

# ArcShield™ Technology, High Voltage, X7R Dielectric, 500 – 1,000 VDC (Commercial & Automotive Grade)

## Overview

KEMET ArcShield high voltage surface mount capacitors in X7R dielectric are designed for use in high voltage applications susceptible to surface arcing (arc-over discharge).

The phenomenon of surface arcing is caused by a high voltage gradient between the two termination surfaces or between one of the termination surfaces and the counter internal electrode structure within the ceramic body. It occurs most frequently at application voltages that meet or exceed 500 V, in high humidity environments, and in chip sizes with minimal bandwidth separation (creepage distance). This phenomenon can either damage surrounding components or lead to a breakdown of the dielectric material, ultimately resulting in a short-circuit condition (catastrophic failure mode).

ArcShield technology (patent pending) features KEMET's highly reliable base metal dielectric system combined with a unique internal shield electrode structure that is designed to suppress an arc-over event while increasing available capacitance. Developed on the principle of a partial Faraday cage, this internal system offers unrivaled performance and reliability when compared to external surface coating technologies.

For added reliability, KEMET's Flexible Termination technology is an available option that provides superior flex performance over standard termination systems. This technology was developed to address flex cracks, which are the primary failure mode of MLCCs and typically the result of excessive tensile and shear stresses produced during board flexure and thermal cycling. Flexible Termination technology inhibits the transfer of board stress to the rigid body of the MLCC, therefore mitigating flex cracks which can result in low IR or short circuit failures.

KEMET's ArcShield high voltage surface mount MLCCs are manufactured in state-of-the-art ISO/TS 16949:2002 certified facilities and are also available in Automotive Grade, which undergo stricter testing protocol and inspection criteria. Whether under-hood or in-cabin, these devices are designed for mission and safety-critical automotive circuits or applications requiring proven, reliable performance in harsh environments. Automotive Grade devices meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.



## Ordering Information

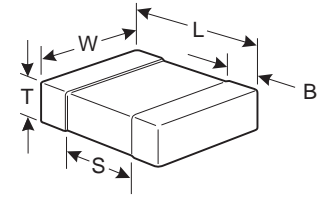
C	1812	V	334	K	C	R	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish <sup>1</sup>	Packaging/Grade (C-Spec) <sup>2</sup>
	0805 1206 1210 1808 1812	V = ArcShield W = ArcShield w/Flexible Termination	2 Sig. Digits + Number of Zeros	J = ± 5% K = ± 10% M = ± 20%	C = 500V B = 630V D = 1000V	R = X7R	A = N/A	C = 100% Matte Sn L = SnPb (5% min)	Blank = Bulk TU = 7" Reel Unmarked TM = 7" Reel Marked AUTO = Automotive Grade 7" Reel Unmarked

<sup>1</sup> Additional termination finish options may be available. Contact KEMET for details.

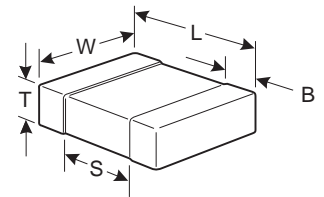
<sup>1,2</sup> SnPb termination finish option is not available on Automotive Grade product.

<sup>2</sup> Additional reeling or packaging options may be available. Contact KEMET for details.

## Dimensions – Standard Termination – Millimeters (Inches)



EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)	See Table 2 for Thickness	0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	Solder Wave or Solder Reflow
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		Solder Reflow Only
1808	4520	4.70 (.185) ± 0.50 (.020)	2.00 (.079) ± 0.20 (.008)		0.60 (.024) ± 0.35 (.014)		
1812	4532	4.50 (.177) ± 0.30 (.012)	3.20 (.126) ± 0.30 (.012)		0.60 (.024) ± 0.35 (.014)		



## Dimensions – Flexible Termination – Millimeters (Inches)

EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0805	2012	2.10 (.083) +0.30 (.012)/-0.20 (.008)	1.25 (.049) ± 0.20 (.008)	See Table 2 for Thickness	0.50 (0.02) +0.10(.004)/-0.25 (.010)	0.70 (.028)	Solder Wave or Solder Reflow
1206	3216	3.30 (.130) ± 0.40 (.016)	1.60 (.063) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)	N/A	
1210	3225	3.30 (.130) ± 0.40 (.016)	2.50 (.098) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)		Solder Reflow Only
1808	4520	4.70 (.185) ± 0.50 (.020)	2.00 (.079) ± 0.20 (.008)		0.70 (.028) ± 0.35 (.014)		
1812	4532	4.50 (.178) ± 0.40 (.016)	3.20 (.126) ± 0.30 (.012)		0.70 (.028) ± 0.35 (.014)		

## Benefits

- ArcShield (patent pending) technology
- Base metal electrode(BME) dielectric system
- Industry leading CV values
- -55°C to +125°C operating temperature range
- Exceptional performance at high frequencies
- Base metal electrode (BME) dielectric system
- Pb-Free and RoHS Compliant
- EIA 0805, 1206, 1210, 1808, and 1812 case sizes
- DC voltage ratings of 500 V, 630 V and 1 KV
- Capacitance offerings ranging from 10 pF to 0.33 µF
- Available capacitance tolerances of ± 5%, ± 10% and ± 20%
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb plated termination finish option available upon request (5% min)
- Flexible Termination option available upon request

## Applications

Typical applications include switch mode power supplies (input filters, resonators, tank circuits, snubber circuits, output filters), high voltage coupling and DC blocking, lighting ballasts, voltage multiplier circuits, DC/DC converters and coupling capacitors in Ćuk converters. Markets include power supply, LCD fluorescent backlight ballasts, HID lighting, telecom equipment, industrial and medical equipment/control, LAN/WAN interface, analog and digital modems, and automotive (electric and hybrid vehicles, charging stations and lighting) applications.

## Application Notes

X7R dielectric is not recommended for AC line filtering or pulse applications.

## Qualification/Certification

Commercial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 4, Performance & Reliability.

Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC-Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC-Q200, please visit their website at [www.aecouncil.com](http://www.aecouncil.com).

## Environmental Compliance

Pb-Free and RoHS Compliant (excluding SnPb termination finish option).



RoHS Compliant

## Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +125°C
Capacitance Change with Reference to +25°C and 0 VDC Applied (TCC)	± 15%
Aging Rate (Max % Cap Loss/Decade Hour)	3.0%
Dielectric Withstanding Voltage	150% of rated voltage for voltage rating of < 1,000 V 120% of rated voltage for voltage rating of ≥ 1,000 V (5 ± 1 seconds and charge/discharge not exceeding 50 mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	2.5%
Insulation Resistance (IR) Limit @ 25°C	100 megohm microfarads or 10 GΩ (500 VDC applied for 120 ± 5 seconds @ 25°C)

Regarding aging rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1,000 hours.

To obtain IR limit, divide MΩ-μF value by the capacitance and compare to GΩ limit. Select the lower of the two limits.

Capacitance and dissipation factor (DF) measured under the following conditions:

1 kHz ± 50 Hz and 1.0 ± 0.2 Vrms if capacitance ≤ 10 μF

120 Hz ± 10 Hz and 0.5 ± 0.1 Vrms if capacitance > 10 μF

Note: When measuring capacitance, it is important to ensure the set voltage level is held constant. The HP4284 and Agilent E4980 have a feature known as Automatic Level Control (ALC). The ALC feature should be switched to "ON."

## Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance					
Dielectric	Rated DC Voltage	Capacitance Value	DF (%)	Cap Shift	IR
X7R	> 25	All	3.0	± 20%	10% of Initial Limit
	16/25		5.0		
	< 16		7.5		

**Table 1A – Capacitance Range/Selection Waterfall (0805 – 1812 Case Sizes)**

Cap	Cap Code	Series			C0805			C1206			C1210			C1808			C1812		
		Voltage Code			C	B	D	C	B	D	C	B	D	C	B	D	C	B	D
		Voltage DC			500	630	1000	500	630	1000	500	630	1000	500	630	1000	500	630	1000
		Cap Tolerance			<b>Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions</b>														
2,000 pF	202	J	K	M															
2,200 pF	222	J	K	M	DG	DG	DG												
2,700 pF	272	J	K	M	DG	DG	DG												
3,300 pF	332	J	K	M	DG	DG	DG												
3,900 pF	392	J	K	M	DG	DG	DG												
4,700 pF	472	J	K	M	DG	DG	DG												
5,600 pF	562	J	K	M	DG	DG													
6,800 pF	682	J	K	M	DG	DG													
8,200 pF	822	J	K	M	DG	DG													
10,000 pF	103	J	K	M	DG														
12,000 pF	123	J	K	M	DG			ED	ED	ED									
15,000 pF	153	J	K	M				EF	EF	EM									
18,000 pF	183	J	K	M				EJ	EJ	EJ			LE	LE	LE				
22,000 pF	223	J	K	M				EJ	EJ	EJ	FG	FG	FG	LE	LE	LE			
27,000 pF	273	J	K	M				EJ	EJ		FG	FG	FG	LE	LE	LE	GD	GD	GD
33,000 pF	333	J	K	M				EJ	EJ		FG	FG	FH	LA	LA	LA	GD	GD	GD
39,000 pF	393	J	K	M				EJ			FG	FG	FH	LA	LA	LA	GD	GD	GD
47,000 pF	473	J	K	M				EJ			FG	FH	FK	LA	LA	LB	GD	GD	GD
56,000 pF	563	J	K	M				EJ			FG	FH	FK	LA	LA	LB	GD	GD	GE
62,000 pF	623	J	K	M				EJ			FG	FM		LA	LA	LC	GD	GD	GE
68,000 pF	683	J	K	M				EJ			FG	FM		LA	LA	LC	GD	GD	GE
82,000 pF	823	J	K	M							FH	FK		LA	LC		GD	GE	GK
0.10 uF	104	J	K	M							FM			LA	LC		GD	GE	GJ
0.12 uF	124	J	K	M							FK			LA			GE	GH	
0.15 uF	154	J	K	M							FK			LB			GE	GJ	
0.18 uF	184	J	K	M														GK	
0.22 uF	224	J	K	M														GJ	
0.27 uF	274	J	K	M														GL	
0.33 uF	334	J	K	M														GS	
0.39 uF	394	J	K	M															
0.47 uF	474	J	K	M															
Cap	Cap Code	Voltage DC			500	630	1000	500	630	1000	500	630	1000	500	630	1000	500	630	1000
		Voltage Code			C	B	D	C	B	D	C	B	D	C	B	D	C	B	D
		Series			C0805			C1206			C1210			C1808			C1812		

Patent pending technology

KEMET reserves the right to substitute product with an improved temperature characteristic, tighter capacitance tolerance and/or higher voltage capability within the same form factor (configuration and dimensions).

**Table 2 – Chip Thickness/Packaging Quantities**

Thickness Code	Case Size	Thickness ± Range (mm)	Paper Quantity		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
DG	0805	1.25 ± 0.15	0	0	2,500	10,000
ED	1206	1.00 ± 0.10	0	0	2,500	10,000
EF	1206	1.20 ± 0.15	0	0	2,500	10,000
EM	1206	1.25 ± 0.15	0	0	2,500	10,000
EJ	1206	1.70 ± 0.20	0	0	2,000	8,000
FG	1210	1.25 ± 0.15	0	0	2,500	10,000
FH	1210	1.55 ± 0.15	0	0	2,000	8,000
FM	1210	1.70 ± 0.20	0	0	2,000	8,000
FK	1210	2.10 ± 0.20	0	0	2,000	8,000
LE	1808	1.00 ± 0.10	0	0	2,500	10,000
LA	1808	1.40 ± 0.15	0	0	1,000	4,000
LB	1808	1.60 ± 0.15	0	0	1,000	4,000
LC	1808	2.00 ± 0.15	0	0	1,000	4,000
GD	1812	1.25 ± 0.15	0	0	1,000	4,000
GE	1812	1.30 ± 0.10	0	0	1,000	4,000
GH	1812	1.40 ± 0.15	0	0	1,000	4,000
GK	1812	1.60 ± 0.20	0	0	1,000	4,000
GJ	1812	1.70 ± 0.15	0	0	1,000	4,000
GL	1812	1.90 ± 0.20	0	0	1,000	4,000
GS	1812	2.10 ± 0.20	0	0	1,000	4,000
Thickness Code	Case Size	Thickness ± Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel
			Paper Quantity		Plastic Quantity	

Package quantity based on finished chip thickness specifications.

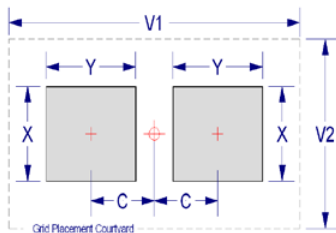
Table 3A – Land Pattern Design Recommendations per IPC–7351 (Standard Termination)

EIA Size Code	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)				
		C	Y	X	V1	V2	C	Y	X	V1	V2	C	Y	X	V1	V2
01005	0402	0.33	0.46	0.43	1.60	0.90	0.28	0.36	0.33	1.30	0.70	0.23	0.26	0.23	1.00	0.50
0201	0603	0.38	0.56	0.52	1.80	1.00	0.33	0.46	0.42	1.50	0.80	0.28	0.36	0.32	1.20	0.60
0402	1005	0.50	0.72	0.72	2.20	1.20	0.45	0.62	0.62	1.90	1.00	0.40	0.52	0.52	1.60	0.80
0603	1608	0.90	1.15	1.10	4.00	2.10	0.80	0.95	1.00	3.10	1.50	0.60	0.75	0.90	2.40	1.20
0805	2012	1.00	1.35	1.55	4.40	2.60	0.90	1.15	1.45	3.50	2.00	0.75	0.95	1.35	2.80	1.70
1206	3216	1.60	1.35	1.90	5.60	2.90	1.50	1.15	1.80	4.70	2.30	1.40	0.95	1.70	4.00	2.00
1210	3225	1.60	1.35	2.80	5.65	3.80	1.50	1.15	2.70	4.70	3.20	1.40	0.95	2.60	4.00	2.90
1808	4520	2.30	1.75	2.30	7.40	3.30	2.20	1.55	2.20	6.50	2.70	2.10	1.35	2.10	5.80	2.40
1812	4532	2.15	1.60	3.60	6.90	4.60	2.05	1.40	3.50	6.00	4.00	1.95	1.20	3.40	5.30	3.70
1825	4564	2.15	1.60	6.90	6.90	7.90	2.05	1.40	6.80	6.00	7.30	1.95	1.20	6.70	5.30	7.00
2220	5650	2.75	1.70	5.50	8.20	6.50	2.65	1.50	5.40	7.30	5.90	2.55	1.30	5.30	6.60	5.60
2225	5664	2.70	1.70	6.90	8.10	7.90	2.60	1.50	6.80	7.20	7.30	2.50	1.30	6.70	6.50	7.00

**Density Level A:** For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes. KEMET only recommends wave soldering of EIA 0603, 0805 and 1206 case sizes.

**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).



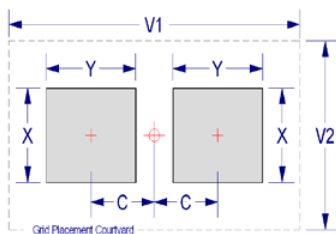
**Table 3B – Land Pattern Design Recommendations per IPC–7351 (Flexible Termination)**

EIA Size Code	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)				
		C	Y	X	V1	V2	C	Y	X	V1	V2	C	Y	X	V1	V2
0603	1608	0.85	1.25	1.10	4.00	2.10	0.75	1.05	1.00	3.10	1.50	0.65	0.85	0.90	2.40	1.20
0805	2012	1.10	1.30	1.55	4.50	2.60	1.00	1.10	1.45	3.60	2.00	0.90	0.90	1.35	2.90	1.70
1206	3216	1.60	1.65	1.90	5.90	2.90	1.50	1.45	1.80	5.00	2.30	1.40	1.25	1.70	4.30	2.00
1210	3225	1.60	1.65	2.80	5.90	3.80	1.50	1.45	2.70	5.00	3.20	1.40	1.25	2.60	4.30	2.90
1808	4520	2.25	1.85	2.30	7.40	3.30	2.15	1.65	2.20	6.50	2.70	2.05	1.45	2.10	5.80	2.40
1812	4532	2.10	1.80	3.60	7.00	4.60	2.00	1.60	3.50	6.10	4.00	1.90	1.40	3.40	5.40	3.70
1825	4564	2.15	1.80	6.90	7.10	7.90	2.05	1.60	6.80	6.20	7.30	1.95	1.40	6.70	5.50	7.00
2220	5650	2.85	2.10	5.50	8.80	6.50	2.75	1.90	5.40	7.90	5.90	2.65	1.70	5.30	7.20	5.60
2225	5664	2.85	2.10	6.90	8.80	7.90	2.75	1.90	6.80	7.90	7.30	2.65	1.70	6.70	7.20	7.00

*Density Level A: For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes. KEMET only recommends wave soldering of EIA 0603, 0805 and 1206 case sizes.*

*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).*



## Soldering Process

Recommended Soldering Technique:

- Solder wave or solder reflow for EIA case sizes 0603, 0805 and 1206
- All other EIA case sizes are limited to solder reflow only

Recommended Soldering Profile:

- KEMET recommends following the guidelines outlined in IPC/JEDEC J–STD–020

**Table 4 – Performance & Reliability: Test Methods and Conditions**

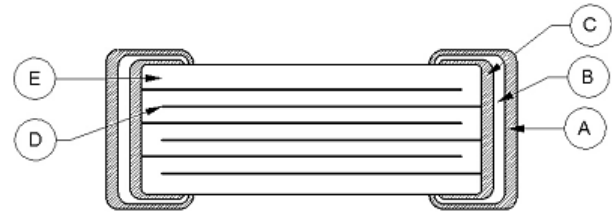
Stress	Reference	Test or Inspection Method
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2 mm (min) for all except 3 mm for C0G.
Solderability	J-STD-002	Magnification 50 X. Conditions:
		a) Method B, 4 hours @ 155°C, dry heat @ 235°C
		b) Method B @ 215°C category 3
		c) Method D, category 3 @ 260°C
Temperature Cycling	JESD22 Method JA-104	1,000 cycles (-55°C to +125°C), measurement at 24 hours. +/- 2 hours after test conclusion.
Biased Humidity	MIL-STD-202 Method 103	Load Humidity: 1,000 hours 85°C/85% RH and 300 VDC maximum. Add 100 K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1,000 hours 85°C/85% RH and 1.5 V. Add 100 K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a and 7b not required. Unpowered. Measurement at 24 hours. +/- 2 hours after test conclusion.
Thermal Shock	MIL-STD-202 Method 107	-55°C/+125°C. Note: Number of cycles required-300. Maximum transfer time-20 seconds. Dwell time-15 minutes. Air-Air.
High Temperature Life	MIL-STD-202 Method 108	1,000 hours at 125°C (85°C for X5R, Z5U and Y5V) with rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0 VDC, for 1,000 hours.
Mechanical Shock	MIL-STD-202 Method 213	Figure 1 of Method 213, Condition F.
Resistance to Solvents	MIL-STD-202 Method 215	Add aqueous wash chemical, OKEM Clean or equivalent.

## Storage & Handling

Ceramic chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature—reels may soften or warp, and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40°C, and maximum storage humidity not exceed 70% relative humidity. Temperature fluctuations should be minimized to avoid condensation on the parts, and atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability, chip stock should be used promptly, preferably within 1.5 years of receipt.

## Construction – Standard Termination

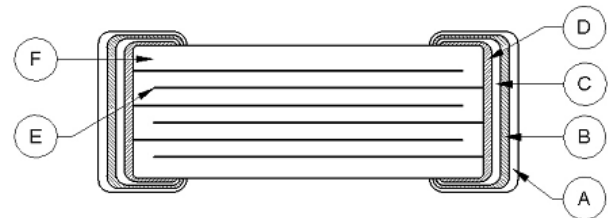
Reference	Item		Material	
A	Termination System	Finish	100% Matte Sn	SnPb (5% min)
B		Barrier Layer	Ni	
D		Base metal	Cu	
E	Inner Electrode		Ni	
F	Dielectric Material		BaTiO <sub>3</sub>	



Note: Image is exaggerated in order to clearly identify all components of construction.

## Construction – Flexible Termination

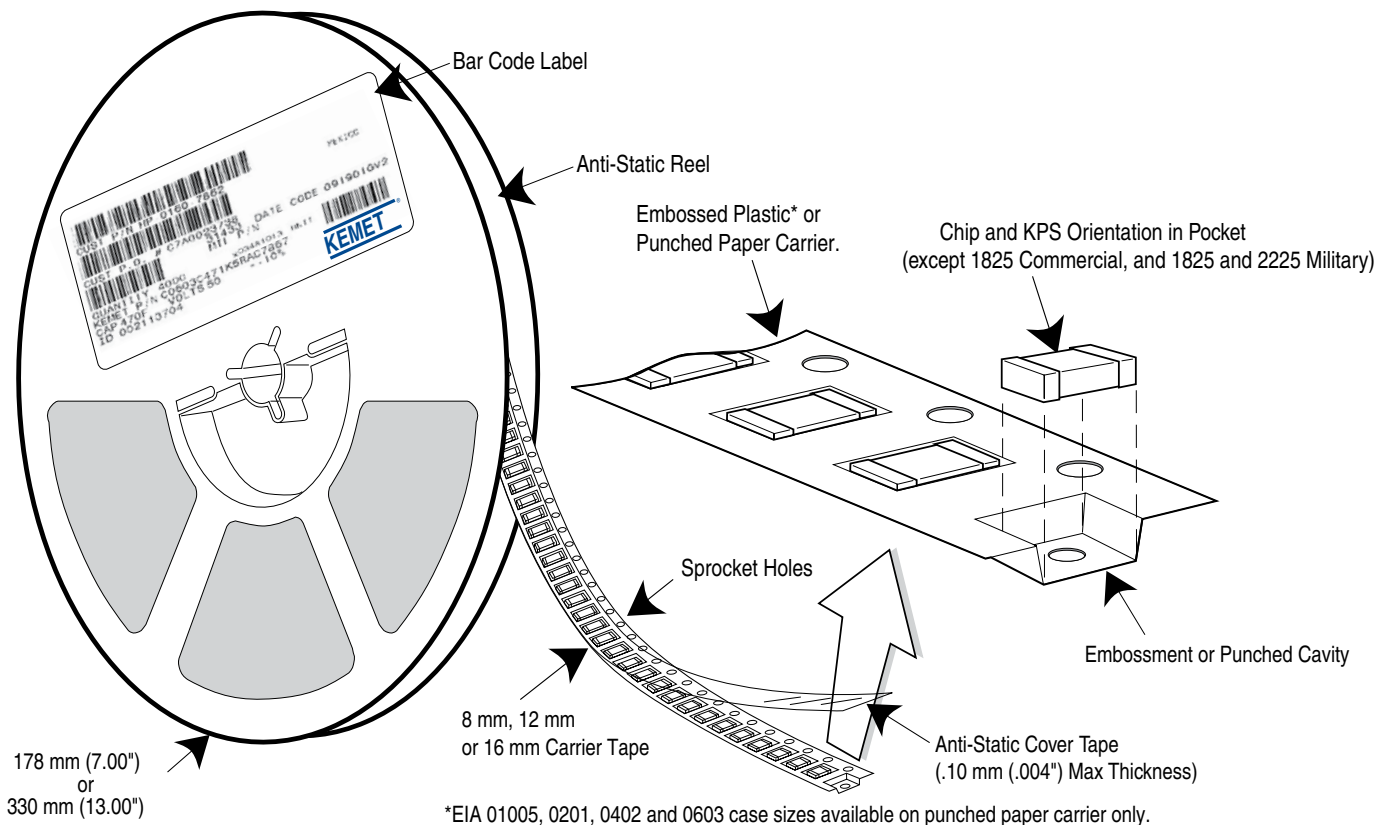
Reference	Item		Material	
A	Termination System	Finish	100% Matte Sn	SnPb (5% min)
B		Barrier Layer	Ni	
C		Epoxy Layer	Ag	
D	Base metal		Cu	
E	Inner Electrode		Ni	
F	Dielectric Material		BaTiO <sub>3</sub>	



Note: Image is exaggerated in order to clearly identify all components of construction.

## Tape & Reel Packaging Information

KEMET offers multilayer ceramic chip capacitors packaged in 8, 12 and 16 mm tape on 7" and 13" reels in accordance with EIA Standard 481. This packaging system is compatible with all tape fed automatic pick and place systems. See Table 2 for details on reeling quantities for commercial chips.



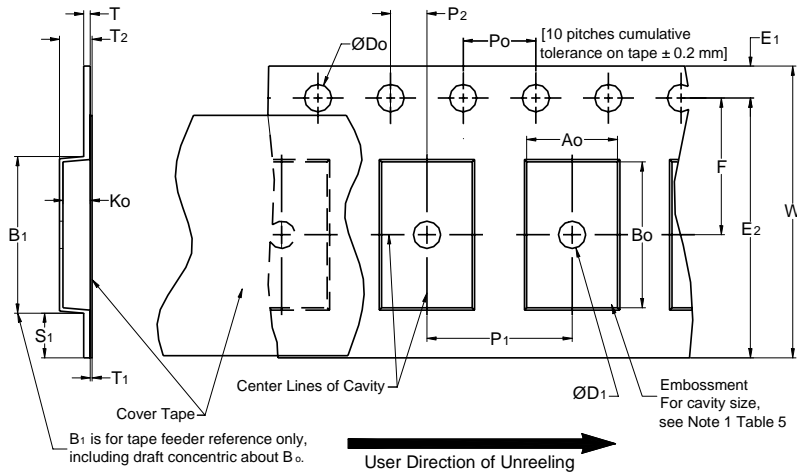
**Table 5 – Carrier Tape Configuration (mm)**

EIA Case Size	Tape Size (W)*	Lead Space (P <sub>1</sub> )*
01005 – 0402	8	2
0603 – 1210	8	4
1805 – 1808	12	4
≥ 1812	12	8
KPS 1210	12	8
KPS 1812 & 2220	16	12
Array 0508 & 0612	8	4

\*Refer to Figure 1 for W and P<sub>1</sub> carrier tape reference locations.

\*Refer to Table 6 for tolerance specifications.

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



**Table 6 – Embossed (Plastic) Carrier Tape Dimensions**

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	D <sub>0</sub>	D <sub>1</sub> Min. Note 1	E <sub>1</sub>	P <sub>0</sub>	P <sub>2</sub>	R Ref. Note 2	S <sub>1</sub> Min. Note 3	T Max.	T <sub>1</sub> Max.
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 <sub>1</sub> Max. Note 4	E <sub>2</sub> Min.	F	P <sub>1</sub>	T <sub>2</sub> Max	W Max	A <sub>0</sub> , B <sub>0</sub> & K <sub>0</sub>	
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  $S_1 < 1.0$  mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481 paragraph 4.3 section b).
- B<sub>1</sub> dimension is a reference dimension for tape feeder clearance only.
- The cavity defined by A<sub>0</sub>, B<sub>0</sub> and K<sub>0</sub> 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 3).
  - lateral movement of the component is restricted to 0.5 mm maximum for 8 and 12 mm wide tape and to 1.0 mm maximum for 16 mm tape (see Figure 4).
  - for KPS Series product, A<sub>0</sub> and B<sub>0</sub> are measured on a plane 0.3 mm above the bottom of the pocket.
  - see Addendum in EIA Standard 481 for standards relating to more precise taping requirements.

Figure 2 – Punched (Paper) Carrier Tape Dimensions

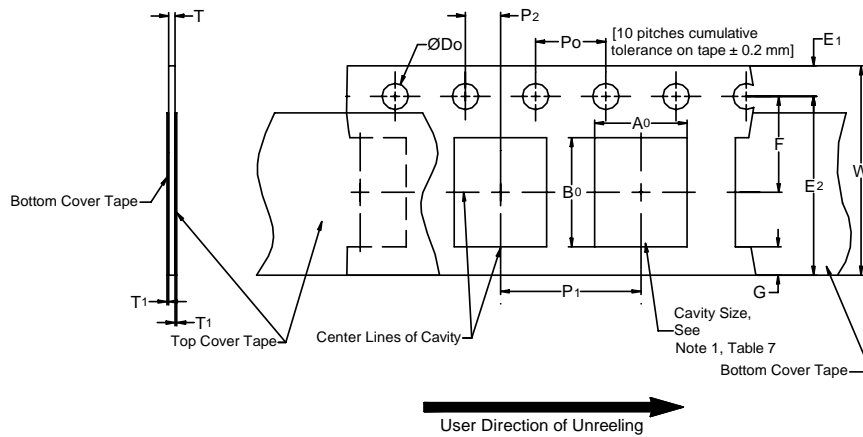


Table 7 – Punched (Paper) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)							
Tape Size	$D_0$	$E_1$	$P_0$	$P_2$	$T_1$ Max	G Min	R Ref. Note 2
8 mm	$1.5 +0.10 -0.0$ ( $0.059 +0.004 -0.0$ )	$1.75 \pm 0.10$ ( $0.069 \pm 0.004$ )	$4.0 \pm 0.10$ ( $0.157 \pm 0.004$ )	$2.0 \pm 0.05$ ( $0.079 \pm 0.002$ )	0.10 (.004) Max.	0.75 (.030)	25 (.984)
Variable Dimensions — Millimeters (Inches)							
Tape Size	Pitch	$E_2$ Min	F	$P_1$	T Max	W Max	$A_0 B_0$
8 mm	Half (2 mm)	6.25 (0.246)	$3.5 \pm 0.05$ ( $0.138 \pm 0.002$ )	$2.0 \pm 0.05$ ( $0.079 \pm 0.002$ )	1.1 (0.098)	8.3 (0.327)	Note 1
8 mm	Single (4 mm)			$4.0 \pm 0.10$ ( $0.157 \pm 0.004$ )		8.3 (0.327)	

- The cavity defined by  $A_0$ ,  $B_0$  and  $T$  shall surround the component with sufficient clearance that:
  - the component does not protrude beyond either 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.
  - lateral movement of the component is restricted to 0.5 mm maximum (see Figure 4).
  - see Addendum in EIA Standard 481 for standards relating to more precise taping requirements.
- The tape with or without components shall pass around  $R$  without damage (see Figure 5).

## Packaging Information Performance Notes

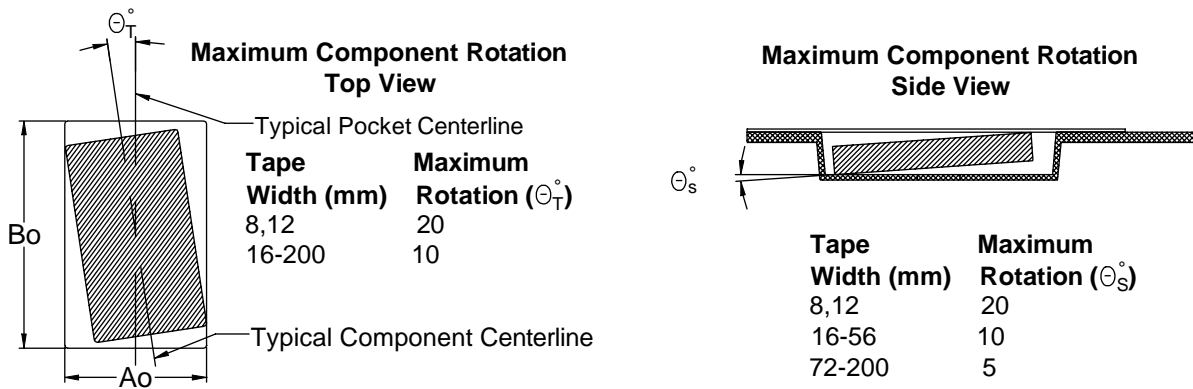
1. Cover Tape Break Force: 1.0 Kg minimum.
2. Cover Tape Peel Strength: The total peel strength of the cover tape from the carrier tape shall be:

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)

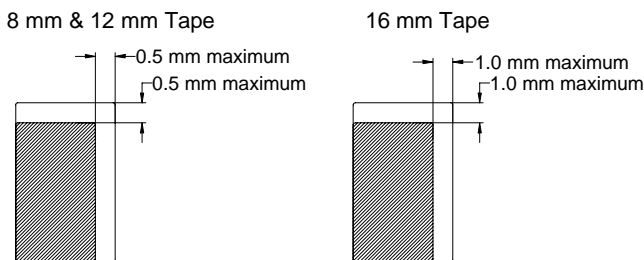
The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ± 10 mm/minute.

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.

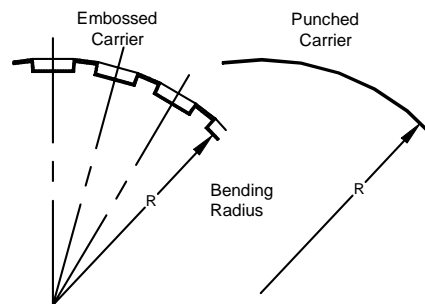
### Figure 3 – Maximum Component Rotation



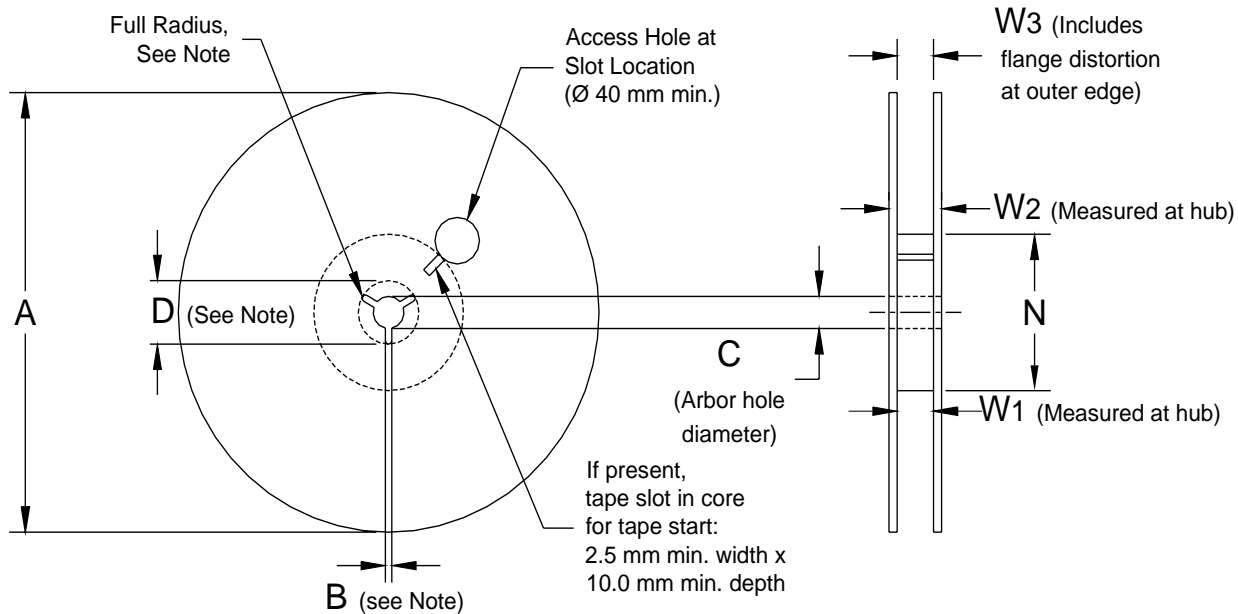
### Figure 4 – Maximum Lateral Movement



### Figure 5 – Bending Radius



**Figure 6 – Reel Dimensions**



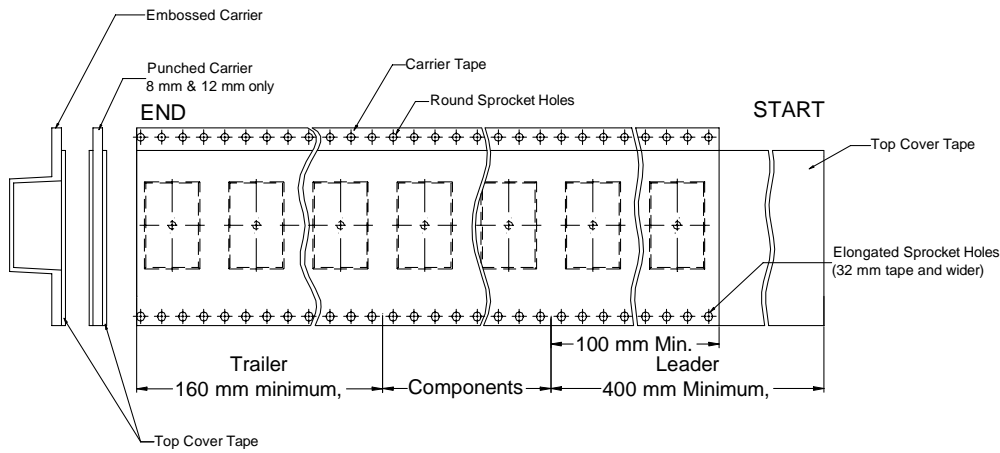
Note: Drive spokes optional; if used, dimensions B and D shall apply.

**Table 8 – Reel Dimensions**

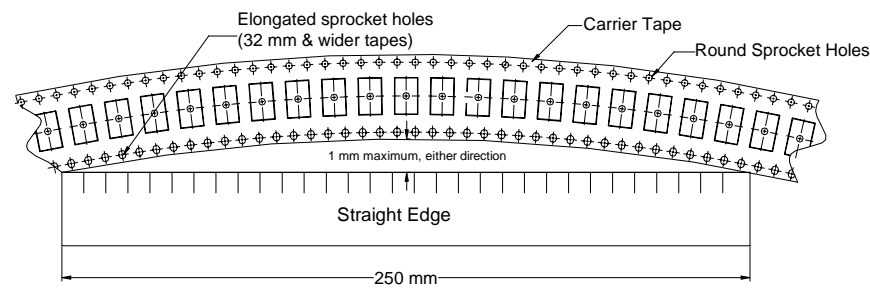
Metric will govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Min	C	D Min
8 mm	$178 \pm 0.20$ ( $7.008 \pm 0.008$ )	1.5 (0.059)	$13.0 + 0.5 / - 0.2$ ( $0.521 + 0.02 / - 0.008$ )	20.2 (0.795)
12 mm	or			
16 mm	$330 \pm 0.20$ ( $13.000 \pm 0.008$ )			
Variable Dimensions — Millimeters (Inches)				
Tape Size	N Min	$W_1$	$W_2$ Max	$W_3$
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 7 – Tape Leader & Trailer Dimensions**



**Figure 8 – Maximum Camber**



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Färjestaden, Sweden  
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Beijing, China  
Tel: 86-10-5829-1711

Shanghai, China  
Tel: 86-21-6447-0707

Taipei, Taiwan  
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Tel: 65-6586-1900

Penang, Malaysia  
Tel: 60-4-6430200

Bangalore, India  
Tel: 91-806-53-76817

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## Other KEMET Resources

Tools	
Resource	Location
Configure A Part: CapEdge	<a href="http://capacitoredge.kemet.com">http://capacitoredge.kemet.com</a>
SPICE & FIT Software	<a href="http://www.kemet.com/spice">http://www.kemet.com/spice</a>
Search Our FAQs: KnowledgeEdge	<a href="http://www.kemet.com/keask">http://www.kemet.com/keask</a>

Product Information	
Resource	Location
Products	<a href="http://www.kemet.com/products">http://www.kemet.com/products</a>
Technical Resources (Including Soldering Techniques)	<a href="http://www.kemet.com/technicalpapers">http://www.kemet.com/technicalpapers</a>
RoHS Statement	<a href="http://www.kemet.com/rohs">http://www.kemet.com/rohs</a>
Quality Documents	<a href="http://www.kemet.com/qualitydocuments">http://www.kemet.com/qualitydocuments</a>

Product Request	
Resource	Location
Sample Request	<a href="http://www.kemet.com/sample">http://www.kemet.com/sample</a>
Engineering Kit Request	<a href="http://www.kemet.com/kits">http://www.kemet.com/kits</a>

Contact	
Resource	Location
Website	<a href="http://www.kemet.com">www.kemet.com</a>
Contact Us	<a href="http://www.kemet.com/contact">http://www.kemet.com/contact</a>
Investor Relations	<a href="http://www.kemet.com/ir">http://www.kemet.com/ir</a>
Call Us	1-877-MyKEMET
Twitter	<a href="http://twitter.com/kemetcapacitors">http://twitter.com/kemetcapacitors</a>

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