

Surface Mount Multilayer Ceramic Capacitors

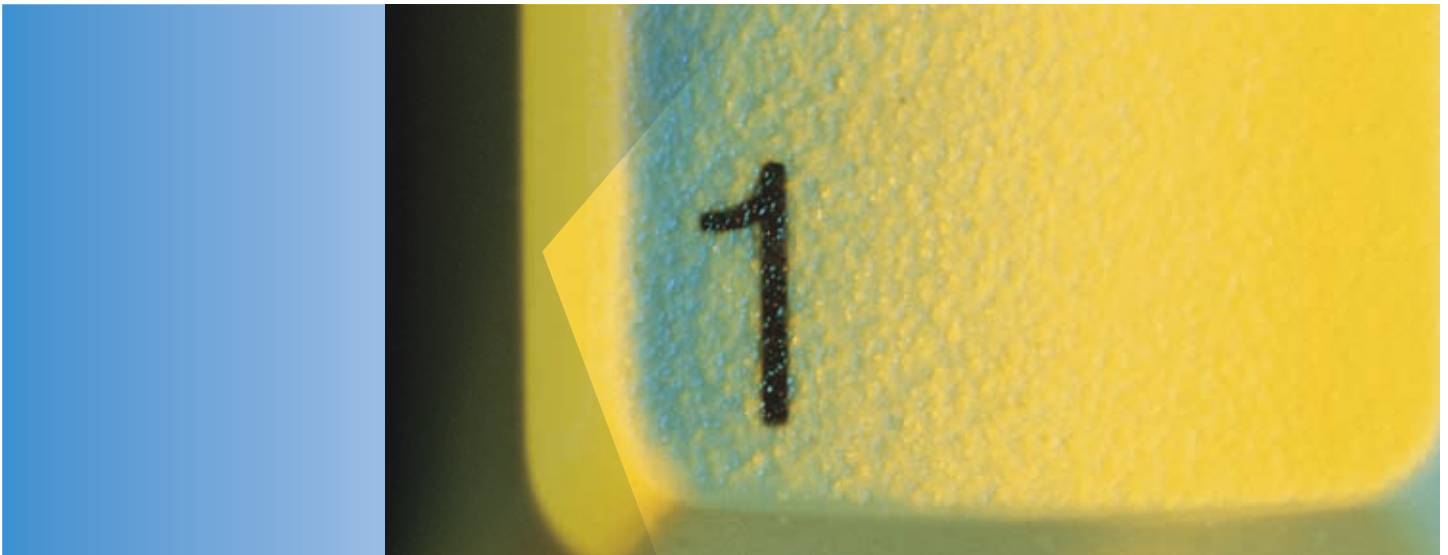
Automotive Grade



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The Capacitance Company
KEMET
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No bouncing from supplier to supplier to find what you need. No multiple web sites and phone calls to get answers.

When you partner with KEMET, our entire global organization seamlessly provides you with the coordinated action and service you need. We're your single, integrated source for capacitance solutions worldwide, offering 95% of possible dielectric solutions, to cover practically any application. With new, innovative products year after year after year. Global availability. Full design collaboration, with fast custom design and prototyping to give your new products a competitive edge. Plus consistent quality, reliability and on-time delivery.

All from one company that's easy to work with and totally dedicated to your success. For anything to do with capacitance, call *The Capacitance Company* – KEMET.



Looking for a hassle-free source for 95% of possible dielectric solutions?

KEMET is the place for one-stop dielectric shopping. We offer our customers the broadest selection of capacitor technologies in the industry, including tantalum, ceramic, aluminum, electrolytic, film and paper.

But the range of products is only the beginning. You simply won't find an electronic components manufacturer more determined to find new technological solutions to customer problems, or more committed to product quality and on-time delivery – in every case, lowering your total cost of ownership as much as we possibly can. It's how we've helped customers succeed for more than 90 years. And it's how we're helping them succeed today.



We're everywhere you need us to be.

AMERICA

Canada
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Germany
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Portugal
Sweden
Switzerland
United Kingdom

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Hong Kong
India
Indonesia
Japan
Malaysia
Singapore
Taiwan

The next time you board an airplane, boot up your computer or read about a breakthrough medical device, a piece of our technology is likely involved. KEMET customers include nearly all of the world's major electronics original equipment manufacturers, manufacturing services companies and electronics distributors. High Reliability versions of our capacitors are even in outer space, part of every important military and aerospace effort of the past 60 years, from the first Telstar satellite and Apollo 11 to the Patriot missile, International Space Station and Mars Pathfinder.

Our sales offices can't be quite as ubiquitous as our products, but we do pride ourselves on being where you need us. This map shows you our sales offices around the world.

As you can see, we're not only easy to work with, we're easy to find. And we're more than ready to be your single source capacitance solutions supplier.

One world. One source. One KEMET.

One WORLD One Brand One Strategy One Focus One Team One KEMET



Why *The Capacitance Company* is also the “Easy-To-Buy-From” company.

When you choose KEMET, you'll enjoy a level of responsiveness you just won't get from any other component manufacturer. You simply won't find an electronic components manufacturer more passionate about customer service. Our innovative service offerings and superior localized support are known throughout the industry, powered by our global, customer-focused sales organization and worldwide logistics capabilities. We're 100% committed to serving any customer, anywhere, and meeting customer needs when they need to be met.

Whether you need rush samples, technical assistance, in-person consultations or accelerated custom design, design collaboration and prototype services, we have a solution. If it's anything to do with capacitance, we can help – and help fast.



Working to make a better world.

At KEMET, we're proud to work with customers to develop products that truly make the world a better, safer, more connected place to live – from hand-held devices to automotive systems to the greenest energy technology.

As a company, KEMET is dedicated to economically, environmentally and socially sustainable development. We've adopted the Electronic Industry Code of Conduct (EICC), addressing all aspects of corporate responsibility. All of our commercial-grade products are available in RoHS-compliant versions with Pb-free terminations. Our manufacturing facilities have won numerous environmental excellence awards and recognitions. And our supply chain is certified to be sourced from areas that are neither environmentally protected nor under conflict.

After all, we believe that doing the right thing is in everyone's interest.



Which capacitor is right for you?

As The Capacitance Company, we make over 95% of possible dielectric solutions – the broadest selection of capacitor technologies in the industry. By offering a wide variety of dielectrics, dimensions, voltages, temperature characteristics and terminations, KEMET capacitors satisfy an expansive range of customer requirements and applications.

In fact, if the capacitor you need hasn't been invented, it's only because you haven't asked. We can quickly develop custom products and carry out early-stage manufacturing through our accelerated collaboration services. Available through our global innovation and manufacturing centers around the world, accelerated collaboration brings together the necessary people, equipment and facilities together to get the job done, on time and in budget.

Of course, when you're under pressure to design smaller and smaller products with greater and greater functionality, there's no time for the traditional back-and-forth with your suppliers. With KEMET, you get direct contact to the engineers and other professionals who can help you successfully solve your design problems, and in record time. We deal personally with customers to ascertain the new part types needed for their next-generation products. In many cases, we can go from start to samples in only four months.

We've helped some of the world's most prominent electronics companies slash time to market and gain significant windows of competitive advantage. We can do the same for you, too.

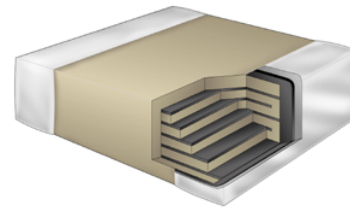
Overview

KEMET's Automotive Grade Series surface mount capacitors in C0G dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocol and inspection criteria have been established for automotive grade products in recognition of potentially harsh environmental conditions. KEMET automotive grade series capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

C0G dielectric features a 125°C maximum operating temperature and is considered "stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes C0G dielectric as a Class I material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q and stability of capacitance characteristics are required. C0G exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 30\text{ppm}/^\circ\text{C}$ from -55°C to $+125^\circ\text{C}$.

Benefits

- AEC-Q200 automotive qualified
- -55°C to $+125^\circ\text{C}$ operating temperature range
- RoHS compliant
- EIA 0402, 0603, 0805, 1206, 1210, 1812 and 2220 case sizes
- DC voltage ratings of 10V, 16V, 25V, 50V, 100V and 200V
- Capacitance offerings ranging from 0.5pF up to 0.47 μF
- Available capacitance tolerances of $\pm 0.25\text{pF}$, $\pm 0.5\text{pF}$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- No piezoelectric noise
- Extremely low ESR and ESL
- High thermal stability
- High ripple current capability
- Preferred capacitance solution at line frequencies and into the MHz range
- No capacitance change with respect to applied rated DC voltage
- Negligible capacitance change with respect to temperature from -55°C to $+125^\circ\text{C}$
- No capacitance decay with time
- 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)



Ordering Information

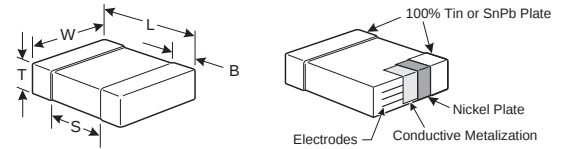
C	1206	C	104	J	3	G	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ¹	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ²	Packaging/Grade (C-Spec) ³
	0402 0603 0805 1206 1210 1812 2220	C = Standard	2 Sig. Digits + Number of Zeros Use 9 for 1.0 - 9.9pF Use 8 for 0.5 - .99pF ex. 2.2pF = 229 ex. 0.5pF = 508	C = $\pm 0.25\text{pF}$ D = $\pm 0.5\text{pF}$ F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	8 = 10V 4 = 16V 3 = 25V 5 = 50V 1 = 100V 2 = 200V	G = C0G	A = N/A	C = 100% Matte Sn	AUTO = Automotive Grade 7" Reel Unmarked

¹ Additional capacitance tolerance offerings may be available. Contact KEMET for details.

² Additional termination finish options may be available. Contact KEMET for details

³ 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	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)	See Table 2 for Thickness	0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	Solder Wave or Solder Reflow
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		
1812	4532	4.50 (.177) ± 0.30 (.012)	3.20 (.126) ± 0.30 (.012)		0.60 (.024) ± 0.35 (.014)		
2220	5650	5.70 (.224) ± 0.40 (.016)	5.00 (.197) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		

Applications

Typical applications include critical timing, tuning, circuits requiring low loss, circuits with pulse, high current, decoupling, bypass, filtering, transient voltage suppression, blocking and energy storage.

Qualification/Certification

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.

Environmental Compliance

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)	±30PPM/°C
Aging Rate (Max % Cap Loss/Decade Hour)	0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	0.1%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

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:

1MHz ± 100kHz and 1.0Vrms ± 0.2V if capacitance ≤ 1000pF

1kHz ± 50Hz and 1.0Vrms ± 0.2V if capacitance > 1000pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
C0G	All	All	0.5	0.3% or ± 0.25 pF	10% of Initial Limit

Table 1A – AUTO C0G Dielectric, (0402 - 1206 Case Sizes)

Cap	Cap Code	Series						C0402						C0603						C0805						C1206					
		Voltage Code						8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2
		Voltage DC						10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200
		Cap Tolerance						Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																							
0.5-0.75 pF	508-758	C	D					BB	BB	BB	BB			CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
1.0-2.4 pF	109-249	C	D					BB	BB	BB	BB			CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
2.7-5.1 pF	279-519	C	D				K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
5.6-9.1 pF	569-919	C	D			J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
10-13 pF	100-130	C	D			J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
15-36 pF	150-360	C	D		G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
27-51 pF	270-510		D		G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
39-51 pF	390-510		D		F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
56 pF	560				F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
62 pF	620				F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
68 pF	680				F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
75 pF	750				F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
82 pF	820				F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
91 pF	910				F	G	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
100 pF	101				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
110 pF	111				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
120 pF	121				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
130 pF	131				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
150 pF	151				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
160 pF	161				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
180 pF	181				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
200 pF	201				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
220 pF	221				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
240 pF	241				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
270 pF	271				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
300 pF	301				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
330 pF	331				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
360 pF	361				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
390 pF	391				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
430 pF	431				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
470 pF	471				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
510 pF	511				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
560 pF	561				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
620 pF	621				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
680 pF	681				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
750 pF	751				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
820 pF	821				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
910 pF	911				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
1,000 pF	102				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DD	EB	EB	EB	EB	EB	EE
1,100 pF	112				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
1,200 pF	122				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB
1,300 pF	132				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DD	DD	DD	DD	DD	EB	EB	EB	EB	EC	EC
1,500 pF	152				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DD	DD	DD	DD	DD	EB	EB	EB	EB	ED	ED
1,600 pF	162				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DD	DD	DD	DD	DD	EB	EB	EB	EB	ED	ED
1,800 pF	182				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DD	DD	DD	DD	DD	EB	EB	EB	EB	ED	ED
2,000 pF	202				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	ED	ED
2,200 pF	222				F	G	J	K	M	BB	BB	BB	BB	BB		CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EE	ED
2,400 pF	242				F	G	J	K	M							CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EC	EC
2,700 pF	272				F	G	J	K	M							CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	EB	EB	EB	EB	EC	EC
3,000 pF	302				F	G	J	K	M							CB	CB	CB	CB	CB	DD	DD	DD	DD	DD	EC	EC	EC	EC	EC	EC
3,300 pF	332				F	G	J	K	M							CB	CB	CB	CB	CB	DD	DD	DD	DD	DC	EC	EC	EC	EC	EE	
3,600 pF	362				F	G	J	K	M							CB	CB	CB	CB	CB	DD	DD	DD	DD	DC	EC	EC	EC	EC	EE	
3,900 pF	392				F	G	J	K	M							CB	CB	CB	CB	CB	DE	DE	DE	DE	DC	EC	EC	EC	EC	EF	
Cap	Cap Code	Voltage DC						10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200
		Voltage Code						8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2
		Series						C0402						C0603						C0805						C1206					

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).

These products are protected under

Table 1A – AUTO C0G Dielectric, (0402 - 1206 Case Sizes) con't

Cap	Cap Code	Series	C0402						C0603						C0805						C1206					
		Voltage Code	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2
		Voltage DC	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200
		Cap Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																							
4,300 pF	432	F G J K M							CB	CB	CB	CB	CB		DE	DE	DE	DE	DC		EC	EC	EC	EC	EC	
4,700 pF	472	F G J K M							CB	CB	CB	CB	CB		DE	DE	DE	DE	DC		EC	EC	EC	EC	EC	
5,100 pF	512	F G J K M							CB	CB	CB	CB	CB		DE	DE	DE	DE	DC		ED	ED	ED	ED	ED	
5,600 pF	562	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DC		ED	ED	ED	ED	ED	
6,200 pF	622	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DC		EB	EB	EB	EB	EB	
6,800 pF	682	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DC		EB	EB	EB	EB	EB	
7,500 pF	752	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DC		EB	EB	EB	EB	EB	
8,200 pF	822	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DC		EC	EC	EC	EC	EC	
9,100 pF	912	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DC		EC	EC	EC	EC	EC	
10,000 pF	103	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DD		ED	ED	ED	ED	EB	
12,000 pF	123	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DC	DE		EB	EB	EB	EB	EB	
15,000 pF	153	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DD	DG		EB	EB	EB	EB	EB	
18,000 pF	183	F G J K M							CB	CB	CB	CB	CB		DC	DC	DC	DD			EB	EB	EB	EB	EB	
22,000 pF	223	F G J K M													DD	DD	DD	DF			EB	EB	EB	EB	EC	
27,000 pF	273	F G J K M													DF	DF	DF				EB	EB	EB	EB	EE	
33,000 pF	333	F G J K M													DG	DG	DG				EB	EB	EB	EB	EE	
47,000 pF	473	F G J K M													DG	DG	DG				EC	EC	EC	EE	EH	
56,000 pF	563	F G J K M																			ED	ED	ED	EF		
68,000 pF	683	F G J K M																			EF	EF	EF	EH		
82,000 pF	823	F G J K M																			EH	EH	EH	EH		
0.10 µF	104	F G J K M																			EH	EH	EH			
Cap	Cap Code	Voltage DC	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200
		Voltage Code	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2	8	4	3	5	1	2
		Series	C0402						C0603						C0805						C1206					

Table 1B – (1210 - 2220 Case Sizes)

Cap	Cap Code	Series	C1210						C1812			C2220		
		Voltage Code	8	4	3	5	1	2	5	1	2	3	1	2
		Voltage DC	10	16	25	50	100	200	50	100	200	50	100	200
		Cap Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions											
0.5-0.75 pF	508-758	C D												
1.0-2.4 pF	109-249	C D												
2.7-5.1 pF	279-519	C D				K	M							
5.6-9.1 pF	569-919	C D			J	K	M							
10-13 pF	100-130	C D			J	K	M							
15-24 pF	150-240	C D		G	J	K	M							
27-36 pF	270-360	D		G	J	K	M							
39-51 pF	390-510	D	F	G	J	K	M							
56-82 pF	560-820		F	G	J	K	M							
91-180 pF	910-181		F	G	J	K	M							
200-360 pF	201-361		F	G	J	K	M							
390 pF	391		F	G	J	K	M							
430 pF	431		F	G	J	K	M							
470 pF	471		F	G	J	K	M							
510 pF	511		F	G	J	K	M							
560 pF	561		F	G	J	K	M							
620 pF	621		F	G	J	K	M							
Cap	Cap Code	Voltage DC	10	16	25	50	100	200	50	100	200	50	100	200
		Voltage Code	8	4	3	5	1	2	5	1	2	3	1	2
		Series	C1210						C1812			C2220		

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).

These products are protected under US Patents 7,172,985 & 7,670,981, other patents pending, and any foreign counterparts.

Table 1B – AUTO C0G Dielectric, (1210 - 2220 Case Sizes) con't

Cap	Cap Code	Series						C1210						C1812			C2220		
		Voltage Code						8	4	3	5	1	2	5	1	2	3	1	2
		Voltage DC						10	16	25	50	100	200	50	100	200	50	100	200
		Cap Tolerance						Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions											
680 pF	681			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
750 pF	751			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
820 pF	821			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
910 pF	911			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
1,000 pF	102			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
1,100 pF	112			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
1,200 pF	122			F	G	J	K	M	FB	FB	FB	FB	FB	FB	GB	GB	GB		
1,300 pF	132			F	G	J	K	M	FB	FB	FB	FB	FB	FC	GB	GB	GB		
1,500 pF	152			F	G	J	K	M	FB	FB	FB	FB	FB	FE	GB	GB	GB		
1,600 pF	162			F	G	J	K	M	FB	FB	FB	FB	FB	FE	GB	GB	GB		
1,800 pF	182			F	G	J	K	M	FB	FB	FB	FB	FB	FE	GB	GB	GB		
2,000 pF	202			F	G	J	K	M	FB	FB	FB	FB	FC	FE	GB	GB	GB		
2,200 pF	222			F	G	J	K	M	FB	FB	FB	FB	FC	FG	GB	GB	GB		
2,400 pF	242			F	G	J	K	M	FB	FB	FB	FB	FC	FC					
2,700 pF	272			F	G	J	K	M	FB	FB	FB	FB	FC	FC	GB	GB	GB		
3,000 pF	302			F	G	J	K	M	FB	FB	FB	FB	FC	FF					
3,300 pF	332			F	G	J	K	M	FB	FB	FB	FB	FF	FF	GB	GB	GB		
3,600 pF	362			F	G	J	K	M	FB	FB	FB	FB	FF	FF					
3,900 pF	392			F	G	J	K	M	FB	FB	FB	FB	FF	FF	GB	GB	GB		
4,300 pF	432			F	G	J	K	M	FB	FB	FB	FB	FF	FG					
4,700 pF	472			F	G	J	K	M	FF	FF	FF	FF	FG	FG	GB	GB	GD		
5,100 pF	512			F	G	J	K	M	FB	FB	FB	FB	FG	FG					
5,600 pF	562			F	G	J	K	M	FB	FB	FB	FB	FG		GB	GB	GH		
6,200 pF	622			F	G	J	K	M	FB	FB	FB	FB	FG						
6,800 pF	682			F	G	J	K	M	FB	FB	FB	FB	FG		GB	GB	GJ	JB	JB
7,500 pF	752			F	G	J	K	M	FC	FC	FC	FC	FC						
8,200 pF	822			F	G	J	K	M	FC	FC	FC	FC	FC		GB	GH		JB	JB
9,100 pF	912			F	G	J	K	M	FE	FE	FE	FE	FE						
10,000 pF	103			F	G	J	K	M	FF	FF	FF	FF	FF		GB	GH		JB	JB
12,000 pF	123			F	G	J	K	M	FG	FG	FG	FG	FB		GB	GG		JB	JB
15,000 pF	153			F	G	J	K	M	FG	FG	FG	FG	FB		GB	GB		JB	JB
18,000 pF	183			F	G	J	K	M	FB	FB	FB	FB	FB		GB	GB		JB	JB
22,000 pF	223			F	G	J	K	M	FB	FB	FB	FB	FB		GB	GB		JB	JB
27,000 pF	273			F	G	J	K	M	FB	FB	FB	FB	FB		GB	GB		JB	JB
33,000 pF	333			F	G	J	K	M	FB	FB	FB	FB	FB		GB	GB		JB	JB
47,000 pF	473			F	G	J	K	M	FB	FB	FB	FB	FE		GB	GB		JB	JB
56,000 pF	563			F	G	J	K	M	FB	FB	FB	FB	FF		GB	GB		JB	JB
68,000 pF	683			F	G	J	K	M	FB	FB	FB	FC	FG		GB	GB		JB	JB
82,000 pF	823			F	G	J	K	M	FC	FC	FC	FF	FH		GB	GB		JB	JB
0.10 µF	104			F	G	J	K	M	FE	FE	FE	FG	FM		GB	GD		JB	JB
0.12 µF	124			F	G	J	K	M	FG	FG	FG	FH			GB	GH		JB	JB
0.15 µF	154			F	G	J	K	M	FH	FH	FH	FM			GD	GN		JB	JB
0.18 µF	184			F	G	J	K	M	FJ	FJ	FJ				GH			JB	JD
0.22 µF	224			F	G	J	K	M	FK	FK	FK				GK			JB	JD
0.27 µF	274			F	G	J	K	M										JB	JF
0.33 µF	334			F	G	J	K	M										JD	JG
0.47 µF	474			F	G	J	K	M										JG	
Cap	Cap Code	Voltage DC						10	16	25	50	100	200	50	100	200	50	100	200
		Voltage Code						8	4	3	5	1	2	5	1	2	3	1	2
		Series						C1210						C1812			C2220		

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).

These products are protected under US Patents 7,172,985 & 7,670,981, other patents pending, and any foreign counterparts.

Overview

KEMET's Automotive Grade Series surface mount capacitors in X5R dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocol and inspection criteria have been established for automotive grade products in recognition of potentially harsh environmental conditions. KEMET automotive grade series capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

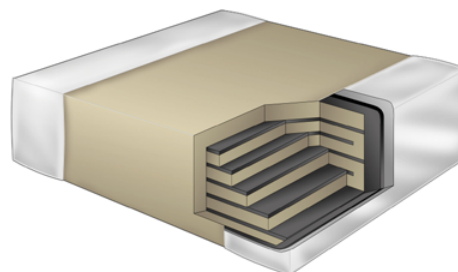
KEMET's X5R dielectric features an 85°C maximum operating temperature and is considered "semi-stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes X5R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X5R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55°C to +85°C.

Benefits

- AEC-Q200 automotive qualified
- -55°C to +85°C operating temperature range
- Pb-Free and RoHS compliant
- Temperature stable dielectric
- EIA 0402, 0603, 0805, 1206, and 1210 case sizes
- DC voltage ratings of 4V, 6.3V, 10V, 16V, 25V, 35V and 50V
- Capacitance offerings ranging from .012 μ F to 22 μ F
- Available capacitance tolerances of $\pm 10\%$ and $\pm 20\%$
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include decoupling, bypass and filtering.



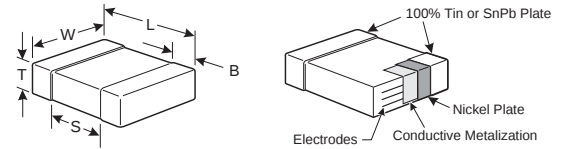
Ordering Information

C	1206	C	475	K	3	P	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ³
	0402 0603 0805 1206 1210	C = Standard	2 Sig. Digits + Number of Zeros	K = $\pm 10\%$ M = $\pm 20\%$	7 = 4V 9 = 6.3V 8 = 10V 4 = 16V 3 = 25V	P = X5R	A = N/A	C = 100% Matte Sn	AUTO = Automotive Grade 7" Reel Unmarked

¹ Additional termination finish options may be available. Contact KEMET for details

² 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	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)	See Table 2 for Thickness	0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	Solder Wave or Solder Reflow
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		

Qualification/Certification

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.

Environmental Compliance

Pb-Free and RoHS compliant

Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +85°C
Capacitance Change with Reference to +25°C and 0 Vdc Applied (TCC)	±15%
Aging Rate (Max % Cap Loss/Decade Hour)	4.0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limits @ 25°C	See Dissipation Factor Limit Table
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 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:

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

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
X5R	>25	All	3.0	± 20%	10% of Initial Limit
	25		7.5		
	<25	< 0.56µF	7.5		
	<25	≥ 0.56µF	12.0		

Dissipation Factor Limit Table

Rated Voltage	Capacitance	Dissipation Factor (Limit)
50V - 200V	All	3%
25V	All	5%
<25V	< 0.56µF	5%
<25V	≥ 0.56µF	10%

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 1 – AUTO X5R Dielectric, (0201 - 1206 Case Sizes)

Cap	Cap Code	Series		C0402						C0603						C0805						C1206						C1210					
		Voltage Code		7	9	8	4	3	5	7	9	8	4	3	5	7	9	8	4	3	5	9	8	4	3	1	9	8	4	3	6	5	
		Voltage DC		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	35	50	
		Cap Tolerance		Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																													
10,000 pF	103	K	M																														
12,000 pF	123	K	M	BB	BB	BB	UD																										
15,000 pF	153	K	M	BB	BB	BB	UD																										
18,000 pF	183	K	M	BB	BB	BB	UD																										
22,000 pF	223	K	M	BB	BB	BB	UD																										
27,000 pF	273	K	M	BB	BB	BB	UD																										
33,000 pF	333	K	M	BB	BB	BB	UD																										
39,000 pF	393	K	M	BB	BB	BB	UD																										
47,000 pF	473	K	M	BB	BB	BB	UD																										
56,000 pF	563	K	M	BB	BB	BB	UD																										
68,000 pF	683	K	M	BB	BB	BB	UD																										
82,000 pF	823	K	M	BB	BB	BB	UD																										
0.10 µF	104	K	M	BB	BB	BB																											
0.12 µF	124	K	M																														
0.15 µF	154	K	M																														
0.18 µF	184	K	M																														
0.22 µF	224	K	M							CC	CC	CC	CC									EB	EB	EB	EB								
0.27 µF	274	K	M							CC	CC	CC	CC									EB	EB	EB	EB								
0.33 µF	334	K	M							CC	CC	CC	CC									EB	EB	EB	EB								
0.39 µF	394	K	M							CC	CC	CC	CC									EB	EB	EB	EB								
0.47 µF	474	K	M							CC	CC	CC	CC			DC	DC	DC	DC	DC		EC	EC	EC	EC			FD	FD	FD	FD	FD	
0.56 µF	564	K	M							CC	CC	CC	CC			DD	DD	DD	DD	DD		ED	ED	ED	ED			FD	FD	FD	FD	FD	
0.68 µF	684	K	M							CC	CC	CC	CC			DE	DE	DE	DE	DE		EE	EE	EE	EE			FD	FD	FD	FD	FD	
0.82 µF	824	K	M							CC	CC	CC	CC			DF	DF	DF	DF	DF		EF	EF	EF	EF			FF	FF	FF	FF	FF	
1.0 µF	105	K	M							CC	CC	CC	CC			DG	DG	DG	DG	DG		EE	EE	EE	EH			FH	FH	FH	FH	FH	
1.2 µF	125	K	M													DC	DC	DC	DC			EC	EC	EC	EC			FD	FD	FD	FD	FG	
1.5 µF	155	K	M													DC	DC	DC	DC			EC	EC	EC	EC			FD	FD	FD	FD	FG	
1.8 µF	185	K	M													DD	DD	DD	DD			EC	EC	EC	EC			FD	FD	FD	FD	FG	
2.2 µF	225	K	M													DD	DD	DD	DD			EE	EE	EE	EE			FG	FG	FG	FG	FG	
2.7 µF	275	K	M													DL	DL	DL	DL			EF	EF	EF	EF			FG	FG	FG	FG	FH	
3.3 µF	335	K	M													DE	DE	DE	DH			EH	EH	EH	EH			FH	FH	FH	FH	FM	
3.9 µF	395	K	M													DH	DH	DH	DH			EH	EH	EH	EH			FJ	FJ	FJ	FJ	FK	
4.7 µF	475	K	M													DH	DH	DH	DG			EH	EH	EH	EH			FK	FK	FK	FK	FS	
5.6 µF	565	K	M													DH	DH	DH				EK	EK	EH				FG	FG	FG	FE		
6.8 µF	685	K	M													DH	DH	DH				EK	EK	EH				FJ	FJ	FJ	FJ		
8.2 µF	825	K	M																			ED	ED	EH				FK	FK	FK	FG		
10 µF	106	K	M																			EH	EH	EH				FK	FK	FK	FH		
12 µF	126	K	M																			EK	EK	EG				FD	FD	FG			
15 µF	156	K	M																			EK	EK	EH				FF	FF	FG			
18 µF	186	K	M																			ED	ED	EH				FG	FG	FH			
22 µF	226	K	M																									FH	FH	FJ			
27 µF	276	K	M																														
33 µF	336	K	M																														
39 µF	396	K	M																														
47 µF	476	K	M																														
100 µF	107	K	M																														
Cap	Cap Code	Voltage DC		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	35	50	
		Voltage Code		7	9	8	4	3	5	7	9	8	4	3	5	7	9	8	4	3	5	9	8	4	3	1	9	8	4	3	6	5	
		Series		C0402						C0603						C0805						C1206						C1210					

UD = Under Development

Overview

KEMET's Automotive Grade Series surface mount capacitors in X7R dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocol and inspection criteria have been established for automotive grade products in recognition of potentially harsh environmental conditions. KEMET automotive grade series capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

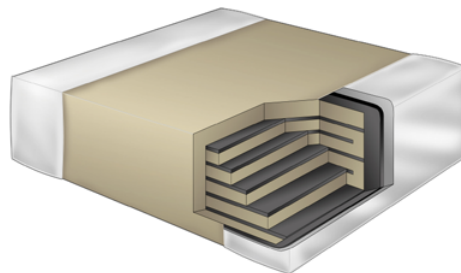
X7R dielectric features a 125°C maximum operating temperature and is considered "temperature stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C.

Benefits

- AEC Q200 automotive qualified
- -55°C to +125°C operating temperature range
- Pb-Free and RoHS compliant
- Temperature stable dielectric
- EIA 0402, 0603, 0805, 1206, 1210, 1812, and 2220 case sizes
- DC voltage ratings of 6.3V, 10V, 16V, 25V, 50V, 100V and 200V
- Capacitance offerings ranging from 150pF to 22 μ F
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression.



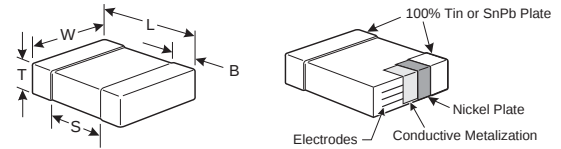
Ordering Information

C	0805	C	225	M	4	R	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ³
	0402 0603 0805 1206 1210 1812 2220	C = Standard	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	R = X7R	A = N/A	C = 100% Matte Sn	AUTO = Automotive Grade 7" Reel Unmarked

¹ Additional termination finish options may be available. Contact KEMET for details

² 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	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)	See Table 2 for Thickness	0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	Solder Wave or Solder Reflow
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		
1812	4532	4.50 (.177) ± 0.30 (.012)	3.20 (.126) ± 0.30 (.012)		0.60 (.024) ± 0.35 (.014)		
2220	5650	5.70 (.224) ± 0.40 (.016)	5.00 (.197) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		

Qualification/Certification

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.

Environmental Compliance

Pb-Free and 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	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 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 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:

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

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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		

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 – AUTO X7R Dielectric, (0402 - 1206 Case Sizes)

Cap	Cap Code	Series			C0402					C0603							C0805							C1206						
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2
		Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																									
150 pF	151	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
180 pF	181	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
220 pF	221	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
270 pF	271	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
330 pF	331	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
390 pF	391	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
470 pF	471	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
560 pF	561	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
680 pF	681	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
820 pF	821	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
1,000 pF	102	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,200 pF	122	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,500 pF	152	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,800 pF	182	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
2,200 pF	222	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
2,700 pF	272	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
3,300 pF	332	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
3,900 pF	392	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
4,700 pF	472	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
5,600 pF	562	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
6,800 pF	682	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
8,200 pF	822	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
10,000 pF	103	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
12,000 pF	123	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
15,000 pF	153	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
18,000 pF	183	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
22,000 pF	223	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
27,000 pF	273	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
33,000 pF	333	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
39,000 pF	393	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
47,000 pF	473	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
56,000 pF	563	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
68,000 pF	683	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
82,000 pF	823	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
0.10 µF	104	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
0.12 µF	124	J	K	M						CB	CB	CB	CB				DC	DC	DC	DC	DC	DC	DC	EC	EC	EC	EC	EC	EC	EC
0.15 µF	154	J	K	M						CB	CB	CB	CB				DC	DC	DC	DC	DC	DC	DC	EC	EC	EC	EC	EC	EC	EC
0.18 µF	184	J	K	M						CB	CB	CB	CB				DC	DC	DC	DC	DC	DC	DC	EC	EC	EC	EC	EC	EC	EC
0.22 µF	224	J	K	M						CB	CB	CB	CD				DC	DC	DC	DC	DC	DC	DC	EC	EC	EC	EC	EC	EC	EC
0.27 µF	274	J	K	M						CB	CB	CB					DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
0.33 µF	334	J	K	M						CB	CB	CB					DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
0.39 µF	394	J	K	M						CB	CB	CB					DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
0.47 µF	474	J	K	M						CB	CB	CB					DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
0.56 µF	564	J	K	M													DC	DC	DC	DC	DC	DC	DC	ED	ED	ED	ED	ED	ED	ED
0.68 µF	684	J	K	M													DC	DC	DC	DC	DC	DC	DC	EE	EE	EE	EE	EE	EE	EE
0.82 µF	824	J	K	M													DC	DC	DC	DC	DC	DC	DC	EF	EF	EF	EF	EF	EF	EF
1.0 µF	105	J	K	M													DC	DC	DC	DC	DC	DC	DC	EF	EF	EF	EF	EF	EF	EF
1.2 µF	125	J	K	M													DC	DC	DC	DC	DC	DC	DC	ED	ED	ED	ED	ED	ED	ED
1.5 µF	155	J	K	M													DC	DC	DC	DC	DC	DC	DC	EF	EF	EF	EF	EF	EF	EF
1.8 µF	185	J	K	M													DC	DC	DC	DC	DC	DC	DC	EF	EF	EF	EF	EF	EF	EF
2.2 µF	225	J	K	M													DC	DC	DC	DC	DC	DC	DC	ED	ED	ED	ED	ED	ED	ED
2.7 µF	275	J	K	M																				EN	EN	EN	EN	EN	EN	EN
3.3 µF	335	J	K	M																				ED	ED	ED	ED	ED	ED	ED
Cap	Cap Code	Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2
		Series			C0402					C0603							C0805							C1206						

Table 1A – AUTO X7R Dielectric, (0402 - 1206 Case Sizes) con't

Cap	Cap Code	Series			C0402					C0603						C0805						C1206												
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2				
		Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200				
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																													
3.9 μF	395	J	K	M																						EF	EF	EF	EH					
4.7 μF	475	J	K	M																							EF	EF	EF	EH				
5.6 μF	565	J	K	M																							EH	EH	EH					
6.8 μF	685	J	K	M																							EH	EH	EH					
8.2 μF	825	J	K	M																							EH	EH	EH					
10 μF	106	J	K	M																							EH	EH	EH					
12 μF	126	J	K	M																								EH	EH	EH				
Cap	Cap Code	Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200				
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2				
		Series			C0402					C0603						C0805						C1206												

Table 1B – (1210 - 2220 Case Sizes)

Cap	Cap Code	Series			C1210							C1812					C2220			
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions															
2,200 pF	222	J	K	M	FB	FB	FB	FB	FB	FB										
2,700 pF	272	J	K	M	FB	FB	FB	FB	FB	FB										
3,300 pF	332	J	K	M	FB	FB	FB	FB	FB	FB										
3,900 pF	392	J	K	M	FB	FB	FB	FB	FB	FB										
4,700 pF	472	J	K	M	FB	FB	FB	FB	FB	FB										
5,600 pF	562	J	K	M	FB	FB	FB	FB	FB	FB										
6,800 pF	682	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
8,200 pF	822	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
10,000 pF	103	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
12,000 pF	123	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
15,000 pF	153	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
18,000 pF	183	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
22,000 pF	223	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
27,000 pF	273	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
33,000 pF	333	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
39,000 pF	393	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
47,000 pF	473	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
56,000 pF	563	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
68,000 pF	683	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB	GB					
82,000 pF	823	J	K	M	FB	FB	FB	FB	FB	FC		GB	GB	GB	GB					
0.10 μF	104	J	K	M	FB	FB	FB	FB	FB	FD		GB	GB	GB	GB					
0.12 μF	124	J	K	M	FB	FB	FB	FB	FB	FD		GB	GB	GB	GB					
0.15 μF	154	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GB	GB					
0.18 μF	184	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GB	GB					
0.22 μF	224	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GB	GB					
0.27 μF	274	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GG		JC	JC			
0.33 μF	334	J	K	M	FD	FD	FD	FD	FD	FD		GB	GB	GG		JC	JC			
0.39 μF	394	J	K	M	FD	FD	FD	FD	FD	FD		GB	GB	GG		JC	JC			
0.47 μF	474	J	K	M	FD	FD	FD	FD	FD	FD		GB	GB	GG		JC	JC			
0.56 μF	564	J	K	M	FD	FD	FD	FD	FD	FF		GC	GC	GG		JC	JC			
Cap	Cap Code	Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Series			C1210							C1812					C2220			

Table 1B – AUTO X7R Dielectric, (1210 - 2220 Case Sizes) con't

Cap	Cap Code	Series			C1210						C1812					C2220				
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions															
0.68 μF	684	J	K	M	FD	FD	FD	FD	FD	FG		GC	GC	GG		JC	JC			
0.82 μF	824	J	K	M	FF	FF	FF	FF	FF	FL		GE	GE	GG		JC	JC			
1.0 μF	105	J	K	M	FH	FH	FH	FH	FH	FM		GE	GE	GG		JC	JC			
1.2 μF	125	J	K	M	FH	FH	FH	FH	FG							JC	JC			
1.5 μF	155	J	K	M	FH	FH	FH	FH	FG							JC	JC			
1.8 μF	185	J	K	M	FH	FH	FH	FH	FG							JD	JD			
2.2 μF	225	J	K	M	FJ	FJ	FJ	FJ	FG			GO	GO			JF	JF			
2.7 μF	275	J	K	M	FE	FE	FE	FG	FH											
3.3 μF	335	J	K	M	FF	FF	FF	FM	FM											
3.9 μF	395	J	K	M	FG	FG	FG	FG	FK											
4.7 μF	475	J	K	M	FC	FC	FC	FG	FS			GK	GK							
5.6 μF	565	J	K	M	FF	FF	FF	FH												
6.8 μF	685	J	K	M	FG	FG	FG	FM												
8.2 μF	825	J	K	M	FH	FH	FH	FK												
10 μF	106	J	K	M	FH	FH	FH	FS				GK				JF	JO			
12 μF	126	J	K	M																
15 μF	156	J	K	M																
18 μF	186	J	K	M																
22 μF	226	J	K	M	FS	FS														
47 μF	476	J	K	M																
Cap	Cap Code	Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Series			C1210						C1812					C2220				

Capacitor Array, C0G Dielectric, 10VDC-200VDC (Commercial & Automotive Grade)

Overview

KEMET's Ceramic Chip Capacitor Array in C0G dielectric is an advanced passive technology where multiple capacitor elements are integrated into one common monolithic structure. Array technology promotes reduced placement costs and increased throughput. This is achieved by alternatively placing one device rather than two or four discrete devices. Use of capacitor arrays also saves board space which translates into increased board density and more functions per board. Arrays consume only a portion of the space required for standard chips resulting in savings in inventory and pick/place machine positions.

KEMET's C0G dielectric features a 125°C maximum operating temperature and is considered "stable." The Electronics Components, Assemblies & Materials Association (EIA)

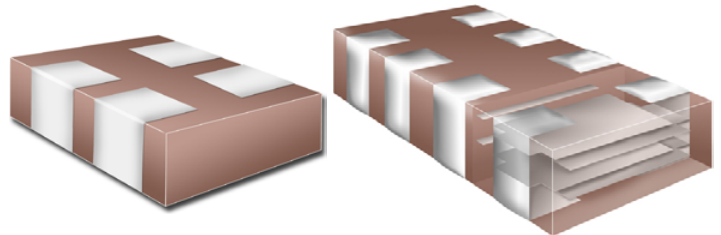
characterizes C0G dielectric as a Class I material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q and stability of capacitance characteristics are required. C0G exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 30\text{ppm}/^\circ\text{C}$ from -55°C to $+125^\circ\text{C}$.

KEMET automotive grade array capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

Benefits

- -55°C to $+125^\circ\text{C}$ operating temperature range
- Saves both circuit board and inventory space
- Reduces placement costs and increases throughput
- RoHS compliant
- EIA 0508 (2-element) and 0612 (4-element) case sizes
- DC voltage ratings of 10V, 16V, 25V, 50V, 100V and 200V
- Capacitance offerings ranging from 10pF to 2200pF
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- Non-polar device, minimizing installation concerns

- Flexible termination option is standard on 0508 case size arrays
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available upon request (5% min)
- Commercial and Automotive (AEC-Q200) grades available



Ordering Information

CA	06	4	C	104	K	4	G	A	C	TU
Ceramic Array	Case Size (L" x W") ¹	Number of Capacitors	Specification/ Series ²	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ³	Packaging/Grade (C-Spec) ⁴
	05 = 0508 06 = 0612	2 = 2 4 = 4	C = Standard X = Flexible Termination	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	8 = 10V 4 = 16V 3 = 25V 5 = 50V 1 = 100V 2 = 200V	G = C0G	A = N/A	C = 100% Matte Sn	Blank = Bulk TU = 7" Reel Unmarked AUTO = Automotive Grade

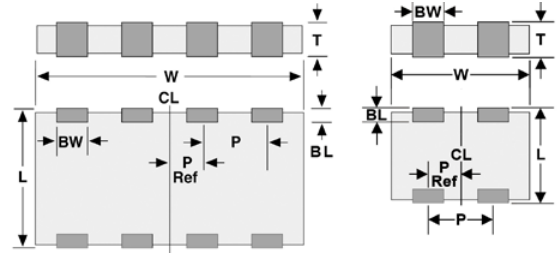
¹ All previous reference to metric case dimension "1632" has been replaced with an inch standard reference of "0612". Please reference all new designs using the "0612" nomenclature. "CA064" replaces "C1632" in the ordering code.

² 0508 case size is only available with the flexible termination option. "X" must be used in the 6th character position when ordering this case size. 0612 (1632) case size is not currently available with the flexible termination option. "C" must be used in the 6th character position when ordering this case size.

³ Additional termination finish options may be available. Contact KEMET for details.

⁴ 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	BW Bandwidth	BL Bandlength	T Thickness	P Pitch	P/2 Reference
0508	1220	1.30 (.051) ± 0.15 (.006)	2.10 (.083) ± 0.15 (.006)	0.53 (.021) ± 0.08 (.003)	0.30 (.012) ± 0.20 (.008)	See Table 2 for Thickness	1.00 (.039)	0.50 (.020) ± 0.10 (.004)
0612	1632	1.60 (.063) ± 0.20 (.008)	3.20 (.126) ± 0.20 (.008)	0.40 (0.06) ± 0.20 (.008)	0.30 (.012) ± 0.20 (.008)		0.80 (.031)	0.40 (.031) ± 0.05 (.002)

Applications

Typical applications include those that can benefit from board area savings, cost savings and overall volumetric reduction such as telecommunications, computers, handheld devices and automotive.

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.

Environmental Compliance

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)	±30PPM/°C
Aging Rate (Max % Cap Loss/Decade Hour)	0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	0.1%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

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:

1MHz ± 100kHz and 1.0Vrms ± 0.2V if capacitance ≤ 1000pF

1kHz ± 50Hz and 1.0Vrms ± 0.2V if capacitance > 1000pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
C0G	All	All	0.5	0.3% or ± 0.25 pF	10% of Initial Limit

Table 1 – Array C0G Dielectric, (0508 - 0612 Case Sizes)

Cap	Cap Code	Series			CA052 (0508 Case Size)					CA064 (0612 Case Size)					
		Voltage Code			8	4	3	5	1	8	4	3	5	1	2
		Voltage DC			10	16	25	50	100	10	16	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions										
10 pF	100	J	K	M						MA	MA	MA	MA	MA	MA
12 pF	120	J	K	M						MA	MA	MA	MA	MA	MA
15 pF	150	J	K	M						MA	MA	MA	MA	MA	MA
18 pF	180	J	K	M						MA	MA	MA	MA	MA	MA
22 pF	220	J	K	M						MA	MA	MA	MA	MA	MA
27 pF	270	J	K	M						MA	MA	MA	MA	MA	MA
33 pF	330	J	K	M						MA	MA	MA	MA	MA	MA
39 pF	390	J	K	M						MA	MA	MA	MA	MA	MA
47 pF	470	J	K	M						MA	MA	MA	MA	MA	MA
56 pF	560	J	K	M						MA	MA	MA	MA	MA	MA
68 pF	680	J	K	M						MA	MA	MA	MA	MA	MA
82 pF	820	J	K	M						MA	MA	MA	MA	MA	MA
100 pF	101	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
120 pF	121	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
150 pF	151	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
180 pF	181	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
220 pF	221	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
270 pF	271	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
330 pF	331	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
390 pF	391	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
470 pF	471	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA		
560 pF	561	J	K	M	PA	PA	PA	PA	PA						
680 pF	681	J	K	M	PA	PA	PA	PA	PA						
820 pF	821	J	K	M	PA	PA	PA	PA	PA						
1,000 pF	102	J	K	M	PA	PA	PA	PA	PA						
1,100 pF	112	J	K	M	PA	PA	PA	PA	PA						
1,200 pF	122	J	K	M	PA	PA	PA	PA	PA						
1,300 pF	132	J	K	M	PA	PA	PA	PA	PA						
1,500 pF	152	J	K	M	PA	PA	PA	PA	PA						
1,600 pF	162	J	K	M	PA	PA	PA	PA	PA						
1,800 pF	182	J	K	M	PA	PA	PA	PA	PA						
2,000 pF	202	J	K	M	PA	PA	PA	PA	PA						
2,200 pF	222	J	K	M	PA	PA	PA	PA	PA						
Cap	Cap Code	Voltage DC			10	16	25	50	100	10	16	25	50	100	200
		Voltage Code			8	4	3	5	1	8	4	3	5	1	2
		Series			CA052 (0508 Case Size)					CA064 (0612 Case Size)					

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).

These products are protected under US Patents 7,172,985 & 7,670,981, other patents pending, and any foreign counterparts.

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
PA	0508	0.80 ± 0.10	4000	10000	N/A	N/A	N/A
MA	0612	0.80 ± 0.10	4000	10000	N/A	N/A	N/A

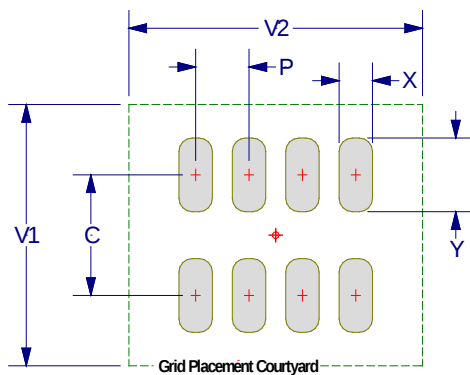
Table 3 – Chip Capacitor Array Land Pattern Design Recommendations per IPC-7351

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	P	V1	V2	C	Y	X	P	V1	V2	C	Y	X	P	V1	V2
0508/CA052	1220	1.60	1.00	0.55	1.00	3.50	3.30	1.50	0.90	0.50	1.00	2.90	2.80	1.40	0.75	0.45	1.00	2.40	2.50
0612/CA064	1632	1.80	1.10	0.50	0.80	3.90	4.40	1.80	0.95	0.50	0.80	3.30	3.90	1.70	0.85	0.40	0.80	2.80	3.60

Density Level A: For low-density Product applications. Provides a wider process window for reflow solder processes. Soldering processes for array type capacitors.

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 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 1.8kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2mm (min) for all except 3mm for C0G.
Solderability	J-STD-002	Magnification 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	1000 cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X 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.

Storage and 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. In addition, 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.

Capacitor Array, X7R Dielectric, 10VDC-200VDC (Commercial & Automotive Grade)

Overview

KEMET's Ceramic Chip Capacitor Array in X7R dielectric is an advanced passive technology where multiple capacitor elements are integrated into one common monolithic structure. Array technology promotes reduced placement costs and increased throughput. This is achieved by alternatively placing one device rather than two or four discrete devices. Use of capacitor arrays also saves board space which translates into increased board density and more functions per board. Arrays consume only a portion of the space required for standard chips resulting in savings in inventory and pick/place machine positions.

KEMET's X7R dielectric features a 125°C maximum operating temperature and is considered "temperature stable." The Electronics Components, Assemblies & Materials Association (EIA)

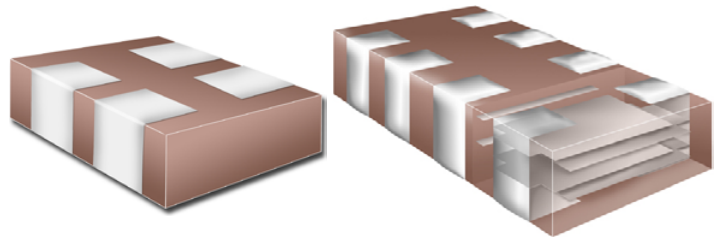
characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C.

KEMET automotive grade array capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

Benefits

- -55°C to +125°C operating temperature range
- Saves both circuit board and inventory space
- Reduces placement costs and increases throughput
- RoHS compliant
- EIA 0508 (2-element) and 0612 (4-element) case sizes
- DC voltage ratings of 10V, 16V, 25V, 50V, 100V and 200V
- Capacitance offerings ranging from 10pF to 2200pF
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- Non-polar device, minimizing installation concerns

- Flexible termination option is standard on 0508 case size arrays
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available upon request (5% min)
- Commercial and Automotive (AEC-Q200) grades available



Ordering Information

CA	06	4	C	104	K	4	R	A	C	TU
Ceramic Array	Case Size (L" x W") ¹	Number of Capacitors	Specification/ Series ²	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ³	Packaging/Grade (C-Spec) ⁴
	05 = 0508 06 = 0612	2 = 2 4 = 4	C = Standard X = Flexible Termination	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	8 = 10V 4 = 16V 3 = 25V 5 = 50V 1 = 100V 2 = 200V	R = X7R	A = N/A	C = 100% Matte Sn	Blank = Bulk TU = 7" Reel Unmarked AUTO = Automotive Grade

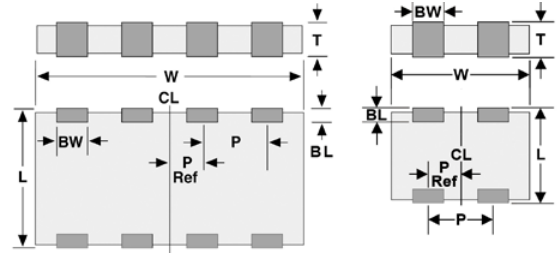
¹ All previous reference to metric case dimension "1632" has been replaced with an inch standard reference of "0612". Please reference all new designs using the "0612" nomenclature. "CA064" replaces "C1632" in the ordering code.

² 0508 case size is only available with the flexible termination option. "X" must be used in the 6th character position when ordering this case size. 0612 (1632) case size is not currently available with the flexible termination option. "C" must be used in the 6th character position when ordering this case size.

³ Additional termination finish options may be available. Contact KEMET for details.

⁴ 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	BW Bandwidth	BL Bandlength	T Thickness	P Pitch	P/2 Reference
0508	1220	1.30 (.051) ± 0.15 (.006)	2.10 (.083) ± 0.15 (.006)	0.53 (.021) ± 0.08 (.003)	0.30 (.012) ± 0.20 (.008)	See Table 2 for Thickness	1.00 (.039)	0.50 (.020) ± 0.10 (.004)
0612	1632	1.60 (.063) ± 0.20 (.008)	3.20 (.126) ± 0.20 (.008)	0.40 (0.06) ± 0.20 (.008)	0.30 (.012) ± 0.20 (.008)		0.80 (.031)	0.40 (.031) ± 0.05 (.002)

Applications

Typical applications include those that can benefit from board area savings, cost savings and overall volumetric reduction such as telecommunications, computers, handheld devices and automotive.

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.

Environmental Compliance

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	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	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 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:

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

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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 1 – Array X7R Dielectric, (0508 - 0612 Case Sizes)

Cap	Cap Code	Series			CA052 (0508 Case Size)					CA064 (0612 Case Size)					
		Voltage Code			8	4	3	5	1	8	4	3	5	1	2
		Voltage DC			10	16	25	50	100	10	16	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions										
330 pF	331	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
390 pF	391	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
470 pF	471	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
560 pF	561	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
680 pF	681	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	MA
820 pF	821	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
1,000 pF	102	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
1,200 pF	122	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
1,500 pF	152	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
1,800 pF	182	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
2,200 pF	222	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
2,700 pF	272	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
3,300 pF	332	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
3,900 pF	392	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
4,700 pF	472	J	K	M	PA	PA	PA	PA	PA	MA	MA	MA	MA	MA	
5,600 pF	562	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
6,800 pF	682	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
8,200 pF	822	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
10,000 pF	103	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
12,000 pF	123	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
15,000 pF	153	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
18,000 pF	183	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
22,000 pF	223	J	K	M	PA	PA	PA	PA		MA	MA	MA	MA		
27,000 pF	273	J	K	M	PA	PA	PA	PA		MA	MA				
33,000 pF	333	J	K	M	PA	PA	PA	PA		MA	MA				
39,000 pF	393	J	K	M	PA	PA	PA	PA		MA	MA				
47,000 pF	473	J	K	M	PA	PA	PA	PA		MA	MA				
56,000 pF	563	J	K	M	PA	PA	PA	PA		MA	MA				
68,000 pF	683	J	K	M	PA	PA	PA	PA		MA	MA				
82,000 pF	823	J	K	M	PA	PA	PA	PA		MA	MA				
0.10 uF	104	J	K	M	PA	PA	PA	PA		MA	MA				
0.15 uF	154	J	K	M	PA										
0.22 uF	224	J	K	M	PA										
Cap	Cap Code	Voltage DC			10	16	25	50	100	10	16	25	50	100	200
		Voltage Code			8	4	3	5	1	8	4	3	5	1	2
		Series			CA052 (0508 Case Size)					CA064 (0612 Case Size)					

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
PA	0508	0.80 ± 0.10	4000	10000	N/A	N/A	N/A
MA	0612	0.80 ± 0.10	4000	10000	N/A	N/A	N/A

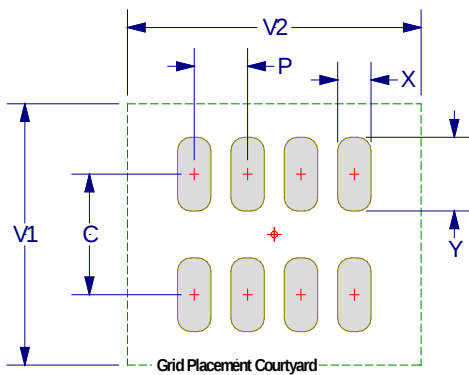
Table 3 – Chip Capacitor Array Land Pattern Design Recommendations per IPC-7351

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	P	V1	V2	C	Y	X	P	V1	V2	C	Y	X	P	V1	V2
0508/CA052	1220	1.60	1.00	0.55	1.00	3.50	3.30	1.50	0.90	0.50	1.00	2.90	2.80	1.40	0.75	0.45	1.00	2.40	2.50
0612/CA064	1632	1.80	1.10	0.50	0.80	3.90	4.40	1.80	0.95	0.50	0.80	3.30	3.90	1.70	0.85	0.40	0.80	2.80	3.60

Density Level A: For low-density Product applications. Provides a wider process window for reflow solder processes. Soldering processes for array type capacitors.

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 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 1.8kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2mm (min) for all except 3mm for C0G.
Solderability	J-STD-002	Magnification 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	1000 Cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X 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.

Storage and 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. In addition, 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.

Open Mode Design (FO-CAP), X7R Dielectric, 16VDC-200VDC (Commercial & Automotive Grade)

Overview

KEMET's Ceramic Open Mode capacitor in X7R dielectric is designed to significantly minimize the probability of a low IR or short circuit condition when forced to failure in a board stress flex situation, thus reducing the potential for catastrophic failure. The Open Mode capacitor may experience a drop in capacitance; however, a short is unlikely because a crack will not typically propagate across counter electrodes within the device's "active area." Since there will not be any current leakage associated with a typical Open Mode flex crack, there is no localized heating and therefore little chance for a catastrophic and potentially costly failure event.

Driven by the demand for a more robust and reliable component, the Open Mode capacitor was designed for critical applications where higher operating temperatures and mechanical stress are

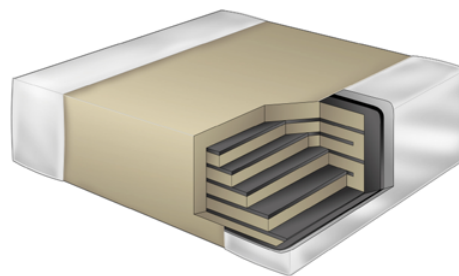
a concern. These capacitors are manufactured in state of the art ISO/TS 16949:2002 certified facilities and are widely used in automotive circuits as well as power supplies (input and output filters) and general electronic applications.

When combined with flexible termination technology these devices offer the ultimate level of protection against a low IR or short circuit condition. Open Mode devices compliment KEMET's Floating Electrode (FE-CAP) and Floating Electrode with Flexible Termination (FF-CAP) product lines by providing a fail-safe design optimized for mid to high 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°C to $+125^{\circ}\text{C}$.

Benefits

- -55°C to $+125^{\circ}\text{C}$ operating temperature range
- Open Mode/fail open design
- Mid to high capacitance flex mitigation
- Pb-Free and RoHS compliant
- EIA 0805, 1206, 1210 and 1812 case sizes
- DC voltage ratings of 16V, 25V, 50V, 100V and 200V
- Capacitance offerings ranging from 1000pF to 6.8 μF
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability

- SnPb termination finish option available upon request (5% min)
- Commercial and Automotive (AEC-Q200) grades available
- SnPb termination finish option available upon request (5% min)
- Flexible termination option available upon request



Ordering Information

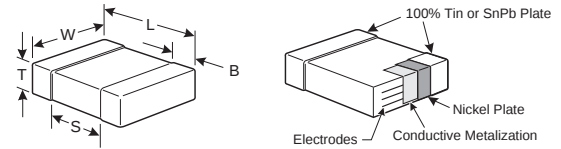
C	1210	J	685	K	3	R	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ²
	0805 1206 1210 1812	F = Open Mode J = Open Mode w/Flexible Termination	2 Sig. Digits + Number of Zeros	K = $\pm 10\%$ M = $\pm 20\%$	4 = 16V 3 = 25V 5 = 50V 1 = 100V 2 = 200V	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

¹ Additional termination finish options may be available. Contact KEMET for details.

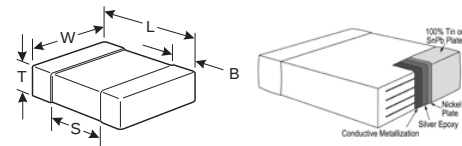
^{1,2} SnPb termination finish option is not available on automotive grade product.

² 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)		
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)		
1812	4532	4.50 (.178) ± 0.40 (.016)	3.20 (.126) ± 0.30 (.012)		0.70 (.028) ± 0.35 (.014)		

Applications

Typical applications include input side filtering (power plane/bus), high current (battery line) and circuits that cannot be fused to open when short circuits occur due to flex cracks. Markets include automotive applications that are directly connected to the battery and/or involve conversion to a 42V system and raw power input side filtering in power conversion.

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 at www.aecouncil.com.

Environmental Compliance

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

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	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 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 hours.

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 ± 0.2 Vrms if capacitance $\leq 10\mu F$

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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		

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 1 – Open Mode Design, X7R Dielectric, (0805 - 1812 Case Sizes)

Cap	Cap Code	Series		C0805F/J					C1206F/J					C1210F/J					C1812F/J			
		Voltage Code		4	3	5	1	2	4	3	5	1	2	4	3	5	1	2	3	5	1	2
		Voltage DC		16	25	50	100	200	16	25	50	100	200	16	25	50	100	200	25	50	100	200
		Cap Tolerance		Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																		
1,000 pF	102	K	M	DD	DD	DD	DD	DD														
1,200 pF	122	K	M	DD	DD	DD	DD	DD														
1,500 pF	152	K	M	DD	DD	DD	DD	DD														
1,800 pF	182	K	M	DD	DD	DD	DD	DD														
2,200 pF	222	K	M	DD	DD	DD	DD	DD														
2,700 pF	272	K	M	DD	DD	DD	DD	DD														
3,300 pF	332	K	M	DD	DD	DD	DD	DD														
3,900 pF	392	K	M	DD	DD	DD	DD	DD														
4,700 pF	472	K	M	DD	DD	DD	DD	DD														
5,600 pF	562	K	M	DD	DD	DD	DD	DD														
6,800 pF	682	K	M	DD	DD	DD	DD	DD														
8,200 pF	822	K	M	DD	DD	DD	DD	DD														
10,000 pF	103	K	M	DD	DD	DD	DD	DD														
12,000 pF	123	K	M	DD	DD	DD	DD	DG														
15,000 pF	153	K	M	DD	DD	DD	DD	DG														
18,000 pF	183	K	M	DD	DD	DD	DD		EC	EC	EC	EC	EC									
22,000 pF	223	K	M	DD	DD	DD	DG		EC	EC	EC	EC	EC									
27,000 pF	273	K	M	DD	DD	DD	DG		EC	EC	EC	EC	EC									
33,000 pF	333	K	M	DD	DD	DD	DG		EC	EC	EC	EC	EC									
39,000 pF	393	K	M	DD	DD	DD	DG		EC	EC	EC	EC	EC									
47,000 pF	473	K	M	DD	DD	DD	DE		EC	EC	EC	EC	EG					GB	GB	GB	GB	
56,000 pF	563	K	M	DD	DD	DD			EC	EC	EC	EC	EG					GB	GB	GB	GB	
68,000 pF	683	K	M	DD	DD	DG	DG		EC	EC	EC	EC	EG	FD	FD	FD	FD	FD	GB	GB	GB	GB
82,000 pF	823	K	M	DD	DD	DG			EC	EC	EC	EC	EG	FD	FD	FD	FD	FD	GB	GB	GB	GB
0.10 µF	104	K	M	DG	DG	DG			EC	EC	EC	EC	EG	FD	FD	FD	FD	FG	GB	GB	GB	GB
0.12 µF	124	K	M	DG	DG				EC	EC	EC	EC		FD	FD	FD	FD	FG	GB	GB	GB	GB
0.15 µF	154	K	M	DG	DG				EC	EC	EC	EG		FD	FD	FD	FD	FH	GB	GB	GB	GB
0.18 µF	184	K	M	DG	DG				EC	EC	EC	EG		FD	FD	FD	FD	FH	GB	GB	GB	GB
0.22 µF	224	K	M	DG	DD	DG			EC	EC	EC	ED		FD	FD	FD	FD	FJ	GB	GB	GB	GC
0.27 µF	274	K	M	DD	DD				EC	EC	EC			FD	FD	FD	FD		GB	GB	GB	GF
0.33 µF	334	K	M	DD	DG				EG	EG	EG	EG		FD	FD	FD	FH		GB	GB	GB	GK
0.39 µF	394	K	M	DD	DG				EG	EG				FD	FD	FD	FG	FH	GB	GB	GB	GL
0.47 µF	474	K	M	DE	DG				EG	EG	EC			FD	FD	FD	FJ		GB	GB	GC	
0.56 µF	564	K	M						EG					FD	FD	FD	FR		GB	GB	GD	
0.68 µF	684	K	M	DG					EG					FD	FG	FG	FR		GD	GD	GF	
0.82 µF	824	K	M						EG					FD	FG	FH			GD	GD	GK	
1.0 µF	105	K	M						EG	EC	EH			FD	FH	FJ	FS		GN	GN	GM	
1.2 µF	125	K	M											FG								
1.5 µF	155	K	M											FH								
1.8 µF	185	K	M											FH								
2.2 µF	225	K	M						EC	EH				FJ	FM	FM						
2.7 µF	275	K	M																			
3.3 µF	335	K																				
3.9 µF	395	K	M																			
4.7 µF	475	K	M						EH					FG	FM							
6.8 µF	685	K	M											FS	FS							
Cap	Cap Code	Voltage DC		16	25	50	100	200	16	25	50	100	200	16	25	50	100	200	25	50	100	200
		Voltage Code		4	3	5	1	2	4	3	5	1	2	4	3	5	1	2	3	5	1	2
		Series		C0805F					C1206F					C1210F					C1812F			

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	1005	0.20 ± 0.02			15000		
AB	0201	0.30 ± 0.03			15000		
BB	0402	0.50 ± 0.05			10000	50000	50000
BC	0402	0.50 ± 0.10			10000	50000	50000
PA	0508	0.80 ± 0.10	4000	10000			
CB	0603	0.80 ± 0.07			4000	10000	15000
CC	0603	0.80 ± 0.10			4000	10000	15000
CD	0603	0.80 ± 0.15			4000	10000	15000
MA	0612	0.80 ± 0.10	4000	10000			
DB	0805	0.60 ± 0.10			4000	10000	15000
DC	0805	0.78 ± 0.10			4000	10000	15000
DD	0805	0.90 ± 0.10			4000	10000	15000
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			
FV	1210	3.35 ± 0.10	500	1800			
FW	1210	6.15 ± 0.15	200	1000			
PA	1220	0.80 ± 0.10	4000	10000			
MA	1632	0.80 ± 0.10	4000	10000			
NA	1706	0.90 ± 0.10	4000	10000			
NB	1706	1.00 ± 0.10	4000	10000			
NC	1706	1.00 ± 0.15	4000	10000			
LD	1808	0.90 ± 0.10	2500	10000			
LE	1808	1.00 ± 0.10	2500	10000			
LF	1808	1.00 ± 0.15	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			
GP	1812	2.65 ± 0.35	500	1400			
GR	1812	5.00 ± 0.50	350	1000			
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			
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

Package Quantity
Based on Finished Chip
Thickness Specifications

Table 2 – Chip Thickness/Packaging Quantities con't

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
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			
JP	2220	3.50 ± 0.30	250	850			
JR	2220	5.00 ± 0.50	150	600			
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			
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

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).

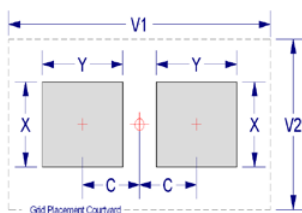


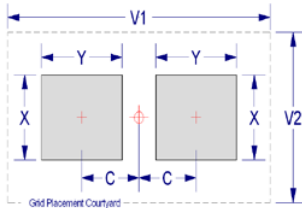
Table 3B – Land Pattern Design Recommendations per IPC-7351 (Flexible Termination)

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 1.8kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2mm (min) for all except 3mm for C0G.
Solderability	J-STD-002	Magnification 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	1000 cycles (-55°C to +125°C). Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2x 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.

Storage and 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. In addition, 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.

Flexible Termination System (FT-CAP) X7R Dielectric, 6.3VDC-250VDC (Commercial Grade & Automotive Grade)

Overview

KEMET's Flexible Termination (FT-CAP) multilayer ceramic capacitor in X7R dielectric incorporates a unique, flexible termination system that is integrated with KEMET's standard termination materials. A conductive silver epoxy is utilized 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. This technology was developed in order to 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. Flexible termination technology directs board flex stress away from the ceramic body and into the termination area, therefore mitigating flex cracks which can result in low IR or short circuit failures.

Although this technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does provide

superior flex performance over standard termination systems. Manufactured in state of the art ISO/TS 16949:2002 certified facilities, the FT-CAP complements KEMET's Open Mode, Floating Electrode (FE-CAP), Floating Electrode with Flexible Termination (FF-CAP) and KEMET Power Solutions (KPS) product lines by providing a complete portfolio of flex mitigation solutions.

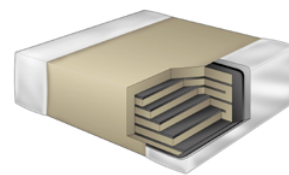
Combined with the stability of an X7R dielectric and designed to accommodate all capacitance requirements, these flex-robust devices are RoHS-compliant, offer up to 5mm of flex-bend capability and exhibit a predictable change in capacitance with respect to time and voltage. Capacitance change with reference to ambient temperature is limited to $\pm 15\%$ from -55°C to $+125^{\circ}\text{C}$.

In addition to commercial grade, automotive grade devices are available which meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

Benefits

- -55°C to $+125^{\circ}\text{C}$ operating temperature range
- Superior flex performance (up to 5mm)
- High capacitance flex mitigation
- Pb-Free and RoHS compliant
- EIA 0603, 0805, 1206, 1210, 1808, 1812, 2220 and 2225 case sizes
- DC voltage ratings of 6.3V, 10V, 16V, 25V, 50V, 100V, 200V and 250V
- Capacitance offerings ranging from 180pF to 22 μF
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available upon request (5% min)
- Commercial and Automotive (AEC-Q200) grades available

**FLEXIBLE
FT-CAP
TERMINATION**



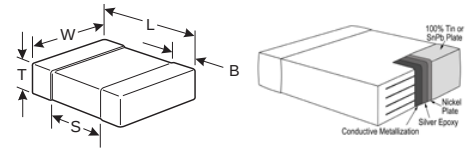
Ordering Information

C	1206	X	106	K	4	R	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ²
	0603 0805 1206 1210 1808 1812 1825 2220 2225	X = 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

¹ Additional termination finish options may be available. Contact KEMET for details.

² 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	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0603	1608	1.60 (.063) +0.20 (.008) / -0.10 (.004)	0.80 (.032) ± 0.15 (.006)	See Table 2 for Thickness	0.45 (.018) +0.05 (.002) / -0.15 (.006)	0.50 (.020)	Solder Wave or Solder Reflow
0805	2012	2.10 (.083) +0.30 (.012) / -0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (.02) +0.10 (.004) / -0.25 (.010)	0.70 (.028)	
1206	3216	3.30 (.130) ± 0.40 (.016)	1.60 (.063) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.30 (.130) ± 0.40 (.016)	2.50 (.098) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)		
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)		
1825	4564	4.60 (.181) ± 0.40 (.016)	6.40 (.252) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		
2220	5650	5.90 (.232) ± 0.75 (.030)	5.00 (.197) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		
2225	5664	5.90 (.232) ± 0.75 (.030)	6.40 (.248) ± 0.40 (.016)		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.

Environmental Compliance

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

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	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 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 hours.

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 ± 0.2 Vrms if capacitance $\leq 10\mu F$

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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		

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 – (FT-CAP), X7R Dielectric, (0603 - 1210 Case Sizes) con't

Cap	Cap Code	Series	C0603X							C0805X							C1206X							C1210X									
		Voltage Code	9	8	4	3	5	1	2	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A
		Voltage DC	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250
		Cap Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																														
10 μF	106	J	K	M													EH	EH	EH														
12 μF	126	J	K	M																													
15 μF	156	J	K	M																													
18 μF	186	J	K	M																													
22 μF	226	J	K	M																													
Cap	Cap Code	Voltage DC	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250
		Voltage Code	9	8	4	3	5	1	2	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A
		Series	C0603X							C0805X							C1206X							C1210X									

Table 1B – (1808 - 2225 Case Sizes)

Cap	Cap Code	Series			C1808X				C1812X					C1825X				C2220X					C2225X				
		Voltage Code			5	1	2	A	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A	
		Voltage DC			50	100	200	250	25	50	100	200	250	50	100	200	250	25	50	100	200	250	50	100	200	250	
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																						
2,200 pF	222	J	K	M																							
2,700 pF	272	J	K	M																							
3,300 pF	332	J	K	M																							
3,900 pF	392	J	K	M																							
4,700 pF	472	J	K	M	LD	LD	LD																				
5,600 pF	562	J	K	M	LD	LD	LD																				
6,800 pF	682	J	K	M	LD	LD	LD		GB	GB	GB	GB	GB														
8,200 pF	822	J	K	M	LD	LD	LD		GB	GB	GB	GB	GB														
10,000 pF	103	J	K	M	LD	LD	LD		GB	GB	GB	GB	GB														
12,000 pF	123	J	K	M	LD	LD	LD		GB	GB	GB	GB	GB														
15,000 pF	153	J	K	M	LD	LD	LD		GB	GB	GB	GB	GB														
18,000 pF	183	J	K	M	LD	LD	LD		GB	GB	GB	GB	GB														
22,000 pF	223	J	K	M	LD	LD			GB	GB	GB	GB	GB	HB	HB	HB	HB										
27,000 pF	273	J	K	M	LD	LD			GB	GB	GB	GB	GB	HB	HB	HB	HB										
33,000 pF	333	J	K	M	LD	LD			GB	GB	GB	GB	GB	HB	HB	HB	HB										
39,000 pF	393	J	K	M	LD	LD			GB	GB	GB	GB	GB	HB	HB	HB	HB										
47,000 pF	473	J	K	M	LD	LD			GB	GB	GB	GB	GB	HB	HB	HB	HB						KC	KC	KC	KC	
56,000 pF	563	J	K	M	LD	LD			GB	GB	GB	GB	GB	HB	HB	HB	HB						KC	KC	KC	KC	
68,000 pF	683	J	K	M	LD				GB	GB	GB	GB	GB	HB	HB	HB	HB						KC	KC	KC	KC	
82,000 pF	823	J	K	M	LD				GB	GB	GB	GB	GB	HB	HB	HB	HB	JC	JC	JC	JC	JC	KC	KC	KC	KC	
0.10 µF	104	J	K	M	LD				GB	GB	GB	GB	GB	HB	HB	HB	HB	JC	JC	JC	JC	JC	KC	KC	KC	KC	
0.12 µF	124	J	K	M	LD				GB	GB	GB	GB	GB	HB	HB	HB	HB	JC	JC	JC	JC	JC	KC	KC	KC	KC	
0.15 µF	154	J	K	M	LD				GB	GB	GB	GB	GE	GE	HB	HB	HB	HB	JC	JC	JC	JC	JC	KC	KC	KC	KC
0.18 µF	184	J	K	M	LD				GB	GB	GB	GF	GG	HB	HB	HB	HB	JC	JC	JC	JC	JC	KC	KC	KC	KC	
0.22 µF	224	J	K	M					GB	GB	GB	GG	GG	HB	HB	HB	HB	JC	JC	JC	JC	JC	KC	KC	KC	KC	
0.27 µF	274	J	K	M					GB	GB	GG	GG	GG	HB	HB	HB	HB	JC	JC	JC	JC	JC	KB	KC	KC	KC	
0.33 µF	334	J	K	M					GB	GB	GG	GG	GG	HB	HB	HB	HB	JC	JC	JC	JC	JC	KB	KC	KC	KC	
0.39 µF	394	J	K	M					GB	GB	GG	GG	GG	HB	HB	HD	HD	JC	JC	JC	JC	JC	KB	KC	KC	KC	
0.47 µF	474	J	K	M					GB	GB	GG	GJ	GJ	HB	HB	HD	HD	JC	JC	JC	JC	JC	KB	KC	KD	KD	
0.56 µF	564	J	K	M					GC	GC	GG			HB	HD	HD	HD	JC	JC	JC	JD	JD	KB	KC	KD	KD	
0.68 µF	684	J	K	M					GC	GC	GG			HB	HD	HD	HD	JC	JC	JD	JD	JD	KB	KC	KD	KD	
0.82 µF	824	J	K	M					GE	GE	GG			HB	HF	HF	HF	JC	JC	JF	JF	JF	KB	KC	KE	KE	
1.0 µF	105	J	K	M					GE	GE	GG			HB	HF	HF	HF	JC	JC	JF	JF	JF	KB	KD	KE	KE	
1.2 µF	125	J	K	M										HB				JC	JC				KB	KE	KE	KE	
Cap	Cap Code	Voltage DC			50	100	200	250	25	50	100	200	250	50	100	200	250	25	50	100	200	250	50	100	200	250	
		Voltage Code			5	1	2	A	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A	
		Series			C1808X				C1812X					C1825X				C2220X					C2225X				

Table 1B – (FT-CAP), X7R Dielectric, (1808 - 2225 Case Sizes) con't

Cap	Cap Code	Series			C1808X				C1812X					C1825X				C2220X					C2225X				
		Voltage Code			5	1	2	A	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A	
		Voltage DC			50	100	200	250	25	50	100	200	250	50	100	200	250	25	50	100	200	250	50	100	200	250	
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																						
1.5 μF	155	J	K	M										HC				JC	JC					KC			
1.8 μF	185	J	K	M										HD				JD	JD					KD			
2.2 μF	225	J	K	M										HF				JF	JF					KD			
2.7 μF	275	J	K	M																							
3.3 μF	335	J	K	M																							
3.9 μF	395	J	K	M																							
4.7 μF	475	J	K	M					GK	GK																	
5.6 μF	565	J	K	M																							
6.8 μF	685	J	K	M																							
8.2 μF	825	J	K	M																							
10 μF	106	J	K	M					GK									JF	JO								
12 μF	126	J	K	M																							
15 μF	156	J	K	M														JO									
18 μF	186	J	K	M																							
22 μF	226	J	K	M														JO									
Cap	Cap Code	Voltage DC			50	100	200	250	25	50	100	200	250	50	100	200	250	25	50	100	200	250	50	100	200	250	
		Voltage Code			5	1	2	A	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A	
		Series			C1808X				C1812X				C1825X				C2220X				C2225X						

KPS Series, X7R Dielectric, 10VDC-250VDC (Automotive Grade)

Overview

KEMET Power Solutions (KPS) Automotive Series stacked capacitors utilize a proprietary lead-frame technology to vertically stack one or two multilayer ceramic chip capacitors into a single compact surface mount package. The attached lead-frame mechanically isolates the capacitor/s from the printed circuit board, therefore offering advanced mechanical and thermal stress performance. Isolation also addresses concerns for audible, microphonic noise that may occur when a bias voltage is applied. A two chip stack offers up to double the capacitance in the same or smaller design footprint when compared to traditional surface mount MLCC devices. Providing up to 10mm of board flex capability, KPS Series capacitors are environmentally friendly and in compliance with RoHS legislation. Available in X7R dielectric, these devices are capable of Pb-Free reflow profiles and provide

lower ESR, ESL and higher ripple current capability when compared to other dielectric solutions.

Combined with the stability of an X7R dielectric, KEMET's KPS Series 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°C to $+125^{\circ}\text{C}$.

KPS Series automotive grade capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

Benefits

- AEC-Q200 automotive qualified
- -55°C to $+125^{\circ}\text{C}$ operating temperature range
- Reliable and robust termination system
- EIA 1210, 1812 and 2220 Case sizes
- DC voltage ratings of 10V, 16V, 25V, 50V, 100V and 250V
- Capacitance offerings ranging from $0.1\mu\text{F}$ up to $47\mu\text{F}$
- Available capacitance tolerances of $\pm 10\%$ & $\pm 20\%$
- Higher capacitance in the same footprint
- Potential board space savings
- Advanced protection against thermal and mechanical stress
- Provides up to 10mm of board flex capability
- Reduces audible, microphonic noise
- Extremely low ESR and ESL
- Pb-Free and RoHS compliant
- Capable of Pb-Free reflow profiles
- Non-polar device, minimizing installation concerns
- Tantalum and electrolytic alternative



Ordering Information

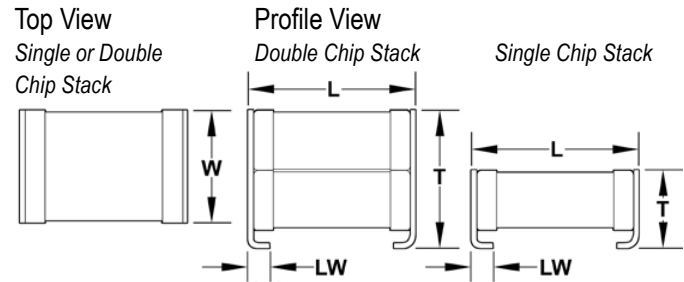
C	2220	C	106	M	5	R	2	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ¹	Voltage	Dielectric	Failure Rate/Design	Leadframe Finish ²	Packaging/Grade (C-Spec) ³
	1210 1812 2220	C = Standard	2 Sig. Digits + Number of Zeros	K = $\pm 10\%$ M = $\pm 20\%$	8 = 10V 4 = 16V 3 = 25V 5 = 50V 1 = 100V A = 250V	R = X7R	1 = KPS Single Chip Stack 2 = KPS Double Chip Stack	C = 100% Matte Sn	AUTO = Automotive Grade 7" Reel Unmarked

¹ Double chip stacks ("2" in the 13th character position of the ordering code) are only available in M ($\pm 20\%$) capacitance tolerance. Single chip stacks ("1" in the 13th character position of the ordering code) are available in K ($\pm 10\%$) or M ($\pm 20\%$) tolerances.

² Additional leadframe finish options may be available. Contact KEMET for details.

³ Additional reeling or packaging options may be available. Contact KEMET for details.

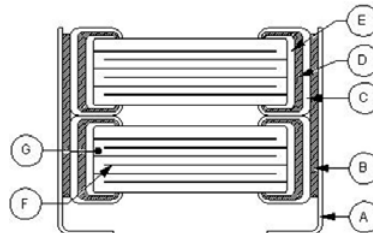
Dimensions – Millimeters (Inches)



Chip Stack	EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	LW Lead Width	Mounting Technique
Single	1210	3225	3.50 (.138) ± 0.30 (.012)	2.60 (.102) ± 0.30 (.012)	3.35 (.132) ± 0.10 (.004)	0.80 (.032) ± 0.15 (.006)	Solder Reflow Only
	1812	4532	5.00 (.197) ± 0.50 (.020)	3.50 (.138) ± 0.50 (.020)	2.65 (.104) ± 0.35 (.014)	1.10 (.043) ± 0.30 (.012)	
	2220	5650	6.00 (.236) ± 0.50 (.020)	5.00 (.197) ± 0.50 (.020)	3.50 (.138) ± 0.30 (.012)	1.60 (.063) ± 0.30 (.012)	
Double	1210	3225	3.50 (.138) ± 0.30 (.012)	2.60 (.102) ± 0.30 (.012)	6.15 (.242) ± 0.15 (.006)	0.80 (.031) ± 0.15 (.006)	
	1812	4532	5.00 (.197) ± 0.50 (.020)	3.50 (.138) ± 0.50 (.020)	5.00 (.197) ± 0.50 (.020)	1.10 (.043) ± 0.30 (.012)	
	2220	5650	6.00 (.236) ± 0.50 (.020)	5.00 (.197) ± 0.50 (.020)	5.00 (.197) ± 0.50 (.020)	1.60 (.063) ± 0.30 (.012)	

Outline Drawing

Ref	Name	Material
A	Leadframe	Phosphor Bronze - Alloy 510
B	Leadframe Attach	High Temp Solder
C	Termination	Cu
D		Ni
E		Sn
F	Electrode	Ni
G	Dielectric	BaTiO ₃



Applications

Typical applications include smoothing circuits, DC/DC converters, power supplies (input/output filters), noise reduction (piezoelectric/mechanical), 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.

Qualification/Certification

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.

Environmental Compliance

Pb-Free and 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	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 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 hours.

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 ± 0.2 Vrms if capacitance $\leq 10\mu F$

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

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

Post Environmental Limits

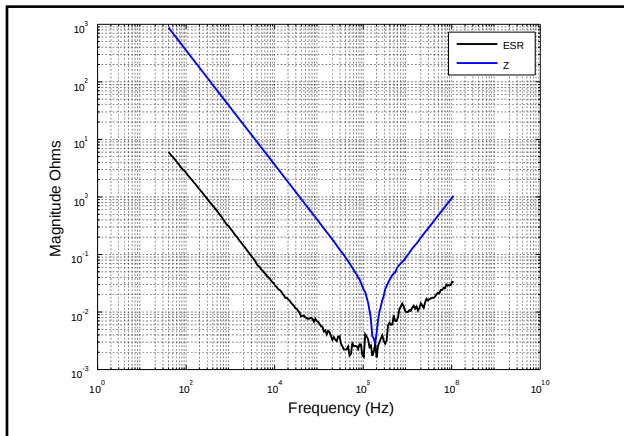
High Temperature Life, Biased Humidity, Moisture Resistance					
Dielectric	Rated DC Voltage	Capacitance Value	DF (%)	Cap Shift	IR
X7R	>25	All	3.0	± 20%	10% of Initial Limit
	16 / 25		5.0		
	< 16		7.5		

Insulation Resistance Limit Table

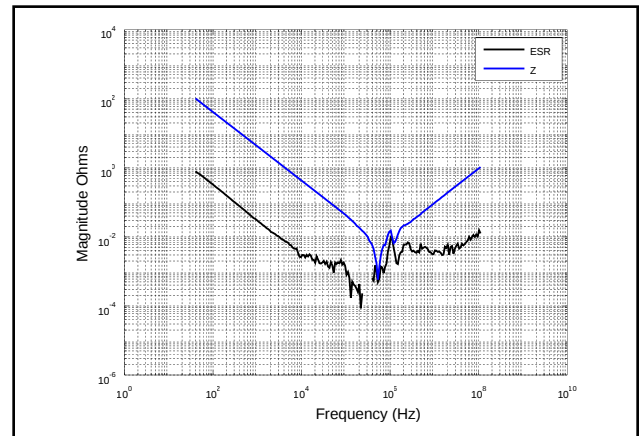
EIA Case Size	1000 megohm microfarads or 100GΩ	500 megohm microfarads or 10GΩ
1210	< 0.39 μF	≥ 0.39 μF
1812	< 2.2 μF	≥ 2.2 μF
2220	< 10 μF	≥ 10 μF

Electrical Characteristics

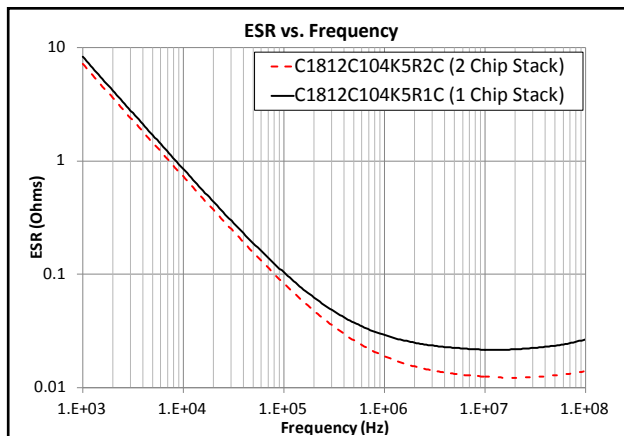
Z and ESR C1210C475M5R1C



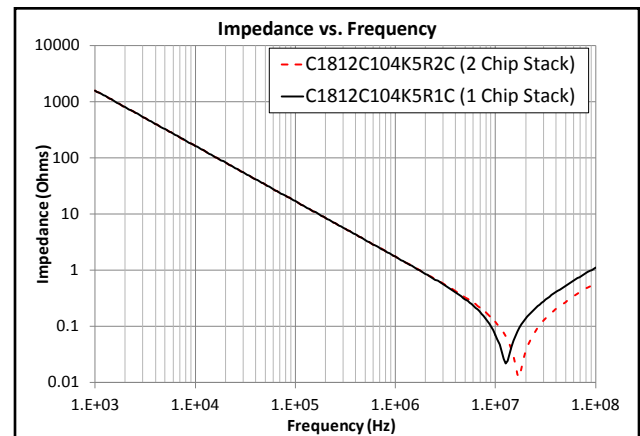
Z and ESR C2220C476M3R2C



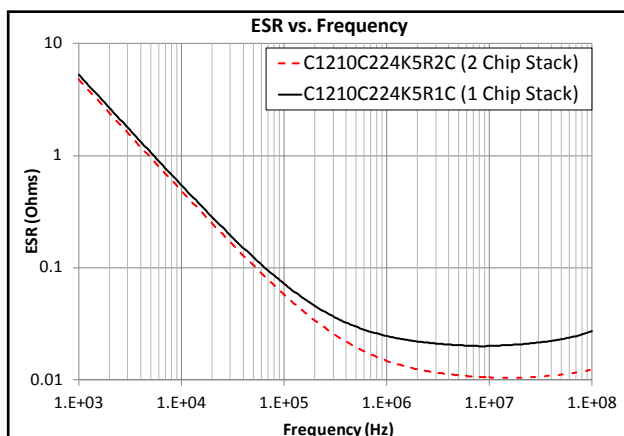
ESR - 1812, .10 μ F, 50V X7R



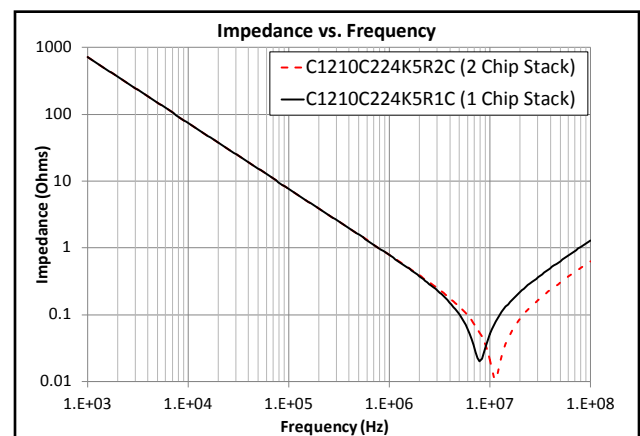
Impedance - 1812, .10 μ F, 50V X7R



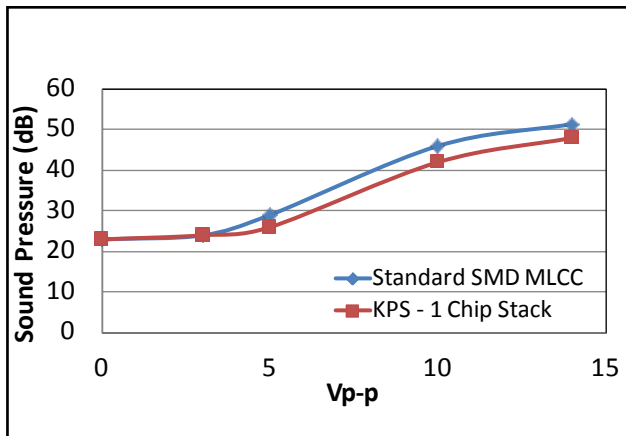
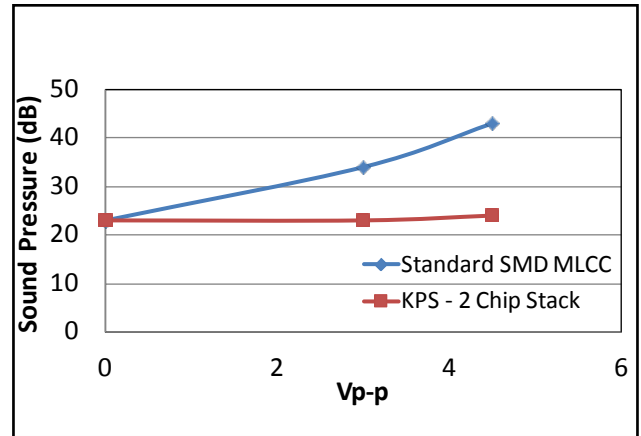
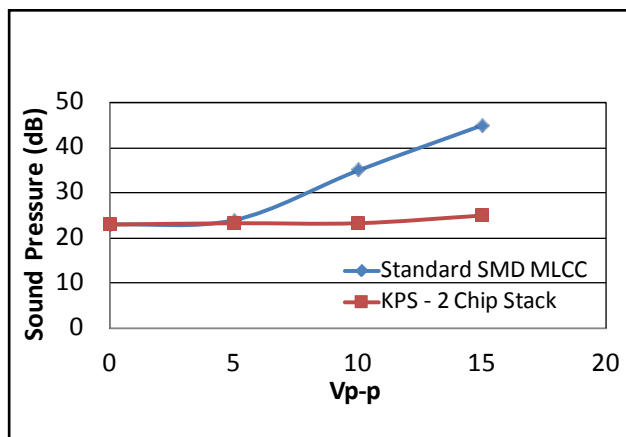
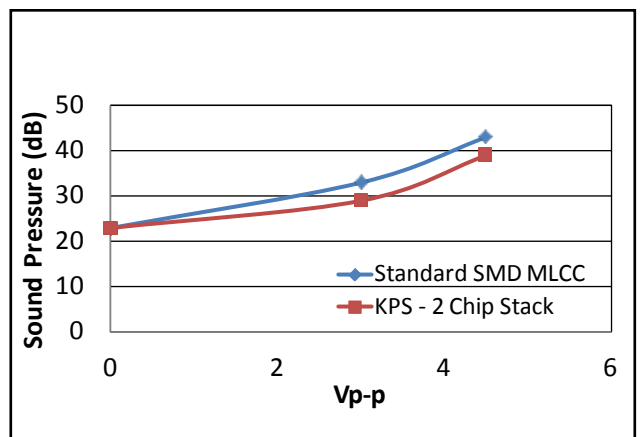
ESR - 1210, .22 μ F, 50V X7R



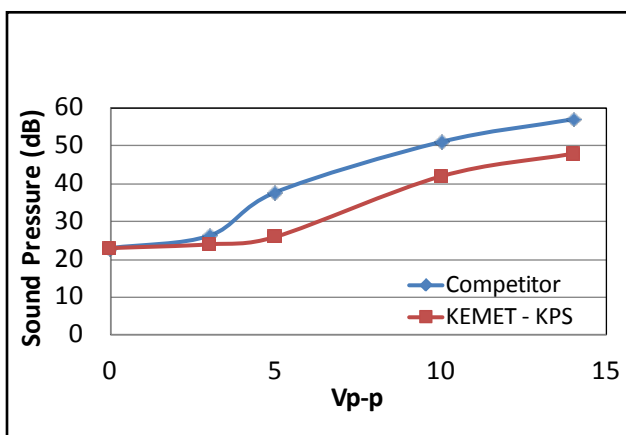
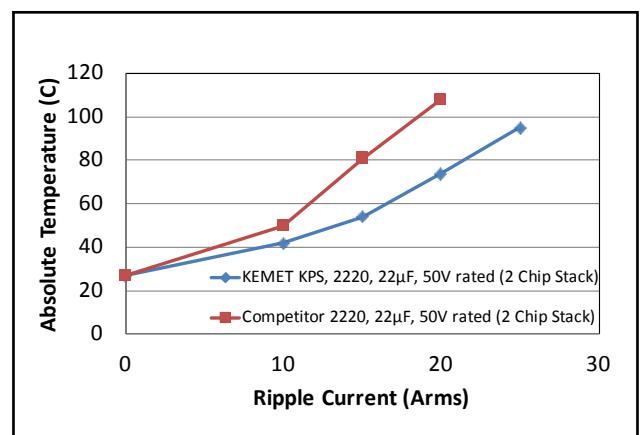
Impedance - 1210, .22 μ F, 50V X7R



Electrical Characteristics con't

Microphonics - 1210, 4.7 μ F, 50V, X7RMicrophonics - 2220, 22 μ F, 50V, X7RMicrophonics - 2220, 47 μ F, 25V, X7RMicrophonics - 1210, 22 μ F, 25V, X7R

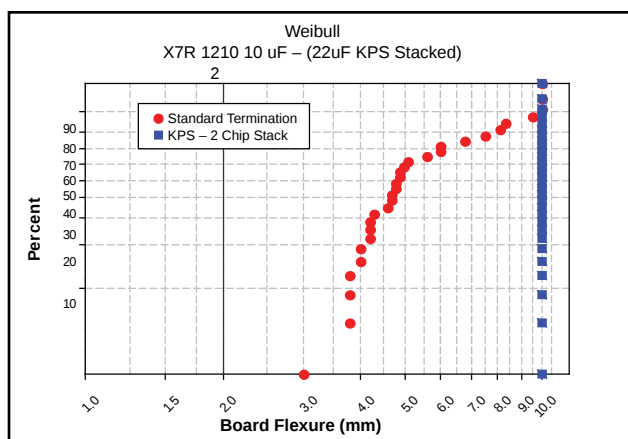
Competitive Comparison

Microphonics - 1210, 4.7 μ F, 50V, X7RRipple Current (Arms) 2220, 22 μ F, 50V

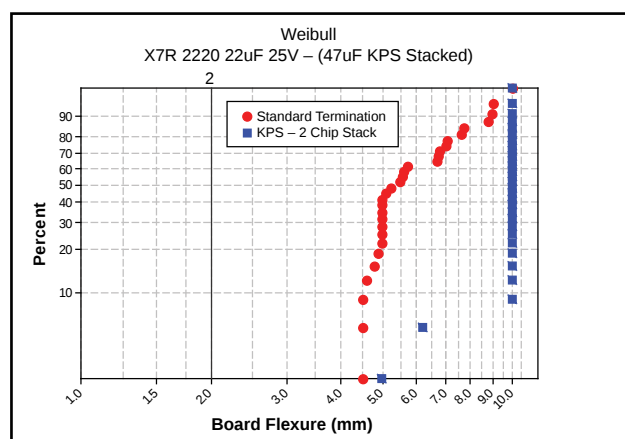
Note: Refer to Table 4 for test method.

Electrical Characteristics

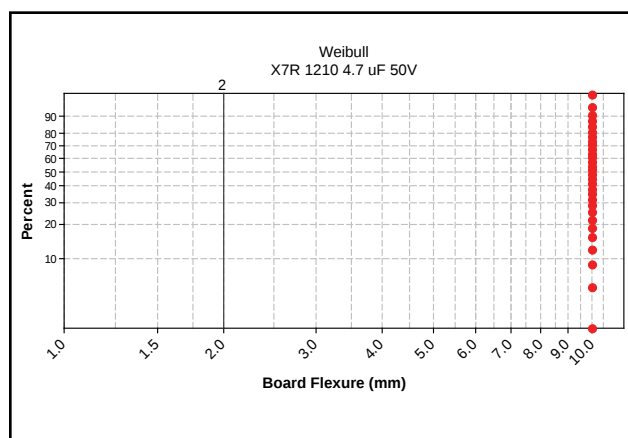
Board Flex vs. Termination Type



Board Flex vs. Termination Type



Board Flexure to 10mm



Board Flexure to 10mm

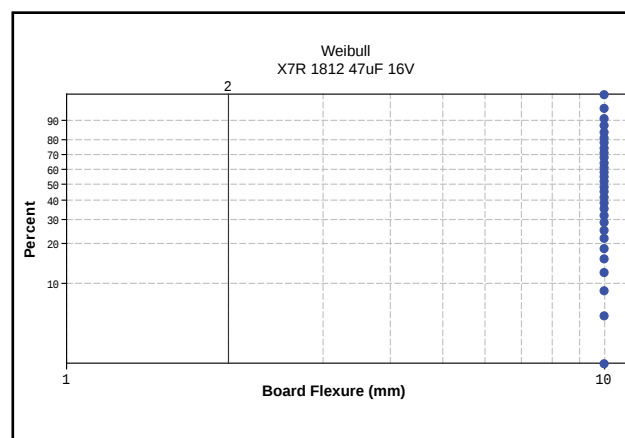


Table 1 – KPS Series, X7R Dielectric, (1210 - 2220 Case Sizes)

Cap	Cap Code	Series		C1210						C1812					C2220				
		Voltage Code		8	4	3	5	1	A	4	3	5	1	A	4	3	5	1	A
		Voltage DC		10	16	25	50	100	250	16	25	50	100	250	16	25	50	100	250
		Cap Tolerance		Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions															
Single Chip Stack																			
0.10 uF	104	K	M	FV	FV	FV	FV	FV	FV	GP	GP	GP	UD	UD	JP	JP	JP	UD	UD
0.22 uF	224	K	M	FV	FV	FV	FV	FV	FV	GP	GP	GP	UD	UD	JP	JP	JP	UD	UD
0.47 uF	474	K	M	FV	FV	FV	FV	FV	FV	GP	GP	GP	UD	UD	JP	JP	JP	UD	UD
1.0 uF	105	K	M	FV	FV	FV	FV	FV	FV	GP	GP	GP	UD		JP	JP	JP	UD	UD
2.2 uF	225	K	M	FV	FV	FV	FV			GP	GP	GP			JP	JP	JP	UD	
3.3 uF	335	K	M	FV	FV	FV	FV			GP	GP	GP			JP	JP	JP	UD	
4.7 uF	475	K	M	FV	FV	FV	FV			GP	GP	GP			JP	JP	JP		
10 uF	106	K	M	FV	FV	FV				GP	GP				JP	JP	JP		
15 uF	156	K	M												JP	JP			
22 uF	226	K	M												JP	JP			
33 uF	336	K	M																
47 uF	476	K	M																
100 uF	107	K	M																
Double Chip Stack																			
0.10 uF	104		M	FW	FW	FW	FW	FW	FW	GR	GR	GR	UD	UD	JR	JR	JR	UD	UD
0.22 uF	224		M	FW	FW	FW	FW	FW	FW	GR	GR	GR	UD	UD	JR	JR	JR	UD	UD
0.47 uF	474		M	FW	FW	FW	FW	FW	FW	GR	GR	GR	UD	UD	JR	JR	JR	UD	UD
1.0 uF	105		M	FW	FW	FW	FW	FW	FW	GR	GR	GR	UD	UD	JR	JR	JR		
2.2 uF	225		M	FW	FW	FW	FW	FW	FW	GR	GR	GR	UD		JR	JR	JR		
3.3 uF	335		M	FW	FW	FW	FW			GR	GR	GR	UD		JR	JR	JR	UD	
4.7 uF	475		M	FW	FW	FW	FW			GR	GR	GR			JR	JR	JR	UD	
10 uF	106		M	FW	FW	FW	FW			GR	GR	GR			JR	JR	JR		
22 uF	226		M	FW	FW	FW				GR	GR				JR	JR	JR		
33 uF	336		M												JR	JR			
47 uF	476		M												JR	JR			
100 uF	107		M																
220 uF	227		M																
Cap	Cap Code	Voltage DC		10	16	25	50	100	250	16	25	50	100	250	16	25	50	100	250
		Voltage Code		8	4	3	5	1	A	4	3	5	1	A	4	3	5	1	A
		Series		C1210						C1812					C2220				

UD = Under Development

Table 2 – Chip Thickness / Packaging Quantities

Thickness Code	Chip Size	Thickness ± Range (mm)	Qty per Reel 7" Plastic	Qty per Reel 13" Plastic
FV	1210	3.35 ± 0.10	600	2000
FW	1210	6.15 ± 0.15	300	1000
GP	1812	2.65 ± 0.35	500	2000
GR	1812	5.00 ± 0.50	400	1700
JP	2220	3.50 ± 0.30	300	1300
JR	2220	5.00 ± 0.50	200	800

Package Quantity Based on Finished Chip Thickness Specifications

Soldering Process

Recommended Soldering Technique:

- Solder reflow only

Recommended Soldering Profile:

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

Table 3 – KPS Land Pattern Design Recommendations

EIA Size Code	Metric Size Code	Median (Nominal) Land Protrusion (mm)		
		X	Y	2xC
1210	3225	1.75	1.14	3.00
1812	4532	2.87	1.35	4.39
2220	5650	4.78	2.08	5.38

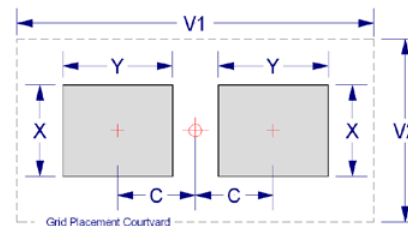


Table 4 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8kg 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/ EIA-198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2X 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.

Storage and 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. In addition, 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.

High Voltage with Flexible Termination System (HV FT-CAP)

X7R Dielectric, 500VDC-3000VDC (Commercial & Automotive Grade)

Overview

KEMET's High Voltage with Flexible Termination (HV FT-CAP) surface mount MLCCs in X7R dielectric combine high voltage and flexible termination technologies. Featuring a 125°C maximum operating temperature and considered "temperature stable," these devices 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. Utilizing a conductive silver epoxy between the base metal and nickel barrier layers of KEMET's standard termination system, flexible termination technology directs board flex stress away from the ceramic body and into the termination area, therefore mitigating flex cracks which can result in low IR or short circuit failures. Although flexible termination technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does provide superior flex performance over standard termination systems.

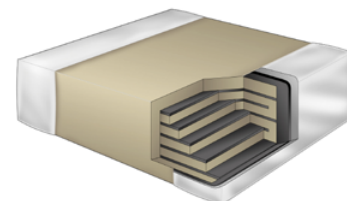
The HV FT-CAP offers low leakage current, exhibits low ESR at high frequencies and finds conventional use as snubbers or filters in applications such as switching power supplies and lighting

ballasts. Their exceptional performance at high frequencies has made them a preferred choice of design engineers worldwide. In addition to their use in power supplies, these capacitors are widely used in industries related to automotive(hybrid), telecommunications, medical, military, aerospace, semiconductors and test/diagnostic equipment.

Combined with the stability of an X7R dielectric and designed to accommodate all capacitance requirements, these flex-robust devices are RoHS-compliant, offer up to 5mm of flex-bend capability and exhibit a predictable change in capacitance with respect to time and voltage. Capacitance change with reference to ambient temperature is limited to $\pm 15\%$ from -55°C to +125°C.

KEMET's high voltage surface mount MLCCs are manufactured in state of the art ISO/TS 16949:2002 certified facilities and are available in both commercial and automotive grades. Automotive grade devices meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

HIGH VOLTAGE
FLEXIBLE
FT-CAP
TERMINATION



Ordering Information

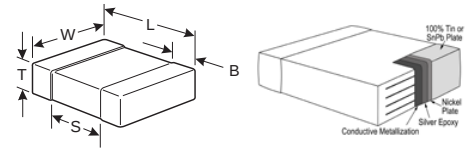
C	1210	X	473	K	C	R	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ²
	0805 1206 1210 1808 1812 1825 2220 2225	X = Flexible Termination	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	C = 500V B = 630V D = 1000V F = 1500V G = 2000V Z = 2500V H = 3000V	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

¹ SnPb termination finish option is not available on automotive grade product.

¹ Additional termination finish options may be available. Contact KEMET for details.

² 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	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	Solder Reflow Only
1210	3225	3.30 (.130) ± 0.40 (.016)	2.50 (.098) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)		
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)		
1825	4564	4.60 (.181) ± 0.40 (.016)	6.40 (.252) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		
2220	5650	5.90 (.232) ± 0.75 (.030)	5.00 (.197) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		
2225	5664	5.90 (.232) ± 0.75 (.030)	6.40 (.248) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		

Benefits

- -55°C to +125°C operating temperature range
- Superior flex performance (up to 5mm)
- Pb-Free and RoHS compliant
- EIA 0805, 1206, 1210, 1808, 1812, 1825, 2220 and 2225 case sizes
- DC voltage ratings of 500V, 630V, 1KV, 1.5KV, 2KV, 2.5KV and 3KV
- Capacitance offerings ranging from 62pF to 0.27µF
- Available capacitance tolerances of ±5%, ±10% or ±20%.
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- Commercial & Automotive (AEC-Q200) grades available
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb plated termination finish option available upon request (5% min)

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. X7R dielectrics are not designed 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 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.

Environmental Compliance

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

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 < 1000V 120% of rated voltage for voltage rating of ≥ 1000V (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	2.5%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 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:

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

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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 – (HV FT-CAP), X7R Dielectric, (0805 - 1812 Case Sizes)

Cap	Cap Code	Series		C0805			C1206					C1210					C1808								C1812							
		Voltage Code		C	B	D	C	B	D	F	G	C	B	D	F	G	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H		
		Voltage DC		500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000		
		Cap Tolerance		Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																												
56 pF	560	J	K	M	DG	DG	DG																									
62 pF	620	J	K	M	DG	DG	DG																									
68 pF	680	J	K	M	DG	DG	DG																									
75 pF	750	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
82 pF	820	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
91 pF	910	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
100 pF	101	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
110 pF	111	J	K	M	DG	DG	DG	EF	EF	EF	EF	EF						LB	LB	LB	LB	LB	LB	LB								
120 pF	121	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG						LA	LA	LA	LA	LB	LB	LB								
130 pF	131	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB								
150 pF	151	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK	
180 pF	181	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK	
220 pF	221	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK	
270 pF	271	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK	
330 pF	331	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK	
390 pF	391	J	K	M	DG	DG	DG	EF	EF	EF	EF		FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK	
470 pF	471	J	K	M	DG	DG	DG	EF	EF	EF	EF		FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK	GK	
560 pF	561	J	K	M	DG	DG	DG	EF	EF	EF	EF		FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK	GK	
680 pF	681	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LC	LC	GH	GH	GH	GH	GH	GK	GK	
820 pF	821	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LC	LC	GH	GH	GH	GH	GH	GK	GK	
1,000 pF	102	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LC	LC	GH	GH	GH	GH	GH	GK	GK	
1,200 pF	122	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LB	LB	LB	LB	LC			GH	GH	GH	GH	GH	GK	GK	
1,500 pF	152	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
1,800 pF	182	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
2,000 pF	202	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
2,200 pF	222	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
2,700 pF	272	J	K	M	DG	DG	DG	EF	EF	EF	EG		FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GK			
3,300 pF	332	J	K	M	DG	DG	DG	EF	EF	EF	EG		FL	FL	FL	FL	FM	LA	LA	LA	LA	LB			GH	GH	GH	GH	GK			
3,900 pF	392	J	K	M	DG	UD	UD	EF	EF	EF	EG		FL	FL	FL	FL	FK	LA	LA	LA	LA	LB			GH	GH	GH	GH	GK			
4,700 pF	472	J	K	M	DG	UD	UD	EF	EF	EF	EG		FL	FL	FL	FL	FK	LA	LA	LA	LA	LB			GH	GH	GH	GH				
5,600 pF	562	J	K	M	DG	UD		EF	EF	EF			FL	FL	FL	FM		LA	LB	LB	LB	LC			GH	GH	GH	GK				
6,800 pF	682	J	K	M	DG	UD		EG	EG	EG			FL	FL	FL	FM		LA	LB	LB	LB	LC			GH	GH	GH	GK				
8,200 pF	822	J	K	M	DG	UD		EG	EG	EG			FL	FL	FL	FK		LA	LB	LB	LB	LC			GH	GH	GH	GK				
10,000 pF	103	J	K	M	UD			EG	EG	EG			FL	FL	FL	FK		LA	LB	LB	LB	LC			GH	GH	GH	GK				
12,000 pF	123	J	K	M	UD			EG	UD	UD			FL	FL	FL	FK		LA	LC	LC					GH	GK	GK	GK				
15,000 pF	153	J	K	M				EG	UD	UD			FL	FL	FL			LA	LC	LC					GH	GK	GK					
18,000 pF	183	J	K	M				UD	UD	UD			FL	FL	FL			LA	UD	UD					GH	GK	GK					
22,000 pF	223	J	K	M				UD	UD	UD			FL	FM	FM			LA	UD	UD					GH	GK	GK					
27,000 pF	273	J	K	M				UD	UD				FM	FK	FK			LA	UD	UD					GH	UD	UD					
33,000 pF	333	J	K	M				UD	UD				FM	UD	UD			LC	UD	UD					GH	UD	UD					
39,000 pF	393	J	K	M				UD					FK	UD	UD			LC	UD	UD					GH	UD	UD					
47,000 pF	473	J	K	M				UD					FK	UD	UD			LC	UD	UD					GH	UD	UD					
56,000 pF	563	J	K	M				UD					UD	UD	UD			LC	UD	UD					GH	UD	UD					
62,000 pF	623	J	K	M				UD					UD	UD	UD			UD	UD	UD					GK	UD	UD					
68,000 pF	683	J	K	M				UD					UD	UD	UD			UD	UD	UD					UD	UD	UD					
82,000 pF	823	J	K	M									UD	UD				UD	UD						UD	UD	UD					
0.10 μF	104	J	K	M									UD	UD				UD	UD						UD	UD	UD					
0.12 μF	124	J	K	M									UD					UD							UD	UD	UD					
0.15 μF	154	J	K	M									UD					UD							UD	UD	UD					
0.18 μF	184	J	K	M																					UD	UD	UD					
0.22 μF	224	J	K	M																					UD	UD	UD					
0.27 μF	274	J	K	M																					UD	UD	UD					
0.33 μF	334	J	K	M																					UD	UD	UD					
Cap	Cap Code	Voltage DC		500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000		
		Voltage Code		C	B	D	C	B	D	F	G	C	B	D	F	G	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H		
		Series		C0805			C1206					C1210					C1808								C1812							

UD = Under Development

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 1B – (HV FT-CAP), X7R Dielectric, (1825 - 2225 Case Sizes)

Cap	Cap Code	Series			C1825								C2220								C2225							
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H			
		Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000			
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																							
180 pF	181	J	K	M																								
220 pF	221	J	K	M																								
270 pF	271	J	K	M																								
330 pF	331	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP										
390 pF	391	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP										
470 pF	471	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
560 pF	561	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
680 pF	681	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
820 pF	821	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,000 pF	102	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,200 pF	122	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,500 pF	152	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,800 pF	182	J	K	M	HE	HE	HE	HE	HE	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
2,000 pF	202	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KF	KF	KF	KF	KF	KF	KF			
2,200 pF	222	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KF	KF	KF	KF	KF	KF	KF			
2,700 pF	272	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KE	KE	KE	KE	KE	KF	KF			
3,300 pF	332	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KE	KE	KE	KE	KE	KF	KF			
3,900 pF	392	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JE	JP	JP	KE	KE	KE	KE	KE	KF	KF			
4,700 pF	472	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KE	KF	KF			
5,600 pF	562	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KE	KF	KF			
6,800 pF	682	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KF					
8,200 pF	822	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KF					
10,000 pF	103	J	K	M	HE	HE	HE	HE				JE	JE	JE	JE				KE	KE	KE	KE	KF					
12,000 pF	123	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP				KE	KE	KE	KE	KF					
15,000 pF	153	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP				KE	KE	KE	KE						
18,000 pF	183	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP				KE	KE	KE	KE						
22,000 pF	223	J	K	M	HE	HG	HG	HG				JE	JP	JP	JP				KE	KF	KF	KF						
27,000 pF	273	J	K	M	HE	HG	HG	HG				JE	JP	JP	JP				KE	KF	KF	KF						
33,000 pF	333	J	K	M	HE	HG	HG					JE	JP	JP	JP				KE	KF	KF	KF						
39,000 pF	393	J	K	M	HE	HG	HG					JE	JP	JP					KE	KF	KF	KF						
47,000 pF	473	J	K	M	HE	HG	HG					JE	JP	JP					KE	KF	KF	KF						
56,000 pF	563	J	K	M	HE							JE							KE	KF	KF							
62,000 pF	623	J	K	M	HG							JE							KF	KF	KF							
68,000 pF	683	J	K	M	HG							JE							KE	KF	KF							
82,000 pF	823	J	K	M	HG							JE							KE	KF	KF							
0.10 µF	104	J	K	M	HG							JE							KE									
0.12 µF	124	J	K	M	HG							JE							KE									
0.15 µF	154	J	K	M	HG							JP							KF									
0.18 µF	184	J	K	M	HG							JP							KF									
0.22 µF	224	J	K	M	HG							JP							KF									
0.27 µF	274	J	K	M															KF									
0.33 µF	334	J	K	M																								
0.39 µF	394	J	K	M																								
0.47 µF	474	J	K	M																								
0.56 µF	564	J	K	M																								
Cap	Cap Code	Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000			
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H			
		Series			C1825								C2220								C2225							

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).

High Temperature 150°C, Ultra-Stable X8R Dielectric, 25VDC-100VDC (Commercial & Automotive Grade)

Overview

KEMET's Ultra-Stable X8R dielectric features a 150°C maximum operating temperature, offering the latest in high temperature dielectric technology and reliability for extreme temperature applications. It offers the same temperature capability as conventional X8R, but without the capacitance loss due to applied DC voltage. Ultra-Stable X8R exhibits no change in capacitance with respect to voltage and boasts a minimal change in capacitance with reference to ambient temperature. It is a suitable replacement for higher capacitance and larger footprint devices that fail to offer capacitance stability. Capacitance change with respect to temperature is limited to $\pm 15\%$ from -55°C to +150°C.

Driven by the demand for a more robust and reliable component, Ultra-Stable X8R dielectric capacitors were developed for critical applications where reliability and capacitance stability at higher operating temperatures are a concern. These capacitors are manufactured in state of the art ISO/TS 16949:2002 certified facilities and are widely used in automotive circuits as well as general high temperature applications.

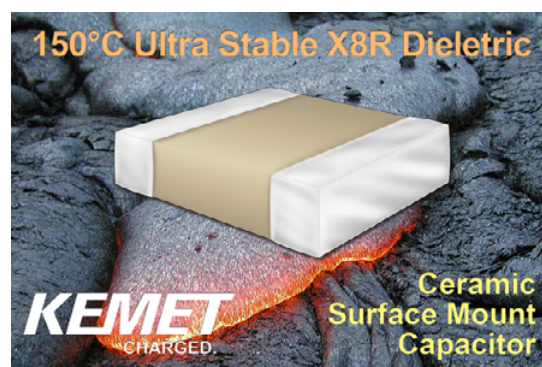
In addition to commercial grade, automotive grade devices are available and meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

Benefits

- -55°C to +150°C operating temperature range
- Pb-Free and RoHS compliant
- EIA 0402, 0603, 0805, 1206, 1210 and 1812 case sizes
- DC voltage ratings of 25V, 50V and 100V
- Capacitance offerings ranging from 10pF to 0.22 μ F
- Available capacitance tolerances of $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$,
- Extremely low ESR and ESL
- High thermal stability
- High ripple current capability
- No capacitance change with respect to applied rated DC voltage
- Non-polar device, minimizing installation concerns
- Offered in both commercial and automotive grades
- 100% pure matte tin-plated termination finish that allowing for excellent solderability.
- SnPb plated termination finish option available upon request (5% min)

Applications

Typical applications include decoupling, bypass and filtering in extreme environments such as down-hole oil exploration, under-hood automotive, military and aerospace.



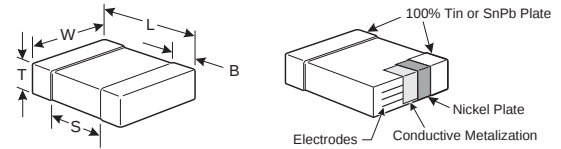
Ordering Information

C	1210	C	184	K	3	H	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ²
	0402 0603 0805 1206 1210 1812	C = Standard	2 Sig. Digits + Number of Zeros	F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	3 = 25V 5 = 50V 1 = 100V	H = Ultra Stable X8R	A = N/A	C = 100% Matte Sn L = SnPb (5% min)	Blank = Bulk TU = 7" Reel Unmarked AUTO = Automotive Grade 7" Reel Unmarked

¹ Additional termination finish options may be available. Contact KEMET for details.

² 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	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)	See Table 2 for Thickness	0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	Solder Wave or Solder Reflow
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		
1812	4532	4.50 (.177) ± 0.30 (.012)	3.20 (.126) ± 0.30 (.012)		0.60 (.024) ± 0.35 (.014)		

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.

Environmental Compliance

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

Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +150°C
Capacitance Change with Reference to +25°C and 0 Vdc Applied (TCC)	±15%
Aging Rate (Max % Cap Loss/Decade Hour)	0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limits @ 25°C	2.5%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

To obtain IR limit, divide $M\Omega \cdot \mu F$ 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:

1MHz ± 100kHz and $1.0 \pm 0.2 V_{rms}$ if capacitance ≤ 1000pF.

1kHz ± 50Hz and $1.0 \pm 0.2 V_{rms}$ if capacitance > 1000pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
Ultra Stable X8R	All	All	2.5	0.3% or ± 0.25 pf	10% of Initial Limit

Table 1 – X8R Dielectric, (0402 - 1812 Case Sizes)

Cap	Cap Code	Series					C0402			C0603			C0805			C1206			C1210			C1812	
		Voltage Code					3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	5	1
		Voltage DC					25	50	100	25	50	100	25	50	100	25	50	100	25	50	100	50	100
		Cap Tolerance					Product Availability and Chip Thickness Codes See Table 2 for Chip Thickness Dimensions																
100 pF	101	F	G	J	K	M	BB	BB	BB														
110 pF	111	F	G	J	K	M	BB	BB	BB														
120 pF	121	F	G	J	K	M	BB	BB	BB														
130 pF	131	F	G	J	K	M	BB	BB	BB														
150 pF	151	F	G	J	K	M	BB	BB	BB														
160 pF	161	F	G	J	K	M	BB	BB	BB														
180 pF	181	F	G	J	K	M	BB	BB	BB														
200 pF	201	F	G	J	K	M	BB	BB	BB														
220 pF	221	F	G	J	K	M	BB	BB	BB														
240 pF	241	F	G	J	K	M	BB	BB	BB														
270 pF	271	F	G	J	K	M	BB	BB	BB														
300 pF	301	F	G	J	K	M	BB	BB	BB														
330 pF	331	F	G	J	K	M	BB	BB	BB														
360 pF	361	F	G	J	K	M	BB	BB	BB														
390 pF	391	F	G	J	K	M	BB	BB	BB														
430 pF	431	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
470 pF	471	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
510 pF	511	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
560 pF	561	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
620 pF	621	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
680 pF	681	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
750 pF	751	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
820 pF	821	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
910 pF	911	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
1,000 pF	102	F	G	J	K	M	BB	BB	BB	CB	CB	CB											
1,100 pF	112	F	G	J	K	M	BB	BB		CB	CB	CB											
1,200 pF	122	F	G	J	K	M	BB	BB		CB	CB	CB											
1,300 pF	132	F	G	J	K	M	BB	BB		CB	CB	CB											
1,500 pF	152	F	G	J	K	M	BB	BB		CB	CB	CB											
1,600 pF	162	F	G	J	K	M				CB	CB	CB											
1,800 pF	182	F	G	J	K	M				CB	CB	CB											
2,000 pF	202	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
2,200 pF	222	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
2,400 pF	242	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
2,700 pF	272	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
3,000 pF	302	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
3,300 pF	332	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
3,600 pF	362	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
3,900 pF	392	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
4,300 pF	432	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
4,700 pF	472	F	G	J	K	M				CB	CB	CB	DC	DC	DC								
5,100 pF	512	F	G	J	K	M				CB	CB		DC	DC	DC								
5,600 pF	562	F	G	J	K	M				CB	CB		DC	DC	DC								
6,200 pF	622	F	G	J	K	M				CB	CB		DC	DC	DC								
6,800 pF	682	F	G	J	K	M				CB	CB		DC	DC	DC	EB	EB	EB					
7,500 pF	752	F	G	J	K	M				CB			DC	DC	DC	EB	EB	EB					
8,200 pF	822	F	G	J	K	M				CB			DC	DC	DC	EB	EB	EB					
9,100 pF	912	F	G	J	K	M				CB			DC	DC	DC	EB	EB	EB					
10,000 pF	103	F	G	J	K	M				CB			DC	DC	DD	EB	EB	EB					
12,000 pF	123	F	G	J	K	M							DC	DC	DE	EB	EB	EB	FB	FB	FB		
15,000 pF	153	F	G	J	K	M							DC	DD	DG	EB	EB	EB	FB	FB	FB	GB	GB
18,000 pF	183	F	G	J	K	M							DC	DD		EB	EB	EB	FB	FB	FB	GB	GB
22,000 pF	223	F	G	J	K	M							DD	DF		EB	EB	EC	FB	FB	FB	GB	GB
27,000 pF	273	F	G	J	K	M							DF			EB	EB	EE	FB	FB	FB	GB	GB
33,000 pF	333	F	G	J	K	M							DG			EB	EB	EE	FB	FB	FB	GB	GB
47,000 pF	473	F	G	J	K	M										EC	EE	EH	FB	FB	FE	GB	GB
56,000 pF	563	F	G	J	K	M										ED	EF	EH	FB	FB	FF	GB	GB
Cap	Cap Code	Voltage DC					25	50	100	25	50	100	25	50	100	25	50	100	25	50	100	50	100
		Voltage Code					3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	5	1
		Series					C0402			C0603			C0805			C1206			C1210			C1812	

Table 1 – X8R Dielectric, (0402 - 1812 Case Sizes) con't

Cap	Cap Code	Series					C0402			C0603			C0805			C1206			C1210			C1812	
		Voltage Code					3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	5	1
		Voltage DC					25	50	100	25	50	100	25	50	100	25	50	100	25	50	100	50	100
		Cap Tolerance					Product Availability and Chip Thickness Codes See Table 2 for Chip Thickness Dimensions																
68,000 pF	683	F	G	J	K	M									EF	EH			FB	FC	FG	GB	GB
82,000 pF	823	F	G	J	K	M									EH	EH			FC	FF	FH	GB	GB
100,000 pF	104	F	G	J	K	M													FE	FG	FM	GB	GD
120,000 pF	124	F	G	J	K	M													FG	FH		GB	GH
150,000 pF	154	F	G	J	K	M													FH	FM		GD	GN
180,000 pF	184	F	G	J	K	M													FJ			GH	
220,000 pF	224	F	G	J	K	M																GK	
Cap	Cap Code	Voltage DC					25	50	100	25	50	100	25	50	100	25	50	100	25	50	100	50	100
		Voltage Code					3	5	1	3	5	1	3	5	1	3	5	1	3	5	1	5	1
		Series					C0402			C0603			C0805			C1206			C1210			C1812	

High Temperature 150°C, X8L Dielectric, 10VDC-50VDC (Commercial & Automotive Grade)

Overview

KEMET's X8L dielectric features a 150°C maximum operating temperature and is considered "general purpose high temperature." These components are fixed, ceramic dielectric capacitors suited for high temperature bypass and decoupling applications or frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X8L exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature up to 125°C. Beyond 125°C X8L displays a wider variation in capacitance. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C and +15, -40% from 125°C to 150°C.

Driven by the demand for a more robust and reliable component, X8L dielectric capacitors were developed for critical applications where reliability at higher operating temperatures are a concern. These capacitors are manufactured in state of the art ISO/TS

16949:2002 certified facilities and are widely used in automotive circuits as well as general high temperature applications.

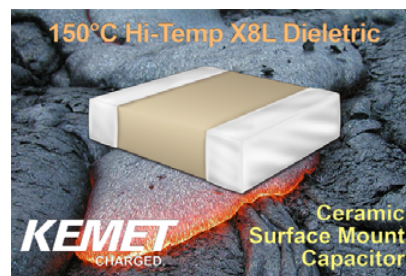
Concerned with flex cracks resulting from excessive shear stresses produced during board flexure or thermal cycling? These devices are available with KEMET's Flexible termination technology which directs board flex stress away from the ceramic body and into the termination area, therefore mitigating flex cracks which can result in low IR or short circuit failures. Although flexible termination technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does provide superior flex performance over standard termination systems.

In addition to commercial grade, automotive grade devices are available and meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

Benefits

- -55°C to +150°C operating temperature range
- Pb-Free & RoHS compliant
- EIA 0402, 0603, 0805, 1206 & 1210 case sizes
- DC voltage ratings of 10V, 25V & 50V
- Capacitance offerings ranging from .012 μ F to 10 μ F
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ & $\pm 20\%$
- Commercial & Automotive (AEC-Q200) grades available
- Non-polar device, minimizing installation concerns

- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available upon request (5% min)
- Flexible termination option available upon request



Ordering Information

C	1210	X	106	K	8	N	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series ¹	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ²	Packaging/Grade (C-Spec) ³
	0402 0603 0805 1206 1210	C = Standard X = Flexible Termination	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	8 = 10V 3 = 25V 5 = 50V	N = X8L	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

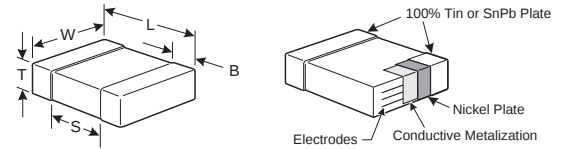
¹ The flexible termination option is not available on EIA 0402 case size product. "C" must be used in the 6th character position when ordering this case size.

² Additional termination finish options may be available. Contact KEMET for details.

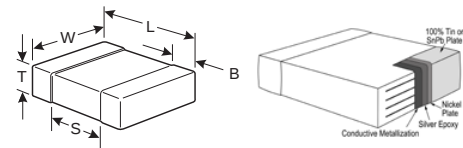
^{2,3} SnPb termination finish option is not available on automotive grade product.

³ 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
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)	See Table 2 for Thickness	0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	Solder Wave or Solder Reflow
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		



Dimensions – Flexible Termination – Millimeters (Inches)

EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0603	1608	1.60 (.063) +0.20 (.008)/-0.10 (.004)	0.80 (.032) ± 0.15 (.006)	See Table 2 for Thickness	0.45 (.018) +0.05 (.002)/-0.15 (.006)	0.50 (.020)	Solder Wave or Solder Reflow
0805	2012	2.10 (.083) +0.30 (.012)/-0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) +0.10 (.004)/-0.25 (.010)	0.70 (.028)	
1206	3216	3.30 (.130) ± 0.40 (.016)	1.60 (.063) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)	N/A	Solder Reflow Only
1210	3225	3.30 (.130) ± 0.40 (.016)	2.50 (.098) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)		

Applications

Typical applications include use in extreme environments such as down-hole oil exploration, under-hood automotive, military and aerospace.

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 at www.aecouncil.com.

Environmental Compliance

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

Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +150°C
Capacitance Change with Reference to +25°C and 0 Vdc Applied (TCC)	±15% (-55°C–125°C) +15, -40% (125°C–150°C)
Aging Rate (Max % Cap Loss/Decade Hour)	3.0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limits @ 25°C	3.5% (10V) and 2.5% (25V & 50V)
Insulation Resistance (IR) Limit @ 25°C	500 megohm microfarads or 10GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 hours.

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 ± 0.2 Vrms.

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
X8L	>25	All	3.0	± 20%	10% of Initial Limit
	25		5.0		
	10		7.5		

Table 1 – X8L Dielectric, (0402 - 1210 Case Sizes)

Cap	Cap Code	Series			C0402		C0603			C0805			C1206			C1210		
		Voltage Code			8	3	8	3	5	8	3	5	8	3	5	8	3	5
		Voltage DC			10	25	10	25	50	10	25	50	10	25	50	10	25	50
		Cap Tolerance			Product Availability and Chip Thickness Codes See Table 2 for Chip Thickness Dimensions													
12,000 pF	123	J	K	M	BB	BB												
15,000 pF	153	J	K	M	BB	BB												
18,000 pF	183	J	K	M	BB	BB												
22,000 pF	223	J	K	M	BB	BB												
27,000 pF	273	J	K	M	BB	BB												
33,000 pF	333	J	K	M	BB													
39,000 pF	393	J	K	M	BB													
47,000 pF	473	J	K	M	BB		CB	CB	CB									
56,000 pF	563	J	K	M														
68,000 pF	683	J	K	M														
82,000 pF	823	J	K	M														
0.10 μ F	104	J	K	M														
0.12 μ F	124	J	K	M			CB	CB										
0.15 μ F	154	J	K	M			CB	CB		DG	DG	DG						
0.18 μ F	184	J	K	M			CB			DG	DG	DG						
0.22 μ F	224	J	K	M			CB			DD	DD	DG						
0.27 μ F	274	J	K	M						DD	DD							
0.33 μ F	334	J	K	M						DD	DD							
0.39 μ F	394	J	K	M						DE	DE					FD	FD	FD
0.47 μ F	474	J	K	M						DE	DE		EG	EG	EG	FD	FD	FD
0.56 μ F	564	J	K	M						DG	DH					FF	FF	FF
0.68 μ F	684	J	K	M						DG	DH					FG	FG	FG
0.82 μ F	824	J	K	M						DG						FL	FL	FL
1.0 μ F	105	J	K	M						DG						FM	FM	FM
1.2 μ F	125	J	K	M									ED	ED		FG	FG	
1.5 μ F	155	J	K	M									EH	EH		FG	FG	
1.8 μ F	185	J	K	M									EF	EH		FG	FG	
2.2 μ F	225	J	K	M									EF	EH		FG	FG	
2.7 μ F	275	J	K	M									EH			FG	FH	
3.3 μ F	335	J	K	M									EH			FM	FM	
3.9 μ F	395	J	K	M									EH			FG	FK	
4.7 μ F	475	J	K	M									EH			FG	FS	
5.6 μ F	565	J	K	M												FH		
6.8 μ F	685	J	K	M												FM		
8.2 μ F	825	J	K	M												FK		
10 μ F	106	J	K	M												FS		
Cap	Cap Code	Voltage DC			10	25	10	25	50	10	25	50	10	25	50	10	25	50
		Voltage Code			8	3	8	3	5	8	3	5	8	3	5	8	3	5
		Series			C0402		C0603			C0805			C1206			C1210		

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	1005	0.20 ± 0.02			15000		
AB	0201	0.30 ± 0.03			15000		
BB	0402	0.50 ± 0.05			10000	50000	50000
BC	0402	0.50 ± 0.10			10000	50000	50000
PA	0508	0.80 ± 0.10	4000	10000			
CB	0603	0.80 ± 0.07			4000	10000	15000
CC	0603	0.80 ± 0.10			4000	10000	15000
CD	0603	0.80 ± 0.15			4000	10000	15000
MA	0612	0.80 ± 0.10	4000	10000			
DB	0805	0.60 ± 0.10			4000	10000	15000
DC	0805	0.78 ± 0.10			4000	10000	15000
DD	0805	0.90 ± 0.10			4000	10000	15000
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			
FV	1210	3.35 ± 0.10	500	1800			
FW	1210	6.15 ± 0.15	200	1000			
PA	1220	0.80 ± 0.10	4000	10000			
MA	1632	0.80 ± 0.10	4000	10000			
NA	1706	0.90 ± 0.10	4000	10000			
NB	1706	1.00 ± 0.10	4000	10000			
NC	1706	1.00 ± 0.15	4000	10000			
LD	1808	0.90 ± 0.10	2500	10000			
LE	1808	1.00 ± 0.10	2500	10000			
LF	1808	1.00 ± 0.15	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			
GP	1812	2.65 ± 0.35	500	1400			
GR	1812	5.00 ± 0.50	350	1000			
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			
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

Package Quantity
Based on Finished Chip
Thickness Specifications

Table 2 – Chip Thickness/Packaging Quantities con't

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
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			
JP	2220	3.50 ± 0.30	250	850			
JR	2220	5.00 ± 0.50	150	600			
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			
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

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).

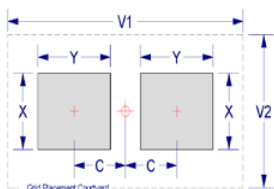


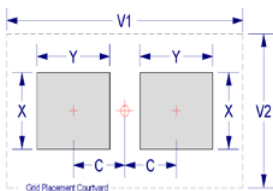
Table 3B – Land Pattern Design Recommendations per IPC-7351 (Flexible Termination)

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 1.8kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2mm (min) for all except 3mm for C0G.
Solderability	J-STD-002	Magnification 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	1000 cycles (-55°C to +125°C). Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2x 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.

Storage and 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. In addition, 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.

High Voltage X7R Dielectric, 500VDC-3000VDC (Commercial & Automotive Grade)

Overview

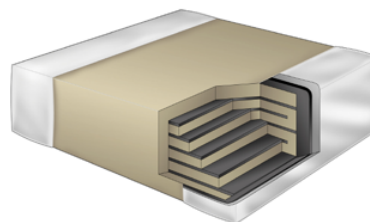
KEMET's high voltage surface mount MLCCs in X7R Dielectric feature a 125°C maximum operating temperature and are considered "temperature stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C.

These devices offer low leakage current, exhibit low ESR at high frequencies and find conventional use as snubbers or filters in applications such as switching power supplies and in lighting ballasts. Their exceptional performance at high frequencies has made them a preferred choice of design engineers worldwide. In addition to their use in power supplies, these capacitors are widely used in industries related to automotive(hybrid), telecommunications, medical, military, aerospace, semiconductors and test/diagnostic equipment.

KEMET's high voltage surface mount MLCCs are manufactured in state of the art ISO/TS 16949:2002 certified facilities and are available in both commercial and automotive grades. Automotive grade devices meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

Benefits

- -55°C to +125°C operating temperature range
- Pb-Free and RoHS compliant
- EIA 0805, 1206, 1210, 1808, 1812, 1825, 2220 and 2225 case sizes
- DC voltage ratings of 500V, 630V, 1KV, 1.5KV, 2KV, 2.5KV and 3KV
- Capacitance offerings ranging from 10pF to 0.27 μ F
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- Commercial & Automotive (AEC-Q200) grades available
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb plated termination finish option available upon request (5% min)



Ordering Information

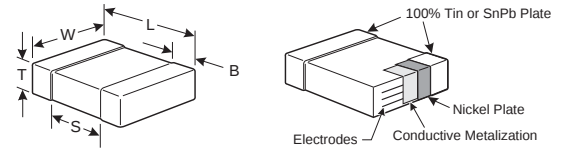
C	1808	C	563	K	C	R	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ²
	0805 1206 1210 1808 1812 1825 2220 2225	C = Standard	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	C = 500V B = 630V D = 1000V F = 1500V G = 2000V Z = 2500V H = 3000V	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

¹ SnPb termination finish option is not available on automotive grade product.

¹ Additional termination finish options may be available. Contact KEMET for details.

² 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	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)		
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)		
1825	4564	4.50 (.177) ± 0.30 (.012)	6.40 (.252) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		
2220	5650	5.70 (.224) ± 0.40 (.016)	5.00 (.197) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		
2225	5664	5.60 (.220) ± 0.40 (.016)	6.40 (.248) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		

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. X7R dielectrics are not designed for AC line filtering applications.

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.

Environmental Compliance

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

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 < 1000V 120% of rated voltage for voltage rating of ≥ 1000V (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	2.5%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 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:

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

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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 – High Voltage X7R Dielectric, (0805 - 1812 Case Sizes) con't

Cap	Cap Code	Series			C0805			C1206					C1210					C1808								C1812									
		Voltage Code			C	B	D	C	B	D	F	G	C	B	D	F	G	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H				
		Voltage DC			500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000				
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																														
15,000 pF	153	J	K	M				EG	UD	UD				FL	FL	FL				LA	LC	LC							GH	GK	GK				
18,000 pF	183	J	K	M				UD	UD	UD				FL	FL	FL				LA	UD	UD							GH	GK	GK				
22,000 pF	223	J	K	M				UD	UD	UD				FL	FM	FM				LA	UD	UD							GH	GK	GK				
27,000 pF	273	J	K	M				UD	UD	UD				FM	FK	FK				LA	UD	UD							GH	UD	UD				
33,000 pF	333	J	K	M				UD	UD					FM	UD	UD				LC	UD	UD							GH	UD	UD				
39,000 pF	393	J	K	M				UD						FK	UD	UD				LC	UD	UD							GH	UD	UD				
47,000 pF	473	J	K	M				UD						FK	UD	UD				LC	UD	UD							GH	UD	UD				
56,000 pF	563	J	K	M				UD						UD	UD	UD				LC	UD	UD							GH	UD	UD				
62,000 pF	623	J	K	M				UD						UD	UD	UD				UD	UD	UD							GK	UD	UD				
68,000 pF	683	J	K	M				UD						UD	UD	UD				UD	UD	UD							UD	UD	UD				
82,000 pF	823	J	K	M										UD	UD					UD	UD								UD	UD	UD				
0.10 µF	104	J	K	M										UD	UD					UD	UD								UD	UD	UD				
0.12 µF	124	J	K	M										UD						UD									UD	UD					
0.15 µF	154	J	K	M										UD						UD									UD	UD					
0.18 µF	184	J	K	M										UD						UD									UD	UD					
0.22 µF	224	J	K	M																									UD						
0.27 µF	274	J	K	M																									UD						
0.33 µF	334	J	K	M																									UD						
Cap	Cap Code	Voltage DC			500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000				
		Voltage Code			C	B	D	C	B	D	F	G	C	B	D	F	G	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H				
		Series			C0805			C1206					C1210					C1808								C1812									

Table 1B – (1825 - 2225 Case Sizes)

Cap	Cap Code	Series			C1825						C2220								C2225							
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	
		Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																					
100 pF	101	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
110 pF	111	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
120 pF	121	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
130 pF	131	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
150 pF	151	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
180 pF	181	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
220 pF	221	J	K	M	HE	HE	HE	HE	HE	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
270 pF	271	J	K	M	HE	HE	HE	HE	HE	HG	JP	JP	JP	JP	JP	JP	JP	KE	KE	KE	KE	KE	KE	KE	KF	
330 pF	331	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KE	KE	KE	KE	KE	KE	KE	KF	
390 pF	391	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KE	KE	KE	KE	KE	KE	KE	KF	
470 pF	471	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
560 pF	561	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
680 pF	681	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
820 pF	821	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
1,000 pF	102	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
1,200 pF	122	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
1,500 pF	152	J	K	M	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
1,800 pF	182	J	K	M	HE	HE	HE	HE	HE	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
2,000 pF	202	J	K	M	HE	HE	HE	HE	HE	HG	JE	JE	JE	JE	JE	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
2,200 pF	222	J	K	M	HE	HE	HE	HE	HE	HG	JE	JE	JE	JE	JE	JP	JP	KF	KF	KF	KF	KF	KF	KF	KF	
Cap	Cap Code	Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	
		Series			C1825						C2220								C2225							

UD = Under Development

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 1B – High Voltage X7R Dielectric, (1825 - 2225 Case Sizes) con't

Cap	Cap Code	Series			C1825							C2220							C2225								
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H		
		Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000		
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																						
2,700 pF	272	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	JP	JP	KE	KE	KE	KE	KE	KF	KF
3,300 pF	332	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	JP	JP	KE	KE	KE	KE	KE	KF	KF
3,900 pF	392	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JE	JP	JP	JP	JP	KE	KE	KE	KE	KE	KF	KF
4,700 pF	472	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP					KE	KE	KE	KE	KE	KF	KF
5,600 pF	562	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP					KE	KE	KE	KE	KE	KF	KF
6,800 pF	682	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP					KE	KE	KE	KE	KF		
8,200 pF	822	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP					KE	KE	KE	KE	KF		
10,000 pF	103	J	K	M	HE	HE	HE	HE				JE	JE	JE	JE						KE	KE	KE	KE	KF		
12,000 pF	123	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP						KE	KE	KE	KE	KF		
15,000 pF	153	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP						KE	KE	KE	KE			
18,000 pF	183	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP						KE	KE	KE	KE			
22,000 pF	223	J	K	M	HE	HG	HG	HG				JE	JP	JP	JP						KE	KF	KF	KF			
27,000 pF	273	J	K	M	HE	HG	HG	HG				JE	JP	JP	JP						KE	KF	KF	KF			
33,000 pF	333	J	K	M	HE	HG	HG					JE	JP	JP	JP						KE	KF	KF	KF			
39,000 pF	393	J	K	M	HE	HG	HG					JE	JP	JP							KE	KF	KF	KF			
47,000 pF	473	J	K	M	HE	HG	HG					JE	JP	JP							KE	KF	KF	KF			
56,000 pF	563	J	K	M	HE							JE									KE	KF	KF				
62,000 pF	623	J	K	M	HG							JE									KE	KF	KF				
68,000 pF	683	J	K	M	HG							JE									KE	KF	KF				
82,000 pF	823	J	K	M	HG							JE									KE	KF	KF				
0.10 µF	104	J	K	M	HG							JE									KE						
0.12 µF	124	J	K	M	HG							JE									KE						
0.15 µF	154	J	K	M	HG							JP									KF						
0.18 µF	184	J	K	M	HG							JP									KF						
0.22 µF	224	J	K	M	HG							JP									KF						
0.27 µF	274	J	K	M																	KF						
0.33 µF	334	J	K	M																							
0.39 µF	394	J	K	M																							
0.47 µF	474	J	K	M																							
0.56 µF	564	J	K	M																							
0.68 µF	684	J	K	M																							
0.82 µF	824	J	K	M																							
1.0 µF	105	J	K	M																							
1.2 µF	125	J	K	M																							
Cap	Cap Code	Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000		
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H		
		Series			C1825							C2220							C2225								

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).

High Voltage with Flexible Termination System (HV FT-CAP)

X7R Dielectric, 500VDC-3000VDC (Commercial & Automotive Grade)

Overview

KEMET's High Voltage with Flexible Termination (HV FT-CAP) surface mount MLCCs in X7R dielectric combine high voltage and flexible termination technologies. Featuring a 125°C maximum operating temperature and considered "temperature stable," these devices 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. Utilizing a conductive silver epoxy between the base metal and nickel barrier layers of KEMET's standard termination system, flexible termination technology directs board flex stress away from the ceramic body and into the termination area, therefore mitigating flex cracks which can result in low IR or short circuit failures. Although flexible termination technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does provide superior flex performance over standard termination systems.

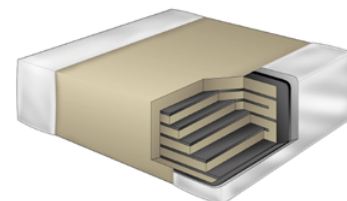
The HV FT-CAP offers low leakage current, exhibits low ESR at high frequencies and finds conventional use as snubbers or filters in applications such as switching power supplies and lighting

ballasts. Their exceptional performance at high frequencies has made them a preferred choice of design engineers worldwide. In addition to their use in power supplies, these capacitors are widely used in industries related to automotive(hybrid), telecommunications, medical, military, aerospace, semiconductors and test/diagnostic equipment.

Combined with the stability of an X7R dielectric and designed to accommodate all capacitance requirements, these flex-robust devices are RoHS-compliant, offer up to 5mm of flex-bend capability and exhibit a predictable change in capacitance with respect to time and voltage. Capacitance change with reference to ambient temperature is limited to $\pm 15\%$ from -55°C to +125°C.

KEMET's high voltage surface mount MLCCs are manufactured in state of the art ISO/TS 16949:2002 certified facilities and are available in both commercial and automotive grades. Automotive grade devices meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

HIGH VOLTAGE
FLEXIBLE
FTCAP
TERMINATION



Ordering Information

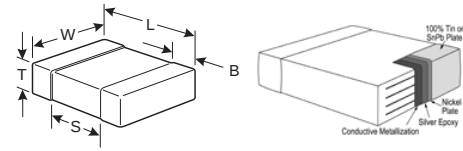
C	1210	X	473	K	C	R	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish ¹	Packaging/Grade (C-Spec) ²
	0805 1206 1210 1808 1812 1825 2220 2225	X = Flexible Termination	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	C = 500V B = 630V D = 1000V F = 1500V G = 2000V Z = 2500V H = 3000V	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

¹ SnPb termination finish option is not available on automotive grade product.

¹ Additional termination finish options may be available. Contact KEMET for details.

² 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	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	Solder Reflow Only
1210	3225	3.30 (.130) ± 0.40 (.016)	2.50 (.098) ± 0.20 (.008)		0.60 (.024) ± 0.25 (.010)		
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)		
1825	4564	4.60 (.181) ± 0.40 (.016)	6.40 (.252) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		
2220	5650	5.90 (.232) ± 0.75 (.030)	5.00 (.197) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		
2225	5664	5.90 (.232) ± 0.75 (.030)	6.40 (.248) ± 0.40 (.016)		0.70 (.028) ± 0.35 (.014)		

Benefits

- -55°C to +125°C operating temperature range
- Superior flex performance (up to 5mm)
- Pb-Free and RoHS compliant
- EIA 0805, 1206, 1210, 1808, 1812, 1825, 2220 and 2225 case sizes
- DC voltage ratings of 500V, 630V, 1KV, 1.5KV, 2KV, 2.5KV and 3KV
- Capacitance offerings ranging from 62pF to 0.27µF
- Available capacitance tolerances of ±5%, ±10% or ±20%.
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- Commercial & Automotive (AEC-Q200) grades available
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb plated termination finish option available upon request (5% min)

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. X7R dielectrics are not designed 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 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.

Environmental Compliance

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

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 < 1000V 120% of rated voltage for voltage rating of ≥ 1000V (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	2.5%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 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:

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

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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 – (HV FT-CAP), X7R Dielectric, (0805 - 1812 Case Sizes)

Cap	Cap Code	Series		C0805			C1206					C1210					C1808								C1812							
		Voltage Code		C	B	D	C	B	D	F	G	C	B	D	F	G	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H		
		Voltage DC		500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000		
		Cap Tolerance		Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																												
56 pF	560	J	K	M	DG	DG	DG																									
62 pF	620	J	K	M	DG	DG	DG																									
68 pF	680	J	K	M	DG	DG	DG																									
75 pF	750	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
82 pF	820	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
91 pF	910	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
100 pF	101	J	K	M	DG	DG	DG	EG	EG	EG	EG	EG						LB	LB	LB	LB	LB	LB	LB								
110 pF	111	J	K	M	DG	DG	DG	EF	EF	EF	EF	EF						LB	LB	LB	LB	LB	LB	LB								
120 pF	121	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG						LA	LA	LA	LA	LB	LB	LB								
130 pF	131	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB								
150 pF	151	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB	GK	GK	GK	GK	GK	GK		
180 pF	181	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB	GK	GK	GK	GK	GK	GK		
220 pF	221	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LB	GK	GK	GK	GK	GK	GK		
270 pF	271	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GK	GK	GK	GK	GK	GK		
330 pF	331	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GK	GK	GK	GK	GK	GK		
390 pF	391	J	K	M	DG	DG	DG	EF	EF	EF	EF		FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GK	GK	GK	GK	GK	GK		
470 pF	471	J	K	M	DG	DG	DG	EF	EF	EF	EF		FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK		
560 pF	561	J	K	M	DG	DG	DG	EF	EF	EF	EF		FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK		
680 pF	681	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK		
820 pF	821	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK		
1,000 pF	102	J	K	M	DG	DG	DG	EF	EF	EF	EF	EG	FL	FL	FL	FL	FL	LA	LA	LA	LA	LB	LB	LC	GH	GH	GH	GH	GH	GK		
1,200 pF	122	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LB	LB	LB	LB	LC			GH	GH	GH	GH	GH	GK		
1,500 pF	152	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
1,800 pF	182	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
2,000 pF	202	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
2,200 pF	222	J	K	M	DG	DG	DG	EF	EF	EF	EG	EG	FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GH			
2,700 pF	272	J	K	M	DG	DG	DG	EF	EF	EF	EG		FL	FL	FL	FL	FM	LA	LA	LA	LA	LB	LC		GH	GH	GH	GH	GK			
3,300 pF	332	J	K	M	DG	DG	DG	EF	EF	EF	EG		FL	FL	FL	FL	FM	LA	LA	LA	LA	LB			GH	GH	GH	GH	GK			
3,900 pF	392	J	K	M	DG	UD	UD	EF	EF	EF	EG		FL	FL	FL	FL	FK	LA	LA	LA	LA	LB			GH	GH	GH	GH	GK			
4,700 pF	472	J	K	M	DG	UD	UD	EF	EF	EF	EG		FL	FL	FL	FL	FK	LA	LA	LA	LA	LB			GH	GH	GH	GH				
5,600 pF	562	J	K	M	DG	UD		EF	EF	EF			FL	FL	FL	FM		LA	LB	LB	LB	LC			GH	GH	GH	GK				
6,800 pF	682	J	K	M	DG	UD		EG	EG	EG			FL	FL	FL	FM		LA	LB	LB	LB	LC			GH	GH	GH	GK				
8,200 pF	822	J	K	M	DG	UD		EG	EG	EG			FL	FL	FL	FK		LA	LB	LB	LB	LC			GH	GH	GH	GK				
10,000 pF	103	J	K	M	UD			EG	EG	EG			FL	FL	FL	FK		LA	LB	LB	LB	LC			GH	GH	GH	GK				
12,000 pF	123	J	K	M	UD			EG	UD	UD			FL	FL	FL	FK		LA	LC	LC					GH	GK	GK	GK				
15,000 pF	153	J	K	M				EG	UD	UD			FL	FL	FL			LA	LC	LC					GH	GK	GK					
18,000 pF	183	J	K	M				UD	UD	UD			FL	FL	FL			LA	UD	UD					GH	GK	GK					
22,000 pF	223	J	K	M				UD	UD	UD			FL	FM	FM			LA	UD	UD					GH	GK	GK					
27,000 pF	273	J	K	M				UD	UD				FM	FK	FK			LA	UD	UD					GH	UD	UD					
33,000 pF	333	J	K	M				UD	UD				FM	UD	UD			LC	UD	UD					GH	UD	UD					
39,000 pF	393	J	K	M				UD					FK	UD	UD			LC	UD	UD					GH	UD	UD					
47,000 pF	473	J	K	M				UD					FK	UD	UD			LC	UD	UD					GH	UD	UD					
56,000 pF	563	J	K	M				UD					UD	UD	UD			LC	UD	UD					GH	UD	UD					
62,000 pF	623	J	K	M				UD					UD	UD	UD			UD	UD	UD					GK	UD	UD					
68,000 pF	683	J	K	M				UD					UD	UD	UD			UD	UD	UD					UD	UD	UD					
82,000 pF	823	J	K	M									UD	UD				UD	UD						UD	UD	UD					
0.10 μF	104	J	K	M									UD	UD				UD	UD						UD	UD	UD					
0.12 μF	124	J	K	M									UD					UD							UD	UD	UD					
0.15 μF	154	J	K	M									UD					UD							UD	UD	UD					
0.18 μF	184	J	K	M																					UD	UD	UD					
0.22 μF	224	J	K	M																					UD	UD	UD					
0.27 μF	274	J	K	M																					UD	UD	UD					
0.33 μF	334	J	K	M																					UD	UD	UD					
Cap	Cap Code	Voltage DC		500	630	1000	500	630	1000	1500	2000	500	630	1000	1500	2000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000		
		Voltage Code		C	B	D	C	B	D	F	G	C	B	D	F	G	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H		
		Series		C0805			C1206					C1210					C1808								C1812							

UD = Under Development

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 1B – (HV FT-CAP), X7R Dielectric, (1825 - 2225 Case Sizes)

Cap	Cap Code	Series			C1825								C2220								C2225							
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H			
		Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000			
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																							
180 pF	181	J	K	M																								
220 pF	221	J	K	M																								
270 pF	271	J	K	M																								
330 pF	331	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP										
390 pF	391	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP										
470 pF	471	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
560 pF	561	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
680 pF	681	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
820 pF	821	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,000 pF	102	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,200 pF	122	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,500 pF	152	J	K	M	HG	HG	HG	HG	HG	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
1,800 pF	182	J	K	M	HE	HE	HE	HE	HE	HG	HG	JP	JP	JP	JP	JP	JP	JP	KF	KF	KF	KF	KF	KF	KF			
2,000 pF	202	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KF	KF	KF	KF	KF	KF	KF			
2,200 pF	222	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KF	KF	KF	KF	KF	KF	KF			
2,700 pF	272	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KE	KE	KE	KE	KE	KF	KF			
3,300 pF	332	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JE	JE	JE	JE	JP	JP	KE	KE	KE	KE	KE	KF	KF			
3,900 pF	392	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JE	JP	JP	KE	KE	KE	KE	KE	KF	KF			
4,700 pF	472	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KE	KF	KF			
5,600 pF	562	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KE	KF	KF			
6,800 pF	682	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KF					
8,200 pF	822	J	K	M	HE	HE	HE	HE	HE			JE	JE	JE	JE	JP			KE	KE	KE	KE	KF					
10,000 pF	103	J	K	M	HE	HE	HE	HE				JE	JE	JE	JE				KE	KE	KE	KE	KF					
12,000 pF	123	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP				KE	KE	KE	KE	KF					
15,000 pF	153	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP				KE	KE	KE	KE						
18,000 pF	183	J	K	M	HE	HE	HE	HG				JE	JP	JP	JP				KE	KE	KE	KE						
22,000 pF	223	J	K	M	HE	HG	HG	HG				JE	JP	JP	JP				KE	KF	KF	KF						
27,000 pF	273	J	K	M	HE	HG	HG	HG				JE	JP	JP	JP				KE	KF	KF	KF						
33,000 pF	333	J	K	M	HE	HG	HG					JE	JP	JP	JP				KE	KF	KF	KF						
39,000 pF	393	J	K	M	HE	HG	HG					JE	JP	JP					KE	KF	KF	KF						
47,000 pF	473	J	K	M	HE	HG	HG					JE	JP	JP					KE	KF	KF	KF						
56,000 pF	563	J	K	M	HE							JE							KE	KF	KF							
62,000 pF	623	J	K	M	HG							JE							KF	KF	KF							
68,000 pF	683	J	K	M	HG							JE							KE	KF	KF							
82,000 pF	823	J	K	M	HG							JE							KE	KF	KF							
0.10 µF	104	J	K	M	HG							JE							KE									
0.12 µF	124	J	K	M	HG							JE							KE									
0.15 µF	154	J	K	M	HG							JP							KF									
0.18 µF	184	J	K	M	HG							JP							KF									
0.22 µF	224	J	K	M	HG							JP							KF									
0.27 µF	274	J	K	M															KF									
0.33 µF	334	J	K	M																								
0.39 µF	394	J	K	M																								
0.47 µF	474	J	K	M																								
0.56 µF	564	J	K	M																								
Cap	Cap Code	Voltage DC			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000			
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H			
		Series			C1825								C2220								C2225							

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	Chip Size	Thickness $\pm$ 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	1005	0.20 $\pm$ 0.02			15000		
AB	0201	0.30 $\pm$ 0.03			15000		
BB	0402	0.50 $\pm$ 0.05			10000	50000	50000
BC	0402	0.50 $\pm$ 0.10			10000	50000	50000
PA	0508	0.80 $\pm$ 0.10	4000	10000			
CB	0603	0.80 $\pm$ 0.07			4000	10000	15000
CC	0603	0.80 $\pm$ 0.10			4000	10000	15000
CD	0603	0.80 $\pm$ 0.15			4000	10000	15000
MA	0612	0.80 $\pm$ 0.10	4000	10000			
DB	0805	0.60 $\pm$ 0.10			4000	10000	15000
DC	0805	0.78 $\pm$ 0.10			4000	10000	15000
DD	0805	0.90 $\pm$ 0.10			4000	10000	15000
DL	0805	0.95 $\pm$ 0.10	4000	10000			
DE	0805	1.00 $\pm$ 0.10	2500	10000			
DF	0805	1.10 $\pm$ 0.10	2500	10000			
DG	0805	1.25 $\pm$ 0.15	2500	10000			
DH	0805	1.25 $\pm$ 0.20	2500	10000			
EB	1206	0.78 $\pm$ 0.10	4000	10000	4000	10000	
EK	1206	0.80 $\pm$ 0.10	2000	8000			
EC	1206	0.90 $\pm$ 0.10	4000	10000			
EN	1206	0.95 $\pm$ 0.10	4000	10000			
ED	1206	1.00 $\pm$ 0.10	2500	10000			
EE	1206	1.10 $\pm$ 0.10	2500	10000			
EF	1206	1.20 $\pm$ 0.15	2500	10000			
EM	1206	1.25 $\pm$ 0.15	2500	10000			
EG	1206	1.60 $\pm$ 0.15	2000	8000			
EH	1206	1.60 $\pm$ 0.20	2000	8000			
EJ	1206	1.70 $\pm$ 0.20	2000	8000			
FB	1210	0.78 $\pm$ 0.10	4000	10000			
FC	1210	0.90 $\pm$ 0.10	4000	10000			
FD	1210	0.95 $\pm$ 0.10	4000	10000			
FE	1210	1.00 $\pm$ 0.10	2500	10000			
FF	1210	1.10 $\pm$ 0.10	2500	10000			
FG	1210	1.25 $\pm$ 0.15	2500	10000			
FL	1210	1.40 $\pm$ 0.15	2000	8000			
FO	1210	1.50 $\pm$ 0.20	2000	8000			
FH	1210	1.55 $\pm$ 0.15	2000	8000			
FP	1210	1.60 $\pm$ 0.20	2000	8000			
FM	1210	1.70 $\pm$ 0.20	2000	8000			
FJ	1210	1.85 $\pm$ 0.20	2000	8000			
FN	1210	1.85 $\pm$ 0.20	2000	8000			
FT	1210	1.90 $\pm$ 0.20	1500	4000			
FK	1210	2.10 $\pm$ 0.20	2000	8000			
FR	1210	2.25 $\pm$ 0.20	2000	8000			
FS	1210	2.50 $\pm$ 0.20	1000	4000			
FV	1210	3.35 $\pm$ 0.10	500	1800			
FW	1210	6.15 $\pm$ 0.15	200	1000			
PA	1220	0.80 $\pm$ 0.10	4000	10000			
MA	1632	0.80 $\pm$ 0.10	4000	10000			
NA	1706	0.90 $\pm$ 0.10	4000	10000			
NB	1706	1.00 $\pm$ 0.10	4000	10000			
NC	1706	1.00 $\pm$ 0.15	4000	10000			
LD	1808	0.90 $\pm$ 0.10	2500	10000			
LE	1808	1.00 $\pm$ 0.10	2500	10000			
LF	1808	1.00 $\pm$ 0.15	2500	10000			
LA	1808	1.40 $\pm$ 0.15	1000	4000			
LB	1808	1.60 $\pm$ 0.15	1000	4000			
LC	1808	2.00 $\pm$ 0.15	1000	4000			
GB	1812	1.00 $\pm$ 0.10	1000	4000			
GC	1812	1.10 $\pm$ 0.10	1000	4000			
GD	1812	1.25 $\pm$ 0.15	1000	4000			
GE	1812	1.30 $\pm$ 0.10	1000	4000			
GH	1812	1.40 $\pm$ 0.15	1000	4000			
GF	1812	1.50 $\pm$ 0.10	1000	4000			
GG	1812	1.55 $\pm$ 0.10	1000	4000			
GK	1812	1.60 $\pm$ 0.20	1000	4000			
GJ	1812	1.70 $\pm$ 0.15	1000	4000			
GN	1812	1.70 $\pm$ 0.20	1000	4000			
GL	1812	1.90 $\pm$ 0.20	1000	4000			
GM	1812	2.00 $\pm$ 0.20	1000	4000			
GO	1812	2.50 $\pm$ 0.20	500	2000			
GP	1812	2.65 $\pm$ 0.35	500	1400			
GR	1812	5.00 $\pm$ 0.50	350	1000			
HB	1825	1.10 $\pm$ 0.15	1000	4000			
HC	1825	1.15 $\pm$ 0.15	1000	4000			
HD	1825	1.30 $\pm$ 0.15	1000	4000			
HE	1825	1.40 $\pm$ 0.15	1000	4000			
HF	1825	1.50 $\pm$ 0.15	1000	4000			
Thickness Code	Chip Size	Thickness $\pm$ 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

Package Quantity
Based on Finished Chip
Thickness Specifications

Table 2 – Chip Thickness/Packaging Quantities con't

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
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			
JP	2220	3.50 ± 0.30	250	850			
JR	2220	5.00 ± 0.50	150	600			
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			
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

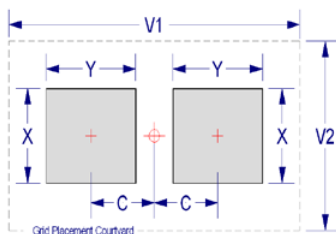
Table 3 – Chip Capacitor Land Pattern Design Recommendations per IPC-7351

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
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).



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 1.8kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: 2mm (min) for all except 3mm for C0G.
Solderability	J-STD-002	Magnification 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	1000 cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X 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.

Storage and 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. In addition, 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.

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.

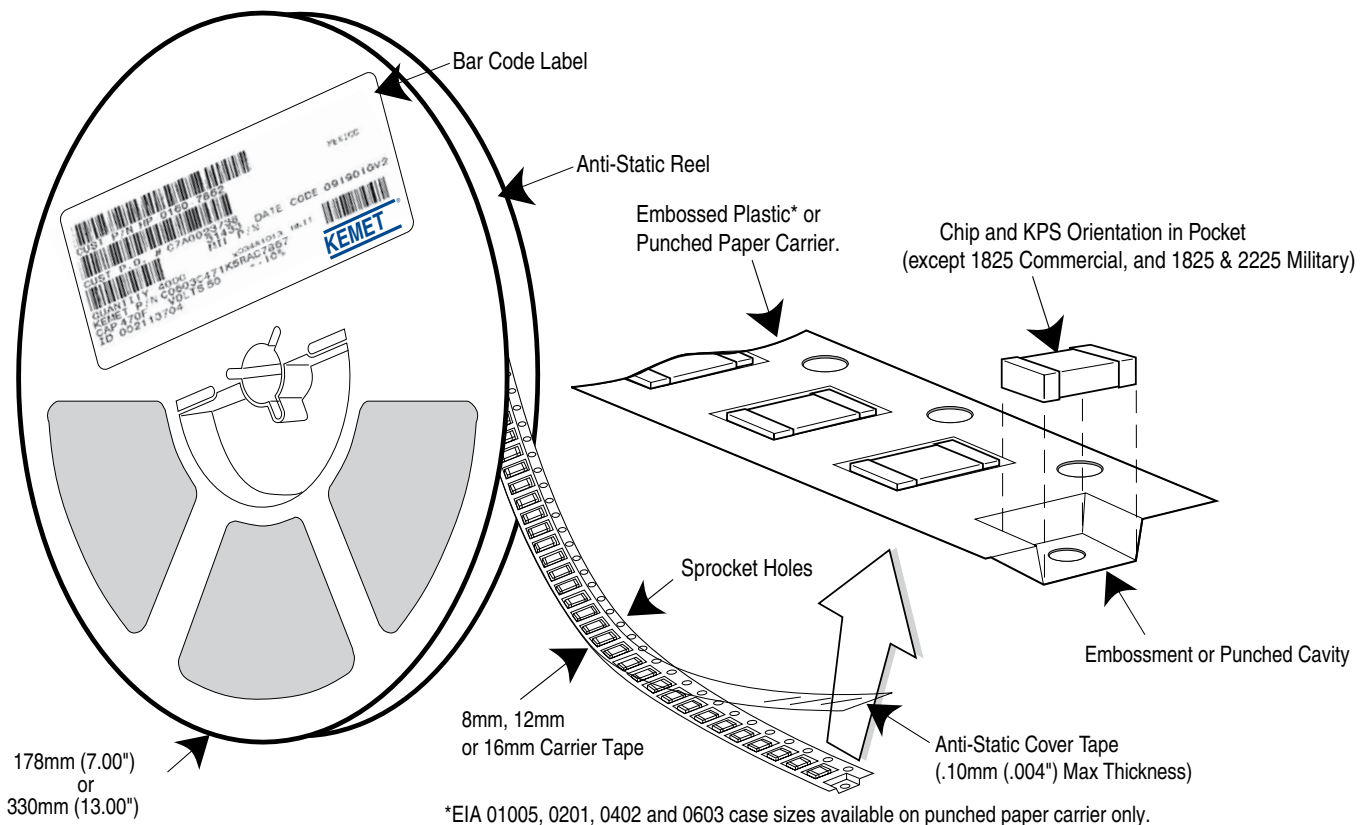
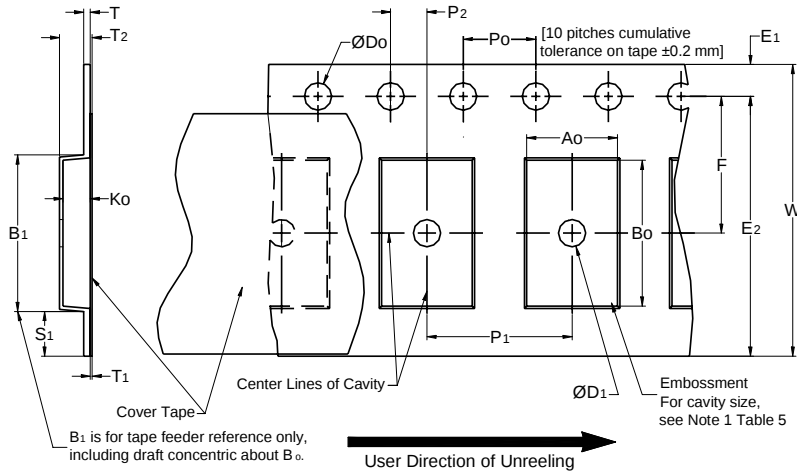


Table 5 – Carrier Tape Configuration (mm)

EIA Case Size	Tape Size (W)*	Lead Space (P_1)*
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_1 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.

[illegible]

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 ±0.10 (0.069 ±0.004)	4.0 ±0.10 (0.157 ±0.004)	2.0 ±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 ± 0.05 (0.138 ± 0.002)	2.0 ± 0.05 (0.079 ± 0.002)	1.1 (0.098)	8.3 (0.327)	Note 5
8mm	Single (4mm)			4.0 ± 0.10 (0.157 ± 0.004)		8.3 (0.327)	

1. The cavity defined by A_0 , B_0 and T shall surround the component with sufficient clearance that:
 - a) the component does not protrude beyond either 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) lateral movement of the component is restricted to 0.5 mm maximum (see Figure 4).
 - d) see Addendum in EIA Document 481 for standards relating to more precise taping requirements.
2. 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 (10gf to 100gf)
12mm & 16mm	0.1 Newton to 1.3 Newton (10gf to 130gf)

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

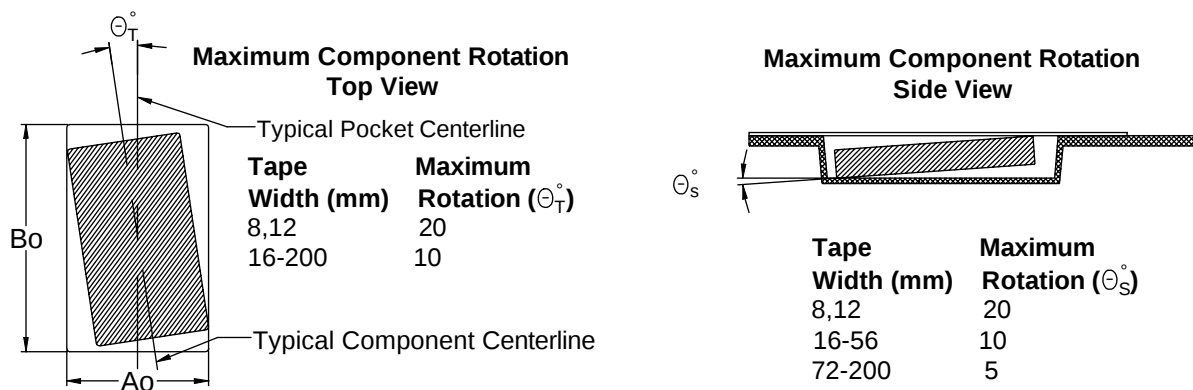


Figure 4 – Maximum Lateral Movement

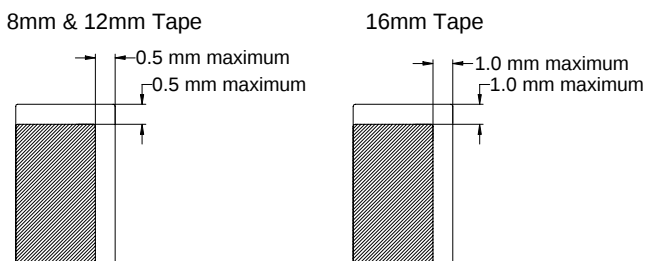


Figure 5 – Bending Radius

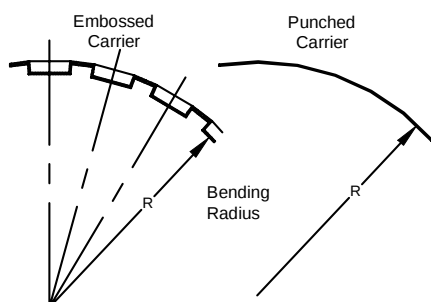
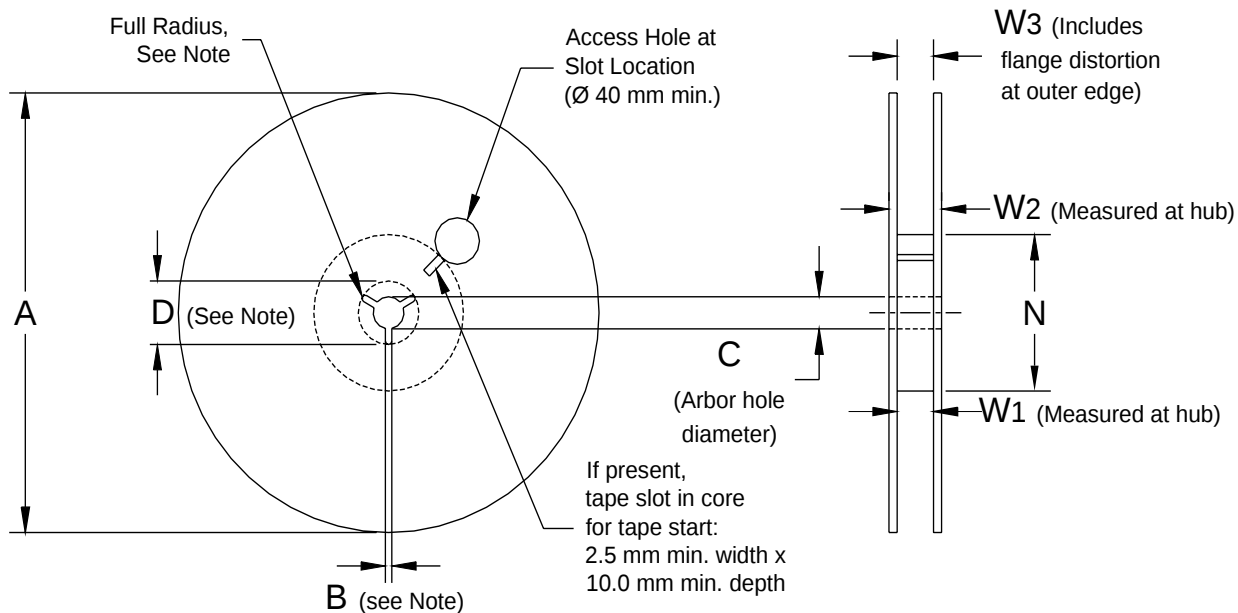


Figure 6 – Reel Dimensions

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
8mm	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)
12mm				
16mm				
Variable Dimensions — Millimeters (Inches)				
Tape Size	N Min	W ₁	W ₂ Max	W ₃
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

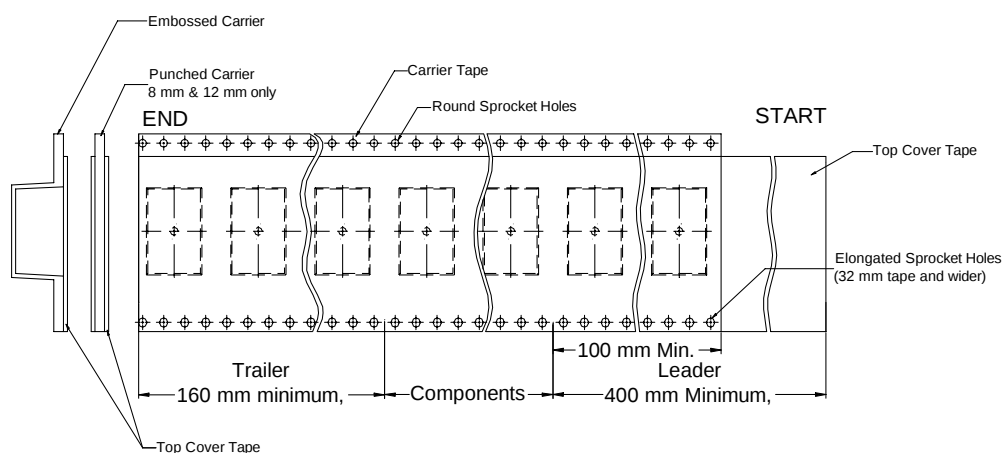


Figure 8 – Maximum Camber

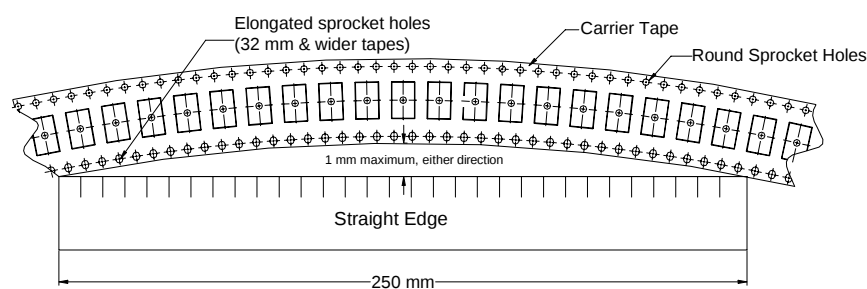


Figure 9 – Bulk Cassette Packaging (Ceramic Chips Only)

Meets Dimensional Requirements IEC-286 and EIAJ 7201

Unit mm *Reference

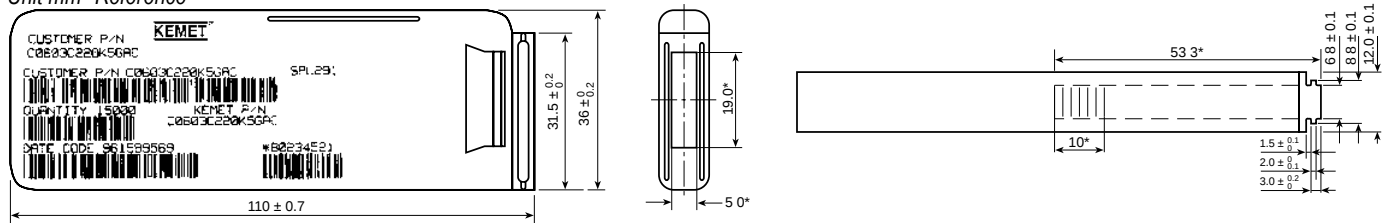


Table 9 – Capacitor Dimensions for Bulk Cassette

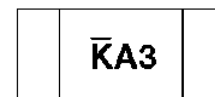
Cassette Packaging – Millimeters

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

Aximax, 400 Series, Axial, Conformally Coated, C0G Dielectric, 50VDC-200VDC (Automotive Grade)

Overview

KEMET's Automotive Grade conformally coated axial through-hole ceramic capacitors in C0G dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocols and inspection criteria have been established for Automotive Grade products in recognition of potentially harsh environmental conditions. KEMET Automotive Grade series capacitors meet the demanding Automotive Electronics Council AEC-Q200 qualification requirements and are manufactured in state-of-the art ISO/TS 16949:2002 certified facilities.

C0G dielectric features a 125°C maximum operating temperature and is considered "stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes C0G dielectric as a Class I material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q and stability of capacitance characteristics are required. C0G exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 30\text{ppm}/^\circ\text{C}$ from -55°C to +125°C.

Benefits

- AEC-Q200 automotive qualified
- Axial through-hole form factor
- Conformally coated
- -55°C to +125°C operating temperature range
- RoHS compliant
- DC voltage ratings of 50V, 100V and 200V
- Capacitance offerings ranging from 1.0pF up to 0.053μF
- Available capacitance tolerances of $\pm 0.25\text{pF}$, $\pm 0.5\text{pF}$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, and $\pm 10\%$
- High temperature solder lead attach
- Extremely low ESR and ESL
- High thermal stability
- High ripple current capability
- No capacitance change with respect to applied rated DC voltage
- Negligible capacitance change with respect to temperature from -55°C to +125°C
- No capacitance decay with time
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated lead finish allowing for excellent solderability
- Encapsulation meets flammability standard UL 94V-0



Ordering Information

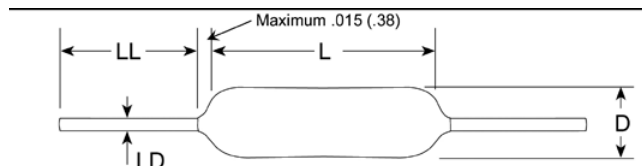
C	410	C	472	J	5	G	5	T	A	AUTO
Ceramic	Style/Size	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ¹	Voltage	Dielectric	Design	Lead Finish ²	Failure Rate	Packaging/Grade (C-Spec)
	410 412 420 430 440	C = Standard	2 Sig. Digits + Number of Zeros Use 9 for 1.0 - 9.9pF Use 8 for 0.5 - .99pF ex. 2.2pF = 229 ex. 0.5pF = 508	C = $\pm 0.25\text{pF}$ D = $\pm 0.5\text{pF}$ F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$	5 = 50V 1 = 100V 2 = 200V	G = C0G	5 = Multilayer	T = 100% Matte Sn H = SnPb (60/40)	A = N/A	AUTO = Automotive Grade 12" Reel

¹ Additional capacitance tolerance offerings may be available. Contact KEMET for details.

² Lead materials:

Standard: 100% matte tin (Sn) with nickel (Ni) underplate and steel core ("T" designation).

Dimensions – Millimeters (Inches)



Series	Style/Size	L Length Max.	D Diameter Max.	LD Lead Diameter	LL Lead Length Min.
C41X	410	0.170 (4.32)	0.100 (2.54)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)
	412	0.170 (4.32)	0.120 (3.05)		
C42X	420	0.260 (6.60)	0.100 (2.54)		
C43X	430	0.290 (7.37)	0.150 (3.81)		
C44X	440	0.400 (10.16)	0.150 (3.81)		

Applications

Typical applications include critical timing, tuning, circuits requiring low loss, circuits with pulse, high current, decoupling, bypass, filtering, transient voltage suppression, blocking and energy storage.

Qualification/Certification

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.

Environmental Compliance

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)	±30PPM/°C
Aging Rate (Max % Cap Loss/Decade Hour)	0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	0.1%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

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:

1MHz ± 100kHz and 1.0Vrms ± 0.2V if capacitance ≤1000pF

1kHz ± 50Hz and 1.0Vrms ± 0.2V if capacitance >1000pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
C0G	All	All	0.5	0.3% or ± 0.25 pF

Table 1A – Series C41X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C410	0.170 (4.32)	0.100 (2.54)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	C0G				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
109	1pF		1pF	1pF	C, D
159	1.5pF		1.5pF	1.5pF	
189	1.8pF		1.8pF	1.8pF	
229	2.2pF		2.2pF	2.2pF	
279	2.7pF		2.7pF	2.7pF	
339	3.3pF		3.3pF	3.3pF	
399	3.9pF		3.9pF	3.9pF	
479	4.7pF		4.7pF	4.7pF	
569	5.6pF		5.6pF	5.6pF	
689	6.8pF		6.8pF	6.8pF	
829	8.2pF		8.2pF	8.2pF	F, G, J, K
100	10pF		10pF	10pF	
120	12pF		12pF	12pF	
150	15pF		15pF	15pF	
180	18pF		18pF	18pF	
220	22pF		22pF	22pF	
270	27pF		27pF	27pF	
330	33pF		33pF	33pF	
390	39pF		39pF	39pF	
470	47pF		47pF	47pF	
560	56pF		56pF	56pF	
680	68pF		68pF	68pF	
820	82pF		82pF	82pF	
101	100pF		100pF	100pF	
121	120pF		120pF	120pF	
151	150pF		150pF	150pF	
181	180pF		180pF	180pF	
221	220pF		220pF	220pF	
271	270pF		270pF	270pF	
331	330pF		330pF		
391	390pF		390pF		
471	470pF		470pF		
561	560pF		560pF		
681	680pF		680pF		
821	820pF		820pF		
102	1000pF		1000pF		
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1B – Series C41X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C412	0.170 (4.32)	0.120 (3.05)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	C0G				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				F, G, J, K
122	1200pF				
152	1500pF				
182	1800pF				
222	2200pF				
272	2700pF				
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1C – Series C42X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C420	0.260 (6.60)	0.100 (2.54)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	C0G				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				F, G, J, K
561	560pF		560pF		
681	680pF		680pF		
821	820pF		820pF		
102	1000pF		1000pF		
122	1200pF		1200pF		
152	1500pF		1500pF		
182	1800pF		1800pF		
222	2200pF		2200pF		
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1D – Series C43X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C430	0.290 (7.37)	0.150 (3.81)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -003 (25.4 + 0.025/ -0.076)	
Dielectric	C0G				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
182	1800pF		1800pF		F, G, J, K
222	2200pF		2200pF		
272	2700pF		2700pF		
332	3300pF		3300pF		
272	2700pF		2700pF		
332	3300pF		3300pF		
392	3900pF		3900pF		
472	4700pF		4700pF		
562	5600pF		5600pF		
682	6800pF		6800pF		
822	8200pF		8200pF		
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1E – Series C44X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C440	0.400 (10.16)	0.150 (3.81)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	C0G				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
562	5600pF		5600pF		F, G, J, K
682	6800pF		6800pF		
822	8200pF		8200pF		
103	0.01μF		0.01μF		
123	0.012μF		0.012μF		
153	0.015μF		0.015μF		
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

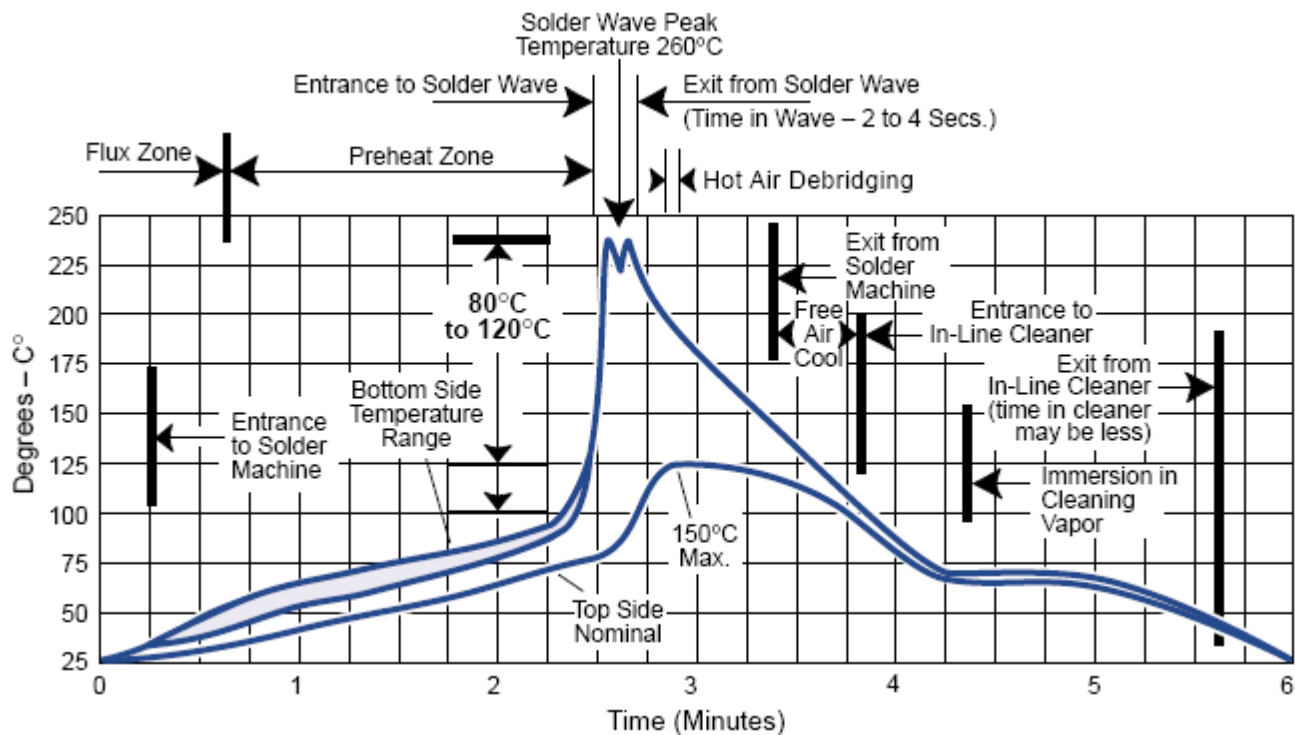
Soldering Process

Recommended Soldering Technique:

- Solder Wave
- Hand Soldering (Manual)

Recommended Soldering Profile:

- Optimum Wave Solder Profile
- Hand Soldering (Manual)



KEMET recommends following the guidelines and techniques outlined in technical bulletins F2103 and F9207.

Manual Solder Profile with Pre-heating (Recommended)

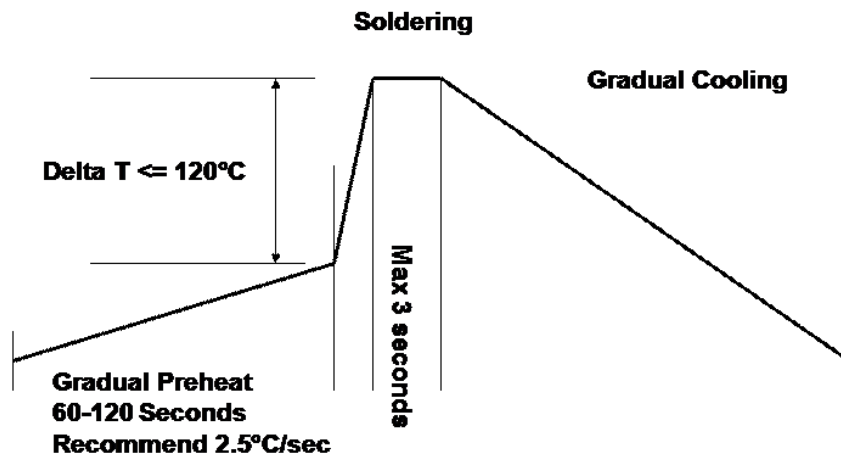


Table 2 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
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	1000 cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0VDC, for 1000 hours.
Vibration	MIL-STD-202 Method 204	5g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000 Hz.
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B. No pre-heat of samples. Note: single wave solder - procedure 2.
Terminal Strength	MIL-STD-202 Method 211	Conditions A (2.3kg or 5 lbs)
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 and 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. In addition, 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.

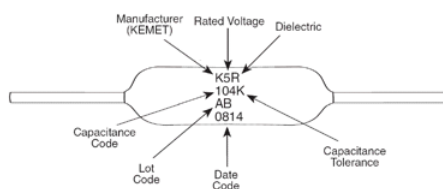
Packaging Details

Lead Spacing	Component Pitch (P1)
0.100 (2.54)	5.08
0.200 (5.08)	3.81
0.400 (10.16)	7.62
0.170 (4.32)	
0.220 (5.59)	
0.275 (6.98)	
0.300 (7.62)	
0.375 (9.52)	
0.475 (12.06)	
0.575 (14.60)	
0.675 (17.14)	

Packaging Quantities

Style/Size	Standard Bulk Quantity	Ammo Pack Quantity Max.	Reel Quantity Max. (12" Reel)
410	300/Box	4000	5000
412	200/Box		
420	300/Box		
430	200/Box	2000	2500
440	200/Box		

Marking



Application Notes

These devices are not recommended for use in overmold applications and/or processes

Aximax, 400 Series, Axial, Conformally Coated, X7R Dielectric, 50VDC-200VDC (Automotive Grade)

Overview

KEMET's Automotive Grade conformally coated axial through-hole ceramic capacitors in X7R dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocols and inspection criteria have been established for Automotive Grade products in recognition of potentially harsh environmental conditions. KEMET Automotive Grade series capacitors meet the demanding Automotive Electronics Council AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

X7R dielectric features a 125°C maximum operating temperature and is considered "temperature stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C.

Benefits

- AEC-Q200 automotive qualified
- Axial through-hole technology
- Conformally coated
- -55°C to +125°C operating temperature range
- RoHS compliant
- X7R temperature stable dielectric
- DC voltage ratings of 50V, 100V, and 200V
- Capacitance offerings ranging from 330pF to 0.68 μ F
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- High temperature solder lead attach
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated lead finish allowing for excellent solderability
- Encapsulation meets flammability standard UL 94V-0)

Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression.



Ordering Information

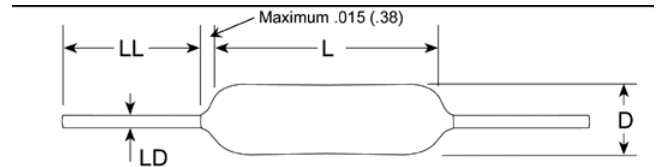
C	410	C	105	K	5	R	5	T	A	AUTO
Ceramic	Style/Size	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ¹	Voltage	Dielectric	Design	Lead Finish ²	Failure Rate	Packaging/Grade (C-Spec)
	410 412 420 430 440	C = Standard	2 Sig. Digits + Number of Zeros.	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	5 = 50V 1 = 100V 2 = 200V	R = X7R	5 = Multilayer	T = 100% Matte Sn	A = N/A	AUTO = Automotive Grade 12" Reel

¹ Additional capacitance tolerance offerings may be available. Contact KEMET for details.

² Lead materials:

Standard: 100% matte tin (Sn) with nickel (Ni) underplate and steel core ("T" designation).

Dimensions – Millimeters (Inches)



Series	Style/Size	L Length Max.	D Diameter Max.	LD Lead Diameter	LL Lead Length Min.
C41X	410	0.170 (4.32)	0.100 (2.54)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)
	412	0.170 (4.32)	0.120 (3.05)		
C42X	420	0.260 (6.60)	0.100 (2.54)		
C43X	430	0.290 (7.37)	0.150 (3.81)		
C44X	440	0.400 (10.16)	0.150 (3.81)		

Qualification/Certification

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.

Environmental Compliance

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	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	3.5%(25V) and 2.5%(50V to 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 48 for this part type or 1000 hours. Please refer to a part number specific datasheet for referee time details.

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 ± 0.2 Vrms if capacitance ≤ 10μF

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

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
X7R	>25	All	3.0	± 20%
	16 / 25		5.0	
	< 16		7.5	

Insulation Resistance Limit Table

Style/Size	1000 megohm microfarads or 100GΩ	500 megohm microfarads or 10GΩ
410	< 0.15μF	≥ 0.15μF
412	< 0.15μF	≥ 0.15μF
420	< 0.47μF	≥ 0.47μF
430	< 0.47μF	≥ 0.47μF
440	< 0.47μF	≥ 0.47μF

Table 1A – Series C41X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C410	0.170 (4.32)	0.100 (2.54)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	X7R				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
331				330pF	J, K, M
391				390pF	
471				470pF	
561	560pF	560pF	560pF	560pF	
681	680pF	680pF	680pF	680pF	
821	820pF	820pF	820pF	820pF	
102	1000pF	1000pF			
122	1200pF	1200pF			
152	1500pF	1500pF			
182	1800pF	1800pF			
222	2200pF	2200pF			
272	2700pF	2700pF			
332	3300pF	3300pF			
392	3900pF	3900pF			
472	4700pF	4700pF			
562	5600pF	5600pF			
682	6800pF	6800pF			
822	8200pF	8200pF			
103	0.01μF	0.01μF			
123	0.012μF	0.012μF			
153	0.015μF	0.015μF			
183	0.018μF	0.018μF			
223	0.022μF				
273	0.027μF				
333	0.033μF				
393	0.039μF				
473	0.047μF				
563	0.056μF				
683	0.068μF				
823	0.082μF				
104	0.1μF				
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

Table 1B – Series C41X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C412	0.170 (4.32)	0.120 (3.05)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -003 (25.4 + 0.025/ -0.076)	
Dielectric	X7R				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
153	0.015μF		0.015μF		J, K, M
183	0.018μF		0.018μF		
223	0.022μF		0.022μF		
273	0.027μF		0.027μF		
333	0.033μF				
393	0.039μF				
473	0.047μF				
563	0.056μF				
683	0.068μF				
823	0.082μF				
104	0.1μF				
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

Table 1C – Series C42X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C420	0.260 (6.60)	0.100 (2.54)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -003 (25.4 + 0.025/ -0.076)	
Dielectric	X7R				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
682			6800pF		J, K, M
822			8200pF		
103			0.01μF		
123			0.012μF		
153			0.015μF		
183			0.018μF		
223			0.022μF		
273			0.027μF		
333			0.033μF		
393			0.039μF		
473	0.047μF				
563	0.056μF				
683	0.068μF				
823	0.082μF				
104	0.1μF				
124	0.12μF				
154	0.15μF				
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

Table 1D – Series C43X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C430	0.290 (7.37)	0.150 (3.81)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	X7R				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				
333			0.033µF		J, K, M
393			0.039µF		
473			0.047µF		
563			0.056µF		
683			0.068µF		
823			0.082µF		
104			0.1µF		
124			0.12µF		
154	0.15µF				
184	0.18µF				
224	0.22µF				
274	0.27µF				
334	0.33µF				
394	0.39µF				
474	0.47µF				
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

Table 1E – Series C44X

Style/Size	Dimensions - In. (mm)				
	L Max.	D Max.	LD Nom.	LL Min.	
C440	0.400 (10.16)	0.150 (3.81)	0.020 + 0.001/ -0.003 (0.51 + 0.025/ -0.076)	1.0 + 0.001/ -0.003 (25.4 + 0.025/ -0.076)	
Dielectric	X7R				
Voltage Code	5		1	2	Cap Tol
Rated Voltage (VDC)	50		100	200	
Cap Code	Available Capacitance				J, K, M
333	0.033µF		0.033µF		
393	0.039µF		0.039µF		
473	0.047µF		0.047µF		
563	0.056µF		0.056µF		
683	0.068µF		0.068µF		
823	0.082µF		0.082µF		
104	0.1µF		0.1µF		
124	0.12µF		0.12µF		
154	0.15µF		0.15µF		
184	0.18µF		0.18µF		
224	0.22µF				
274	0.27µF				
334	0.33µF				
394	0.39µF				
474	0.47µF				
564	0.56µF				
684	0.68µF				
Cap Code	Available Capacitance				Cap Tol
Rated Voltage (VDC)	50		100	200	
Voltage Code	5		1	2	

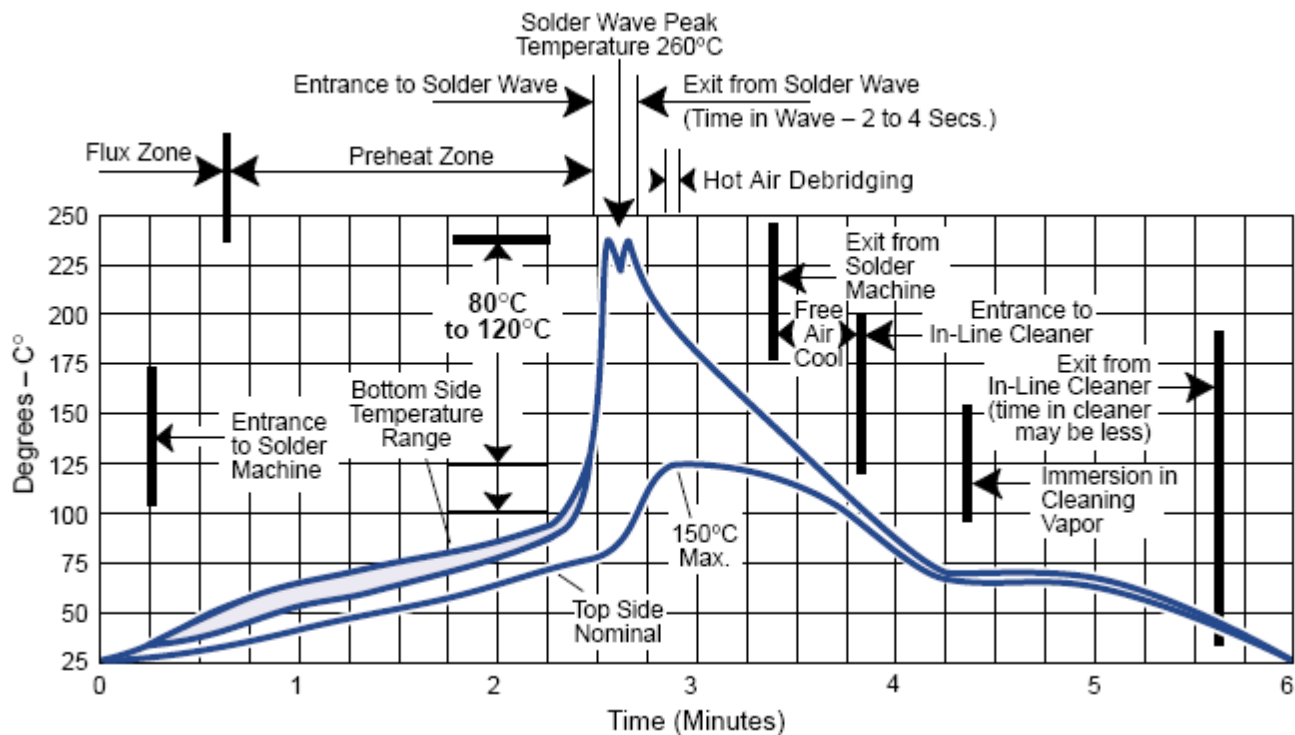
Soldering Process

Recommended Soldering Technique:

- Solder Wave
- Hand Soldering (Manual)

Recommended Soldering Profile:

- Optimum Wave Solder Profile
- Hand Soldering (Manual)



KEMET recommends following the guidelines and techniques outlined in technical bulletins F2103 and F9207.

Manual Solder Profile with Pre-heating (Recommended)

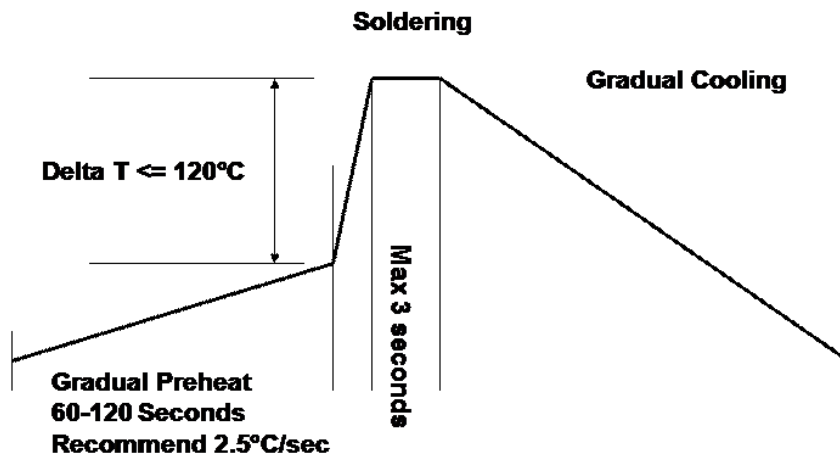


Table 2 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
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	1000 cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0VDC, for 1000 hours.
Vibration	MIL-STD-202 Method 204	5g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000 Hz.
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B. No pre-heat of samples. Note: single wave solder - procedure 2.
Terminal Strength	MIL-STD-202 Method 211	Conditions A (2.3kg or 5 lbs)
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 and 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. In addition, 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.

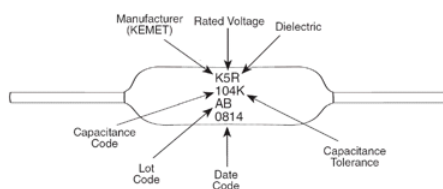
Packaging Details

Lead Spacing	Component Pitch (P1)
0.100 (2.54)	5.08
0.200 (5.08)	3.81
0.400 (10.16)	7.62
0.170 (4.32)	
0.220 (5.59)	
0.275 (6.98)	
0.300 (7.62)	
0.375 (9.52)	
0.475 (12.06)	
0.575 (14.60)	
0.675 (17.14)	

Packaging Quantities

Style/Size	Standard Bulk Quantity	Ammo Pack Quantity Max.	Reel Quantity Max. (12" Reel)
410	300/Box	4000	5000
412	200/Box		
420	300/Box		
430	200/Box	2000	2500
440	200/Box		

Marking



Application Notes

These devices are not recommended for use in overmold applications and/or processes

Goldmax, 300 Series, Radial, Conformally Coated, C0G Dielectric, 50VDC-200VDC (Automotive Grade)

Overview

KEMET's Automotive Grade conformally coated radial through-hole ceramic capacitors in C0G dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocols and inspection criteria have been established for Automotive Grade products in recognition of potentially harsh environmental conditions. KEMET Automotive Grade series capacitors meet the demanding Automotive Electronics Council AEC-Q200 qualification requirements and are manufactured in state-of-the art ISO/TS 16949:2002 certified facilities.

C0G dielectric features a 125°C maximum operating temperature and is considered "stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes C0G dielectric as a Class I material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q and stability of capacitance characteristics are required. C0G exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 30\text{ppm}/^\circ\text{C}$ from -55°C to $+125^\circ\text{C}$.

Benefits

- AEC-Q200 automotive qualified
- Radial through-hole form factor
- Conformally coated
- 0.100", 0.200", and 0.400" lead spacing
- -55°C to $+125^\circ\text{C}$ operating temperature range
- RoHS compliant
- DC voltage ratings of 50V, 100V and 200V
- Capacitance offerings ranging from 1.0pF up to 0.12 μF
- Available capacitance tolerances of $\pm 0.25\text{pF}$, $\pm 0.5\text{pF}$, $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, and $\pm 10\%$
- High temperature solder lead attach
- Extremely low ESR and ESL
- High thermal stability
- High ripple current capability
- No capacitance change with respect to applied rated DC voltage
- Negligible capacitance change with respect to temperature from -55°C to $+125^\circ\text{C}$
- No capacitance decay with time
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated lead finish allowing for excellent solderability
- Encapsulation meets flammability standard UL 94V-0



Ordering Information

C	320			C	153	J	5	G	5	T	A	AUTO
Ceramic	Style/Size			Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ¹	Voltage	Dielectric	Design	Lead Finish ²	Failure Rate	Packaging/Grade (C-Spec) ³
	315	324	335	C = Standard	2 Sig. Digits + Number of Zeros	D = $\pm 0.5\text{pF}$ F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$	5 = 50V 1 = 100V 2 = 200V	G = C0G	5 = Multilayer	T = 100% Matte Sn H = SnPb (60/40)	A = N/A	AUTO = Automotive Grade 12" Reel
	316	325	336									
	317	326	340		Use 9 for							
	318	327	346		1.0 - 9.9pF							
	320	328	350		Use 8 for							
	321	330	356		0.5 - .99pF							
	322	331			ex. 2.2pF = 229							
	323	333			ex. 0.5pF = 508							

¹ Additional capacitance tolerance offerings may be available. Contact KEMET for details.

² Lead materials:

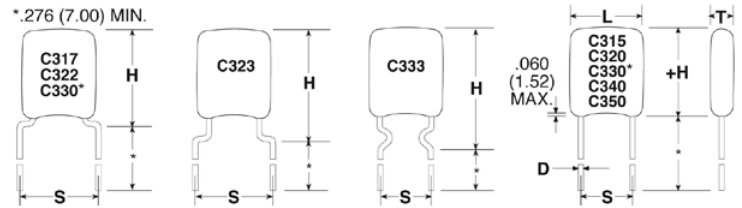
Standard: 100% matte tin (Sn) with nickel (Ni) underplate and steel core ("T" designation).

³ Reeling options:

C-Spec 7301: Recommended for straight lead configuration part types.

C-Spec 7301: Recommended for formed (bent) lead configuration part types.

Dimensions – Millimeters (Inches)



Series	Style/Size	S Lead Spacing Nom.	L Length Max.	D Diameter Max.	T Thickness Max. ¹	LD Lead Diameter	LL Lead Length Min.
C31X	315	0.100 (2.54)	0.150 (3.81)	0.210 (5.33)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)
	316		0.150 (3.81)	0.230 (5.84)	0.100 (2.54)		0.200 (5.08)
C32X	324		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	320		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	326		0.200 (5.08)	0.350 (8.89)	0.125 (3.18) ¹		0.200 (5.08)
C31X	317	0.200 (5.08)	0.150 (3.81)	0.230 (5.84)	0.100 (2.54)		0.276 (7.00)
	318		0.150 (3.81)	0.235 (5.97)	0.100 (2.54)		0.276 (7.00)
C32X	321		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	322		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	323		0.200 (5.08)	0.320 (8.13)	0.125 (3.18) ¹		0.276 (7.00)
	325		0.200 (5.08)	0.320 (8.13)	0.125 (3.18) ¹		0.276 (7.00)
	328		0.200 (5.08)	0.325 (8.26)	0.125 (3.18) ¹		0.276 (7.00)
	327		0.200 (5.08)	0.350 (8.89)	0.125 (3.18) ¹		0.200 (5.08)
	330		0.300 (7.62)	0.360 (9.14)	0.150 (3.81)		0.276 (7.00)
C33X	331		0.300 (7.62)	0.360 (9.14)	0.150 (3.81)		0.276 (7.00)
	333		0.300 (7.62)	0.390 (9.91)	0.150 (3.81)		0.276 (7.00)
	335		0.300 (7.62)	0.420 (10.67)	0.150 (3.81)		0.276 (7.00)
	336		0.300 (7.62)	0.450 (11.43)	0.150 (3.81)		0.200 (5.08)
	340		0.400 (10.16)	0.460 (11.68)	0.150 (3.81)		0.276 (7.00)
C34X	346		0.400 (10.16)	0.590 (14.97)	0.150 (3.81)		0.200 (5.08)
C35X	350	0.400 (10.16)	0.500 (12.70)	0.560 (14.22)	0.200 (5.08)	0.025 (0.64)	0.276 (7.00)
	356		0.500 (12.70)	0.670 (17.02)	0.200 (5.08)		0.200 (5.08)

¹Thickness max. (T) = 0.160" (4.07 mm) for capacitance values greater than or equal to 4.7μF

Applications

Typical applications include critical timing, tuning, circuits requiring low loss, circuits with pulse, high current, decoupling, bypass, filtering, transient voltage suppression, blocking and energy storage.

Qualification/Certification

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.

Environmental Compliance

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)	±30PPM/°C
Aging Rate (Max % Cap Loss/Decade Hour)	0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	0.1%
Insulation Resistance (IR) Limit @ 25°C	1000 megohm microfarads or 100GΩ (Rated voltage applied for 120 ± 5 secs @ 25°C)

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:

1MHz ± 100kHz and 1.0Vrms ± 0.2V if capacitance ≤ 1000pF

1kHz ± 50Hz and 1.0Vrms ± 0.2V if capacitance > 1000pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
C0G	All	All	0.5	0.3% or ± 0.25 pF

Table 1A – Series C31X (0.100" & 0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C315	0.100 (2.54)	0.150 (3.81)	0.210 (5.33)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)	
C316	0.100 (2.54)	0.150 (3.81)	0.230 (5.84)	0.100 (2.54)	0.020 (0.51)	0.200 (5.08)	
C317	0.200 (5.08)	0.150 (3.81)	0.230 (5.84)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)	
C318	0.200 (5.08)	0.150 (3.81)	0.235 (5.97)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)	
Dielectric	C0G						Cap Tol
Voltage Code	5		1		2		
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
109	1pF		1pF		1pF		C, D
129	1.2pF		1.2pF		1.2pF		
159	1.5pF		1.5pF		1.5pF		
189	1.8pF		1.8pF		1.8pF		
229	2.2pF		2.2pF		2.2pF		
279	2.7pF		2.7pF		2.7pF		
339	3.3pF		3.3pF		3.3pF		
399	3.9pF		3.9pF		3.9pF		
479	4.7pF		4.7pF		4.7pF		
569	5.6pF		5.6pF		5.6pF		
689	6.8pF		6.8pF		6.8pF		
829	8.2pF		8.2pF		8.2pF		
100	10pF		10pF		10pF		F, G, J, K
120	12pF		12pF		12pF		
150	15pF		15pF		15pF		
180	18pF		18pF		18pF		
220	22pF		22pF		22pF		
270	27pF		27pF		27pF		
330	33pF		33pF		33pF		
390	39pF		39pF		39pF		
470	47pF		47pF		47pF		
560	56pF		56pF		56pF		
680	68pF		68pF		68pF		
820	82pF		82pF		82pF		
101	100pF		100pF		100pF		
121	120pF		120pF		120pF		
151	150pF		150pF		150pF		
181	180pF		180pF		180pF		
221	220pF		220pF		220pF		
271	270pF		270pF		270pF		
331	330pF		330pF		330pF		
391	390pF		390pF		390pF		
471	470pF		470pF		470pF		
561	560pF		560pF		560pF		
681	680pF		680pF		680pF		
821	820pF		820pF				
102	1000pF		1000pF				
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1B – Series C32X (0.100" & 0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)							
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.		
C324	0.100 (2.54)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C320	0.100 (2.54)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C326	0.100 (2.54)	0.200 (5.08)	0.350 (8.89)	0.125 (3.18)	0.020 (0.51)	0.200 (5.08)		
C321	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C322	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C323	0.200 (5.08)	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C325	0.200 (5.08)	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C328	0.200 (5.08)	0.200 (5.08)	0.325 (8.26)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)		
C327	0.200 (5.08)	0.200 (5.08)	0.350 (8.89)	0.125 (3.18)	0.020 (0.51)	0.200 (5.08)		
Dielectric	C0G						Cap Tol	
Voltage Code	5		1		2			
Rated Voltage (VDC)	50		100		200			
Cap Code	Available Capacitance						Cap Tol	
109	1pF		1pF		1pF			C, D
129	1.2pF		1.2pF		1.2pF			
159	1.5pF		1.5pF		1.5pF			
189	1.8pF		1.8pF		1.8pF			
229	2.2pF		2.2pF		2.2pF			
279	2.7pF		2.7pF		2.7pF			
339	3.3pF		3.3pF		3.3pF			
399	3.9pF		3.9pF		3.9pF			
479	4.7pF		4.7pF		4.7pF		F, G, J, K	
569	5.6pF		5.6pF		5.6pF			
689	6.8pF		6.8pF		6.8pF			
829	8.2pF		8.2pF		8.2pF			
100	10pF		10pF		10pF			
120	12pF		12pF		12pF			
150	15pF		15pF		15pF			
180	18pF		18pF		18pF			
220	22pF		22pF		22pF			
270	27pF		27pF		27pF			
330	33pF		33pF		33pF			
390	39pF		39pF		39pF			
470	47pF		47pF		47pF			
560	56pF		56pF		56pF			
680	68pF		68pF		68pF			
820	82pF		82pF		82pF			
101	100pF		100pF		100pF			
121	120pF		120pF		120pF			
151	150pF		150pF		150pF			
181	180pF		180pF		180pF			
221	220pF		220pF		220pF			
271	270pF		270pF		270pF			
331	330pF		330pF		330pF			
391	390pF		390pF		390pF			
471	470pF		470pF		470pF			
Cap Code	Available Capacitance						Cap Tol	
Rated Voltage (VDC)	50		100		200			
Voltage Code	5		1		2			

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1B – Series C32X (0.100" & 0.200" Lead Spacing) con't

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C324	0.100 (2.54)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C320	0.100 (2.54)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C326	0.100 (2.54)	0.200 (5.08)	0.350 (8.89)	0.125 (3.18)	0.020 (0.51)	0.200 (5.08)	
C321	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C322	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C323	0.200 (5.08)	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C325	0.200 (5.08)	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C328	0.200 (5.08)	0.200 (5.08)	0.325 (8.26)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C327	0.200 (5.08)	0.200 (5.08)	0.350 (8.89)	0.125 (3.18)	0.020 (0.51)	0.200 (5.08)	
Dielectric	C0G						Cap Tol
Voltage Code	5		1		2		
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
561	560pF		560pF		560pF		F, G, J, K
681	680pF		680pF		680pF		
821	820pF		820pF		820pF		
102	1000pF		1000pF		1000pF		
122	1200pF		1200pF		1200pF		
152	1500pF		1500pF		1500pF		
182	1800pF		1800pF		1800pF		
222	2200pF		2200pF		2200pF		
272	2700pF		2700pF		2700pF		
332	3300pF		3300pF		3300pF		
392	3900pF		3900pF				
472	4700pF		4700pF				
562	5600pF		5600pF				
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1C – Series C33X (0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C330	0.200 (5.08)	0.300 (7.62)	0.360 (9.14)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C331	0.200 (5.08)	0.300 (7.62)	0.360 (9.14)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C333	0.200 (5.08)	0.300 (7.62)	0.390 (9.91)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C335	0.200 (5.08)	0.300 (7.62)	0.420 (10.67)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C336	0.200 (5.08)	0.300 (7.62)	0.450 (11.43)	0.150 (3.81)	0.020 (0.51)	0.200 (5.08)	
Dielectric	C0G						Cap Tol
Voltage Code	5		1		2		
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
102	1000pF		1000pF		1000pF		F, G, J, K
122	1200pF		1200pF		1200pF		
152	1500pF		1500pF		1500pF		
182	1800pF		1800pF		1800pF		
222	2200pF		2200pF		2200pF		
272	2700pF		2700pF		2700pF		
332	3300pF		3300pF		3300pF		
392	3900pF		3900pF		3900pF		
472	4700pF		4700pF		4700pF		
562	5600pF		5600pF		5600pF		
682	6800pF		6800pF		6800pF		
822	8200pF		8200pF		8200pF		
103	0.01μF		0.01μF		0.01μF		
123	0.012μF		0.012μF		0.012μF		
153	0.015μF		0.015μF		0.015μF		
183	0.018μF		0.018μF		0.018μF		
223	0.022μF		0.022μF				
273	0.027μF		0.027μF				
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1D – Series C34X (0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C340	0.200 (5.08)	0.400 (10.16)	0.460 (11.68)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C346	0.200 (5.08)	0.400 (10.16)	0.590 (14.97)	0.150 (3.81)	0.020 (0.51)	0.200 (5.08)	
Dielectric	C0G						
Voltage Code	5		1		2		Cap Tol
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						F, G, J, K
103	0.01µF		0.01µF		0.01µF		
123	0.012µF		0.012µF		0.012µF		
153	0.015µF		0.015µF		0.015µF		
183	0.018µF		0.018µF		0.018µF		
223	0.022µF		0.022µF		0.022µF		
273	0.027µF		0.027µF		0.027µF		
333	0.033µF		0.033µF		0.033µF		
393	0.039µF		0.039µF		0.039µF		
473	0.047µF		0.047µF		0.047µF		
563	0.056µF		0.056µF				
683	0.068µF		0.068µF				
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

Table 1E – Series C35X (0.400" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C350	0.400 (10.16)	0.500 (12.70)	0.560 (14.22)	0.200 (5.08)	0.025 (0.64)	0.276 (7.00)	
C356	0.400 (10.16)	0.500 (12.70)	0.670 (17.02)	0.200 (5.08)	0.025 (0.64)	0.200 (5.08)	
Dielectric	C0G						
Voltage Code	5		1		2		Cap Tol
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						F, G, J, K
223	0.022µF		0.022µF		0.022µF		
273	0.027µF		0.027µF		0.027µF		
333	0.033µF		0.033µF		0.033µF		
393	0.039µF		0.039µF		0.039µF		
473	0.047µF		0.047µF		0.047µF		
563	0.056µF		0.056µF		0.056µF		
683	0.068µF		0.068µF		0.068µF		
823	0.082µF		0.082µF				
104	0.1µF		0.1µF				
124	0.12µF		0.12µF				
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

These products are protected under U.S. Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

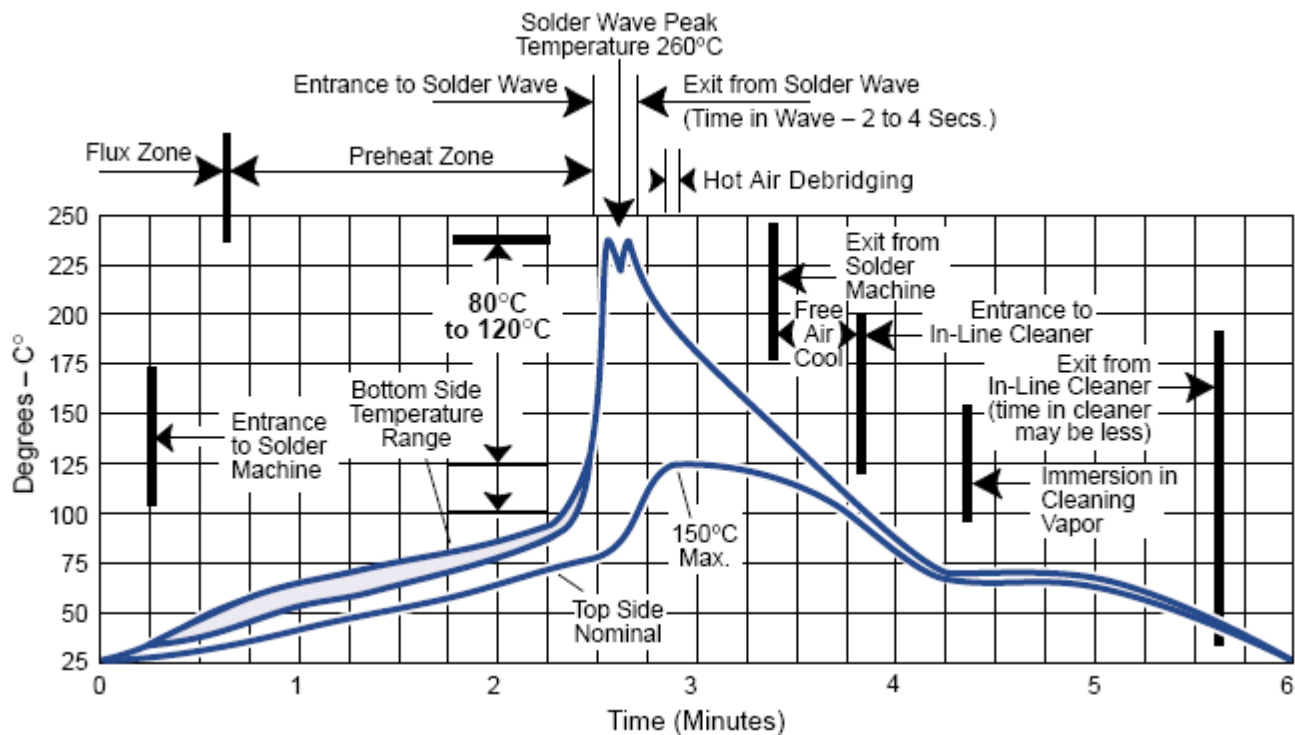
Soldering Process

Recommended Soldering Technique:

- Solder Wave
- Hand Soldering (Manual)

Recommended Soldering Profile:

- Optimum Wave Solder Profile
- Hand Soldering (Manual)



KEMET recommends following the guidelines and techniques outlined in technical bulletins F2103 and F9207.

Manual Solder Profile with Pre-heating (Recommended)

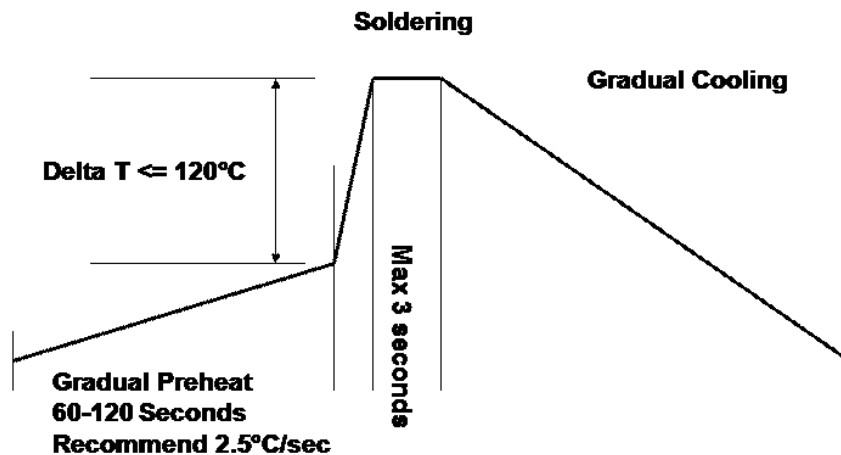


Table 2 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
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	1000 cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0VDC, for 1000 hours.
Vibration	MIL-STD-202 Method 204	5g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000 Hz.
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B. No pre-heat of samples. Note: single wave solder - procedure 2.
Terminal Strength	MIL-STD-202 Method 211	Conditions A (2.3kg or 5 lbs)
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 and 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. In addition, 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.

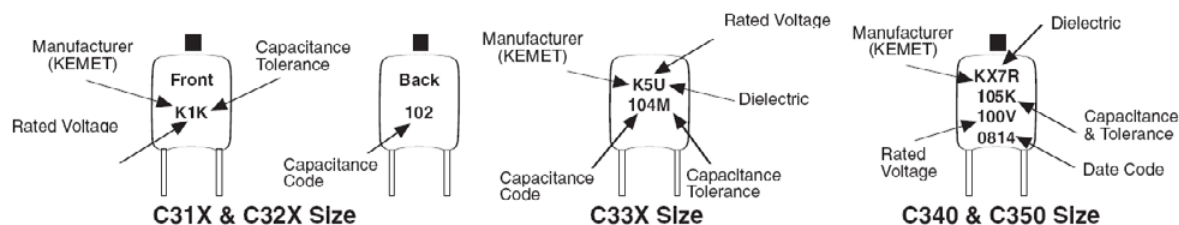
Packaging Details

Lead Spacing	Component Pitch (P1)
0.100 (2.54)	5.08
0.200 (5.08)	3.81
0.400 (10.16)	7.62
0.170 (4.32)	
0.220 (5.59)	
0.275 (6.98)	
0.300 (7.62)	
0.375 (9.52)	
0.475 (12.06)	
0.575 (14.60)	
0.675 (17.14)	

Packaging Quantities

Style/Size	Standard Bulk Quantity	Ammo Pack Quantity Max.	Reel Quantity Max. (12" Reel)
315	500/Bag	2500	2500
316			
317			
318			
320			
321			
322			
323			
324			
325			
326			
327			
328			
330			
331	250/Bag	1500	1500
333			
335			
336			
340	100/Bag	1000	1000
346			
350	50/Bag	N/A	500
356			

Marking



Application Notes

These devices are not recommended for use in overmold applications and/or processes.

Goldmax, 300 Series, Radial, Conformally Coated, X7R Dielectric, 50VDC-200VDC (Automotive Grade)

Overview

KEMET's Automotive Grade conformally coated radial through-hole ceramic capacitors in X7R dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocols and inspection criteria have been established for automotive grade products in recognition of potentially harsh environmental conditions. KEMET Automotive Grade products meet the demanding AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

X7R dielectric features a 125°C maximum operating temperature and is considered "temperature stable." The Electronics Components, Assemblies & Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55°C to +125°C.

Benefits

- AEC-Q200 automotive qualified
- Radial through-hole technology
- Conformally coated
- 0.100", 0.200" and 0.400" lead spacing
- -55°C to +125°C operating temperature range
- RoHS compliant
- X7R temperature stable dielectric
- DC voltage ratings of 50V, 100V and 200V
- Capacitance offerings ranging from 270pF to 4.7 μ F
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- High temperature solder lead attach
- Non-polar device, minimizing installation concerns

- 100% pure matte tin-plated lead finish allowing for excellent solderability
- Encapsulation meets flammability standard UL 94V-0



Ordering Information

C	320			C	106	K	5	R	5	T	A	AUTO
Ceramic	Style/Size			Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance ¹	Voltage	Dielectric	Design	Lead Finish ²	Failure Rate	Packaging/Grade (C-Spec) ³
	315	324	335	C = Standard	2 Sig. Digits + Number of Zeros	J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	5 = 50V 1 = 100V 2 = 200V	R = X7R	5 = Multilayer	T = 100% Matte Sn	A = N/A	AUTO = Automotive Grade 12" Reel
	316	325	336									
	317	326	340									
	318	327	346									
	320	328	350									
	321	330	356									
	322	331										
	323	333										

¹ Additional capacitance tolerance offerings may be available. Contact KEMET for details.

² Lead materials:

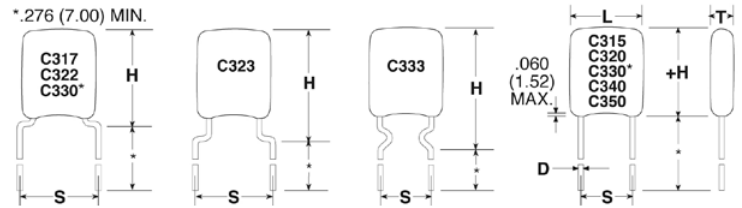
Standard: 100% matte tin (Sn) with nickel (Ni) underplate and steel core ("T" designation).

³ Reeling options:

C-Spec 7301: Recommended for straight lead configuration part types.

C-Spec 7301: Recommended for formed (bent) lead configuration part types.

Dimensions – Millimeters (Inches)



Series	Style/Size	S Lead Spacing Nom.	L Length Max.	D Diameter Max.	T Thickness Max. ¹	LD Lead Diameter	LL Lead Length Min.
C31X	315	0.100 (2.54)	0.150 (3.81)	0.210 (5.33)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)
	316		0.150 (3.81)	0.230 (5.84)	0.100 (2.54)		0.200 (5.08)
C32X	324		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	320		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	326		0.200 (5.08)	0.350 (8.89)	0.125 (3.18) ¹		0.200 (5.08)
C31X	317	0.200 (5.08)	0.150 (3.81)	0.230 (5.84)	0.100 (2.54)		0.276 (7.00)
	318		0.150 (3.81)	0.235 (5.97)	0.100 (2.54)		0.276 (7.00)
C32X	321		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	322		0.200 (5.08)	0.260 (6.60)	0.125 (3.18) ¹		0.276 (7.00)
	323		0.200 (5.08)	0.320 (8.13)	0.125 (3.18) ¹		0.276 (7.00)
	325		0.200 (5.08)	0.320 (8.13)	0.125 (3.18) ¹		0.276 (7.00)
	328		0.200 (5.08)	0.325 (8.26)	0.125 (3.18) ¹		0.276 (7.00)
	327		0.200 (5.08)	0.350 (8.89)	0.125 (3.18) ¹		0.200 (5.08)
	330		0.300 (7.62)	0.360 (9.14)	0.150 (3.81)		0.276 (7.00)
C33X	331		0.300 (7.62)	0.360 (9.14)	0.150 (3.81)		0.276 (7.00)
	333		0.300 (7.62)	0.390 (9.91)	0.150 (3.81)		0.276 (7.00)
	335		0.300 (7.62)	0.420 (10.67)	0.150 (3.81)		0.276 (7.00)
	336		0.300 (7.62)	0.450 (11.43)	0.150 (3.81)		0.200 (5.08)
	340		0.400 (10.16)	0.460 (11.68)	0.150 (3.81)		0.276 (7.00)
C34X	346		0.400 (10.16)	0.590 (14.97)	0.150 (3.81)		0.200 (5.08)
C35X	350	0.400 (10.16)	0.500 (12.70)	0.560 (14.22)	0.200 (5.08)	0.025 (0.64)	0.276 (7.00)
	356		0.500 (12.70)	0.670 (17.02)	0.200 (5.08)		0.200 (5.08)

¹Thickness max. (T) = 0.160" (4.07 mm) for capacitance values greater than or equal to 4.7μF

Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression.

Qualification/Certification

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.

Environmental Compliance

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	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limit @ 25°C	3.5%(25V) and 2.5%(50V to 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 48 for this part type or 1000 hours. Please refer to a part number specific datasheet for referee time details.

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:

1MHz ± 100kHz and 1.0Vrms ± 0.2V if capacitance ≤ 1000pF

1kHz ± 50Hz and 1.0Vrms ± 0.2V if capacitance > 1000pF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & 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
X7R	>25	All	3.0	± 20%
	16 / 25		5.0	
	< 16		7.5	

Insulation Resistance Limit Table

Style/Size	1000 megohm microfarads or 100GΩ	500 megohm microfarads or 10GΩ
312, 313	< 0.82μF	≥ 0.82μF
315, 316, 317, 318, 319	< 0.056μF	≥ 0.056μF
320, 321, 322, 323, 324, 325, 326, 327, 328	< 0.47μF	≥ 0.47μF
330, 331, 333, 335, 336, 337	ALL	N/A
340, 346	< 1.5μF	≥ 1.5μF
350	< 2.7μF	≥ 2.7μF
356	ALL	N/A

Table 1A – Series C31X (0.100" & 0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C315	0.100 (2.54)	0.150 (3.81)	0.210 (5.33)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)	
C316	0.100 (2.54)	0.150 (3.81)	0.230 (5.84)	0.100 (2.54)	0.020 (0.51)	0.200 (5.08)	
C317	0.200 (5.08)	0.150 (3.81)	0.230 (5.84)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)	
C318	0.200 (5.08)	0.150 (3.81)	0.235 (5.97)	0.100 (2.54)	0.020 (0.51)	0.276 (7.00)	
Dielectric	X7R						Cap Tol
Voltage Code	5		1		2		
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
271					270pF		J, K, M
331					330pF		
391					390pF		
471	470pF		470pF		470pF		
561	560pF		560pF		560pF		
681	680pF		680pF		680pF		
821	820pF		820pF		820pF		
102	1000pF		1000pF		1000pF		
122	1200pF		1200pF		1200pF		
152	1500pF		1500pF		1500pF		
182	1800pF		1800pF		1800pF		
222	2200pF		2200pF		2200pF		
272	2700pF		2700pF		2700pF		
332	3300pF		3300pF		3300pF		
392	3900pF		3900pF				
472	4700pF		4700pF				
562	5600pF		5600pF				
682	6800pF		6800pF				
822	8200pF		8200pF				
103	0.01μF		0.01μF				
123	0.012μF		0.012μF				
153	0.015μF						
183	0.018μF						
223	0.022μF						
273	0.027μF						
333	0.033μF						
393	0.039μF						
473	0.047μF						
563	0.056μF						
683	0.068μF						
823	0.082μF						
104	0.1μF						
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

Table 1B – Series C32X (0.100" & 0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C324	0.100 (2.54)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C320	0.100 (2.54)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C326	0.100 (2.54)	0.200 (5.08)	0.350 (8.89)	0.125 (3.18)	0.020 (0.51)	0.200 (5.08)	
C321	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C322	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C323	0.200 (5.08)	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C325	0.200 (5.08)	0.200 (5.08)	0.320 (8.13)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C328	0.200 (5.08)	0.200 (5.08)	0.325 (8.26)	0.125 (3.18)	0.020 (0.51)	0.276 (7.00)	
C327	0.200 (5.08)	0.200 (5.08)	0.350 (8.89)	0.125 (3.18)	0.020 (0.51)	0.200 (5.08)	
Dielectric	X7R						Cap Tol
Voltage Code	5		1		2		
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
271	270pF		270pF		270pF		J, K, M
331	330pF		330pF		330pF		
391	390pF		390pF		390pF		
471	470pF		470pF		470pF		
561	560pF		560pF		560pF		
681	680pF		680pF		680pF		
821	820pF		820pF		820pF		
102	1000pF		1000pF		1000pF		
122	1200pF		1200pF		1200pF		
152	1500pF		1500pF		1500pF		
182	1800pF		1800pF		1800pF		
222	2200pF		2200pF		2200pF		
272	2700pF		2700pF		2700pF		
332	3300pF		3300pF		3300pF		
392	3900pF		3900pF		3900pF		
472	4700pF		4700pF		4700pF		
562	5600pF		5600pF		5600pF		
682	6800pF		6800pF		6800pF		
822	8200pF		8200pF		8200pF		
103	0.01μF		0.01μF		0.01μF		
123	0.012μF		0.012μF		0.012μF		
153	0.015μF		0.015μF		0.015μF		
183	0.018μF		0.018μF		0.018μF		
223	0.022μF		0.022μF		0.022μF		
273	0.027μF		0.027μF		0.027μF		
333	0.033μF		0.033μF		0.033μF		
393	0.039μF		0.039μF		0.039μF		
473	0.047μF		0.047μF		0.047μF		
563	0.056μF		0.056μF				
683	0.068μF		0.068μF				
823	0.082μF		0.082μF				
104	0.1μF		0.1μF				
124	0.12μF						
154	0.15μF						
184	0.18μF						
224	0.22μF						
274	0.27μF						
334	0.33μF						
394	0.39μF						
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

Table 1C – Series C33X (0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C330	0.200 (5.08)	0.300 (7.62)	0.360 (9.14)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C331	0.200 (5.08)	0.300 (7.62)	0.360 (9.14)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C333	0.200 (5.08)	0.300 (7.62)	0.390 (9.91)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C335	0.200 (5.08)	0.300 (7.62)	0.420 (10.67)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C336	0.200 (5.08)	0.300 (7.62)	0.450 (11.43)	0.150 (3.81)	0.020 (0.51)	0.200 (5.08)	
Dielectric	X7R						Cap Tol
Voltage Code	5		1		2		
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
472	4700pF		4700pF		4700pF		J, K, M
562	5600pF		5600pF		5600pF		
682	6800pF		6800pF		6800pF		
822	8200pF		8200pF		8200pF		
103	0.01µF		0.01µF		0.01µF		
123	0.012µF		0.012µF		0.012µF		
153	0.015µF		0.015µF		0.015µF		
183	0.018µF		0.018µF		0.018µF		
223	0.022µF		0.022µF		0.022µF		
273	0.027µF		0.027µF		0.027µF		
333	0.033µF		0.033µF		0.033µF		
393	0.039µF		0.039µF		0.039µF		
473	0.047µF		0.047µF		0.047µF		
563	0.056µF		0.056µF		0.056µF		
683	0.068µF		0.068µF		0.068µF		
823	0.082µF		0.082µF		0.082µF		
104	0.1µF		0.1µF		0.1µF		
124	0.12µF		0.12µF		0.12µF		
154	0.15µF		0.15µF				
184	0.18µF		0.18µF				
224	0.22µF		0.22µF				
274	0.27µF		0.27µF				
334	0.33µF		0.33µF				
394	0.39µF		0.39µF				
474	0.47µF		0.47µF				
564	0.56µF		0.56µF				
684	0.68µF						
824	0.82µF						
105	1.0µF						
125	1.2µF						
155	1.5µF						
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

Table 1D – Series C34X (0.200" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
C340	0.200 (5.08)	0.400 (10.16)	0.460 (11.68)	0.150 (3.81)	0.020 (0.51)	0.276 (7.00)	
C346	0.200 (5.08)	0.400 (10.16)	0.590 (14.97)	0.150 (3.81)	0.020 (0.51)	0.200 (5.08)	
Dielectric	X7R						
Voltage Code	5		1		2		Cap Tol
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
683	0.068μF		0.068μF		0.068μF		J, K, M
823	0.082μF		0.082μF		0.082μF		
104	0.1μF		0.1μF		0.1μF		
124	0.12μF		0.12μF		0.12μF		
154	0.15μF		0.15μF		0.15μF		
184	0.18μF		0.18μF		0.18μF		
224	0.22μF		0.22μF		0.22μF		
274	0.27μF		0.27μF		0.27μF		
334	0.33μF		0.33μF				
394	0.39μF		0.39μF				
474	0.47μF		0.47μF				
564	0.56μF		0.56μF				
684	0.68μF		0.68μF				
824	0.82μF		0.82μF				
105	1.0μF		1.0μF				
125	1.2μF						
155	1.5μF						
185	1.8μF						
225	2.2μF						
Cap Code	Available Capacitance						
Rated Voltage (VDC)	50		100		200		Cap Tol
Voltage Code	5		1		2		

Table 1E – Series C35X (0.400" Lead Spacing)

Style/Size	Dimensions - In. (mm)						
	S Nom.	L Max.	H Max.	T Max.	LD Nom.	LL Min.	
	C350	0.400 (10.16)	0.500 (12.70)	0.560 (14.22)	0.200 (5.08)	0.025 (0.64)	
C356	0.400 (10.16)	0.500 (12.70)	0.670 (17.02)	0.200 (5.08)	0.025 (0.64)	0.200 (5.08)	
Dielectric	X7R						
Voltage Code	5		1		2		Cap Tol
Rated Voltage (VDC)	50		100		200		
Cap Code	Available Capacitance						
184	0.18μF		0.18μF		0.18μF		J, K, M
224	0.22μF		0.22μF		0.22μF		
274	0.27μF		0.27μF		0.27μF		
334	0.33μF		0.33μF		0.33μF		
394	0.39μF		0.39μF		0.39μF		
474	0.47μF		0.47μF		0.47μF		
564	0.56μF		0.56μF				
684	0.68μF		0.68μF				
824	0.82μF		0.82μF				
105	1.0μF		1.0μF				
125	1.2μF		1.2μF				
155	1.5μF						
185	1.8μF						
225	2.2μF						
275	2.7μF						
335	3.3μF						
395	3.9μF						
475	4.7μF						
Cap Code	Available Capacitance						Cap Tol
Rated Voltage (VDC)	50		100		200		
Voltage Code	5		1		2		

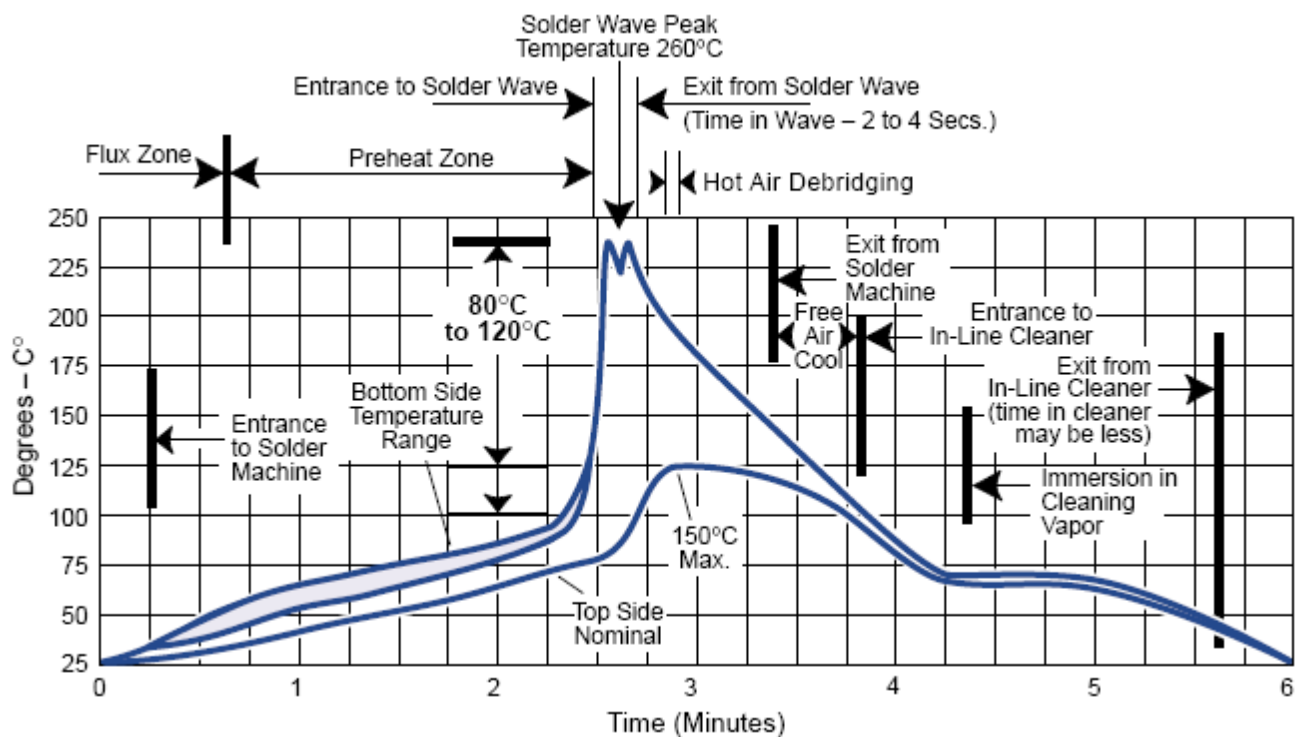
Soldering Process

Recommended Soldering Technique:

- Solder Wave
- Hand Soldering (Manual)

Recommended Soldering Profile:

- Optimum Wave Solder Profile
- Hand Soldering (Manual)



KEMET recommends following the guidelines and techniques outlined in technical bulletins F2103 and F9207.

Manual Solder Profile with Pre-heating (Recommended)

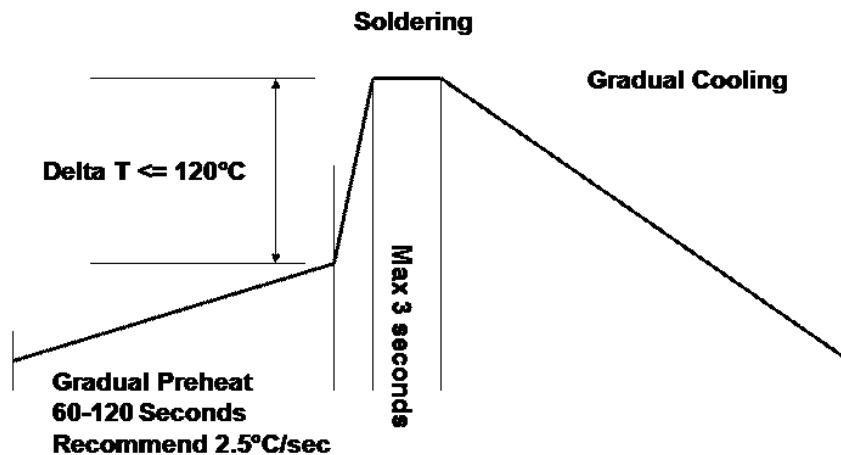


Table 2 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
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	1000 cycles (-55°C to +125°C), Measurement at 24 hours. +/- 2 hours 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 hours. +/- 2 hours after test conclusion.
		Low Volt Humidity: 1000 hours 85°C/85%RH and 1.5V. Add 100K ohm resistor. Measurement at 24 hours. +/- 2 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 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 / EIA -198	1000 hours at 125°C (85°C for X5R, Z5U and Y5V) with 2 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	150°C, 0VDC, for 1000 hours.
Vibration	MIL-STD-202 Method 204	5g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000 Hz.
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B. No pre-heat of samples. Note: single wave solder - procedure 2.
Terminal Strength	MIL-STD-202 Method 211	Conditions A (2.3kg or 5 lbs)
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 and 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. In addition, 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.

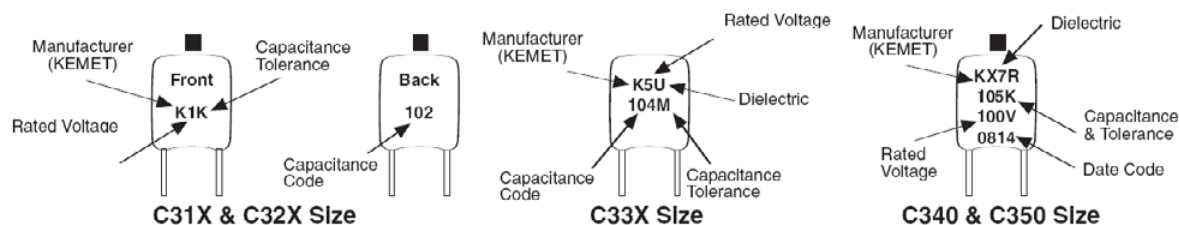
Packaging Details

Lead Spacing	Component Pitch (P1)
0.100 (2.54)	5.08
0.200 (5.08)	3.81
0.400 (10.16)	7.62
0.170 (4.32)	
0.220 (5.59)	
0.275 (6.98)	
0.300 (7.62)	
0.375 (9.52)	
0.475 (12.06)	
0.575 (14.60)	
0.675 (17.14)	

Packaging Quantities

Style/Size	Standard Bulk Quantity	Ammo Pack Quantity Max.	Reel Quantity Max. (12" Reel)
315	500/Bag	2500	2500
316			
317			
318			
320			
321			
322			
323			
324			
325			
326			
327			
328			
330			
331	250/Bag	1500	1500
333			
335			
336			
340	100/Bag	1000	1000
346			
350	50/Bag	N/A	500
356			

Marking



Application Notes

These devices are not recommended for use in overmold applications and/or processes.

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Paris, France
Tel: 33-1-4646-1009

Sasso Marconi, Italy
Tel: 39-051-939111

Milan, Italy
Tel: 39-02-57518176

Rome, Italy
Tel: 39-06-23231718

Madrid, Spain
Tel: 34-91-804-4303

Central Europe

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Dortmund, Germany
Tel: 49-2307-3619672

Kwidzyn, Poland
Tel: 48-55-279-7025

Northern Europe

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Tel: 44-1279-757201

Weymouth, United Kingdom
Tel: 44-1305-830747

Coatbridge, Scotland
Tel: 44-1236-434455

Färjestaden, Sweden
Tel: 46-485-563934

Espoo, Finland
Tel: 358-9-5406-5000

Asia

Northeast Asia

Hong Kong
Tel: 852-2305-1168

Shenzhen, China
Tel: 86-755-2518-1306

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

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

Taipei, Taiwan
Tel: 886-2-27528585

Southeast Asia

Singapore
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	http://capacitoredge.kemet.com
SPICE & FIT Software	http://www.kemet.com/spice
Search Our FAQs: KnowledgeEdge	http://www.kemet.com/keask

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

Product Request	
Resource	Location
Sample Request	http://www.kemet.com/sample
Engineering Kit Request	http://www.kemet.com/kits

Contact	
Resource	Location
Website	www.kemet.com
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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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