

Overview

The KEMET Organic Capacitor (KO-CAP) is a tantalum capacitor with a Ta anode and Ta₂O₅ dielectric. A conductive organic polymer replaces the traditionally used MnO₂ as the cathode plate of the capacitor. This results in very low ESR and improved capacitance retention at high frequency. The KO-CAP also exhibits a benign failure mode which eliminates the ignition failures that can occur in standard MnO₂ tantalum types. KO-CAPs may also be operated at steady state voltages up to 90% of rated voltage for part types with rated voltages of ≤10 volts and up to 80% of rated voltage for part types >10 volts with equivalent or better reliability than traditional MnO₂ tantalum capacitors operated at 50% of rated voltage.

The T530 Series KO-CAP offers the same advantages as the T520 Series but also has the added advantages of higher capacitance, 125°C performance capability, higher ripple current handling capability and a lower ESR range. Packaged as multiple anodes to reduce the depth that the signal must penetrate, this parallel arrangement reduces the ESR further still to achieve the highest capacitance and lowest ESR of any other type of surface mount capacitor with typical ESR values as low as 4 mΩ. With reduced ESR, the enhanced capacitance retention at higher frequencies provides the lowest total capacitance and most economical solution for high power applications.

Benefits

- ESR: 4 mΩ to 40 mΩ
- 125°C maximum operating temperature
- Polymer cathode technology
- High frequency capacitance retention
- Non-ignition failure mode
- Capacitance: 150 μF to 1,500 μF
- 100% accelerated steady state aging
- 100% surge current tested
- Utilizes multiple tantalum anode technology
- Volumetric efficiency
- Use up to 90% of rated voltage (10% derating) for part types ≤ 10 V
- Use up to 80% of rated voltage (20% derating) for part types > 10 V
- Self-healing mechanism
- EIA standard case sizes

Applications

Typical applications include high speed server, microprocessor decoupling and high ripple current 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	530	X	337	M	010	A	T	E005	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Failure Rate/Design	Lead Material	ESR Code	Packaging (C-Spec)
T = Tantalum	530 = High Capacitance 125°C Rated Polymer	D, X, Y	First two digits represent significant figures. Third digit specifies number of zeros.	M = $\pm 20\%$	2R5 = 2.5 V 003 = 3 V 004 = 4 V 006 = 6.3 V 010 = 10 V 016 = 16 V	A = N/A	T = 100% Matte Tin (Sn) Plated H = Tin/Lead (SnPb) Solder Coated (5% Pb minimum) G = Gold Plated	E = ESR Last three digits specify ESR in m Ω (005 = 5 m Ω)	Blank = 7" Reel 7280 = 13" Reel

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	-55°C to 125°C
Rated Capacitance Range	150 – 1,500 μF @ 120 Hz/25°C
Capacitance Tolerance	M Tolerance (20%)
Rated Voltage Range	2.5 – 16 V
DF (120 Hz)	8%
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	105°C @ rated voltage, 2,000 hours 125°C @ 2/3 rated voltage, 2,000 hours	Δ C/C	Within -20%/+10% of initial value			
		DF	≤ initial limit			
		DCL	2 x initial limit @ 125°C			
		ESR	2 x initial limit			
Storage Life	125°C @ 0 volts, 2,000 hours	Δ C/C	Within -20%/+10% of initial value			
		DF	Within initial limits			
		DCL	Within 2.0 x initial limit			
		ESR	Within 2.0 x initial limit			
Humidity	60°C, 90% RH, 1,000 hours, No Load	Δ C/C	Within -5%/+35% of initial value			
		DF	≤ initial limit			
		DCL	Within 3.0 x initial limit			
Temperature Stability	Extreme temperature exposure at a succession of continuous steps at +25°C, -55°C, +25°C, +85°C, +105°C, +25°C		+25°C	-55°C	+85°C	+125°C
		Δ C/C	IL*	±20%	±20%	±30%
		DF	IL	IL	1.2 x IL	1.5 x IL
Surge Voltage	105°C, 1.32 x rated voltage, 33Ω Resistance, 1,000 cycles	Δ C/C	Within -20%/+10% of initial value			
		DF	Within initial limits			
		DCL	Within initial limits			
Mechanical Shock/Vibration	MIL-STD-202, Method 213, Condition I, 100 G peak MIL-STD-202, Method 204, Condition D, 10 Hz to 2,000 Hz, 20 G peak	Δ C/C	Within ±10% of initial value			
		DF	Within initial limits			
		DCL	Within initial limits			

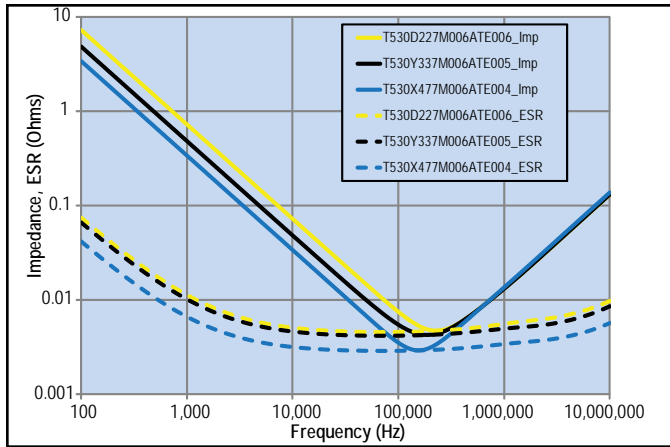
*IL = Initial limit

Certification

DSCC Drawing 04052

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)
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 (.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 (0.169 ±0.012)	4.3 ±0.3 (0.157 ±0.012)	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)
Y	7343-40	7.3 ±0.3 (0.287 ±0.012)	4.3 ±0.3 (0.169 ±0.012)	4.0 (0.157)	2.4 (.094)	1.3 (.051)	0.5 (.020)	0.10 ± 0.10 (.004 ± .004)	1.7 (.067)	1.0 (.039)	0.13 (.005)	3.8 (.150)	3.5 (.138)	3.5 (.138)

Notes: (Ref) – Dimensions provided for reference only. No dimensions 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	Rated Temp
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	mΩ @ +20°C 100 kHz Maximum	(mA) +45°C 100 kHz	Temperature ≤ 260°C	(°C)
2.5	470	D/7343-31	T530D477M2R5A(1)E005	118	8	5	7100	3	125
2.5	470	D/7343-31	T530D477M2R5A(1)E006	118	8	6	6500	3	125
2.5	470	D/7343-31	T530D477M2R5A(1)E010	118	8	10	5000	3	125
2.5	560	D/7343-31	T530D567M2R5A(1)E005	140	8	5	7100	3	125
2.5	680	Y/7343-40	T530Y687M2R5A(1)E005	170	8	5	7300	3	125
2.5	680	Y/7343-40	T530Y687M2R5A(1)E006	170	8	6	6600	3	125
2.5	680	Y/7343-40	T530Y687M2R5(1)E007	170	8	7	6100	3	125
2.5	680	D/7343-31	T530D687M2R5A(1)E006	170	8	6	6500	3	125
2.5	680	D/7343-31	T530D687M2R5A(1)E010	170	8	10	5000	3	125
2.5	680	D/7343-31	T530D687M2R5(1)E007	170	8	7	6000	3	125
2.5	680	X/7343-43	T530X687M2R5A(1)E006	170	8	6	6700	3	125
2.5	1000	Y/7343-40	T530Y108M2R5A(1)E005	250	8	5	7300	3	125
2.5	1000	Y/7343-40	T530Y108M2R5A(1)E006	250	8	6	6600	3	125
2.5	1000	X/7343-43	T530X108M2R5A(1)E004	250	8	4	8200	3	125
2.5	1000	X/7343-43	T530X108M2R5A(1)E005	250	8	5	7300	3	125
2.5	1000	X/7343-43	T530X108M2R5A(1)E006	250	8	6	6700	3	125
2.5	1500	X/7343-43	T530X158M2R5A(1)E005	375	8	5	7300	3	125
3	470	D/7343-31	T530D477M003A(1)E010	141	8	10	5000	3	125
3	680	D/7343-31	T530D687M003A(1)E010	204	8	10	5000	3	125
3	1000	X/7343-43	T530X108M003A(1)E010	300	8	10	5200	3	125
3	1500	X/7343-43	T530X158M003A(1)E008	450	8	8	5800	3	125
4	330	D/7343-31	T530D337M004A(1)E005	132	8	5	7100	3	125
4	330	D/7343-31	T530D337M004A(1)E006	132	8	6	6500	3	125
4	470	D/7343-31	T530D477M004A(1)E006	188	8	6	6500	3	125
4	470	D/7343-31	T530D477M004A(1)E010	188	8	10	5000	3	125
4	470	Y/7343-40	T530Y477M004A(1)E005	188	8	5	7300	3	125
4	470	Y/7343-40	T530Y477M004A(1)E006	188	8	6	6600	3	125
4	680	Y/7343-40	T530Y687M004A(1)E005	272	8	5	7300	3	125
4	680	X/7343-43	T530X687M004A(1)E004	272	8	4	8200	3	125
4	680	X/7343-43	T530X687M004A(1)E005	272	8	5	7300	3	125
4	680	X/7343-43	T530X687M004A(1)E006	272	8	6	6700	3	125
4	680	X/7343-43	T530X687M004A(1)E010	272	8	10	5200	3	125
4	1000	X/7343-43	T530X108M004A(1)E006	400	8	6	6700	3	125
6.3	220	D/7343-31	T530D227M006A(1)E005	139	8	5	7100	3	125
6.3	220	D/7343-31	T530D227M006A(1)E006	139	8	6	6500	3	125
6.3	330	D/7343-31	T530D337M006A(1)E006	208	8	6	6500	3	125
6.3	330	D/7343-31	T530D337M006A(1)E010	208	8	10	5000	3	125
6.3	330	Y/7343-40	T530Y337M006A(1)E005	208	8	5	7300	3	125
6.3	330	Y/7343-40	T530Y337M006A(1)E006	208	8	6	6600	3	125
6.3	330	Y/7343-40	T530Y337M006A(1)E010	208	8	10	5100	3	125
6.3	470	Y/7343-40	T530Y477M006A(1)E005	296	8	5	7300	3	125
6.3	470	X/7343-43	T530X477M006A(1)E004	296	8	4	8200	3	125
6.3	470	X/7343-43	T530X477M006A(1)E005	296	8	5	7300	3	125
6.3	470	X/7343-43	T530X477M006A(1)E006	296	8	6	6700	3	125
6.3	470	X/7343-43	T530X477M006A(1)E010	296	8	10	5200	3	125
6.3	680	X/7343-43	T530X687M006A(1)E010	428	8	10	5200	3	125
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	mΩ @ +20°C 100 kHz Maximum	(mA) +45°C 100 kHz	Temperature ≤ 260°C	(°C)
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	Moisture Sensitivity	Rated Temp

Other part number options:

(1) Standard with tin terminations (14th character = T). Tin/lead terminations is also available (14th character = H).

Also available on large (13 inch) reels. Add 7280 to the end of the part number.

Higher voltage ratings and tighter tolerance product including ESR may be substituted within the same size at KEMET's option. Voltage substitutions 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	Rated Temp
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	mΩ @ +20°C 100 kHz Maximum	(mA) +45°C 100 kHz	Temperature ≤ 260°C	(°C)
6.3	680	X/7343-43	T530X687M006A(1)E018	428	8	18	3900	3	125
10	150	D/7343-31	T530D157M010A(1)E005	150	8	5	7100	3	125
10	150	D/7343-31	T530D157M010A(1)E006	150	8	6	6500	3	125
10	150	D/7343-31	T530D157M010A(1)E010	150	8	10	5000	3	125
10	220	D/7343-31	T530D227M010A(1)E006	220	8	6	6500	3	125
10	220	D/7343-31	T530D227M010A(1)E010	220	8	10	5000	3	125
10	220	Y/7343-40	T530Y227M010A(1)E006	220	8	6	6600	3	125
10	330	X/7343-43	T530X337M010A(1)E004	330	8	4	8200	3	125
10	330	X/7343-43	T530X337M010A(1)E005	330	8	5	7300	3	125
10	330	X/7343-43	T530X337M010A(1)E006	330	8	6	6700	3	125
10	330	X/7343-43	T530X337M010A(1)E010	330	8	10	5200	3	125
16	150	X/7343-43	T530X157M016A(1)E015	240	8	15	4200	3	125
16	150	X/7343-43	T530X157M016A(1)E025	240	8	25	3300	3	125
16	150	X/7343-43	T530X157M016A(1)E040	240	8	40	2600	3	125
VDC	µF	KEMET/EIA	(See below for part options)	µA @ +20°C Maximum/ 5 Minutes	% @ +20°C 120 Hz Maximum	mΩ @ +20°C 100 kHz Maximum	(mA) +45°C 100 kHz	Temperature ≤ 260°C	(°C)
Rated Voltage	Rated Cap	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Maximum Allowable Ripple Current	Moisture Sensitivity	Rated Temp

Other part number options:

(1) Standard with tin terminations (14th character = T). Tin/lead terminations is also available (14th character = H).

Also available on large (13 inch) reels. Add 7280 to the end of the part number.

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

Derating Guidelines

Voltage Rating	Maximum Recommended Steady State Voltage	Maximum Recommended Transient Voltage (1 ms – 1 μs)
-55°C to 105°C		
$2.5\text{ V} \leq V_R \leq 10\text{ V}$	90% of V_R	V_R
$V_R = 16\text{ V}$	80% of V_R	V_R
105°C to 125°C		
$2.5\text{ V} \leq V_R \leq 10\text{ V}$	60% of V_R	67% of V_R
$V_R = 16\text{ V}$	54% of V_R	67% of V_R



V_R = Rated Voltage

Ripple Current/Ripple Voltage

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

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

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

Case Code	EIA Case Code	Maximum Power Dissipation (P max) mWatts @ 45°C with +30°C Rise
W	7343-15	325
Z	7343-17	325
D	7343-31	255
Y	7343-40	263
X	7443-43	270

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		
≤ 45°C	45° C < T ≤ 85°C	85°C < T ≤ 125°C
1.00	0.70	0.25

T = Environmental Temperature

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

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

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

I = rms ripple current (amperes)

E = rms ripple voltage (volts)

P max = maximum power dissipation (watts)

R = ESR at specified frequency (ohms)

Reverse Voltage

Polymer tantalum capacitors are polar devices and may be permanently damaged or destroyed if connected in the wrong polarity. These devices will withstand a small degree of transient voltage reversal for short periods as shown in the below table.

Temperature	Permissible Transient Reverse Voltage
25°C	15% of Rated Voltage
55°C	10% of Rated Voltage
85°C	5% of Rated Voltage
105°C	3% of Rated Voltage
125°C*	1% of Rated Voltage

*For series rated to 125°C

Table 2 – Land Dimensions/Courtyard

KEMET Case	Metric Size Code EIA	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
		X	Y	C	V1	V2	X	Y	C	V1	V2	X	Y	C	V1	V2
D	7343-31	2.55	3.75	2.70	10.20	5.50	2.45	3.35	2.60	9.10	5.00	2.35	2.95	2.50	8.20	4.70
X ¹	7343-43	2.55	3.75	2.70	10.20	5.50	2.45	3.35	2.60	9.10	5.00	2.35	2.95	2.50	8.20	4.70
Y ¹	7343-40	2.55	3.75	2.70	10.20	5.50	2.45	3.35	2.60	9.10	5.00	2.35	2.95	2.50	8.20	4.70

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

Density Level B: For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.

Density Level C: For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC Standard 7351 (IPC-7351).

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



Soldering Process

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

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

Hand soldering should be performed with care due to the difficulty in process control. If performed, care should be taken to avoid contact of the soldering iron to the molded case. The iron should be used to heat the solder pad, applying solder between the pad and the termination, until reflow occurs. Once reflow occurs, the iron should be removed immediately. "Wiping" the edges of a chip and heating the top surface is not recommended.

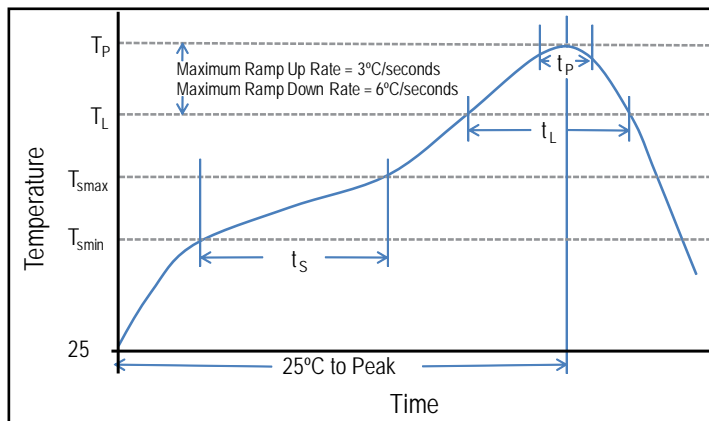
During typical reflow operations, a slight darkening of the gold-colored epoxy may be observed. This slight darkening is normal and not harmful to the product. Marking permanency is not affected by this change.

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

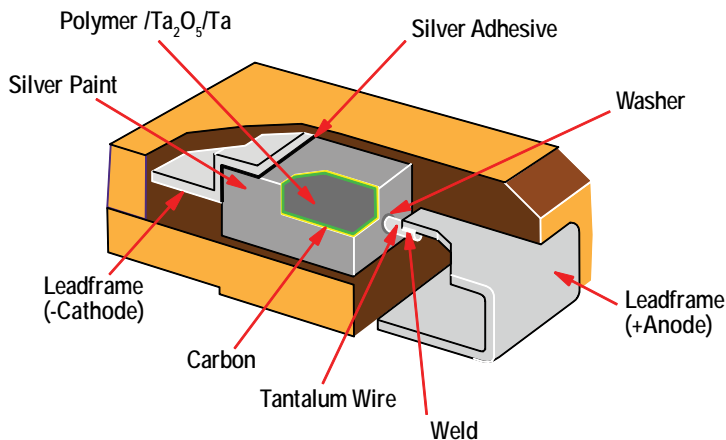
Note: All temperatures refer to the center of the package, measured on the package body surface that is facing up during assembly reflow.

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

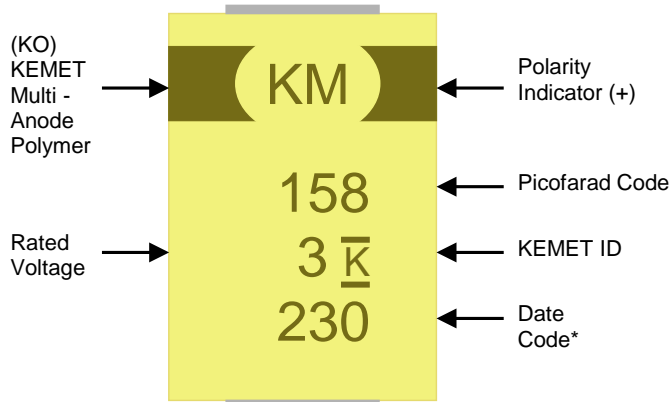
**Case Size A, B, C, H, I, K, M, R, S, T, U, V, W, and Z



Construction



Capacitor Marking



* 230 = 30th week of 2012

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

Storage

All KO-CAP series are shipped in moisture barrier bags with a desiccant and moisture indicator card. These series are 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 40°C and humidity not in excess of 60% RH.

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.

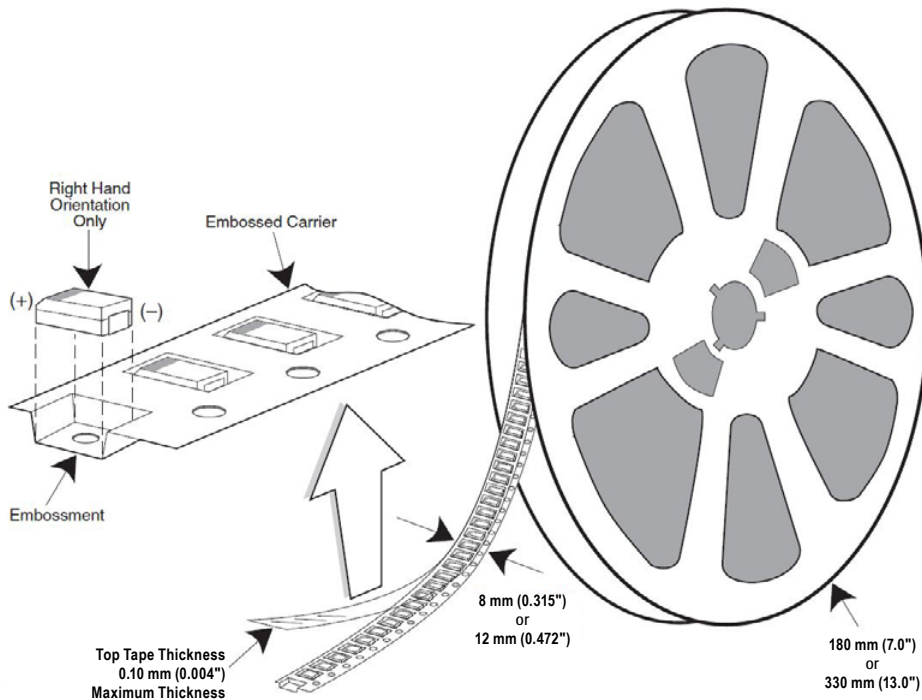


Table 3 – Packaging Quantity

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)		

- 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.
- The tape, with or without components, shall pass around R without damage (see Figure 5).
- If S₁ < 1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481–D, paragraph 4.3, section b).
- B₁ dimension is a reference dimension for tape feeder clearance only.
- The cavity defined by A₀, B₀ and K₀ shall surround the component with sufficient clearance that:
 - the component does not protrude above the top surface of the carrier tape.
 - the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
 - 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).
 - 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).
 - 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

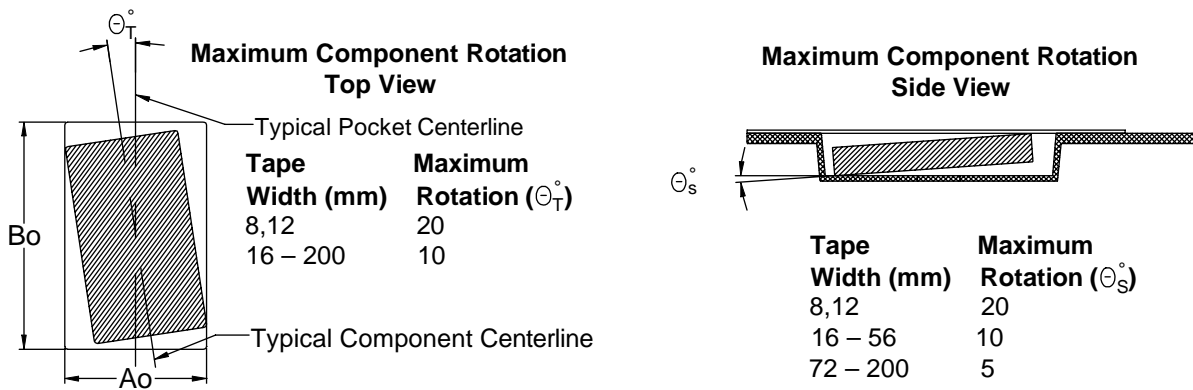


Figure 3 – Maximum Lateral Movement



Figure 4 – Bending Radius

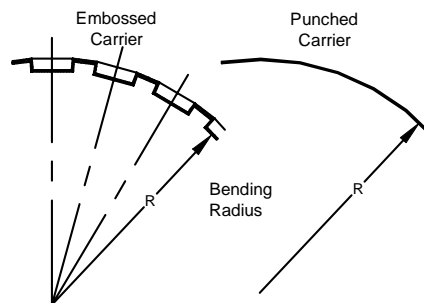
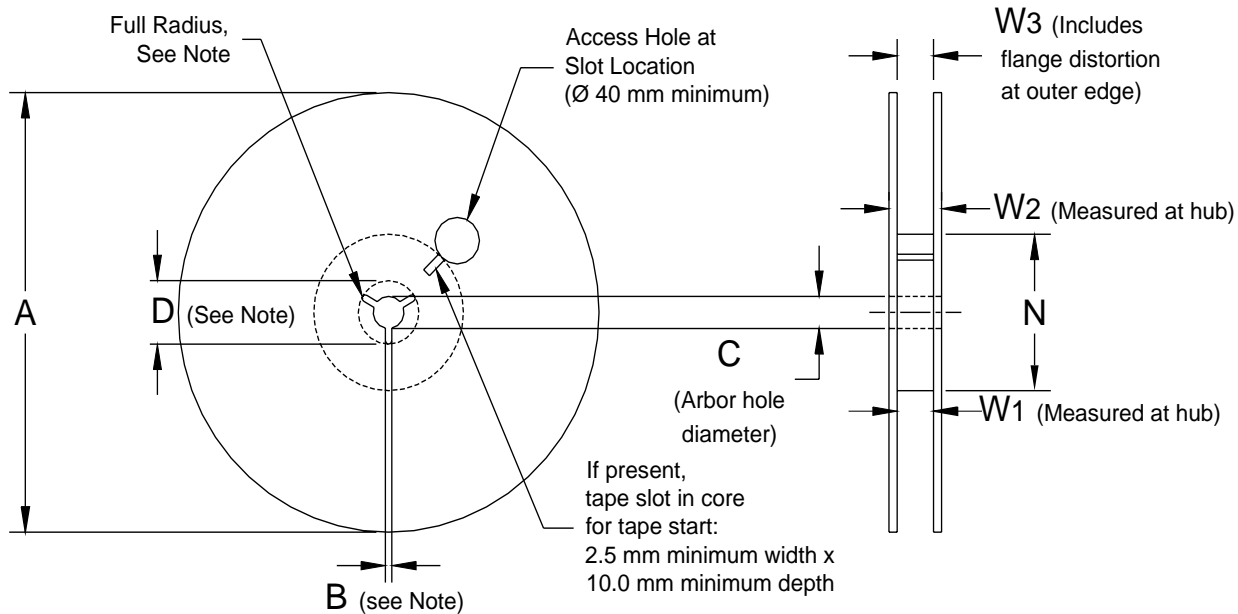


Figure 5 – Reel Dimensions



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

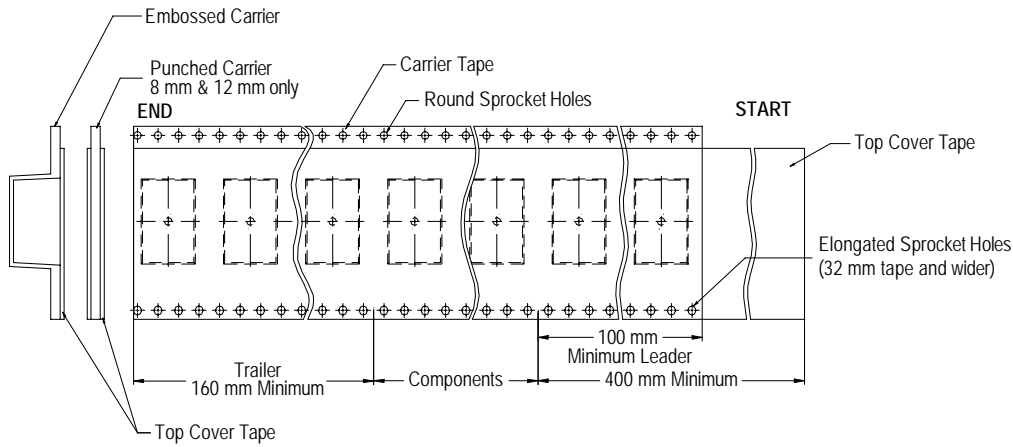
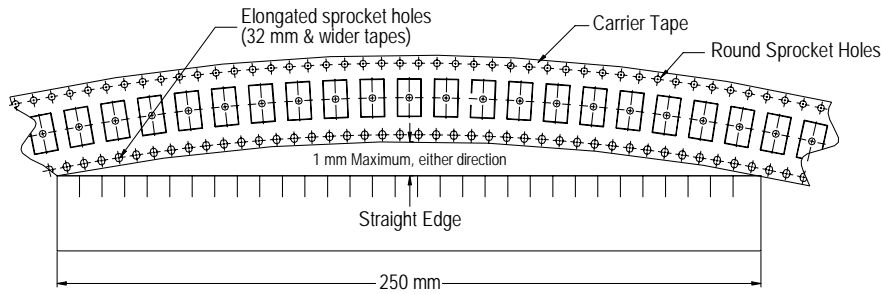


Figure 7 – Maximum Camber



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