016A(2)	5.3	6.0	0.8	433	390	173	1
16	33	C/6032-28	T491C336(1)016A(2)	5.3	6.0	1.2	303	273	121	1
16	33	U/6032-15	T491U336(1)016A(2)	5.3	6.0	1.0	300	270	120	1
16	33	B/3528-21	T491B336(1)016A(2)	5.3	8.0	2.0	206	185	82	1
16	47	D/7343-31	T491D476(1)016A(2)	7.5	6.0	0.8	433	390	173	1
16	47	V/7343-20	T491V476(1)016A(2)	7.5	6.0	0.7	423	381	169	1
16	47	C/6032-28	T491C476(1)016A(2)	7.5	6.0	1.2	303	273	121	1
16	68	V/7343-20	T491V686(1)016A(2)	10.9	6.0	0.7	423	381	169	1
16	68	C/6032-28	T491C686(1)016AT	10.9	6.0	1.0	303	273	121	1
16	68	W/7343-15	T491W686(1)016AT	10.9	6.0	0.8	474	427	190	1
16	68	D/7343-31	T491D686(1)016A(2)	10.9	6.0	0.7	463	417	185	1
16	68	C/6032-28	T491C686(1)016A(2)	10.9	12.0	1.2	303	273	121	1
16	100	X/7343-43	T491X107(1)016A(2)	16.0	8.0	0.7	486	437	194	1
16	100	C/6032-28	T491C107(1)016AT	16.0	10.0	1.0	332	299	133	1
16	100	V/7343-20	T491V107(1)016A(2)	16.0	8.0	0.7	423	381	169	1
16	100	D/7343-31	T491D107(1)016A(2)	16.0	8.0	0.7	463	417	185	1
16	150	X/7343-43	T491X157(1)016A(2)	24.0	8.0	0.5	574	517	230	1
16	150	D/7343-31	T491D157(1)016A(2)	24.0	10.0	0.7	463	417	185	1
16	220	X/7343-43	T491X227(1)016A(2)	35.2	10.0	0.5	574	517	230	1
16	220	E/7360-38	T491E227(1)016A(2)	35.2	7.2	0.9	471	424	188	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
20	0.68	A/3216-18	T491A684(1)020A(2)	0.5	4.0	12.0	79	71	32	1
20	1	A/3216-18	T491A105(1)020A(2)	0.5	4.0	9.0	91	82	36	1
20	1	S/3216-12	T491S105(1)020A(2)	0.5	6.0	18.0	58	52	23	1
20	1.5	A/3216-18	T491A155(1)020A(2)	0.5	6.0	6.5	107	96	43	1
20	1.5	S/3216-12	T491S155(1)020A(2)	0.5	6.0	15.0	63	57	25	1
20	2.2	B/3528-21	T491B225(1)020A(2)	0.5	6.0	3.5	156	140	62	1
20	2.2	A/3216-18	T491A225(1)020A(2)	0.5	6.0	6.0	104	94	42	1
20	3.3	B/3528-21	T491B335(1)020A(2)	0.7	6.0	3.0	168	151	67	1
20	3.3	A/3216-18	T491A335(1)020A(2)	0.7	6.0	4.0	129	116	52	1
20	3.3	T/3528-12	T491T335(1)020A(2)	0.7	6.0	5.0	118	106	47	1
20	4.7	C/6032-28	T491C475(1)020A(2)	0.9	6.0	2.4	214	193	86	1
20	4.7	B/3528-21	T491B475(1)020A(2)	0.9	6.0	3.0	168	151	67	1
20	4.7	A/3216-18	T491A475(1)020A(2)	0.9	6.0	4.0	137	123	55	1
20	6.8	C/6032-28	T491C685(1)020A(2)	1.4	6.0	1.9	241	217	96	1
20	6.8	U/6032-15	T491U685(1)020A(2)	1.4	6.0	1.9	218	196	87	1
20	6.8	B/3528-21	T491B685(1)020A(2)	1.4	6.0	2.5	184	166	74	1
20	6.8	A/3216-18	T491A685(1)020A(2)	1.4	8.0	6.0	112	101	45	1
20	10	C/6032-28	T491C106(1)020A(2)	2.0	6.0	1.6	247	222	99	1
20	10	U/6032-15	T491U106(1)020A(2)	2.0	6.0	1.8	224	202	90	1
20	10	B/3528-21	T491B106(1)020A(2)	2.0	6.0	2.0	201	181	80	1
20	10	A/3216-18	T491A106(M)020A(2)	2.0	10.0	5.0	122	110	49	1
20	15	D/7343-31	T491D156(1)020A(2)	3.0	6.0	1.0	387	348	155	1
20	15	B/3528-21	T491B156(1)020AT	3.0	6.0	2.0	206	185	82	1
20	15	C/6032-28	T491C156(1)020A(2)	3.0	6.0	1.7	254	229	102	1
20	22	D/7343-31	T491D226(1)020A(2)	4.4	6.0	0.8	433	390	173	1
20	22	V/7343-20	T491V226(1)020A(2)	4.4	6.0	0.7	423	381	169	1
20	22	C/6032-28	T491C226(1)020A(2)	4.4	6.0	1.2	303	273	121	1
20	22	B/3528-21	T491B226(1)020A(2)	4.4	8.0	4.0	146	131	58	1
20	33	D/7343-31	T491D336(1)020A(2)	6.6	6.0	0.8	433	390	173	1
20	33	C/6032-28	T491C336(M)020A(2)	6.6	6.0	1.2	303	273	121	1
20	33	V/7343-20	T491V336(1)020A(2)	6.6	8.0	0.7	423	381	169	1
20	33	B/3528-21	T491B336(M)020A(2)	6.6	10.0	4.0	146	131	58	1
20	47	C/6032-28	T491C476(1)020A(2)	9.4	6.0	0.9	350	315	140	1
20	47	X/7343-43	T491X476(1)020AT	9.4	6.0	0.8	454	409	182	1
20	47	D/7343-31	T491D476(1)020A(2)	9.4	6.0	0.7	463	417	185	1
20	68	X/7343-43	T491X686(1)020A(2)	13.6	6.0	0.7	486	437	194	1
20	68	D/7343-31	T491D686(1)020A(2)	13.6	6.0	0.7	463	417	185	1
20	100	X/7343-43	T491X107(1)020A(2)	20.0	8.0	0.5	574	517	230	1
20	100	D/7343-31	T491D107(1)020AT	20.0	8.0	0.9	408	367	163	1
20	100	E/7360-38	T491E107(1)020A(2)	20.0	8.0	0.5	632	569	253	1
20	150	X/7343-43	T491X157(1)020A(2)	30.0	10.0	0.4	642	578	257	1
25	0.33	A/3216-18	T491A334(1)025A(2)	0.5	4.0	15.0	71	64	28	1
25	0.47	A/3216-18	T491A474(1)025A(2)	0.5	4.0	13.0	76	68	30	1
25	0.68	A/3216-18	T491A684(1)025A(2)	0.5	4.0	10.0	87	78	35	1
25	1	B/3528-21	T491B105(1)025A(2)	0.5	4.0	5.0	130	117	52	1
25	1	A/3216-18	T491A105(1)025A(2)	0.5	4.0	8.0	97	87	39	1
25	1	S/3216-12	T491S105(1)025A(2)	0.5	6.0	18.0	58	52	23	1
25	1.5	B/3528-21	T491B155(1)025A(2)	0.5	6.0	5.0	130	117	52	1
25	1.5	A/3216-18	T491A155(1)025A(2)	0.5	6.0	7.0	104	94	42	1
25	2.2	C/6032-28	T491C225(1)025A(2)	0.6	6.0	3.5	177	159	71	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
25	2.2	A/3216-18	T491A225(1)025A(2)	0.6	6.0	7.0	104	94	42	1
25	2.2	B/3528-21	T491B225(1)025A(2)	0.6	6.0	4.5	137	123	55	1
25	3.3	C/6032-28	T491C335(1)025A(2)	0.8	6.0	2.5	210	189	84	1
25	3.3	A/3216-18	T491A335(1)025A(2)	0.8	6.0	7.0	104	94	42	1
25	3.3	B/3528-21	T491B335(1)025A(2)	0.8	6.0	3.5	156	140	62	1
25	4.7	C/6032-28	T491C475(1)025A(2)	1.2	6.0	2.3	214	193	86	1
25	4.7	B/3528-21	T491B475(1)025A(2)	1.2	6.0	1.5	238	214	95	1
25	4.7	A/3216-18	T491A475(M)025A(2)	1.2	8.0	6.0	112	101	45	1
25	6.8	C/6032-28	T491C685(1)025A(2)	1.7	6.0	1.9	241	217	96	1
25	6.8	B/3528-21	T491B685(1)025A(2)	1.7	6.0	2.8	174	157	70	1
25	10	D/7343-31	T491D106(1)025A(2)	2.5	6.0	1.0	387	348	155	1
25	10	C/6032-28	T491C106(1)025A(2)	2.5	6.0	1.5	271	244	108	1
25	10	B/3528-21	T491B106(1)025A(2)	2.5	6.0	2.0	168	151	67	1
25	15	D/7343-31	T491D156(1)025A(2)	3.8	6.0	1.0	387	348	155	1
25	15	V/7343-20	T491V156(1)025AT	3.8	6.0	1.0	354	319	142	1
25	15	C/6032-28	T491C156(1)025A(2)	3.8	6.0	1.5	271	244	108	1
25	15	B/3528-21	T491B156(1)025A(2)	3.8	8.0	4.0	146	131	58	1
25	22	D/7343-31	T491D226(1)025A(2)	5.5	6.0	0.8	433	390	173	1
25	22	C/6032-28	T491C226(1)025A(2)	5.5	6.0	1.0	280	252	112	1
25	22	V/7343-20	T491V226(1)025A(2)	5.5	6.0	0.7	423	381	169	1
25	33	X/7343-43	T491X336(1)025A(2)	8.3	6.0	0.7	486	437	194	1
25	33	D/7343-31	T491D336(1)025A(2)	8.3	6.0	0.7	463	417	185	1
25	33	C/6032-28	T491C336(1)025A(2)	8.3	6.0	0.9	350	315	140	1
25	47	X/7343-43	T491X476(1)025A(2)	11.8	6.0	0.7	486	437	194	1
25	47	D/7343-31	T491D476(1)025A(2)	11.8	6.0	0.7	463	417	185	1
25	68	X/7343-43	T491X686(1)025A(2)	17.0	6.0	0.7	486	437	194	1
25	68	D/7343-31	T491D686(M)025A(2)	17.0	10.0	0.7	463	417	185	1
25	100	X/7343-43	T491X107(1)025A(2)	25.0	8.0	0.3	742	668	297	1
35	0.1	A/3216-18	T491A104(1)035A(2)	0.5	4.0	20.0	61	55	24	1
35	0.15	A/3216-18	T491A154(1)035A(2)	0.5	4.0	19.0	63	57	25	1
35	0.22	A/3216-18	T491A224(1)035A(2)	0.5	4.0	18.0	65	59	26	1
35	0.33	A/3216-18	T491A334(1)035A(2)	0.5	4.0	15.0	71	64	28	1
35	0.47	B/3528-21	T491B474(1)035A(2)	0.5	4.0	8.0	103	93	41	1
35	0.47	A/3216-18	T491A474(1)035A(2)	0.5	4.0	11.0	79	71	32	1
35	0.68	B/3528-21	T491B684(1)035A(2)	0.5	4.0	6.5	114	103	46	1
35	0.68	A/3216-18	T491A684(1)035A(2)	0.5	4.0	8.0	97	87	39	1
35	1	B/3528-21	T491B105(1)035A(2)	0.5	4.0	5.0	130	117	52	1
35	1	A/3216-18	T491A105(1)035A(2)	0.5	4.0	7.0	100	90	40	1
35	1.5	A/3216-18	T491A155(1)035A(2)	0.5	6.0	7.0	104	94	42	1
35	1.5	C/6032-28	T491C155(1)035A(2)	0.5	6.0	4.5	156	140	62	1
35	1.5	B/3528-21	T491B155(1)035A(2)	0.5	6.0	5.0	130	117	52	1
35	2.2	C/6032-28	T491C225(1)035A(2)	0.8	6.0	3.2	185	167	74	1
35	2.2	A/3216-18	T491A225(1)035AT	0.8	6.0	4.0	129	116	52	1
35	2.2	B/3528-21	T491B225(1)035A(2)	0.8	6.0	4.0	146	131	58	1
35	3.3	C/6032-28	T491C335(1)035A(2)	1.2	6.0	2.4	210	189	84	1
35	3.3	B/3528-21	T491B335(1)035A(2)	1.2	6.0	3.5	156	140	62	1
35	4.7	D/7343-31	T491D475(1)035A(2)	1.6	6.0	1.5	316	284	126	1
35	4.7	B/3528-21	T491B475(1)035AT	1.6	6.0	3.0	166	149	66	1
35	4.7	C/6032-28	T491C475(1)035A(2)	1.6	6.0	2.0	224	202	90	1
35	6.8	D/7343-31	T491D685(1)035A(2)	2.4	6.0	1.2	340	306	136	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
35	6.8	V/7343-20	T491V685(1)035AT	2.4	6.0	1.2	323	291	129	1
35	6.8	C/6032-28	T491C685(1)035A(2)	2.4	6.0	1.8	247	222	99	1
35	10	D/7343-31	T491D106(1)035A(2)	3.5	6.0	1.0	387	348	155	1
35	10	C/6032-28	T491C106(1)035A(2)	3.5	6.0	1.6	262	236	105	1
35	10	V/7343-20	T491V106(1)035A(2)	3.5	6.0	1.0	250	225	100	1
35	15	X/7343-43	T491X156(1)035A(2)	5.3	6.0	0.9	428	385	171	1
35	15	D/7343-31	T491D156(1)035A(2)	5.3	6.0	0.8	433	390	173	1
35	22	X/7343-43	T491X226(1)035A(2)	7.7	6.0	0.7	486	437	194	1
35	22	D/7343-31	T491D226(1)035A(2)	7.7	6.0	0.7	463	417	185	1
35	33	X/7343-43	T491X336(1)035A(2)	11.6	6.0	0.6	524	472	210	1
35	33	D/7343-31	T491D336(1)035A(2)	11.6	6.0	0.6	500	450	200	1
35	47	X/7343-43	T491X476(1)035A(2)	16.5	6.0	0.6	524	472	210	1
35	47	E/7360-38	T491E476(1)035A(2)	16.5	10.0	0.5	632	569	253	1
50	0.1	A/3216-18	T491A104(1)050A(2)	0.5	4.0	20.0	61	55	24	1
50	0.15	B/3528-21	T491B154(1)050A(2)	0.5	4.0	16.0	73	66	29	1
50	0.15	A/3216-18	T491A154(1)050A(2)	0.5	4.0	15.0	71	64	28	1
50	0.22	B/3528-21	T491B224(1)050A(2)	0.5	4.0	14.0	78	70	31	1
50	0.22	A/3216-18	T491A224(1)050AT	0.5	4.0	18.0	65	59	26	1
50	0.33	A/3216-18	T491A334(1)050A(2)	0.5	4.0	14.0	73	66	29	1
50	0.33	B/3528-21	T491B334(1)050A(2)	0.5	4.0	10.0	92	83	37	1
50	0.47	A/3216-18	T491A474(1)050A(2)	0.5	4.0	9.5	280	253	112	1
50	0.47	C/6032-28	T491C474(1)050A(2)	0.5	4.0	7.2	117	105	47	1
50	0.47	B/3528-21	T491B474(1)050A(2)	0.5	4.0	9.0	97	87	39	1
50	0.68	A/3216-18	T491A684(1)050A(2)	0.5	4.0	8.0	97	87	39	1
50	0.68	C/6032-28	T491C684(1)050A(2)	0.5	4.0	6.4	125	113	50	1
50	0.68	B/3528-21	T491B684(1)050A(2)	0.5	4.0	8.0	103	93	41	1
50	1	A/3216-18	T491A105(1)050A(2)	0.5	4.0	7.0	104	94	42	1
50	1	C/6032-28	T491C105(1)050A(2)	0.5	4.0	4.8	148	133	59	1
50	1	B/3528-21	T491B105(1)050A(2)	0.5	6.0	6.0	119	107	48	1
50	1	V/7343-20	T491V105(1)050A(2)	0.5	4.0	6.0	144	130	58	1
50	1.5	D/7343-31	T491D155(1)050A(2)	0.8	6.0	3.5	207	186	83	1
50	1.5	C/6032-28	T491C155(1)050A(2)	0.8	6.0	4.4	156	140	62	1
50	2.2	D/7343-31	T491D225(1)050A(2)	1.1	6.0	2.5	245	221	98	1
50	2.2	C/6032-28	T491C225(1)050A(2)	1.1	6.0	3.0	191	172	76	1
50	3.3	C/6032-28	T491C335(1)050AT	1.7	6.0	2.5	210	189	84	1
50	3.3	D/7343-31	T491D335(1)050A(2)	1.7	6.0	1.6	274	247	110	1
50	4.7	D/7343-31	T491D475(1)050A(2)	2.4	6.0	1.2	354	319	142	1
50	6.8	X/7343-43	T491X685(1)050A(2)	3.4	6.0	0.8	406	365	162	1
50	6.8	D/7343-31	T491D685(1)050A(2)	3.4	6.0	0.8	387	348	155	1
50	10	X/7343-43	T491X106(1)050A(2)	5.0	6.0	0.7	486	437	194	1
50	10	D/7343-31	T491D106(1)050A(2)	5.0	6.0	0.8	433	390	173	1
50	15	X/7343-43	T491X156(1)050A(2)	7.5	8.0	0.7	486	437	194	1
50	22	X/7343-43	T491X226(1)050A(2)	11.0	10.0	0.6	524	472	210	1
25	6.8	B/3528-21	T491B685(1)025A(2)	1.7	6.0	2.8	174	157	70	1
25	10	D/7343-31	T491D106(1)025A(2)	2.5	6.0	1.0	387	348	155	1
25	10	C/6032-28	T491C106(1)025A(2)	2.5	6.0	1.5	271	244	108	1
25	10	B/3528-21	T491B106(1)025A(2)	2.5	6.0	2.0	168	151	67	1
25	15	D/7343-31	T491D156(1)025A(2)	3.8	6.0	1.0	387	348	155	1
25	15	V/7343-20	T491V156(1)025AT	3.8	6.0	1.0	354	319	142	1
25	15	C/6032-28	T491C156(1)025A(2)	3.8	6.0	1.5	271	244	108	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
25	15	B/3528-21	T491B156(1)025A(2)	3.8	8.0	4.0	146	131	58	1
25	22	D/7343-31	T491D226(1)025A(2)	5.5	6.0	0.8	433	390	173	1
25	22	C/6032-28	T491C226(1)025A(2)	5.5	6.0	1.0	280	252	112	1
25	22	V/7343-20	T491V226(1)025A(2)	5.5	6.0	0.7	423	381	169	1
25	33	X/7343-43	T491X336(1)025A(2)	8.3	6.0	0.7	486	437	194	1
25	33	D/7343-31	T491D336(1)025A(2)	8.3	6.0	0.7	463	417	185	1
25	33	C/6032-28	T491C336(1)025A(2)	8.3	6.0	0.9	350	315	140	1
25	47	X/7343-43	T491X476(1)025A(2)	11.8	6.0	0.7	486	437	194	1
25	47	D/7343-31	T491D476(1)025A(2)	11.8	6.0	0.7	463	417	185	1
25	68	X/7343-43	T491X686(M)025A(2)	17.0	6.0	0.7	486	437	194	1
25	68	D/7343-31	T491D686(M)025A(2)	17.0	10.0	0.7	463	417	185	1
25	100	X/7343-43	T491X107(1)025A(2)	25.0	8.0	0.3	742	668	297	1
35	0.1	A/3216-18	T491A104(1)035A(2)	0.5	4.0	20.0	61	55	24	1
35	0.15	A/3216-18	T491A154(1)035A(2)	0.5	4.0	19.0	63	57	25	1
35	0.22	A/3216-18	T491A224(1)035A(2)	0.5	4.0	18.0	65	59	26	1
35	0.33	A/3216-18	T491A334(1)035A(2)	0.5	4.0	15.0	71	64	28	1
35	0.47	B/3528-21	T491B474(1)035A(2)	0.5	4.0	8.0	103	93	41	1
35	0.47	A/3216-18	T491A474(1)035A(2)	0.5	4.0	11.0	79	71	32	1
35	0.68	B/3528-21	T491B684(1)035A(2)	0.5	4.0	6.5	114	103	46	1
35	0.68	A/3216-18	T491A684(1)035A(2)	0.5	4.0	8.0	97	87	39	1
35	1	B/3528-21	T491B105(1)035A(2)	0.5	4.0	5.0	130	117	52	1
35	1	A/3216-18	T491A105(1)035A(2)	0.5	4.0	7.0	100	90	40	1
35	1.5	A/3216-18	T491A155(1)035A(2)	0.5	6.0	7.0	104	94	42	1
35	1.5	C/6032-28	T491C155(1)035A(2)	0.5	6.0	4.5	156	140	62	1
35	1.5	B/3528-21	T491B155(1)035A(2)	0.5	6.0	5.0	130	117	52	1
35	2.2	C/6032-28	T491C225(1)035A(2)	0.8	6.0	3.2	185	167	74	1
35	2.2	A/3216-18	T491A225(1)035AT	0.8	6.0	4.0	129	116	52	1
35	2.2	B/3528-21	T491B225(1)035A(2)	0.8	6.0	4.0	146	131	58	1
35	3.3	C/6032-28	T491C335(1)035A(2)	1.2	6.0	2.4	210	189	84	1
35	3.3	B/3528-21	T491B335(1)035A(2)	1.2	6.0	3.5	156	140	62	1
35	4.7	D/7343-31	T491D475(1)035A(2)	1.6	6.0	1.5	316	284	126	1
35	4.7	B/3528-21	T491B475(1)035AT	1.6	6.0	3.0	166	149	66	1
35	4.7	C/6032-28	T491C475(1)035A(2)	1.6	6.0	2.0	224	202	90	1
35	6.8	D/7343-31	T491D685(1)035A(2)	2.4	6.0	1.2	340	306	136	1
35	6.8	V/7343-20	T491V685(1)035AT	2.4	6.0	1.2	323	291	129	1
35	6.8	C/6032-28	T491C685(1)035A(2)	2.4	6.0	1.8	247	222	99	1
35	10	D/7343-31	T491D106(1)035A(2)	3.5	6.0	1.0	387	348	155	1
35	10	C/6032-28	T491C106(1)035A(2)	3.5	6.0	1.6	262	236	105	1
35	10	V/7343-20	T491V106(1)035A(2)	3.5	6.0	1.0	250	225	100	1
35	15	X/7343-43	T491X156(1)035A(2)	5.3	6.0	0.9	428	385	171	1
35	15	D/7343-31	T491D156(1)035A(2)	5.3	6.0	0.8	433	390	173	1
35	22	X/7343-43	T491X226(1)035A(2)	7.7	6.0	0.7	486	437	194	1
35	22	D/7343-31	T491D226(1)035A(2)	7.7	6.0	0.7	463	417	185	1
35	33	X/7343-43	T491X336(1)035A(2)	11.6	6.0	0.6	524	472	210	1
35	33	D/7343-31	T491D336(1)035A(2)	11.6	6.0	0.6	500	450	200	1
35	47	X/7343-43	T491X476(1)035A(2)	16.5	6.0	0.6	524	472	210	1
35	47	E/7360-38	T491E476(1)035A(2)	16.5	10.0	0.5	632	569	253	1
50	0.1	A/3216-18	T491A104(1)050A(2)	0.5	4.0	20.0	61	55	24	1
50	0.15	B/3528-21	T491B154(1)050A(2)	0.5	4.0	16.0	73	66	29	1
50	0.15	A/3216-18	T491A154(1)050A(2)	0.5	4.0	15.0	71	64	28	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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.

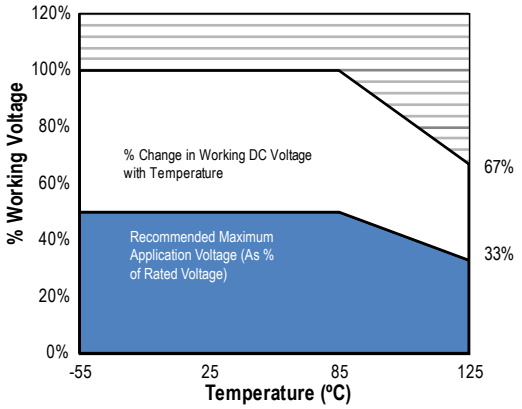
Table 1 – Ratings & Part Number Reference cont'd

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)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 260 °C
50	0.22	B/3528-21	T491B224(1)050A(2)	0.5	4.0	14.0	78	70	31	1
50	0.22	A/3216-18	T491A224(1)050AT	0.5	4.0	18.0	65	59	26	1
50	0.33	A/3216-18	T491A334(1)050A(2)	0.5	4.0	14.0	73	66	29	1
50	0.33	B/3528-21	T491B334(1)050A(2)	0.5	4.0	10.0	92	83	37	1
50	0.47	A/3216-18	T491A474(1)050A(2)	0.5	4.0	9.5	280	253	112	1
50	0.47	C/6032-28	T491C474(1)050A(2)	0.5	4.0	7.2	117	105	47	1
50	0.47	B/3528-21	T491B474(1)050A(2)	0.5	4.0	9.0	97	87	39	1
50	0.68	A/3216-18	T491A684(1)050A(2)	0.5	4.0	8.0	97	87	39	1
50	0.68	C/6032-28	T491C684(1)050A(2)	0.5	4.0	6.4	125	113	50	1
50	0.68	B/3528-21	T491B684(1)050A(2)	0.5	4.0	8.0	103	93	41	1
50	1	A/3216-18	T491A105(1)050A(2)	0.5	4.0	7.0	104	94	42	1
50	1	C/6032-28	T491C105(1)050A(2)	0.5	4.0	4.8	148	133	59	1
50	1	B/3528-21	T491B105(1)050A(2)	0.5	6.0	6.0	119	107	48	1
50	1	V/7343-20	T491V105(1)050A(2)	0.5	4.0	6.0	144	130	58	1
50	1.5	D/7343-31	T491D155(1)050A(2)	0.8	6.0	3.5	207	186	83	1
50	1.5	C/6032-28	T491C155(1)050A(2)	0.8	6.0	4.4	156	140	62	1
50	2.2	D/7343-31	T491D225(1)050A(2)	1.1	6.0	2.5	245	221	98	1
50	2.2	C/6032-28	T491C225(1)050A(2)	1.1	6.0	3.0	191	172	76	1
50	3.3	C/6032-28	T491C335(1)050AT	1.7	6.0	2.5	210	189	84	1
50	3.3	D/7343-31	T491D335(1)050A(2)	1.7	6.0	1.6	274	247	110	1
50	4.7	D/7343-31	T491D475(1)050A(2)	2.4	6.0	1.2	354	319	142	1
50	6.8	X/7343-43	T491X685(1)050A(2)	3.4	6.0	0.8	406	365	162	1
50	6.8	D/7343-31	T491D685(1)050A(2)	3.4	6.0	0.8	387	348	155	1
50	10	X/7343-43	T491X106(1)050A(2)	5.0	6.0	0.7	486	437	194	1
50	10	D/7343-31	T491D106(1)050A(2)	5.0	6.0	0.8	433	390	173	1
50	15	X/7343-43	T491X156(1)050A(2)	7.5	8.0	0.7	486	437	194	1
50	22	X/7343-43	T491X226(1)050A(2)	11.0	10.0	0.6	524	472	210	1
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(mA) 100 kHz +85°C	(mA) 100 kHz +125°C	Reflow Temperature ≤ 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

	-55°C to 85°C	85°C to 125°C
% Change in Working DC Voltage with Temperature	V_R	67% of V_R
Recommended Maximum Application Voltage	50% of V_R	33% of V_R



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 Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C w/+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

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

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

T= Environmental Temperature

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)				
Case	EIA	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

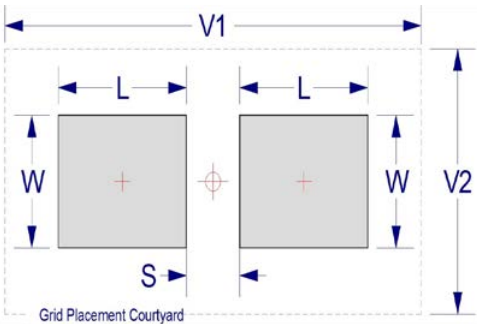
Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.*

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 desity 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.

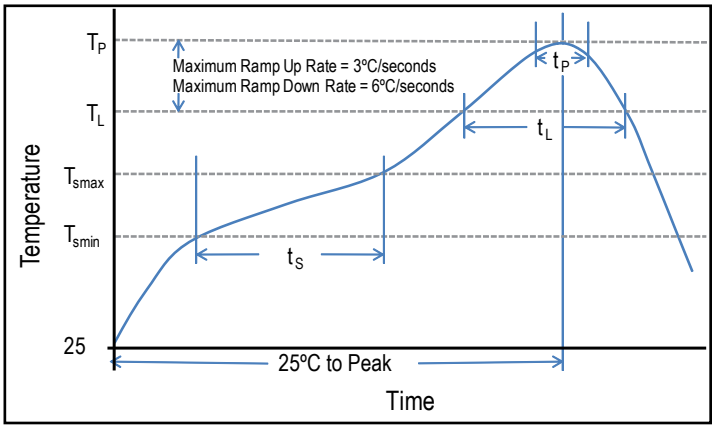
Note that although the X/7343–43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

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.

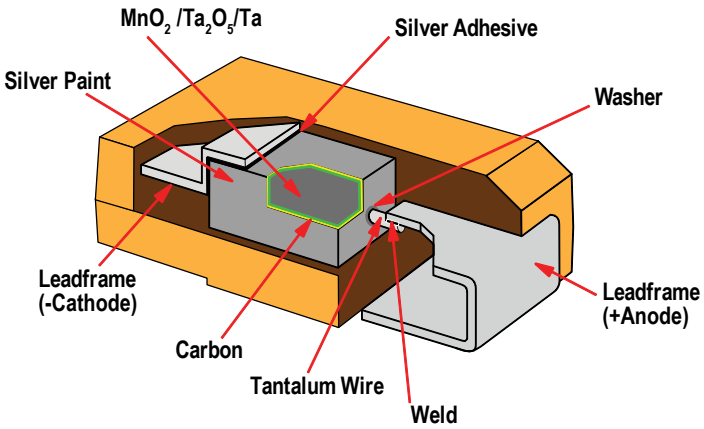
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

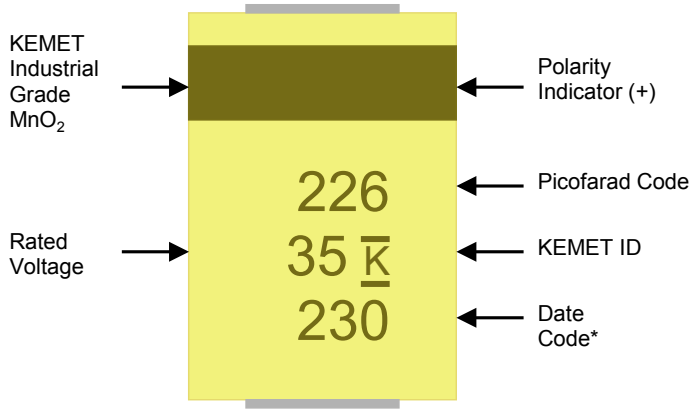
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.
**Case Size D, E, P, Y, and X*
***Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z*



Construction

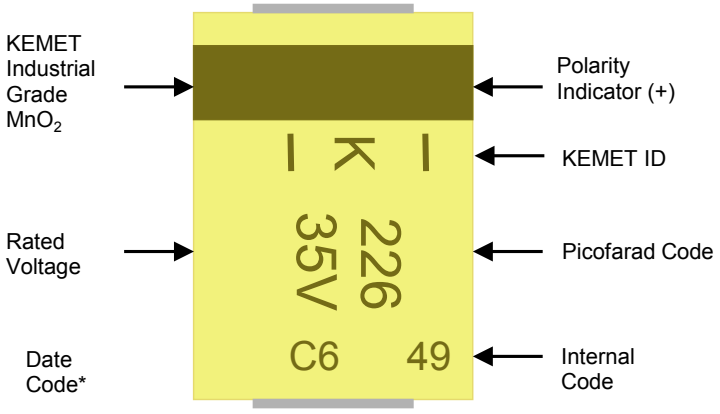


Capacitor Marking



* 230 = 30th week of 2012

C, D, X Case Sizes



Date Code *	
1st digit = Last number of Year	9 = 2009 0 = 2010 1 = 2011 2 = 2012 3 = 2013 4 = 2014
2nd and 3rd digit = Week of the Year	01 = 1st week of the Year to 52 = 52nd 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 = Sept
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 40ºC 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.

T488 Series Small Case Size Substrate Terminal MnO_2

Overview

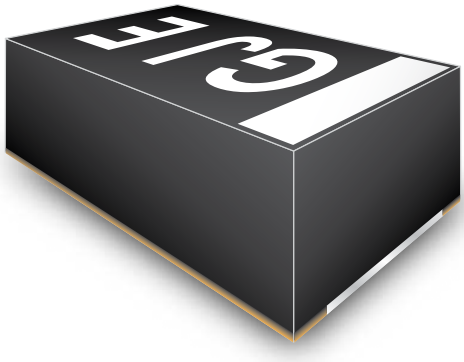
The T488 Series uses a substrate termination design, which results in one of the highest volumetric efficient packaging technologies available today in Tantalum Chip Capacitors. This series offers high capacitance values in the small EIA 2012-12 (2.0 mm (L) x 1.2 mm (W) x 1.2 mm (H)) package size. The T488 Series is ideal for use in densely populated circuits such as smart phones and digital cameras where space restrictions do not allow for larger and more commonly available case sizes.

Applications

Typical applications include densely populated circuits where space restrictions do not allow for larger and more commonly available case sizes such as smart phones, digital cameras, MP3 players, GPS navigation systems, WiFi modules, analytical and test equipment, and audio/sound circuits.

Benefits

- Tantalum Technology
- Substrate Termination
- EIA Case Size 2012 (0805 MLCC Equivalent)
- Low Profile: 1.2 mm maximum
- Improved Volumetric Efficiency
- Use up to 80% of rated voltage (20% derating)
- Capacitance: 220 µF
- Voltage: 4 V
- RoHS Compliant and Halogen Free
- 125°C maximum temperature capability
- Lead free 260°C reflow capable
- MSL Reflow Temp ≤ 260°C = 1



Environmental Compliance

RoHS Compliant (6/6) according to Directive 2002/95/EC. Halogen free.

RoHS Compliant

Halogen Free

Ordering Information

T	488	R	227	M	004	A	A	E2K0
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	ESR Code
T = Tantalum	Substrate Terminal MnO_2	R = 2012	First two digits represent significant figures. Third digit specifies number of zeros. e.g., 227 = 220 µF	M = ±20%	004 = 4 V	A = N/A	A = Ni - Au	E = ESR Last three digits specify ESR in mΩ (2K0 = 2,000 mΩ)

Performance Characteristics

Item	Specifications
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	220 µF @ 120 Hz/25°C
Capacitance Tolerance	M Tolerance (20%)
Rated Voltage Range	4 V
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.1 CV (µA) at rated voltage after 5 minutes

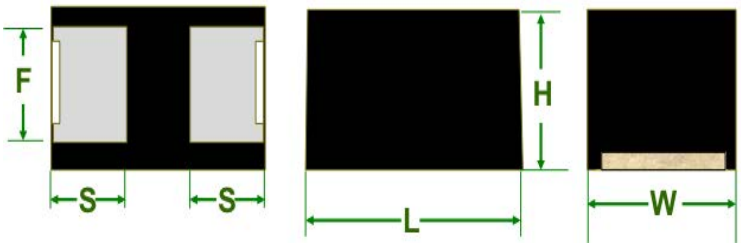
Qualification

Test	Condition/Characteristics				
Endurance	85°C @ rated voltage, 1,000 hours		Δ C/C	Within initial Δ C/C limits	
			DF	Within 1.5 x initial limits	
			DCL	Within initial limit	
Damp Heat Steady State	40°C, 90 to 95% RH, 500 hours		Δ C/C	Within ±20% of initial Δ C/C limits	
			DF	Within 1.5 x initial limits	
			DCL	Within initial limit	
Temperature Stability	Extreme temperature exposure at -55°C and +125°C		+25°C	-55°C	+125°C
		Δ C/C	IL*	-20% to 0% of Δ C/C	-50% - 0% of Δ C/C
		DF	IL	IL	IL
		DCL	IL	IL	1.25 CV
Surge Voltage	1.3 Vr, 85°C, 1,000 Ω resistor, 1,000 cycles		Δ C/C	Within initial Δ C/C limits	
			DF	Within initial limit	
			DCL	Within initial limit	
Mechanical Shock	100 G, Saw-Tooth wave		Δ C/C	Within initial Δ C/C limits	
			DF	Within initial limit	
			DCL	Within initial limit	
Vibration	Frequency: 10 to 2 kHz, Sweep: 1 minute, Amplitude of vibration: 1.5 mm, Vibration Time: Each plane shall be 2 hours for a total of 4 hours.		Δ C/C	Within initial Δ C/C limits	
			DF	Within initial limit	
			DCL	Within initial limit	
Terminal strength	Strength: 4.9 N, Time: 10 ±0.5 seconds (two directions)		Visual	No evidence of mechanical damage	

**IL = Initial limit*

Dimensions – Millimeters

Metric will govern



KEMET	EIA	L	W	H	F	S
R	2012–12	2.0 ±0.1	1.35 ±0.1	1.2 Maximum	0.9 ±0.1	0.55 ±0.1

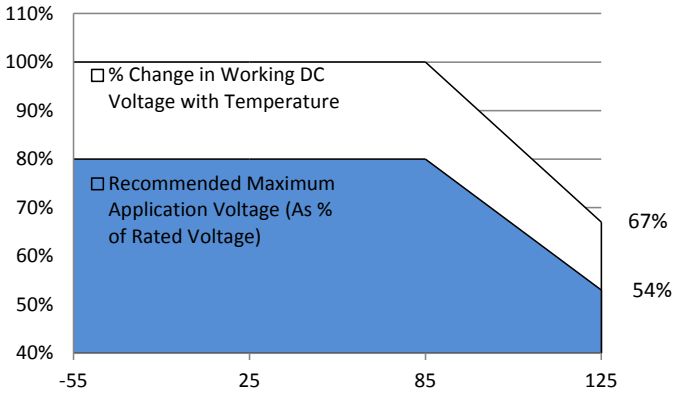
Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current			Rated Temp.
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz, 25°C	(mA) 100 kHz, 85°C	(mA) 100 kHz, 125°C	°C
4	220	R/2012-12	T488R227M004AAE2K0	88.0	6.0	2	224	202	90	125

Refer to Ordering Information for additional detail.

Recommended Voltage Derating Guidelines

	-55°C to 85°C	85°C to 125°C
% Change in Working DC Voltage with Temperature	V_R	See Chart
Recommended Maximum Application Voltage	80% of V_R	See Chart



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 Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C w/+20°C Rise
R	2012-12	25

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

T= Environmental Temperature

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)

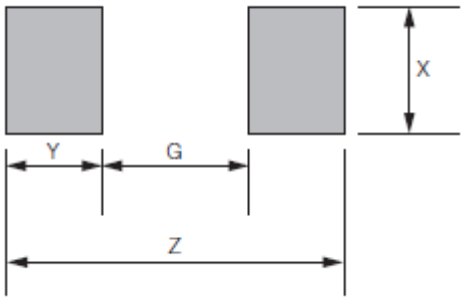
Temperature Compensation Multipliers for Maximum Power Dissipation		
T ≤ 25°C	T ≤ 85°C	T ≤ 125°C
1.00	0.90	0.40

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	Dimensions in mm			
Case	EIA	G Maximum	Z Minimum	X Minimum	Y ref
R	2012–12	1.05	2.05	0.80	1.05

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.

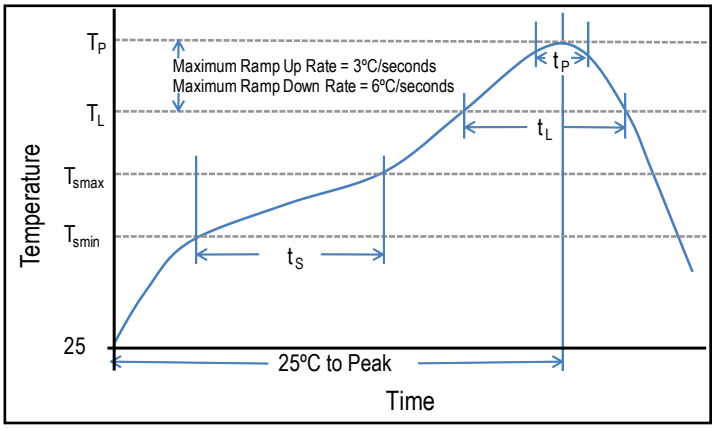
Note that although the X/7343–43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

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.

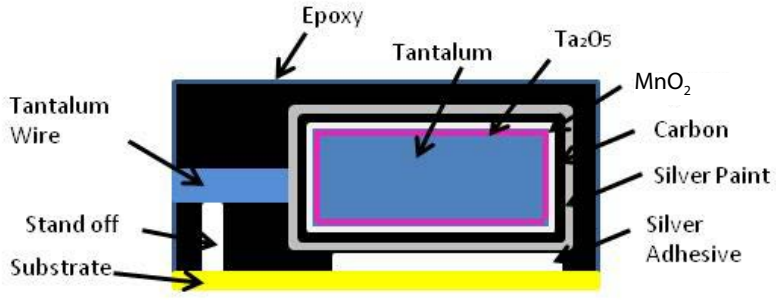
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

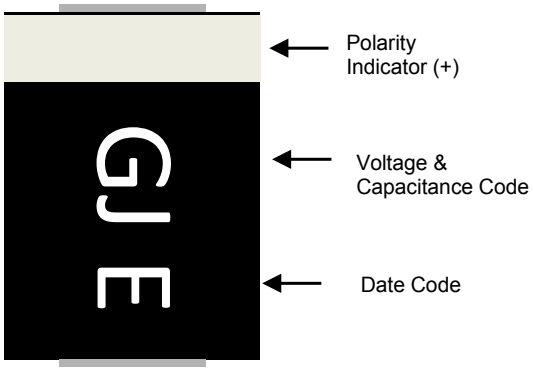
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.
**Case Size D, E, P, Y, and X*
***Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z*



Construction



Capacitor Marking



Code	G
Rated Voltage	4 V

Code	J
Capacitance	220

Date Code *												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013	A	B	C	D	E	F	G	H	J	K	L	M
2014	N	P	Q	R	S	T	U	V	W	X	Y	Z
2015	a	b	c	d	e	f	g	h	j	k	l	m
2016	n	p	q	r	s	t	u	v	w	x	y	z

Storage

The T488 Series is shipped in moisture barrier bags with a desiccant and moisture indicator card. This series is classified as MSL3 (Moisture Sensitivity Level 3). Product contained within the moisture barrier bags should be stored in normal working environments with temperatures not to exceed 30°C and humidity not in excess of 60% RH.

T489 Low DC Leakage MnO_2 Series

Overview

The KEMET T489 Series provides DC leakage current that is 25% lower than the commercial T491 Series. The T489 series also offers improved reliability, low ESR options and meets or exceeds the requirements of EIA standard 535BAAC. This series is classified as MSL (Mositure Sensitivity Level) 1 under J STD 020: unlimited floor life time at ≤30°C / 85% RH. The T489 standard terminations are available in 100% matte tin and provide excellent wetting characteristics and compatibility with today's surface mount solder systems. Tin/lead (Sn/Pb) terminations are available upon request for any part number. Gold-plated terminations are also available for use with conductive epoxy attachment processes. Standard packaging of these devices is tape and reel in accordance with EIA 481-1. This system provides perfect compatibility with all tape-fed placement units.

Benefits

- DC Leakage at 0.0075 CV
- Improved reliability: 0.50%/1,000 hours, 85°C, rated voltage
- Low ESR options available
- Meets or exceeds EIA standard 535BAAC
- Taped and reeled per EIA 481–1
- Symmetrical, compliant terminations
- Laser-marked case
- Halogen-free epoxy
- Capacitance values of 0.1 µF to 470 µF
- Tolerances of ±10% and ±20%
- Voltage rating of 6.3 – 50 VDC
- RoHS Compliant and lead-free terminations
- Operating temperature range of -55˚C to +125˚C

Applications

Typical applications include decoupling and filtering in industrial and automotive high end applications.

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	489	B	156	M	16	A	T	E800
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	ESR
T = Tantalum	Low DC Leakage Series	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 016 = 16 V 020 = 20 V 025 = 25 V 035 = 35 V 050 = 50 V	A = N/A	T = 100% Matte Tin (Sn) Plated H = Standard Solder Coated (SnPb 5% Pb minimum) G = Gold Plated	Last three digits specify ESR in mΩ. (800 = 800 mΩ)

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	0.10 µF to 470 µF @ 120 Hz/25°C
Capacitance Tolerance	K Tolerance (±10%), M Tolerance (±20%)
Rated Voltage Range	6.3 – 50 V
DF(120 Hz)	Refer to Part Number Electrical Specification
ESR (100 kHz)	Refer to Part Number Electrical Specification
Leakage Current	≤ 0.0075 CV (µA) at rated voltage after 5 minutes
Reliability	0.50%/1,000 hours at 85°C, V_R with 0.1 Ω series resistance

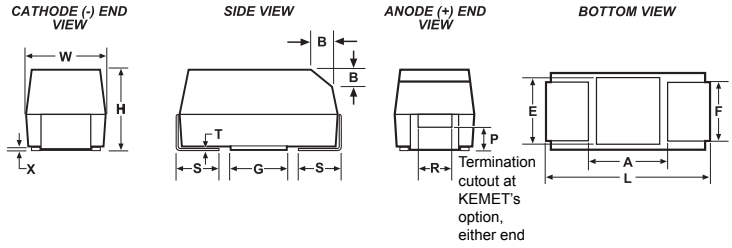
Qualification

Test	Condition		Characteristics			
Endurance	85°C @ rated voltage, 2,000 hours 125°C @ 2/3 rated voltage, 2,000 hours		Δ C/C	Within ±10% of initial value		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Storage Life	125°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, -55C° to 125° 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, +125°C, +25°C			+25°C	-55°C	+85°C	+125°C
		Δ C/C		IL*	±10%	±10%	±20%
		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 (125°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*

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 (0.126 ±0.008)	1.6 ±0.2 (.063 ±0.008)	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 ±02 (0.138 ±0.008)	2.8 ±0.2 (.110 ±0.008)	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 (0.236 ±0.03)	3.2 ±0.3 (.126 ±0.012)	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 (0.287 ±0.012)	4.3 ±0.3 (.169 ±0.012)	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 (0.287 ±0.012)	4.3 ±0.3 (.169 ±0.012)	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)

** MIL–PRF–55365/8 specified dimensions*

Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR		Low ESR	
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +25°C Maximum/ 5 Minutes	% @ +25°C 120 Hz Maximum	mΩ @ +25°C 100 kHz Maximum	E-Spec Code	mΩ @ +25°C 100 kHz Maximum	E-Spec Code
6.3	10	B/3528-21	T489B106(1)006A(2)	0.5	6.0	3000	E3K0		
6.3	15	A/3216-18	T489A156(1)006A(2)	0.7	6.0	2030	E2K0	1500	E1K5
6.3	22	C/6032-28	T489C226(1)006A(2)	1.0	6.0	2000	E2K0		
6.3	47	B/3528-21	T489B476(1)006A(2)	2.1	6.0	1620	E1K6	500	E500
6.3	150	B/3528-21	T489B157(1)006A(2)	7.1	15.0	3000	E3K0		
6.3	100	C/6032-28	T489C107(1)006A(2)	4.5	6.0	440	E440		
6.3	150	C/6032-28	T489C157(1)006A(2)	6.8	8.0	500	E500	300	E300
6.3	100	D/7343-31	T489D107(1)006A(2)	4.7	8.0	800	E800		
6.3	150	D/7343-31	T489D157(1)006A(2)	6.8	6.0	400	E400	150	E150
6.3	220	D/7343-31	T489D227(1)006A(2)	9.9	8.0	360	E360	150	E150
6.3	470	X/7343-43	T489X477(1)006A(2)	21.0	8.0	250	E250	200	E200
10	2.2	A/3216-18	T489A225(1)010A(2)	0.3	6.0	7000	E7K0		
10	4.7	A/3216-18	T489A475(1)010A(2)	0.4	6.0	2900	E2K9		
10	6.8	A/3216-18	T489A685(1)010A(2)	0.5	6.0	2650	E2K6		
10	6.8	B/3528-21	T489B685(1)010A(2)	0.5	6.0	3000	E3K0		
10	10	A/3216-18	T489A106(1)010A(2)	0.8	6.0	2200	E2K2	1800	E1K8
10	15	B/3528-21	T489B156(1)010A(2)	1.1	6.0	2030	E2K0		
10	15	C/6032-28	T489C156(1)010A(2)	1.1	6.0	2000	E2K0		
10	22	B/3528-21	T489B226(1)010A(2)	1.7	6.0	1880	E1K8	700	E700
10	33	B/3528-21	T489B336(1)010A(2)	2.5	6.0	1000	E1K0	650	E650
10	33	C/6032-28	T489C336(1)010A(2)	2.5	6.0	590	E590		
10	33	D/7343-31	T489D336(1)010A(2)	2.5	6.0	1100	E1K1		
10	47	C/6032-28	T489C476(1)010A(2)	3.5	6.0	540	E540		
10	47	D/7343-31	T489D476(1)010A(2)	3.5	6.0	400	E400		
10	68	C/6032-28	T489C686(1)010A(2)	5.1	6.0	490	E490		
10	100	C/6032-28	T489C107(1)010A(2)	7.5	8.0	500	E500		
10	100	D/7343-31	T489D107(1)010A(2)	7.5	6.0	440	E440	150	E150
10	150	D/7343-31	T489D157(1)010A(2)	11.0	8.0	400	E400	150	E150
10	220	D/7343-31	T489D227(1)010A(2)	16.5	8.0	500	E500		
10	330	X/7343-43	T489X337(1)010A(2)	25.0	8.0	300	E300	100	E100
16	1	A/3216-18	T489A105(1)016A(2)	0.3	6.0	10000	E10K		
16	2.2	A/3216-18	T489A225(1)016A(2)	0.3	6.0	4550	E4K5	3500	E3K5
16	3.3	B/3528-21	T489B335(1)016A(2)	0.4	6.0	4500	E4K5		
16	4.7	B/3528-21	T489B475(1)016A(2)	0.6	6.0	3160	E3K1		
16	6.8	B/3528-21	T489B685(1)016A(2)	0.8	6.0	2650	E2K6		
16	6.8	C/6032-28	T489C685(1)016A(2)	0.8	6.0	2500	E2K5		
16	10	B/3528-21	T489B106(1)016A(2)	1.2	6.0	2200	E2K2		
16	10	C/6032-28	T489C106(1)016A(2)	1.2	6.0	2000	E2K0		
16	15	B/3528-21	T489B156(1)016A(2)	1.8	6.0	2030	E2K0	800	E800
16	22	B/3528-21	T489B226(1)016A(2)	2.6	6.0	1100	E1K1	600	E600
16	22	C/6032-28	T489C226(1)016A(2)	2.6	6.0	700	E700	350	E350
16	22	D/7343-31	T489D226(1)016A(2)	2.6	6.0	1100	E1K1		
16	33	C/6032-28	T489C336(1)016A(2)	4.0	6.0	590	E590		
16	47	C/6032-28	T489C476(1)016A(2)	5.6	6.0	540	E540	350	E350
16	47	D/7343-31	T489D476(1)016A(2)	5.6	6.0	540	E540	200	E200
16	68	D/7343-31	T489D686(1)016A(2)	8.2	6.0	490	E490	150	E150
16	100	D/7343-31	T489D107(1)016A(2)	12.0	6.0	440	E440	150	E150
16	150	D/7343-31	T489D157(1)016A(2)	18.0	12.0	700	E700		
20	1	A/3216-18	T489A105(1)020A(2)	0.3	4.0	6630	E6K6		
20	1.5	A/3216-18	T489A155(1)020A(2)	0.3	6.0	5460	E5K4		
20	2.2	A/3216-18	T489A225(1)020A(2)	0.3	6.0	4550	E4K5		
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +25°C Maximum/ 5 Minutes	% @ +25°C 120 Hz Maximum	mΩ @ +25°C 100 kHz Maximum	E-Spec Code	mΩ @ +25°C 100 kHz Maximum	E-Spec Code
Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR		Low ESR	

(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). 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 Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR		Low ESR	
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +25°C Maximum/ 5 Minutes	% @ +25°C 120 Hz Maximum	mΩ @ +25°C 100 kHz Maximum	E-Spec Code	mΩ @ +25°C 100 kHz Maximum	E-Spec Code
20	3.3	A/3216-18	T489A335(1)020A(2)	0.5	6.0	3740	E3K7	3500	E3K5
20	3.3	B/3528-21	T489B335(1)020A(2)	0.5	6.0	3740	E3K7		
20	4.7	B/3528-21	T489B475(1)020A(2)	0.7	6.0	3160	E3K1		
20	6.8	B/3528-21	T489B685(1)020A(2)	1.0	6.0	2650	E2K6		
20	6.8	C/6032-28	T489C685(1)020A(2)	1.0	6.0	2000	E2K0		
20	10	B/3528-21	T489B106(1)020A(2)	1.5	6.0	2200	E2K2	1000	E1K0
20	10	C/6032-28	T489C106(1)020A(2)	1.5	6.0	800	E800	500	E500
20	15	C/6032-28	T489C156(1)020A(2)	2.3	6.0	720	E720	400	E400
20	15	D/7343-31	T489D156(1)020A(2)	2.3	6.0	1100	E1K1		
20	22	D/7343-31	T489D226(1)020A(2)	3.3	6.0	650	E650	300	E300
20	33	C/6032-28	T489C336(1)020A(2)	5.0	6.0	590	E590	300	E300
20	33	D/7343-31	T489D336(1)020A(2)	5.0	6.0	590	E590	250	E250
20	47	D/7343-31	T489D476(1)020A(2)	7.1	6.0	540	E540	200	E200
20	68	D/7343-31	T489D686(1)020A(2)	10.0	6.0	490	E490	200	E200
20	100	X/7343-43	T489X107(1)020A(2)	15.0	6.0	300	E300	150	E150
25	0.47	A/3216-18	T489A474(1)025A(2)	0.3	4.0	9530	E9K5	7000	E7K0
25	0.68	A/3216-18	T489A684(1)025A(2)	0.3	4.0	7980	E7K9		
25	1	A/3216-18	T489A105(1)025A(2)	0.3	4.0	6630	E6K6		
25	2.2	B/3528-21	T489B225(1)025A(2)	0.4	6.0	4550	E4K5		
25	3.3	B/3528-21	T489B335(1)025A(2)	0.6	6.0	3740	E3K7	2000	E2K0
25	4.7	B/3528-21	T489B475(1)025A(2)	0.9	6.0	3160	E3K1	1000	E1K0
25	6.8	B/3528-21	T489B685(1)025A(2)	1.3	6.0	1500	E1K5	1000	E1K0
25	6.8	C/6032-28	T489C685(1)025A(2)	1.3	6.0	1070	E1K0	600	E600
25	10	C/6032-28	T489C106(1)025A(2)	1.9	6.0	800	E800	600	E600
25	10	D/7343-31	T489D106(1)025A(2)	1.9	6.0	1200	E1K2		
25	15	C/6032-28	T489C156(1)025A(2)	2.8	6.0	720	E720		
25	15	D/7343-31	T489D156(1)025A(2)	2.8	6.0	720	E720	300	E300
25	22	D/7343-31	T489D226(1)025A(2)	4.1	6.0	650	E650	300	E300
25	33	D/7343-31	T489D336(1)025A(2)	6.2	6.0	590	E590	400	E400
25	47	D/7343-31	T489D476(1)025A(2)	8.8	6.0	540	E540	250	E250
35	0.1	A/3216-18	T489A104(1)035A(2)	0.3	4.0	20000	E20K		
35	0.22	A/3216-18	T489A224(1)035A(2)	0.3	4.0	13710	E13K		
35	0.33	A/3216-18	T489A334(1)035A(2)	0.3	4.0	11280	E11K		
35	1	A/3216-18	T489A105(1)035A(2)	0.3	4.0	6630	E6K6	3000	E3K0
35	1	B/3528-21	T489B105(1)035A(2)	0.3	4.0	3400	E3K4	2000	E2K0
35	1.5	B/3528-21	T489B155(1)035A(2)	0.4	6.0	5460	E5K4	2500	E2K5
35	2.2	B/3528-21	T489B225(1)035A(2)	0.6	6.0	4550	E4K5	2000	E2K0
35	3.3	B/3528-21	T489B335(1)035A(2)	0.9	6.0	3740	E3K7		
35	3.3	C/6032-28	T489C335(1)035A(2)	0.9	6.0	1840	E1K8	800	E800
35	4.7	C/6032-28	T489C475(1)035A(2)	1.2	6.0	1410	E1K4	600	E600
35	4.7	D/7343-31	T489D475(1)035A(2)	1.2	6.0	1500	E1K5		
35	6.8	C/6032-28	T489C685(1)035A(2)	1.8	6.0	1070	E1K0	600	E600
35	6.8	D/7343-31	T489D685(1)035A(2)	1.8	6.0	1300	E1K3		
35	10	C/6032-28	T489C106(1)035A(2)	2.6	6.0	800	E800	600	E600
35	10	D/7343-31	T489D106(1)035A(2)	2.6	6.0	800	E800	400	E400
35	15	D/7343-31	T489D156(1)035A(2)	3.9	6.0	720	E720	350	E350
35	22	D/7343-31	T489D226(1)035A(2)	5.8	6.0	650	E650	300	E300
50	0.22	A/3216-18	T489A224(1)050A(2)	0.3	4.0	7500	E7K5	7000	E7K0
50	0.33	A/3216-18	T489A334(1)050A(2)	0.3	4.0	7000	E7K0		
50	0.68	B/3528-21	T489B684(1)050A(2)	0.3	4.0	4000	E4K0	2000	E2K0
50	1	C/6032-28	T489C105(1)050A(2)	0.4	4.0	3000	E3K0		
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +25°C Maximum/ 5 Minutes	% @ +25°C 120 Hz Maximum	mΩ @ +25°C 100 kHz Maximum	E-Spec Code	mΩ @ +25°C 100 kHz Maximum	E-Spec Code
Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR		Low ESR	

(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). 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.

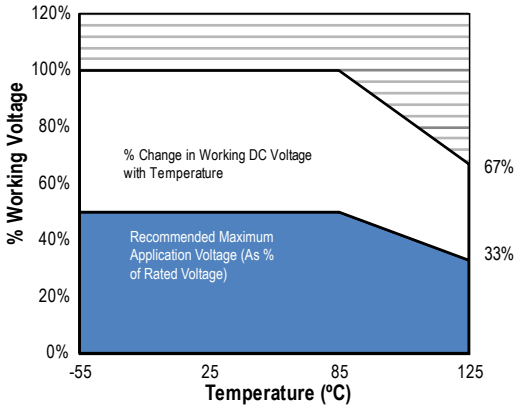
Table 1 – Ratings & Part Number Reference cont'd

Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR		Low ESR	
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +25°C Maximum/ 5 Minutes	% @ +25°C 120 Hz Maximum	mΩ @ +25°C 100 kHz Maximum	E-Spec Code	mΩ @ +25°C 100 kHz Maximum	E-Spec Code
50	1.5	C/6032-28	T489C155(1)050A(2)	0.6	6.0	2500	E2K5	1500	E1K5
50	2.2	C/6032-28	T489C225(1)050A(2)	0.8	6.0	1700	E1K7	1000	E1K0
50	2.2	D/7343-31	T489D225(1)050A(2)	0.8	4.5	2000	E2K0	1200	E1K2
50	3.3	D/7343-31	T489D335(1)050A(2)	1.2	4.5	1100	E1K1	800	E800
50	4.7	D/7343-31	T489D475(1)050A(2)	1.8	4.5	900	E900	600	E600
50	6.8	D/7343-31	T489D685(1)050A(2)	2.6	4.5	700	E700		
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +25°C Maximum/ 5 Minutes	% @ +25°C 120 Hz Maximum	mΩ @ +25°C 100 kHz Maximum	E-Spec Code	mΩ @ +25°C 100 kHz Maximum	E-Spec Code
Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	Standard ESR		Low ESR	

(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). 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

	-55°C to 85°C	85°C to 125°C
% Change in Working DC Voltage with Temperature	V_R	67% of V_R
Recommended Maximum Application Voltage	50% of V_R	33% of V_R



Ripple Current/Ripple Voltage

KEMET Series and Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C w/+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
1.00	0.90	0.40

T= Environmental Temperature

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)
Pmax = 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)				
Case	EIA	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

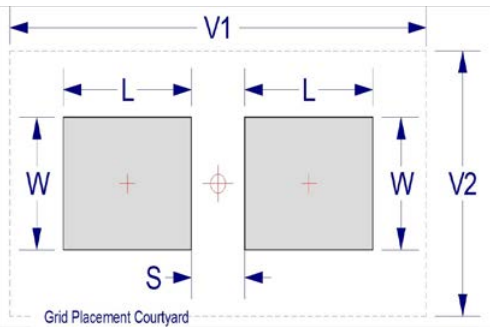
Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.*

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 desity 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.

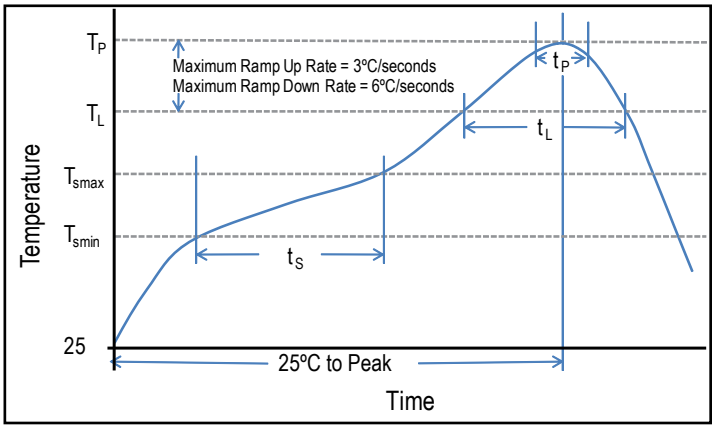
Note that although the X/7343–43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

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.

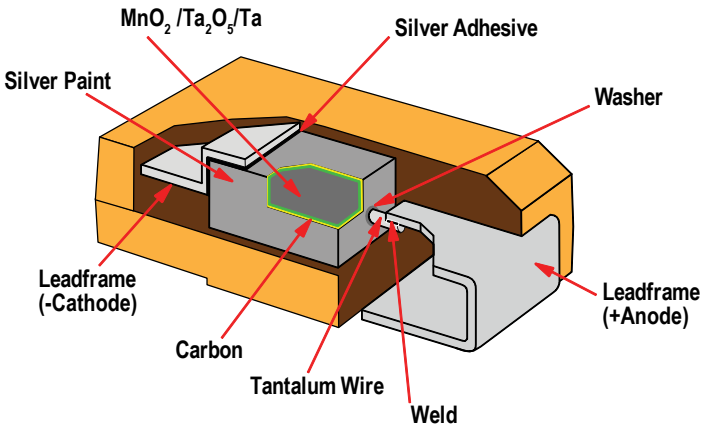
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

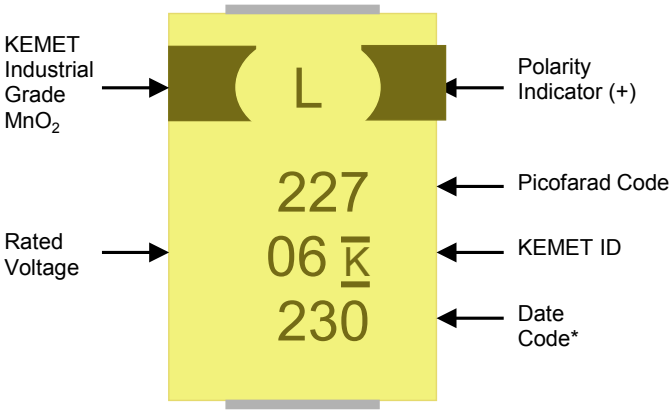
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.
**Case Size D, E, P, Y, and X*
***Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z*



Construction



Capacitor Marking



* 230 = 30th week of 2012

Date Code *	
1st digit = Last number of Year	9 = 2009 0 = 2010 1 = 2011 2 = 2012 3 = 2013 4 = 2014
2nd and 3rd digit = Week of the Year	01 = 1st week of the Year to 52 = 52nd 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 40ºC 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.

T490 Consumer Grade MnO_2 Series

Overview

The KEMET T490 Series, designed for customer product applications (low temperature demanding applications), meets RoHS compliance with leads constructed of 100% matte tin and green molding compound. This series is classified as MSL (Mositure Sensitivity Level) 1 under J STD 020: unlimited floor life time at ≤30°C / 85% RH. Tin/lead (Sn/Pb) terminations are available upon request for any part number. Gold-plated terminations are also available for use with conductive epoxy attachment processes. Standard packaging of these devices is tape and reel in accordance with EIA 481-1. This system provides perfect compatibility with all tape-fed placement units.

Benefits

- Taped and reeled per EIA 481–1
- Symmetrical compliant terminations
- Optional gold-plated terminations
- Laser-marked case
- Suitable for 3 x 260°C reflow passes
- Halogen-free epoxy
- Capacitance values of 47 µF to 470 µF
- Tolerance of ±20%
- Voltage rating of 4 – 10 VDC
- 0.2% per 1,000 hours at 85ºC 0.5 V_R Reliability
- Small and low profile case sizes
- RoHS Compliant and lead-free terminations
- MSL Reflow Temp ≤ 260ºC = 1
- Operating temperature range of -55˚C to +40˚C

Applications

Typical applications include decoupling and filtering in communications end applications such as cellphones and consumer mobile.

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	490	B	227	M	006	A	T	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/ Design	Lead Material	Packaging (C-Spec)
T = Tantalum	Industrial	A, B, T	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	004 = 4 V 006 = 6.3 V 010 = 10 V	A = N/A	T = 100% Matte Tin (Sn) Plated H = Standard Solder Coated (SnPb 5% Pb minimum) G = Gold Plated (A, B only)	Blank = 7" Reel 7280 = 13" Reel

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 40°C
Rated Capacitance Range	47 – 470 µF @ 120 Hz/25°C
Capacitance Tolerance	M Tolerance (20%)
Rated Voltage Range	4 – 10 V
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	≤ 0.01 CV (µA) at rated voltage after 5 minutes

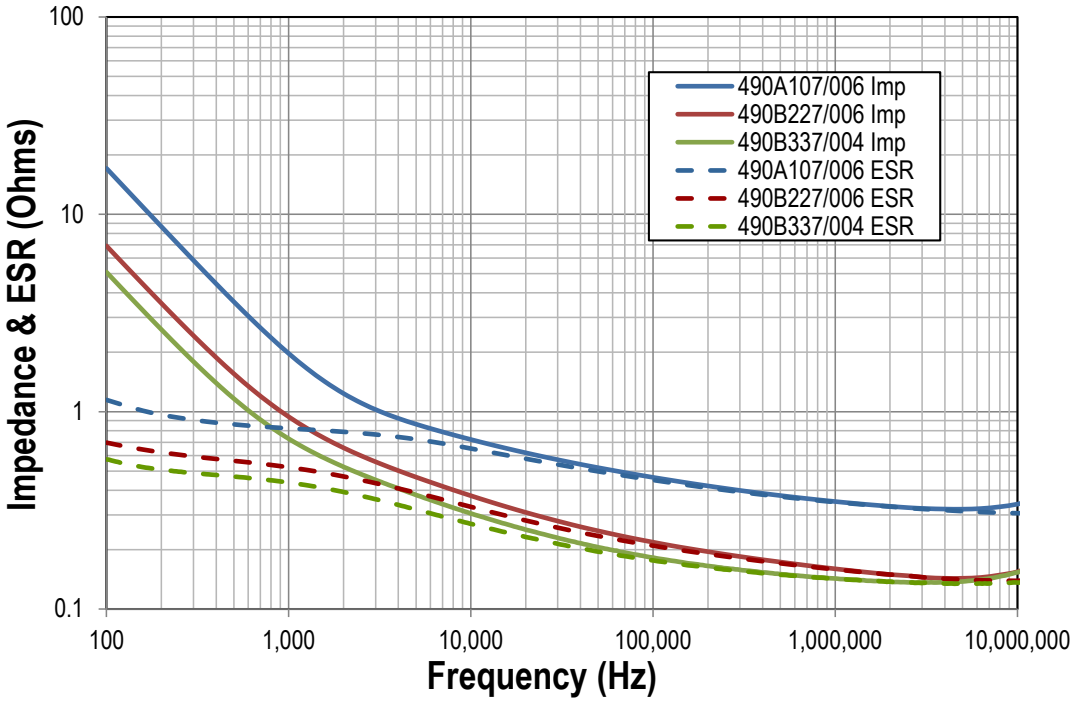
Qualification

Test	Condition		Characteristics			
Endurance	40°C @ 1.0 V_R 85°C @ 1/2 V_R and 125°C @ 1/5 rated voltage, 1,000 hours		Δ C/C	Within +10%/- 20% of initial value		
			DCL	Within 2 x initial limit		
			ESR	Within 2.5 x initial limits		
Storage Life	85°C @ 0 volts, 1,000 hours		Δ C/C	Within +10%/- 20% of initial value		
			DCL	Within 1.25 x initial limit		
			ESR	Within initial limits		
Humidity	40°C, 93% RH, 1,000 hours, no load		Δ C/C	Within -5%/+35% of initial value		
			DCL	Within 2.0 x initial limit		
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	+125°C
		Δ C/C	IL*	±10%	±20%	±30%
		DCL	IL	n/a	10 x IL	15 x IL
Surge Voltage	40°C, 1.32 x rated voltage 1,000 cycles		Δ C/C	Within +10%/- 20% of initial value		
			DCL	Within 2.0 x initial limits		
			ESR	Within 1.25 x initial limits		

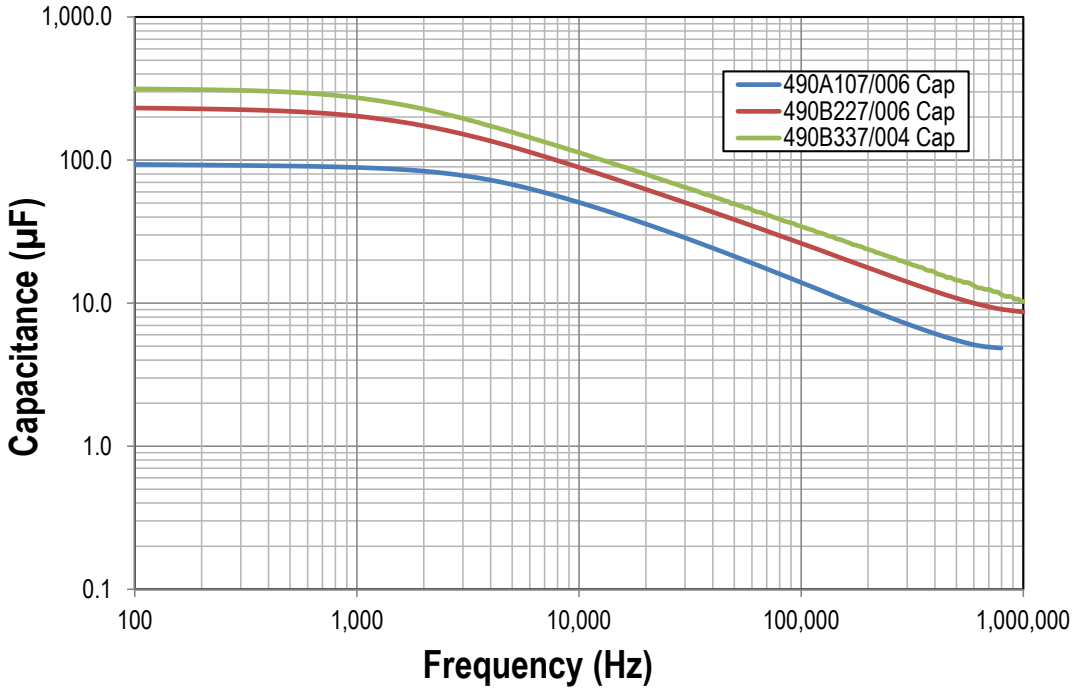
**IL = Initial limit*

Electrical Characteristics

ESR vs. Frequency

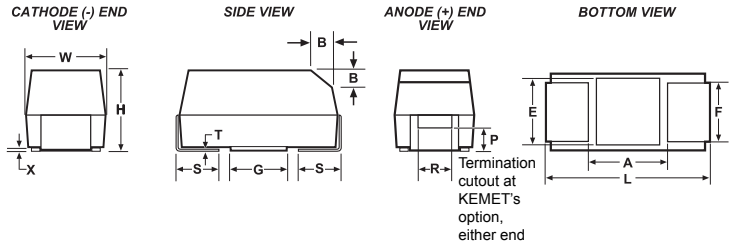


Capacitance vs. Frequency



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 (0.126 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.6 ±0.2 (0.063 ±0.008)	1.2 (0.047)	0.8 (0.031)	0.4 (.016)	0.10 ±0.10 (0.004 ±0.004)	0.4 (0.016)	0.4 (0.016)	0.13 (.005)	0.8 (0.31)	1.1 (0.043)	1.3 (0.051)
B	3528-21	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.9 ±0.2 (0.075 ±0.008)	2.2 (0.087)	0.8 (0.031)	0.4 (.016)	0.10 ±0.10 (0.004 ±0.004)	0.5 (0.020)	1.0 (0.039)	0.13 (.005)	1.1 (0.043)	1.8 (0.071)	2.2 (0.087)
T	3528-12	3.5 ±0.2 (0.138 ±0.008)	2.8 ±0.2 (0.110 ±0.008)	1.2 (0.047)	2.2 (0.087)	0.8 (0.031)	n/a	0.05 (0.002)	n/a	n/a	0.13 (.005)	1.1 (0.043)	1.8 (0.071)	2.2 (0.087)

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	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	ESR	Maximum Allowable Ripple Current	Rated Temperature	Moisture Sensitivity
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(°C)	Reflow Temperature ≤ 260 °C
4	100	A/3216-18	T490A107M004A(1)E500	4.0	0.5	387	40	1
4	150	A/3216-18	T490A157M004A(1)E800	6.0	0.8	306	40	1
4	150	T/3528-12	T490T157M004A(1)E1K1	6.0	1.1	252	40	1
4	220	B/3528-21	T490B227M004A(1)E500	8.8	0.5	412	40	1
4	330	B/3528-21	T490B337M004A(1)E800	13.2	0.8	326	40	1
4	470	B/3528-21	T490B477M004A(1)E1K0	18.8	1.0	291	40	1
6	47	T/3528-12	T490T476M006A(1)E800	2.8	0.8	295	40	1
6	68	A/3216-18	T490A686M006A(1)E1K0	4.1	1.0	274	40	1
6	68	T/3528-12	T490T686M006A(1)E600	4.1	0.6	342	40	1
6	100	A/3216-18	T490A107M006A(1)E500	6.0	0.5	387	40	1
6	100	A/3216-18	T490A107M006A(1)E800	6.0	0.8	306	40	1
6	100	T/3528-12	T490T107M006A(1)E1K0	6.0	1.0	265	40	1
6	150	B/3528-21	T490B157M006A(1)E500	9.0	0.5	412	40	1
6	150	B/3528-21	T490B157M006A(1)E800	9.0	0.8	326	40	1
6	220	B/3528-21	T490B227M006A(1)E300	13.2	0.3	532	40	1
6	220	B/3528-21	T490B227M006A(1)E500	13.2	0.5	412	40	1
6	330	B/3528-21	T490B337M006A(1)E800	19.8	0.8	326	40	1
10	47	T/3528-12	T490T476M010A(1)E1K0	4.7	1.0	265	40	1
10	47	A/3216-18	T490A476M010A(1)E1K0	4.7	1.0	274	40	1
10	150	B/3528-21	T490B157M010A(1)E500	15.0	0.5	412	40	1
10	150	B/3528-21	T490B157M010A(1)E800	15.0	0.8	326	40	1
10	220	B/3528-21	T490B227M010A(1)E800	22.0	0.8	326	40	1
V	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	Ω @ +20°C 100 kHz Maximum	(mA) 100 kHz 25°C	(°C)	Reflow Temperature ≤ 260 °C
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	ESR	Maximum Allowable Ripple Current	Rated Temperature	Moisture Sensitivity

(1) To complete KEMET part number, insert T = 100% Matte Tin (Sn) Plated, G = Gold Plated, H = Standard Solder coated (SnPb 5% Pb minimum). Designates termination finish.

Blue color text denotes "Under Development"

Refer to Ordering Information for additional detail.

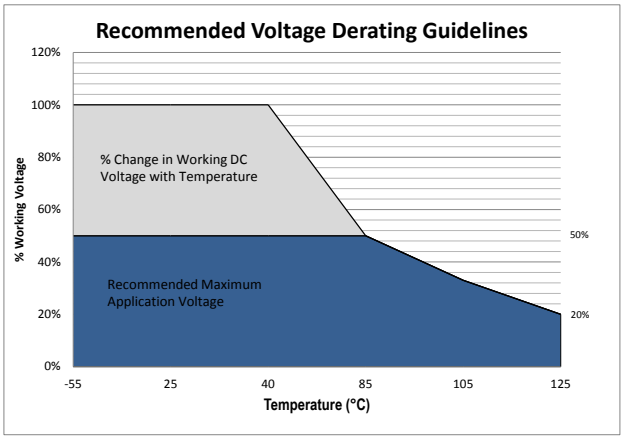
The ESR value may increase up to 1.5 x Initial Limit post mounting

The DCL value may increase up to 2.0 x Initial Limit post mounting

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

-55°C to 40°C		
% Change in Working DC Voltage with Temperature	100% of V_R	V_R
Recommended Maximum Application Voltage	50% of V_R	V_R
40°C to 85°C		
% Change in Working DC Voltage with Temperature	50% of V_R	V_R
Recommended Maximum Application Voltage	50% of V_R	V_R
85°C to 125°C		
% Change in Working DC Voltage with Temperature	20% of V_R	V_R
Recommended Maximum Application Voltage	20% of V_R	V_R



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 Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 25°C w/+20°C Rise
A	3216–18	75
B	3528–21	85
T	3528–12	70

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

Temperature Compensation Multipliers for Maximum Power Dissipation		
T ≤ 25°C	T ≤ 40°C	T ≤ 85°C
1.00	0.90	0.40

T= Environmental Temperature

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
40°C	5% of Rated Voltage
85°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)				
Case	EIA	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

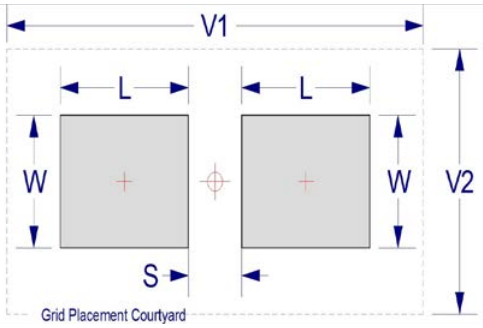
Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.*

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 desity 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.

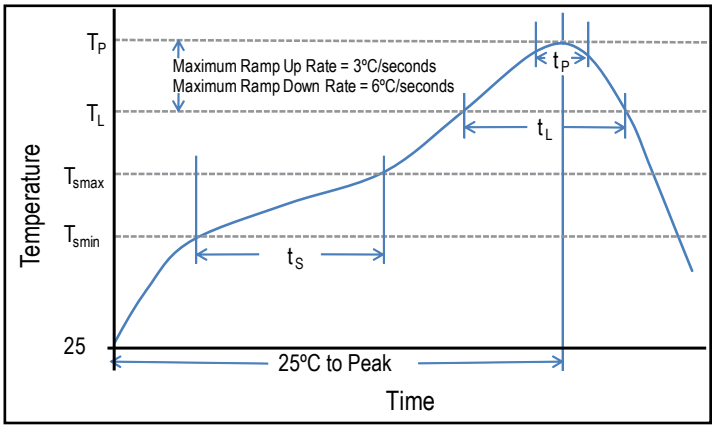
Note that although the X/7343–43 case size can withstand wave soldering, the tall profile (4.3 mm maximum) dictates care in wave process development.

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.

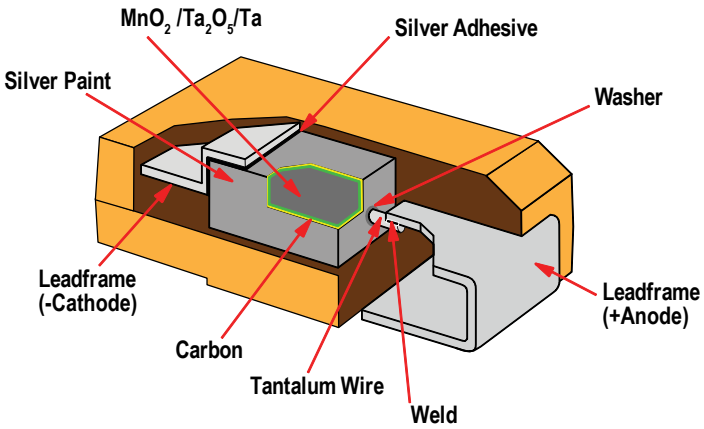
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

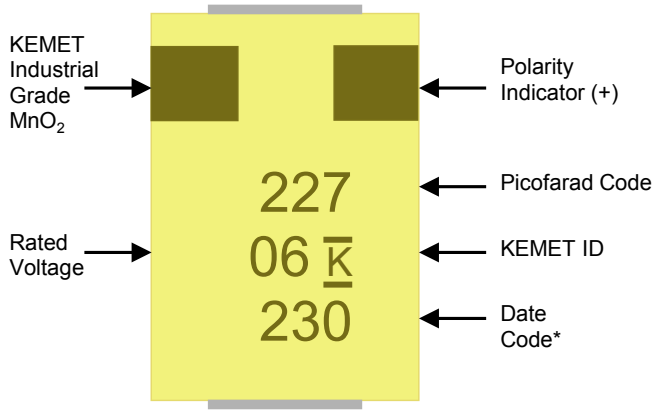
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.
**Case Size D, E, P, Y, and X*
***Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z*



Construction



Capacitor Marking



* 230 = 30th week of 2012

Date Code *	
1st digit = Last number of Year	9 = 2009 0 = 2010 1 =2011 2 = 2012 3 = 2013 4 = 2014
2nd and 3rd digit = Week of the Year	01 = 1st week of the Year to 52 = 52nd 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 40ºC 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.

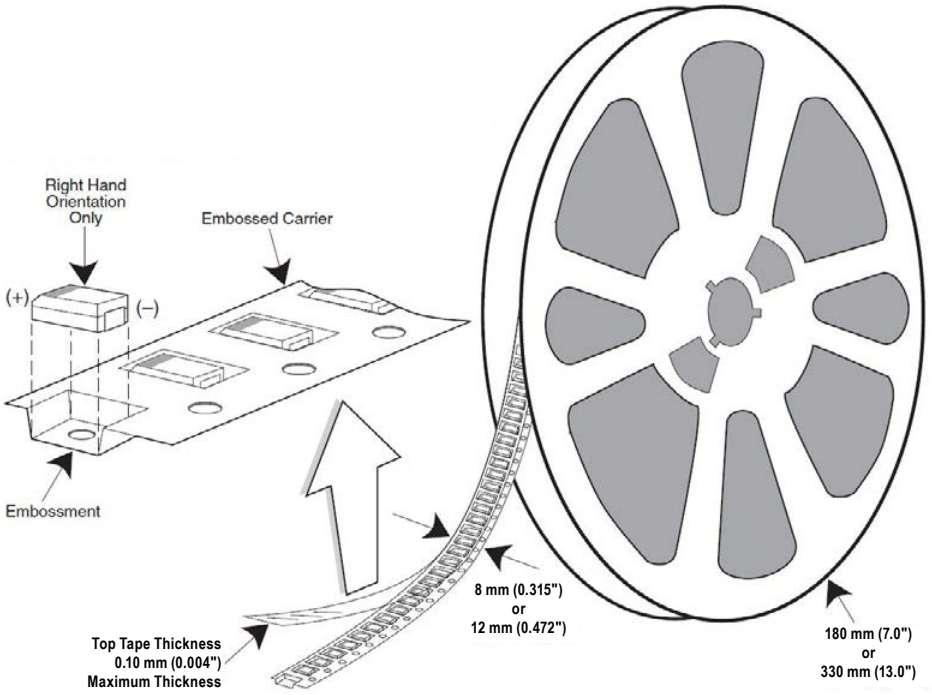


Table 3 – Packaging Quantity

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

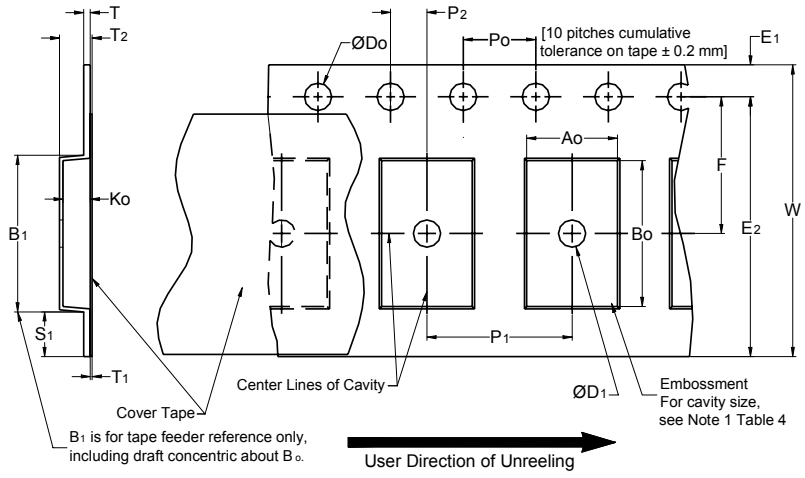


Table 4 – Embossed (Plastic) Carrier Tape Dimensions

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 S_1 < 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. B_1 dimension is a reference dimension for tape feeder clearance only.

5. The cavity defined by A_0, B_0 and K_0 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

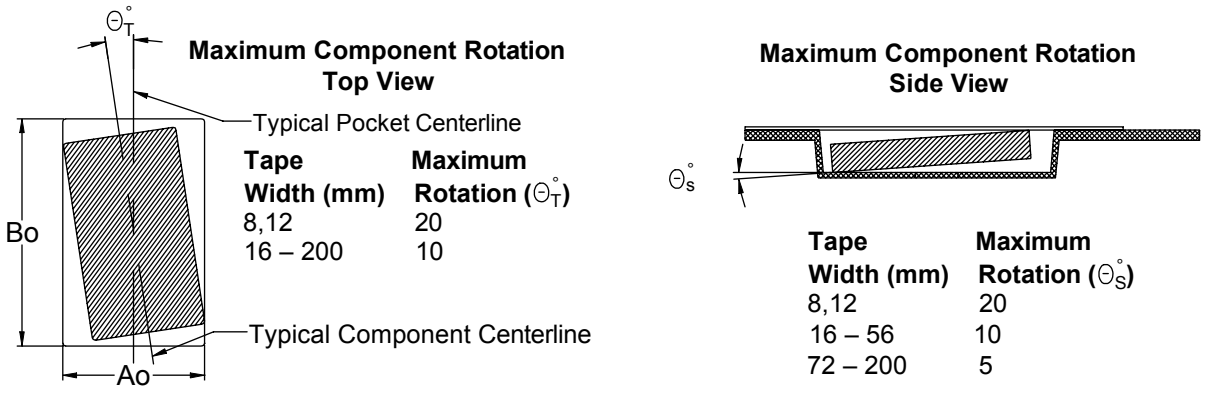


Figure 3 – Maximum Lateral Movement

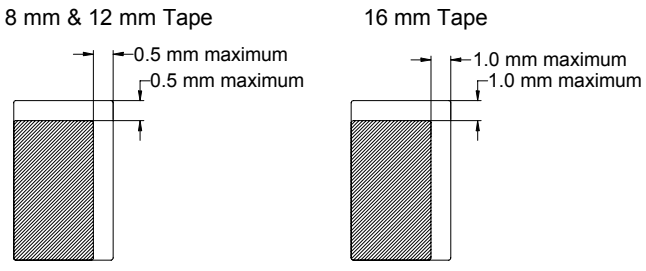


Figure 4 – Bending Radius

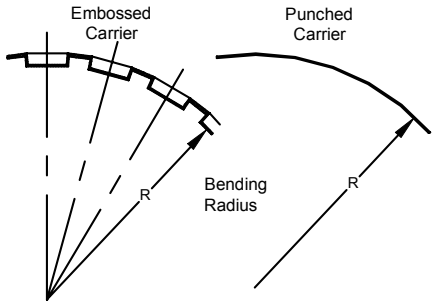
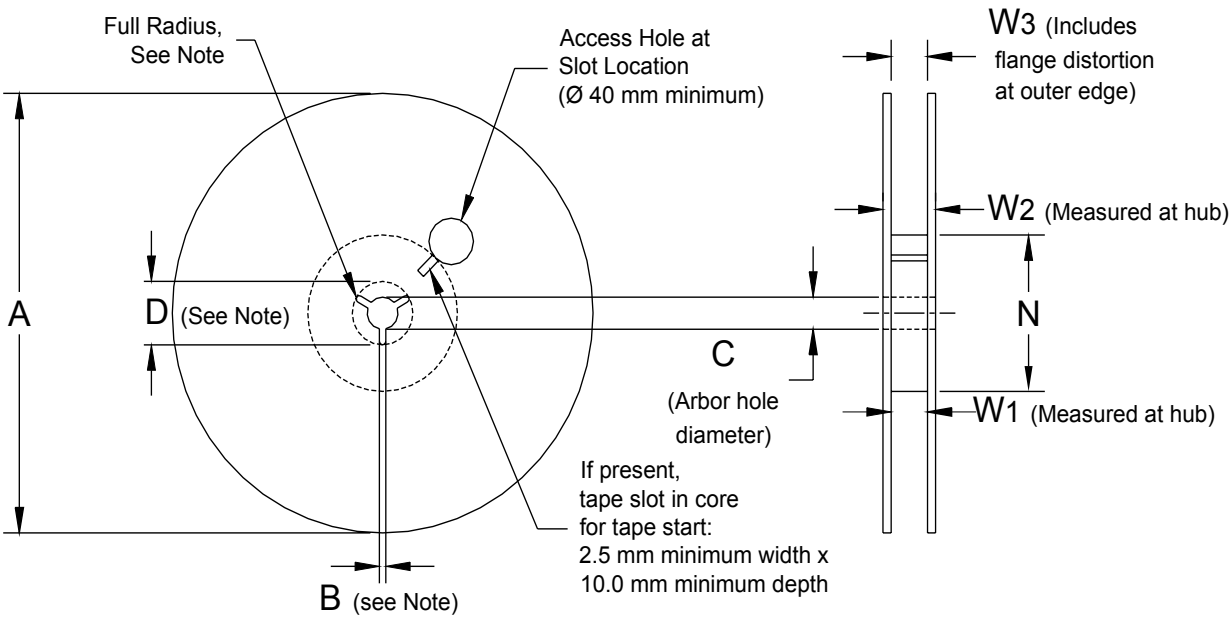


Figure 5 – Reel Dimensions



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

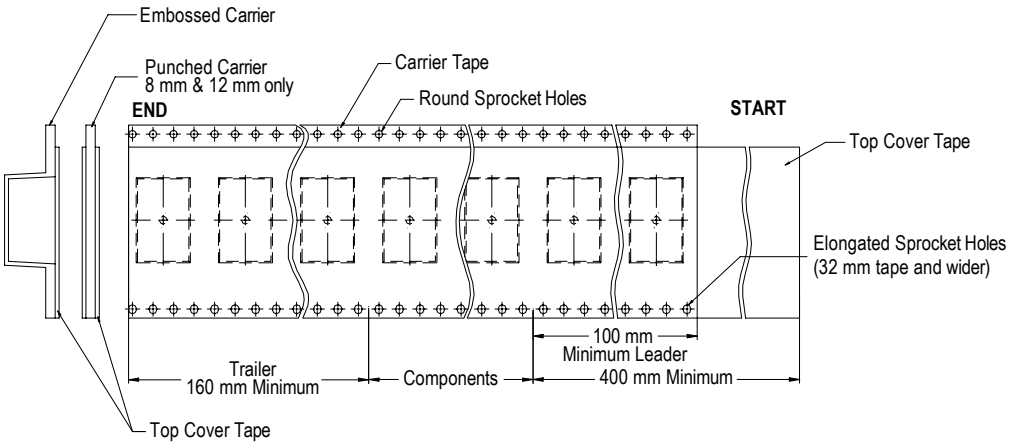
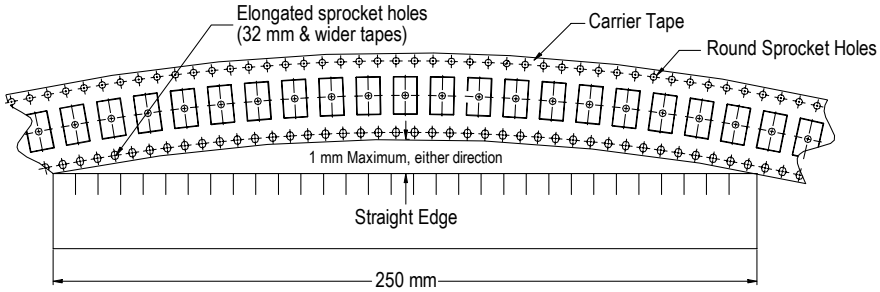


Figure 7 – Maximum Camber



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Resource	Location
Configure A Part: CapEdge	http://capacitoredge.kemet.com
SPICE & FIT Software	http://www.kemet.com/spice
Search Our FAQs: KnowledgeEdge	http://www.kemet.com/keask
Electrolytic LifeCalculator	http://www.kemet.com:8080/elc

Product Information	
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Products	http://www.kemet.com/products
Technical Resources (Including Soldering Techniques)	http://www.kemet.com/technicalpapers
RoHS Statement	http://www.kemet.com/rohs
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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 indicted or that other measures may not be required.

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