Aluminum Organic Capacitor (AO-CAP)

A720 Polymer Aluminum

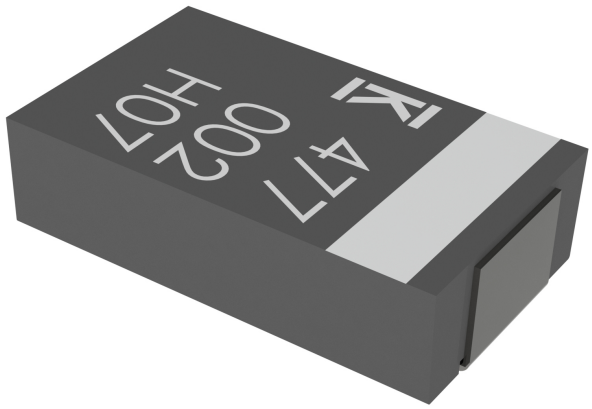
Overview

The KEMET Aluminum Organic Capacitor (AO-CAP) is a solid state aluminum capacitor. The cathode is a conductive organic polymer, which results in very low ESR and improved capacitance retention at a high frequency. AO-CAPs may be operated at steady state voltages up to100% of rated voltage without the need to de-rate.

Since there is no liquid electrolyte, the A720 offers long operational lifetimes, low ESR and high operational temperatures. The inherent low ESR renders the A720 suitable for high ripple current handling. The small package size, high ripple current capability, high operating temperature, low parasistics, and high capacitance make the A720 ideal for high performance microprocessor, FPGA, and ASIC decoupling designs.

Benefits

- Polymer cathode technology
- High frequency capacitance retention
- Non-ignition failure mode
- 100% accelerated steady state aging
- 100% surge current tested
- Volumetric efficiency
- Minimum ESR up to mΩ
- Voltage: 2 – 35 V
- Capacitance: 22 – 470 µF



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Applications

Typical applications include DC/DC converters, notebook PCs, telecommunications, displays, and industrial applications.

Environmental Compliance

RoHS compliant (6/6) according to Directive 2002/95/EC when ordered with 100% Sn, Ni-Pd-Au or non-magnetic 100% Sn solder

- Halogen-free
- Epoxy compliant with UL94 V-0

K-SIM

For a detailed analysis of specific part numbers, please visit ksim.kemet.com to access KEMET's K-SIM software. KEMET K-SIM is designed to simulate behavior of components with respect to frequency, ambient temperature, and DC bias levels.

Ordering Information

A	720	V	477	M	002	A	P	E003	
Capacitor Class	Series	Case Size	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Failure Rate/ Design	Termination Finish	ESR	Packaging (C-Spec)
A = Aluminum	720 = Aluminum Polymer (Gen II)	V	First two digits represent significant figures. Third digit specifies number of zeros.	M = ±20%	002 = 2 2R5 = 2.5 035 = 35	A = N/A	P = Ni-Pd-Au	E = ESR Last three digits specify ESR in mΩ (018 = 18 mΩ)	Blank = 7" Reel 7280 = 13" Reel

Performance Characteristics

Item	Performance Characteristics
Operating Temperature	−55°C to 105°C
Rated Capacitance Range	22 – 470 µF at 120 Hz/25°C
Capacitance Tolerance	M Tolerance (20%)
Rated Voltage Range	2 – 35 V
DF (120 Hz)	Refer to Part Number Electrical Specification Table
ESR (100 kHz)	Refer to Part Number Electrical Specification Table
Leakage Current	Refer to Part Number Electrical Specification Table If there is any concern about leakage current, please perform pre-conditioning to the part following below conditions: * Temperature: 105°C maximum * Voltage: Rated Voltage * Series Resistor: 1,000 Ω * Charge Time: 1 hour minimum * Measuring: Discharge the capacitor(s), store them for 4 to 24 hours at room temperature and RH ≤ 60%

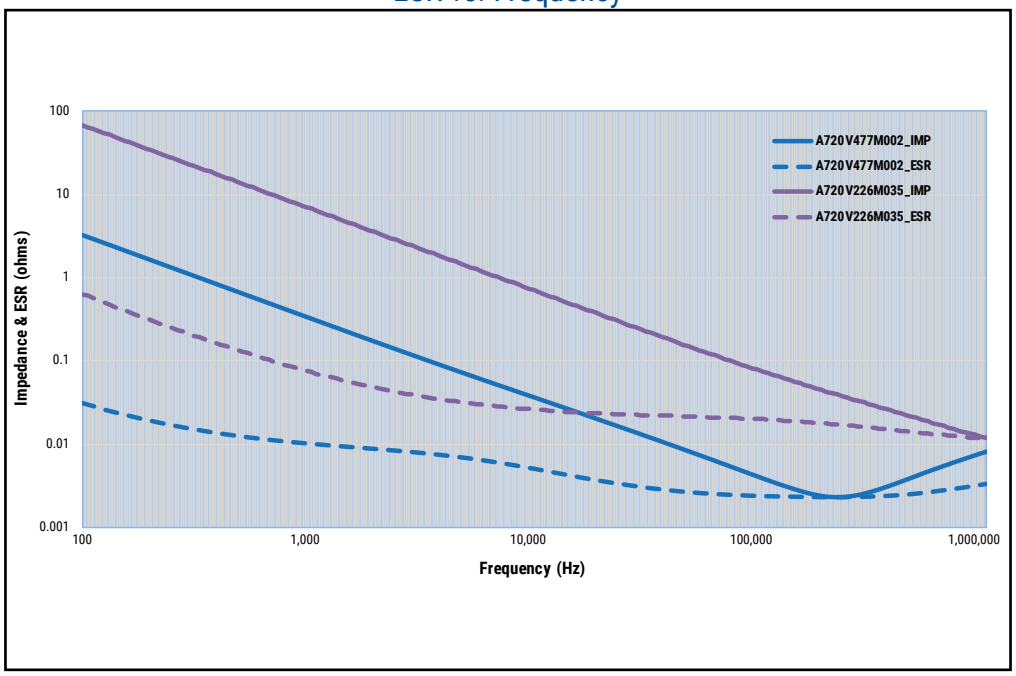
Qualification

Test	Condition		Characteristics			
Endurance	105°C at 1.0 V_R, 2,000 hours		Δ C/C	Within ±10% of initial value (for ≤ 16 V parts) Within ±20% of initial value (for ≥ 16 V parts)		
			DF	≤ initial limit		
			DCL	Within 1.25 x initial limit		
			ESR	Within 2.0 x initial limit		
Storage Life	105°C at 0 volts, 2,000 hours		Δ C/C	Within ±10% of initial value (for ≤ 16 V parts) Within ±20% of initial value (for ≥ 16 V parts)		
			DF	Within initial limits		
			DCL	Within 1.25 x initial limit		
			ESR	Within 2.0 x initial limit		
Humidity	60°C, 90% RH, 500 hours, no load		Δ C/C	Within −20/+50% of initial value		
			DF	Within 2.0 x initial limit		
			DCL	Within 5.0 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	+105°C
		Δ C/C		IL*	±15%	±15%	±20%
		DF		IL	IL	IL	IL
		DCL		IL	N/A	2 x IL	2 x IL
Surge Voltage	105°C, 1.32 x Rated Voltage, 33 Ω resistance, 1,000 cycles		Δ C/C	Within ±10% of initial value (for ≤ 16 V parts) Within ±20% of initial value (for ≥ 16 V parts)		
			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 (for ≤ 16 V parts) Within ±20% of initial value (for ≥ 16 V parts)		
			DF	Within initial limits		
			DCL	Within initial limits		

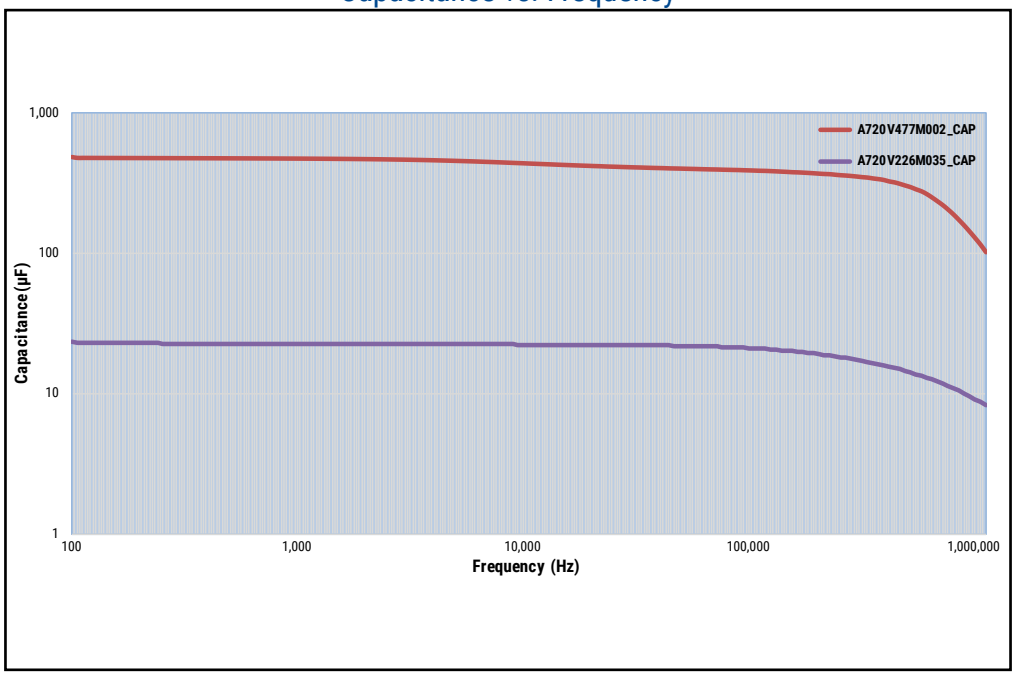
**IL = Initial Limit*

Electrical Characteristics

ESR vs. Frequency

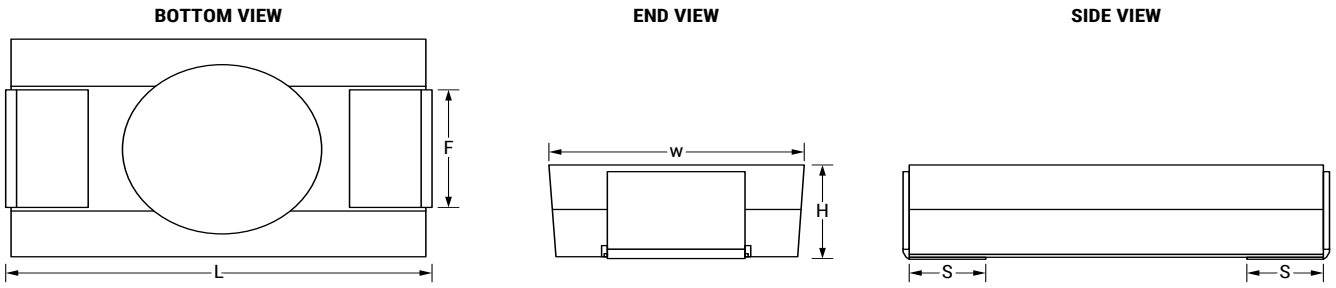


Capacitance vs. Frequency



Dimensions – Millimeters (Inches)

Metric will govern



KEMET	EIA	L	W	H	F ±0.1 ±(0.004)	S ±0.3 ±(0.012)	Weight
V	7343–21	7.3±0.3 (0.287±0.012)	4.3±0.3 (0.169±0.012)	1.9±0.2 (0.075±0.008)	2.4 (0.094)	1.3 (0.051)	141.00

Notes: (Ref) – Dimensions provided for reference only.
These weights are provide as reference. If exact weights are needed, please contact your KEMET Sale Representative.

Table 1 – Ratings & Part Number Reference

Rated Voltage	Rated Capacitance	Case Code/ Case Size	KEMET Part Number	DC Leakage	DF	ESR	Ripple Current (rms)	MSL	Maximum Operating Temp.
VDC at 105°C	µF	KEMET/EIA	(See below for part options)	µA at +25°C Maximum/5 Minutes	% at +25°C 120 Hz Maximum	mΩ at 25°C 100 kHz Maximum	mA at 100 kHz with/T = +20°C at –55°C to 105°C	Reflow Temp ≤ 260°C	°C
2	470	V/7343-21	A720V477M002APE006	56.4	6	6	8,260	3	105
2	470	V/7343-21	A720V477M002APE4R5	56.4	6	4.5	9,540	3	105
2	470	V/7343-21	A720V477M002APE003	56.4	6	3	11,690	3	105
2.5	470	V/7343-21	A720V477M2R5APE4R5	70.5	6	4.5	9,540	3	105
2.5	470	V/7343-21	A720V477M2R5APE003	70.5	6	3	11,690	3	105
4	330	V/7343-21	A720V337M004APE006	79.2	6	6	8,260	3	105
4	330	V/7343-21	A720V337M004APE4R5	79.2	6	4.5	9,540	3	105
4	330	V/7343-21	A720V337M004APE003	79.2	6	3	11,690	3	105
6.3	330	V/7343-21	A720V337M006APE4R5	83.2	6	4.5	9,540	3	105
16	100	V/7343-21	A720V107M016APE040	160	6	40	3,200	3	105
16	100	V/7343-21	A720V107M016APE025	160	6	25	4,000	3	105
16	100	V/7343-21	A720V107M016APE015	160	6	15	5,200	3	105
16	100	V/7343-21	A720V107M016APE010	160	6	10	6,400	3	105
35	22	V/7343-21	A720V226M035APE040	77	6	40	3,200	3	105

Derating Guidelines

Voltage Rating	Maximum Recommended Steady State Voltage	Maximum Recommended Transient Voltage
	−55°C to 105°C	
2 – 35 V	V_R	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.

Power capability is determined based on a 20°C temperature rise. A higher temperature rise and therefore higher power capability is allowable as long as the ambient temperature, plus, temperature rise due to ripple current, does not exceed the rated temperature of the part.

The maximum power dissipation by case size can be determined using the below table.

KEMET Series and Case Code	EIA Case Code	Maximum Power Dissipation (Pmax) mWatts at 25°C with +20°C Rise
A720V	7343–21	410

Using the Pmax of the device, the maximum allowable RMS ripple current or voltage may be determined.

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

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)

Refer to part number listings for permittable Arms limits.

Reverse Voltage

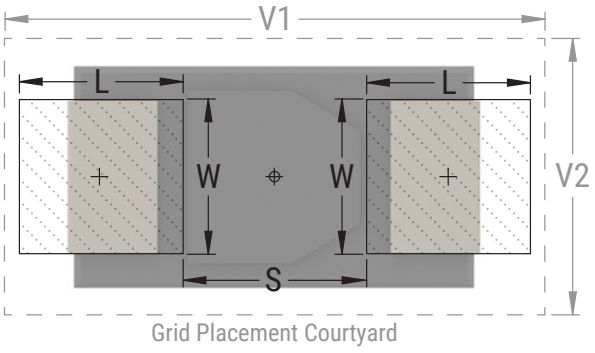
Polymer aluminum capacitors are polar devices and may be permanently damaged or destroyed if connected in the wrong polarity. These devices will withstand a certain degree of transient voltage reversal for short periods, as shown in the below table. Please note that these parts may not be operated continuously in reverse, even within these limits.

Temperature	Permissible Transient Reverse Voltage
25°C	60% of rated voltage
55°C	50% of rated voltage
85°C	40% of rated voltage
105°C	30% 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
V	7343–21	2.55	2.77	3.67	10.22	5.60	2.43	2.37	3.87	9.12	5.10	2.33	1.99	4.03	8.26	4.84

Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes.*
Density Level B: *For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.*
Density Level C: *For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC standard 7351 (IPC–7351).*
[1] Height of these chips may create problems in wave soldering.
[2] Land pattern geometry is too small for silkscreen outline.



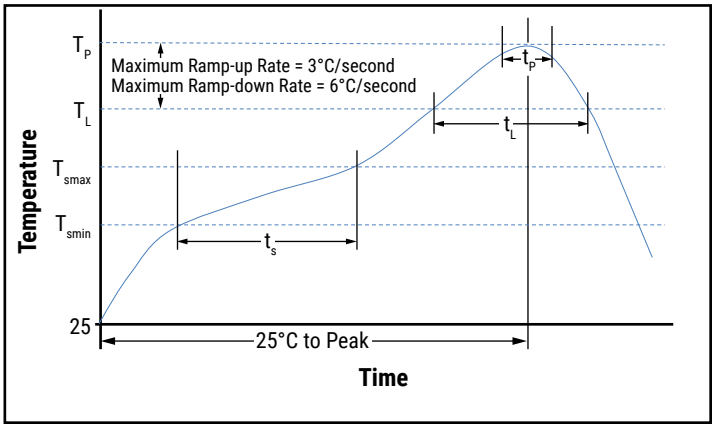
Soldering Process

The KEMET 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.

Notes:
Hand soldering leads to risk of damage. If performed use tweezers to hold both capacitors terminals followed by welding procedure. Avoid excessive force and touching capacitor body while soldering. Once the capacitor is removed from the board should not be weld again.

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.
** For Case Size height > 2.5 mm*
*** For Case Size height ≤ 2.5 mm*



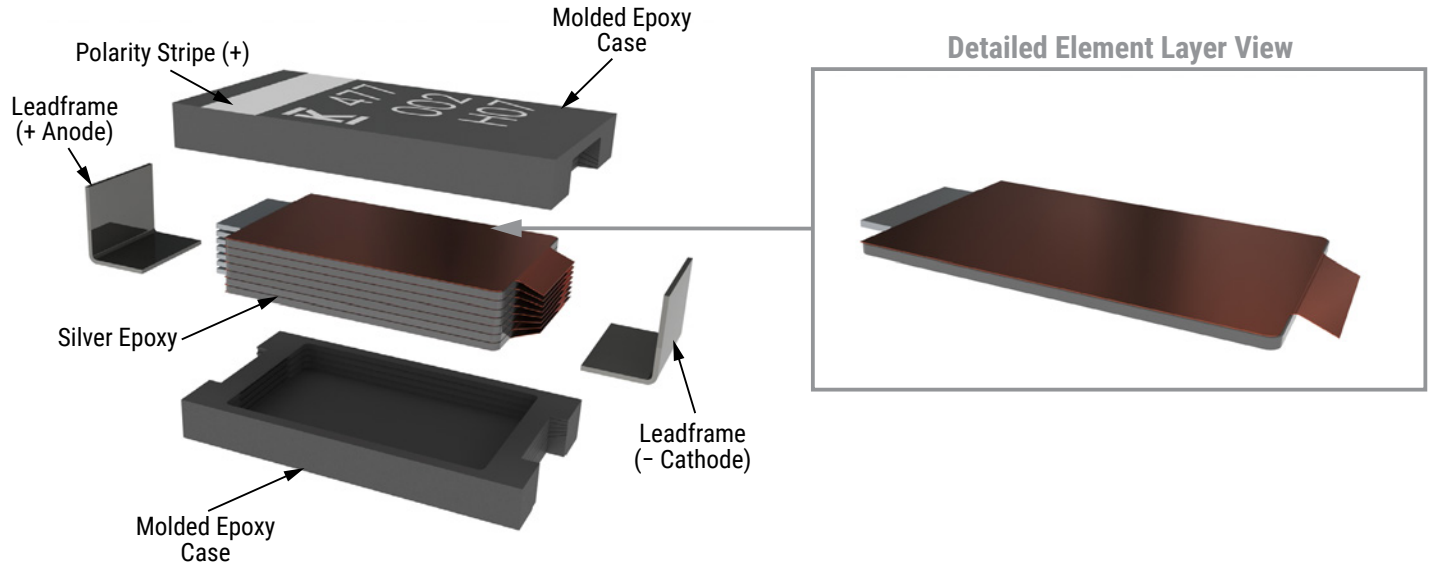
Storage

All AO-CAP Series are shipped in moisture barrier bags (MBBs) with desiccant and humidity indicator card (HIC). These parts are classified as MSL3 (Moisture Sensitivity Level 3) per IPC/JEDEC J-STD-020 and packaged per IPC/JEDEC J-STD-033. MSL3 specifies a floor time of 168H at 30°C maximum temperature and 60% relative humidity. Unused capacitors should be sealed in a MBB with fresh desiccant.

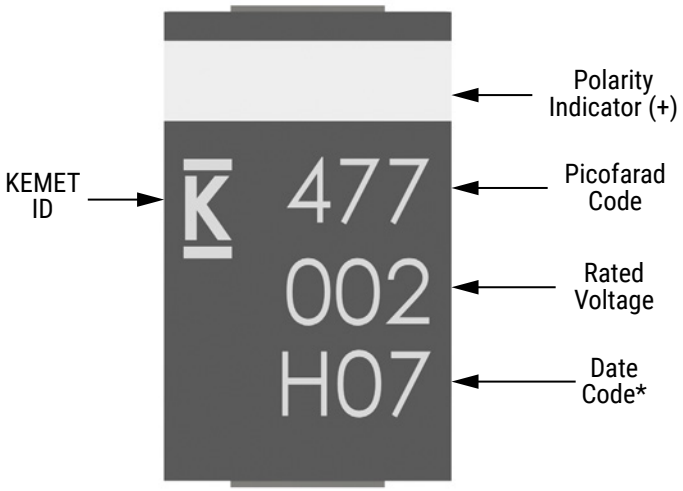
The calculated shelf life in a sealed bag would be 12 months from a bag seal date in a storage environment of < 40°C and humidity < 90% RH. It should be 24 months from a bag seal date in a storage environment of < 30°C and humidity < 70% RH.

If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure..

Construction



Capacitor Marking



* H07 = 7th week of 2017

Date Code *	
Year	Week
H = 2017 I = 2018 J = 2019 K = 2020	01 = 1st week of the year to 52 = 52nd week of the year

Tape & Reel Packaging Information

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

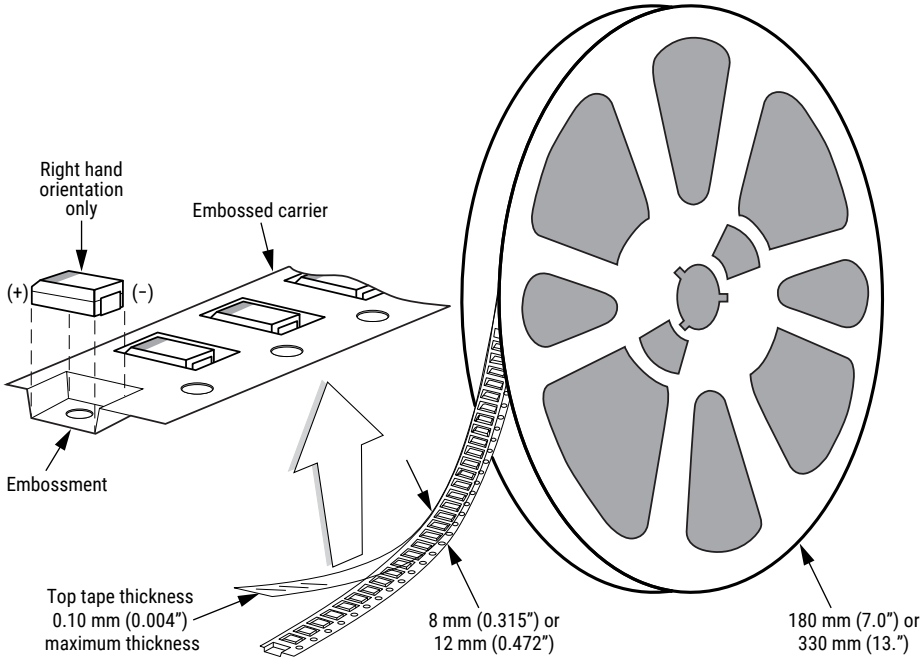


Table 3 – Packaging Quantity

Case Code		Tape Width (mm)	7" Reel*	13" Reel*
KEMET	EIA			
V	7343-21	12	1,000	3,000

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

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

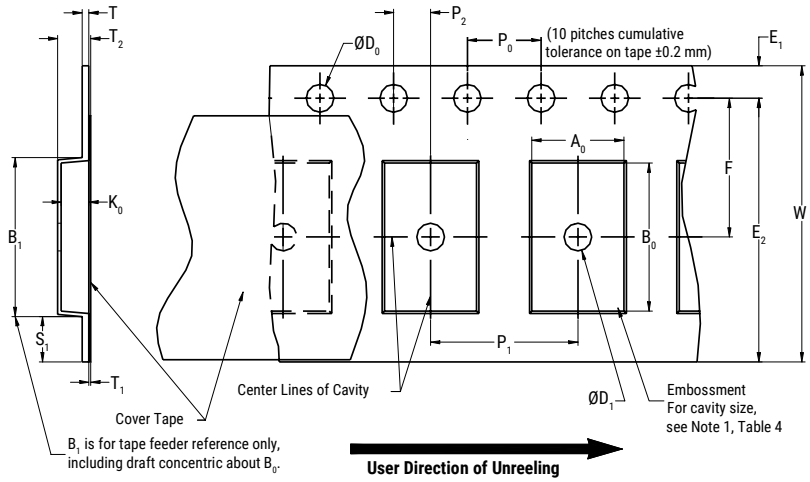


Table 4 – Embossed (Plastic) Carrier Tape Dimensions

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)			

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)	2.0 ±0.05 or 4.0 ±0.10 (0.079 ±0.002 or 0.157 ±0.004)	2.5 (0.098)	8.3 (0.327)	Note 5
12 mm	Single (4 mm) and Double (8 mm)	8.2 (0.323)	10.25 (0.404)	5.5 ±0.05 (0.217 ±0.002)	2.0 ±0.05 (0.079 ±0.002) or 4.0 ±0.10 (0.157 ±0.004) or 8.0 ±0.10 (0.315 ±0.004)	4.6 (0.181)	12.3 (0.484)	

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 4).

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 (see Figure 2).

(d) lateral movement of the component is restricted to 0.5 mm maximum for 8 mm and 12 mm wide 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 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

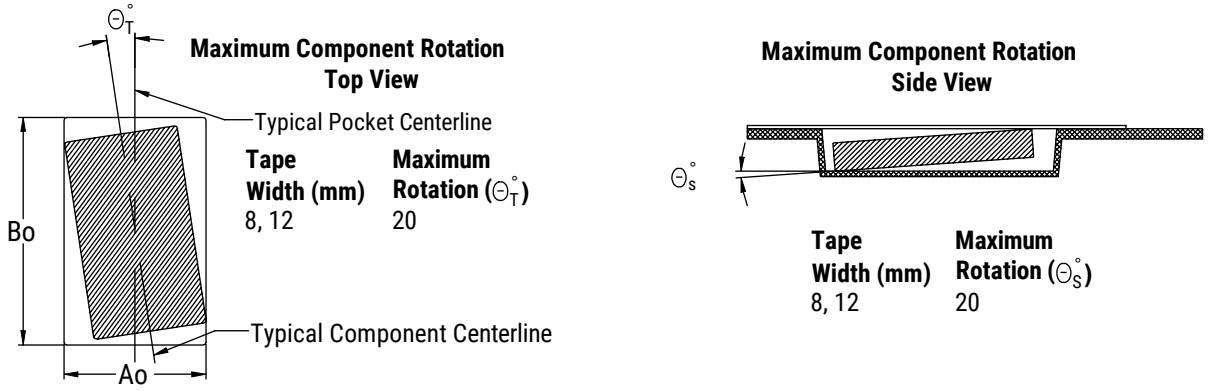


Figure 3 – Maximum Lateral Movement

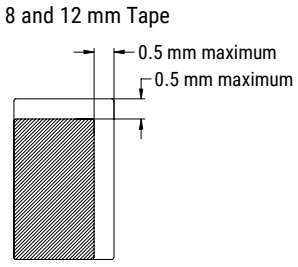


Figure 4 – Bending Radius

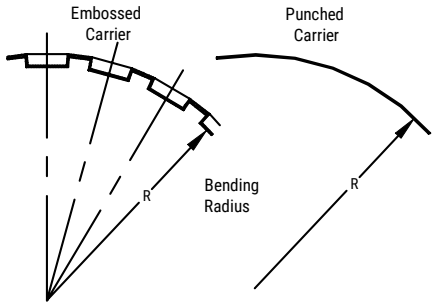
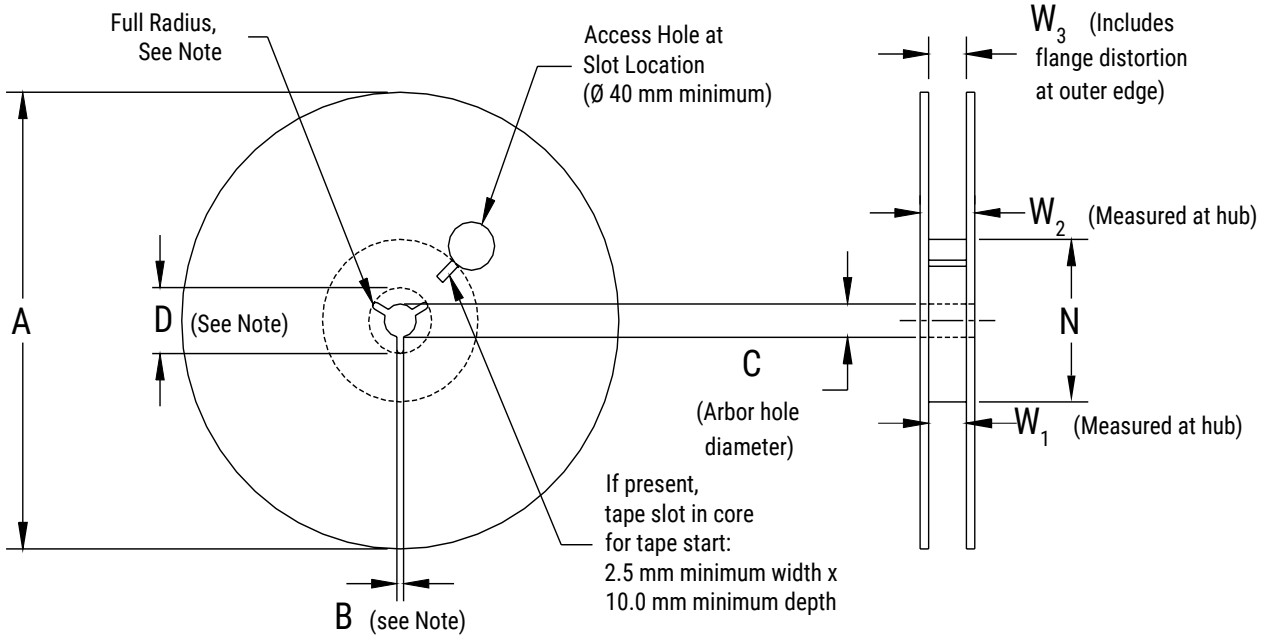


Figure 5 – Reel Dimensions



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				

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)	

Figure 6 – Tape Leader & Trailer Dimensions

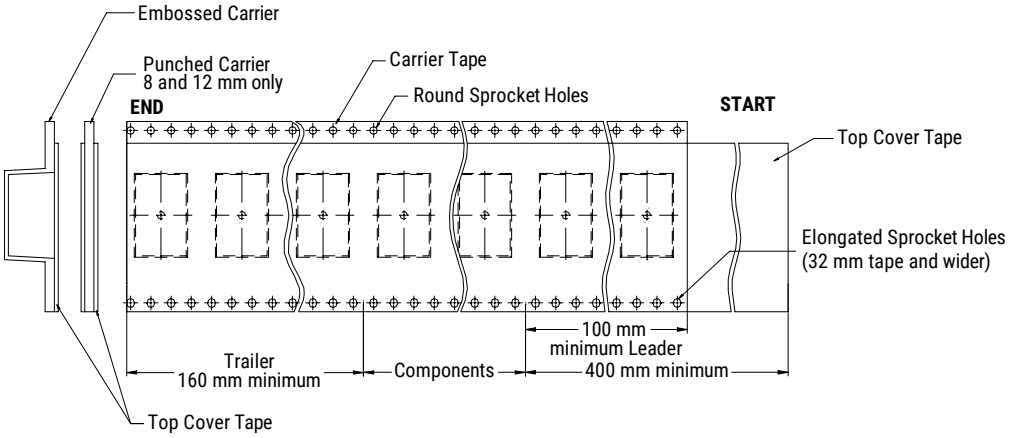
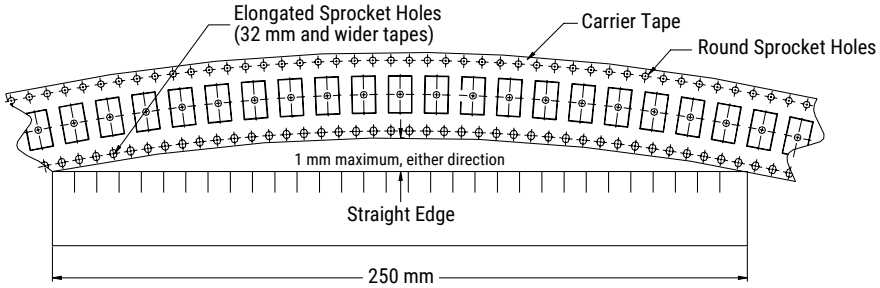


Figure 7 – Maximum Camber



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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

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.