

# Floating Electrode Design with Flexible Termination System (FF-CAP), X7R Dielectric, 6.3VDC-250VDC (Commercial & Automotive Grade)

## Overview

KEMET's Floating Electrode with Flexible Termination capacitor (FF-CAP) combines two existing KEMET technologies—Floating Electrode and Flexible Termination. The floating electrode component utilizes a cascading internal electrode design configured to form multiple capacitors in series within a single monolithic structure. This unique configuration results in enhanced voltage and ESD performance over standard capacitor designs while allowing for a fail-open condition if mechanically damaged (cracked). The flexible termination component utilizes a conductive silver epoxy between the base metal and nickel barrier layers of KEMET's standard termination system in order to establish pliability while maintaining terminal strength, solderability and electrical performance. Both technologies address the primary failure mode of MLCCs—flex cracks, which are typically the result of excessive shear stresses produced during board flexure or thermal cycling.

Although neither technology can eliminate the potential for mechanical damage that may propagate during extreme

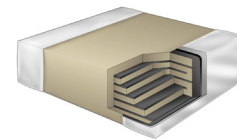
environmental and/or handling conditions, the combination of these two technologies provide the ultimate level of protection against a low IR or short circuit condition. Designed for safety critical applications, the FF-CAP is Pb-Free and RoHS compliant meets the requirements of the Automotive Electronics Council's AEC-Q200 and is widely used in automotive circuits as well as power supplies (input and output filters) and general electronic applications.

Combined with the stability of an X7R dielectric, the FF-CAP complements KEMET's Open Mode, Floating Electrode (FE-CAP), Flexible Termination (FT-CAP) and KEMET Power Solutions (KPS) product lines by providing an ultimate fail-safe design optimized for low to mid range capacitance values. These devices exhibit a predictable change in capacitance with respect to time and voltage and boast a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to  $\pm 15\%$  from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

## Benefits

- $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  operating temperature range
- Superior flex performance (up to 5mm)
- Floating Electrode/fail open design
- Low to mid capacitance flex mitigation
- Pb-Free and RoHS compliant
- EIA 0603, 0805, 1206, 1210, and 1812 case sizes
- DC voltage ratings of 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 250V
- Capacitance offerings ranging from 180pF to 0.22 $\mu\text{F}$
- Available capacitance tolerances of  $\pm 5\%$ ,  $\pm 10\%$  and  $\pm 20\%$
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated end metallization allowing for excellent solderability
- SnPb end metallization option available upon request (5% min)
- Commercial and Automotive (AEC-Q200) grades available

FLEXIBLE  
FTCAP  
TERMINATION



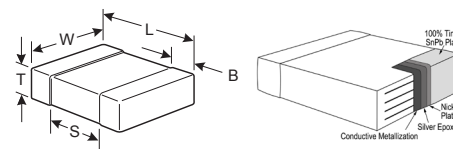
## Ordering Information

C	0805	Y	104	K	5	R	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	End Metallization <sup>1</sup>	Packaging/Grade (C-Spec) <sup>2</sup>
	0603 0805 1206 1210 1812	Y = Floating Electrode w/ Flexible Termination	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	9 = 6.3V 8 = 10V 4 = 16V 3 = 25V 5 = 50V 1 = 100V 2 = 200V A = 250V	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 options may be available. Contact KEMET for details.

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

## Dimensions – Millimeters (Inches)



EIA Size Code	Metric Size Code	L Length	W Width	B Bandwidth	T Thickness	Mounting Technique
0603	1608	1.6 (.063) ± 0.20 (.008)	0.80 (.032) ± 0.15 (.006)	0.45 (.018) ± 0.15 (.006)	See Table 2 for Thickness	Solder Wave or Solder Reflow
0805	2012	2.1 (.083) ± 0.30 (.012)	1.25 (.049) ± 0.20 (.008)	0.50 (0.02) ± 0.25 (.010)		
1206	3216	3.3 (.130) ± 0.40 (.016)	1.60 (.063) ± 0.20 (.008)	0.60 (.024) ± 0.25 (.010)		Solder Reflow Only
1210	3225	3.3 (.130) ± 0.40 (.016)	2.50 (.098) ± 0.20 (.008)	0.60 (.024) ± 0.25 (.010)		
1812	4532	4.5 (.178) ± 0.40 (.016)	3.20 (.126) ± 0.30 (.012)	0.70 (.028) ± 0.35 (.014)		

## Applications

Typical applications include circuits with a direct battery or power source connection, critical and safety relevant circuits without (integrated) current limitation and any application that is subject to high levels of board flexure or temperature cycling. Examples include raw power input side filtering (power plane/bus), high current applications (automobile battery line) and circuits that cannot be fused to open. Markets include consumer, medical, industrial (power supply), automotive, aerospace and telecom.

## Qualification/Certification

Commercial grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 4, Performance and 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 @[www.aecouncil.com](http://www.aecouncil.com).

## Environmental Compliance

RoHS PRC ( Peoples Republic of China) 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):	3.5%
Dielectric Withstanding Voltage:	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limits @ 25°C:	5%(10V), 3.5%(16V & 25V) and 2.5%(50V to 200V)
Insulation Resistance (IR) Limit @ 25°C:	See Insulation Resistance Limit Table

To obtain IR limit, divide  $M\Omega \cdot \mu F$  value by the capacitance and compare to  $G\Omega$  limit. Select the lower of the two limits.

Capacitance and Dissipation Factor (DF) measured under the following conditions:

1kHz ± 50Hz and  $1.0 \pm 0.2$  Vrms if capacitance  $\leq 10\mu F$

120Hz ± 10Hz and  $0.5 \pm 0.1$  Vrms if capacitance  $> 10\mu F$

## Insulation Resistance Limit Table

EIA Case Size	1000 megohm microfarads or 100GΩ	500 megohm microfarads or 10GΩ
0201	N/A	ALL
0402	< .012μF	≥ .012μF
0603	< .047μF	≥ .047μF
0805	< .047μF	≥ .047μF
1206	< 0.22μF	≥ 0.22μF
1210	< 0.39μF	≥ 0.39μF
1808	ALL	N/A
1812	< 2.2μF	≥ 2.2μF
1825	ALL	N/A
2220	< 10μF	≥ 10μF
2225	ALL	N/A

**Table 1A – (0603 - 0805 Case Sizes)**

Cap	Cap Code	Series			C0603Y							C0805Y																
		Voltage Code			9	8	4	3	5	1	2	9	8	4	3	5	1	2	A									
		Voltage VDC			6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	250									
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																							
150 pF	151	J	K	M																								
180 pF	181	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
220 pF	221	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
270 pF	271	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
330 pF	331	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
390 pF	391	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
470 pF	471	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
560 pF	561	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
680 pF	681	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
820 pF	821	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
1,000 pF	102	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
1,200 pF	122	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
1,500 pF	152	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
1,800 pF	182	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
2,200 pF	222	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
2,700 pF	272	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
3,300 pF	332	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
3,900 pF	392	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
4,700 pF	472	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
5,600 pF	562	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
6,800 pF	682	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
8,200 pF	822	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
10,000 pF	103	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
12,000 pF	123	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
15,000 pF	153	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC										
18,000 pF	183	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DD											
22,000 pF	223	J	K	M	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DD											
27,000 pF	273	J	K	M								DC	DC	DC	DC	DC												
33,000 pF	333	J	K	M								DC	DC	DC	DC	DC												
39,000 pF	393	J	K	M								DC	DC	DC	DC	DC												
47,000 pF	473	J	K	M								DC	DC	DC	DC	DC												
56,000 pF	563	J	K	M								DD	DD	DD	DD	DD												
68,000 pF	683	J	K	M								DD	DD	DD	DD	DD												
82,000 pF	823	J	K	M								DG	DG	DG	DG	DG												
0.10 uF	104	J	K	M								DG	DG	DG	DG	DG												
Cap	Cap Code	Voltage VDC			6.3	10	16	25	50	100	200	Voltage Code			6.3	10	16	25	50	100	200	250						
		Voltage Code			9	8	4	3	5	1	2	Series			C0603Y							C0805Y						
		Series			C0603Y							C0805Y																



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

Thickness Code	Chip Size	Thickness ± Range (mm)	Qty per Reel 7" Plastic	Qty per Reel 13" Plastic	Qty per Reel 7" Paper	Qty per Reel 13" Paper	Qty per Bulk Cassette
AA	01005	0.20 ± 0.02			15000		
AB	0201	0.30 ± 0.03			15000		
BB	0402	0.50 ± 0.05			10000	50000	50000
CB	0603	0.80 ± 0.07			4000	10000	15000
CC	0603	0.80 ± 0.10			4000	10000	
CD	0603	0.80 ± 0.15			4000	10000	
DC	0805	0.78 ± 0.10			4000	10000	
DD	0805	0.90 ± 0.10			4000	10000	
DL	0805	0.95 ± 0.10	4000	10000			
DE	0805	1.00 ± 0.10	2500	10000			
DF	0805	1.10 ± 0.10	2500	10000			
DG	0805	1.25 ± 0.15	2500	10000			
DH	0805	1.25 ± 0.20	2500	10000			
EB	1206	0.78 ± 0.10	4000	10000	4000	10000	
EK	1206	0.80 ± 0.10	2000	8000			
EC	1206	0.90 ± 0.10	4000	10000			
EN	1206	0.95 ± 0.10	4000	10000			
ED	1206	1.00 ± 0.10	2500	10000			
EE	1206	1.10 ± 0.10	2500	10000			
EF	1206	1.20 ± 0.15	2500	10000			
EM	1206	1.25 ± 0.15	2500	10000			
EG	1206	1.60 ± 0.15	2000	8000			
EH	1206	1.60 ± 0.20	2000	8000			
EJ	1206	1.70 ± 0.20	2000	8000			
FB	1210	0.78 ± 0.10	4000	10000			
FC	1210	0.90 ± 0.10	4000	10000			
FD	1210	0.95 ± 0.10	4000	10000			
FE	1210	1.00 ± 0.10	2500	10000			
FF	1210	1.10 ± 0.10	2500	10000			
FG	1210	1.25 ± 0.15	2500	10000			
FL	1210	1.40 ± 0.15	2000	8000			
FO	1210	1.50 ± 0.20	2000	8000			
FH	1210	1.55 ± 0.15	2000	8000			
FP	1210	1.60 ± 0.20	2000	8000			
FM	1210	1.70 ± 0.20	2000	8000			
FJ	1210	1.85 ± 0.20	2000	8000			
FN	1210	1.85 ± 0.20	2000	8000			
FT	1210	1.90 ± 0.20	1500	4000			
FK	1210	2.10 ± 0.20	2000	8000			
FR	1210	2.25 ± 0.20	2000	8000			
FS	1210	2.50 ± 0.20	1000	4000			
PA	1220	0.80 ± 0.10	4000	10000			
MA	1632	0.80 ± 0.10	4000	10000			
NA	1706	0.90 ± 0.10	4000	10000			
NA	1706	0.90 ± 0.10	4000	10000			
LD	1808	0.90 ± 0.10	2500	10000			
LA	1808	1.40 ± 0.15	1000	4000			
LB	1808	1.60 ± 0.15	1000	4000			
LC	1808	2.00 ± 0.15	1000	4000			
GB	1812	1.00 ± 0.10	1000	4000			
GC	1812	1.10 ± 0.10	1000	4000			
GD	1812	1.25 ± 0.15	1000	4000			
GE	1812	1.30 ± 0.10	1000	4000			
GH	1812	1.40 ± 0.15	1000	4000			
GF	1812	1.50 ± 0.10	1000	4000			
GG	1812	1.55 ± 0.10	1000	4000			
GK	1812	1.60 ± 0.20	1000	4000			
GJ	1812	1.70 ± 0.15	1000	4000			
GN	1812	1.70 ± 0.20	1000	4000			
GL	1812	1.90 ± 0.20	1000	4000			
GM	1812	2.00 ± 0.20	1000	4000			
GO	1812	2.50 ± 0.20	500	2000			
HB	1825	1.10 ± 0.15	1000	4000			
HC	1825	1.15 ± 0.15	1000	4000			
HD	1825	1.30 ± 0.15	1000	4000			
HE	1825	1.40 ± 0.15	1000	4000			
HF	1825	1.50 ± 0.15	1000	4000			
HG	1825	1.60 ± 0.20	1000	4000			
JB	2220	1.00 ± 0.15	1000	4000			
JC	2220	1.10 ± 0.15	1000	4000			
JD	2220	1.30 ± 0.15	1000	4000			
JE	2220	1.40 ± 0.15	1000	4000			
JF	2220	1.50 ± 0.15	1000	4000			
JP	2220	1.60 ± 0.20	1000	4000			
JG	2220	1.70 ± 0.15	1000	4000			
JH	2220	1.80 ± 0.15	1000	4000			
JO	2220	2.40 ± 0.15	500	2000			
KB	2225	1.00 ± 0.15	1000	4000			
KC	2225	1.10 ± 0.15	1000	4000			
KD	2225	1.30 ± 0.15	1000	4000			
KE	2225	1.40 ± 0.15	1000	4000			
KF	2225	1.60 ± 0.20	1000	4000			

Package Quantity  
 Based on Finished Chip  
 Thickness Specifications

## 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-020D.1

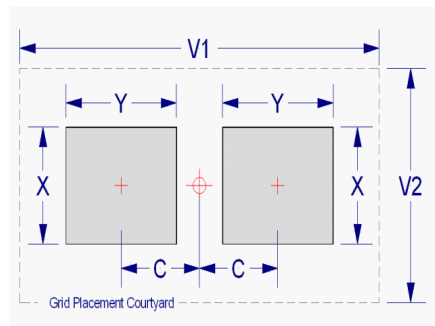
**Table 3 – Chip Capacitor Land Pattern Design Recommendations per IPC-7351**

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	1.05	1.45	1.55	4.60	2.60	0.95	1.25	1.45	3.70	2.00	0.85	1.05	1.35	3.00	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).



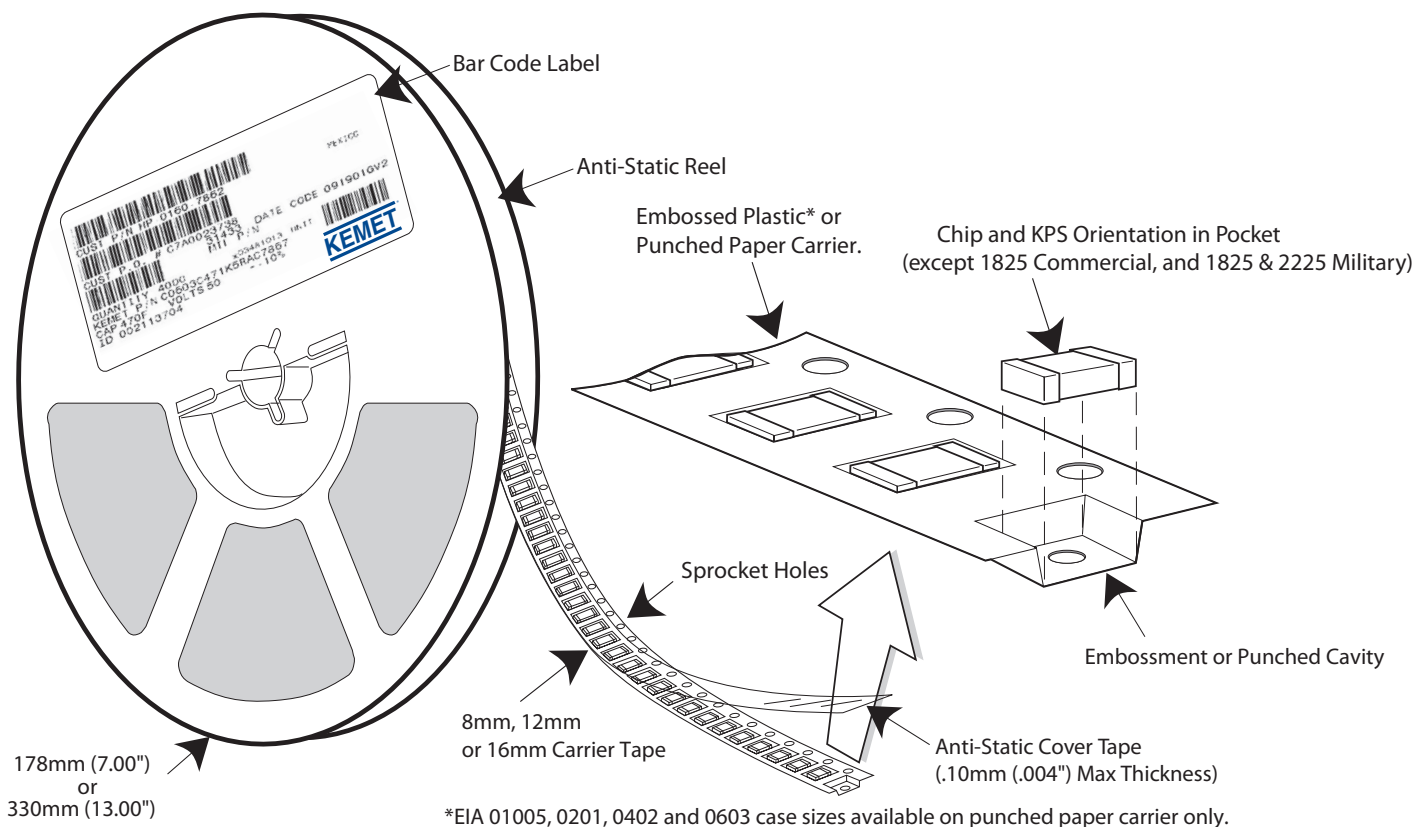
**Table 4 – Performance & Reliability: Test Methods and Conditions**

Stress	Reference	Test or Inspection Method
Ripple Current	Heat Generation $\Delta T$ : 20°C max.	Reflow solder the capacitor onto a PC board and apply voltage with 10kHz~1Mhz sine curve. (Ripple voltage must be < rated voltage)
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2mm (min) for all except 3mm for C0G.
Solderability	J-STD-002	Magnification 50X. Conditions:
		a) Method B, 4 hrs @ 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	1000 Cycles (-55°C to +125°C), Measurement at 24 hrs. +/- 2 hrs after test conclusion.
Biased Humidity	MIL-STD-202 Method 103	Load Humidity: 1000 hours 85°C/85%RH and Rated Voltage. Add 100K ohm resistor. Measurement at 24 hrs. +/- 2 hrs after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hrs. +/- 2 hrs after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 7b not required. Unpowered. Measurement at 24 hrs. +/- 2 hrs 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	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 1.5X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0VDC, for 1000 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.



## Tape & Reel Packaging Information

KEMET offers Multilayer Ceramic Chip Capacitors packaged in 8mm, 12mm and 16mm 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.



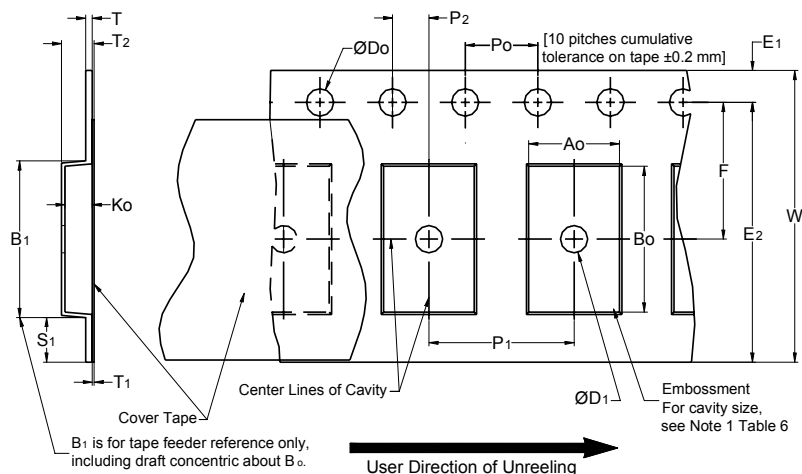
**Table 5 – Carrier Tape Configuration (mm)**

EIA Case Size	Tape size (W)*	Pitch (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**



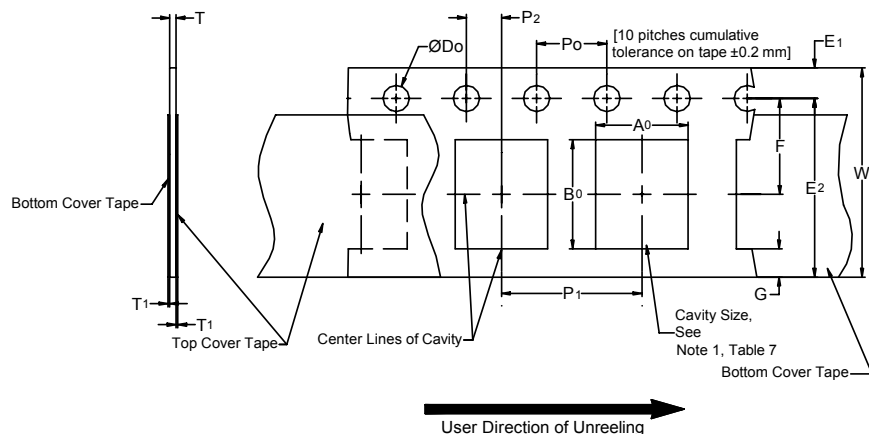
**Table 6 – Embossed (Plastic) Carrier Tape Dimensions**

Metric will govern

Constant Dimensions — Millimeters (Inches)									
Tape Size	$D_0$	$D_1$ Min. Note 1	$E_1$	$P_0$	$P_2$	R Ref. Note 2	$S_1$ Min. Note 3	T Max.	$T_1$ Max.
8mm	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)
12mm		1.5 (0.059)				30 (1.181)			
16mm									
Variable Dimensions — Millimeters (Inches)									
Tape Size	Pitch	$B_1$ Max. Note 4	$E_2$ Min.	F	$P_1$	$T_2$ Max	W Max	$A_0, B_0$ & $K_0$	
8mm	Single (4mm)	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	
12mm	Single (4mm) & Double (8mm)	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)		
16mm	Triple (12mm)	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 Document 481 paragraph 4.3 (b)).
- $B_1$  dimension is a reference dimension for tape feeder clearance only.
- The cavity defined by  $A_0$ ,  $B_0$  and  $K_0$  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 12mm tapes and 10° maximum for 16mm tapes (see Figure 3).
  - lateral movement of the component is restricted to 0.5 mm maximum for 8mm and 12mm wide tape and to 1.0mm maximum for 16mm tape (see Figure 4).
  - for KPS Series product  $A_0$  and  $B_0$  are measured on a plane 0.3mm above the bottom of the pocket.
  - see Addendum in EIA Document 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
8mm	$1.5 +0.10-0.0$ (0.059 +0.004, -0.0)	$1.75 \pm 0.10$ (0.069 ±0.004)	$4.0 \pm 0.10$ (0.157 ±0.004)	$2.0 \pm 0.05$ (0.079 ±0.002)	0.10 (.004) Max.	0.75 (.030)	25 (.984)
Variable Dimensions — Millimeters (Inches)							
Tape Size	Pitch	E2 Min	F	$P_1$	T Max	W Max	$A_0 B_0$
8mm	Half (2mm)	6.25 (0.246)	$3.5 \pm 0.05$ (0.138 ± 0.002)	$2.0 \pm 0.05$ (0.079 ± 0.002)	1.1 (0.098)	8.3 (0.327)	Note 5
8mm	Single (4mm)			$4.0 \pm 0.10$ (0.157 ± 0.004)			

- 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 Document 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

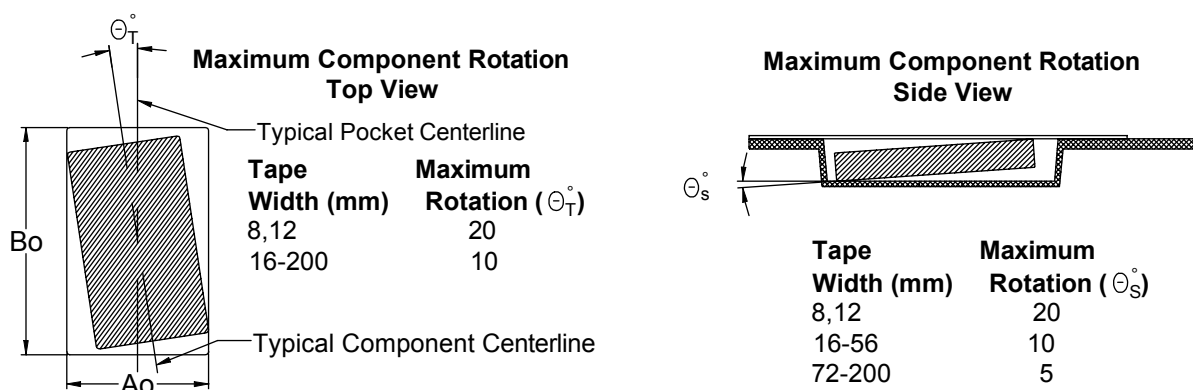
1. **Cover Tape Break Force:** 1.0 Kg Minimum.
2. **Cover Tape Peel Strength:** The total peel strength of the cover tape from the carrier tape shall be:

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

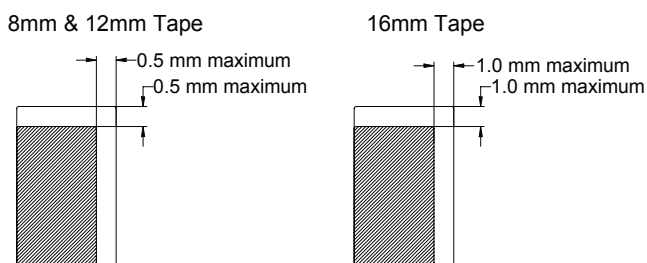
The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300±10 mm/minute.

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

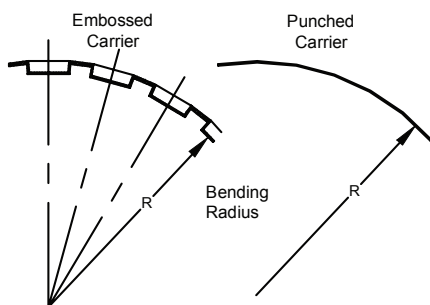
## Figure 3 – Maximum Component Rotation



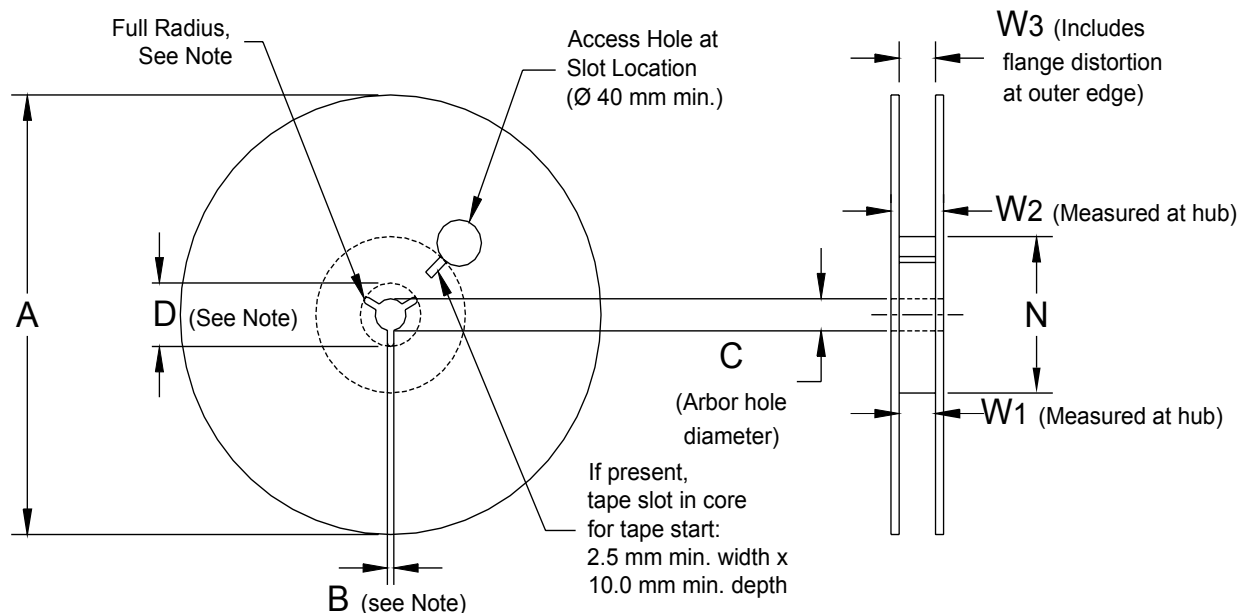
## Figure 4 – Maximum Lateral Movement



## Figure 5 – Bending Radius



**Figure 6 – Reel Dimensions**

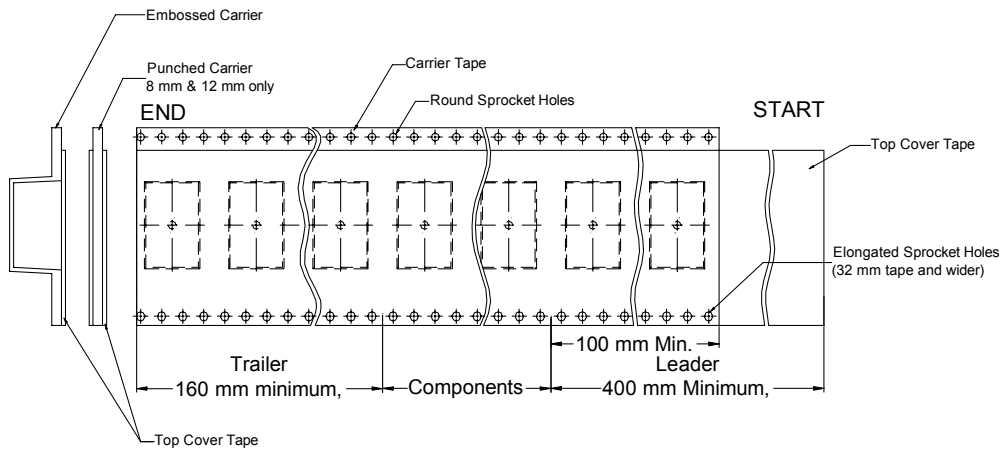


**Table 8 – Reel Dimensions**

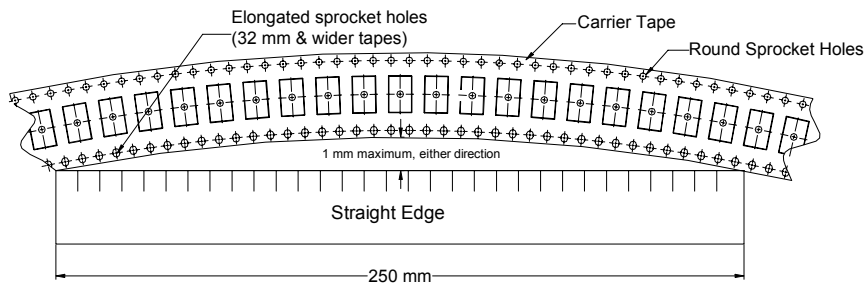
Metric Dimensions Will Govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Min	C	D Min
8mm	178 ± 0.20 (7.008 ± 0.008)	1.5 (0.059)	13.0 +0.5/-0.2 (0.521 +0.02/-0.008)	20.2 (0.795)
12mm	or			
16mm	330 ± 0.20 (13.000 ± 0.008)			
Variable Dimensions — Millimeters (Inches)				
Tape Size	N Min	W <sub>1</sub>	W <sub>2</sub> Max	W <sub>3</sub>
8mm	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
12mm		12.4 +2.0/-0.0 (0.488 +0.078/-0.0)	18.4 (0.724)	
16mm		16.4 +2.0/-0.0 (0.646 +0.078/-0.0)	22.4 (0.882)	

**Figure 7 – Tape Leader & Trailer Dimensions**



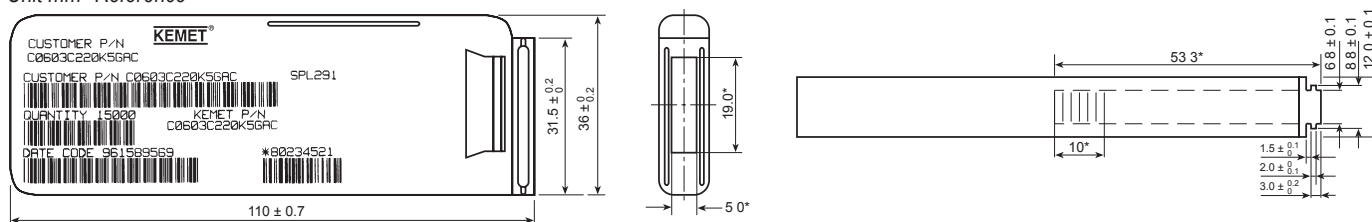
**Figure 8 – Maximum Camber**



## Figure 9 – Bulk Cassette Packaging (Ceramic Chips Only)

Meets Dimensional Requirements IEC-286 and EIAJ 7201

Unit mm \*Reference



## Table 9 – Capacitor Dimensions for Bulk Cassette

Cassette Packaging – Millimeters

EIA Size Code	Metric Size Code	L Length	W Width	B Bandwidth	S Separation minimum	T Thickness	Number of Pcs/Cassette
0402	1005	1.0 ± 0.05	0.5 ± 0.05	0.2 to 0.4	0.3	0.5 ± .05	50,000
0603	1608	1.6 ± 0.07	0.8 ± 0.07	0.2 to 0.5	0.7	0.8 ± .07	15,000

## Table 10 – Capacitor Marking

Laser marking is available as an extra-cost option for most KEMET ceramic chips. Such marking is two sided, and includes a K to identify KEMET, followed by two characters (per EIA-198) to identify the capacitance value. Note that marking is not available for any Y5V chip. In addition, the 0603 marking option is limited to the K only. (Marking Optional – Not Available for 0402 Size)

Numeral Alpha Character	Capacitance (pF) For Various Numeral Identifiers									
	9	0	1	2	3	4	5	6	7	
A	0.1	1	10	100	1000	10000	100000	1000000	10000000	
B	0.11	1.1	11	110	1100	11000	110000	1100000	11000000	
C	0.12	1.2	12	120	1200	12000	120000	1200000	12000000	
D	0.13	1.3	13	130	1300	13000	130000	1300000	13000000	
E	0.15	1.5	15	150	1500	15000	150000	1500000	15000000	
F	0.16	1.6	16	160	1600	16000	160000	1600000	16000000	
G	0.18	1.8	18	180	1800	18000	180000	1800000	18000000	
H	0.2	2	20	200	2000	20000	200000	2000000	20000000	
J	0.22	2.2	22	220	2200	22000	220000	2200000	22000000	
K	0.24	2.4	24	240	2400	24000	240000	2400000	24000000	
L	0.27	2.7	27	270	2700	27000	270000	2700000	27000000	
M	0.3	3	30	300	3000	30000	300000	3000000	30000000	
N	0.33	3.3	33	330	3300	33000	330000	3300000	33000000	
P	0.36	3.6	36	360	3600	36000	360000	3600000	36000000	
Q	0.39	3.9	39	390	3900	39000	390000	3900000	39000000	
R	0.43	4.3	43	430	4300	43000	430000	4300000	43000000	
S	0.47	4.7	47	470	4700	47000	470000	4700000	47000000	
T	0.51	5.1	51	510	5100	51000	510000	5100000	51000000	
U	0.56	5.6	56	560	5600	56000	560000	5600000	56000000	
V	0.62	6.2	62	620	6200	62000	620000	6200000	62000000	
W	0.68	6.8	68	680	6800	68000	680000	6800000	68000000	
X	0.75	7.5	75	750	7500	75000	750000	7500000	75000000	
Y	0.82	8.2	82	820	8200	82000	820000	8200000	82000000	
Z	0.91	9.1	91	910	9100	91000	910000	9100000	91000000	
a	0.25	2.5	25	250	2500	25000	250000	2500000	25000000	
b	0.35	3.5	35	350	3500	35000	350000	3500000	35000000	
d	0.4	4	40	400	4000	40000	400000	4000000	40000000	
e	0.45	4.5	45	450	4500	45000	450000	4500000	45000000	
f	0.5	5	50	500	5000	50000	500000	5000000	50000000	
m	0.6	6	60	600	6000	60000	600000	6000000	60000000	
n	0.7	7	70	700	7000	70000	700000	7000000	70000000	
t	0.8	8	80	800	8000	80000	800000	8000000	80000000	
y	0.9	9	90	900	9000	90000	900000	9000000	90000000	



Example shown is 1,000 pF capacitor

## 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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Although all product-related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.



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 Tel: 44-1305-830747  
 Fax: 44-1305-760670

Thörnblads Väg 6  
 Färjestaden 386 90  
 Sweden  
 Tel: 46-485-563934  
 Fax: 46-485-563938

Stella Business Park  
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 Espoo 02600  
 Finland  
 Tel: 358-9-5406-5000  
 Fax: 358-9-5406-5010

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 Tel: 852-2305-1168  
 Fax: 852-2759-0345

Room 1411, 14/F New China  
 Insurance Edifice  
 Mintian Road, CBD Futian District  
 Shenzhen 518001  
 China  
 Tel: 1-867-55-25181306  
 Fax: 1-867-55-25181307

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 No.1-3 Xin Yuan South Road  
 Chao Yang District  
 Beijing 100027  
 China  
 Tel: 86-10-5829-1711  
 Fax: 86-10-5829-1963

Room 2602, Grand Gateway Tower 1  
 No.1 Hong Qiao Road  
 Shanghai 200030  
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 Fax: 86-21-6447-0070

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 Tel: 6-04-6430200  
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