Surface Mount Multilayer Ceramic Chip Capacitors (SMD MLCCs)

High Voltage X7R Dielectric, 500 – 3,000 VDC (Commercial Grade)

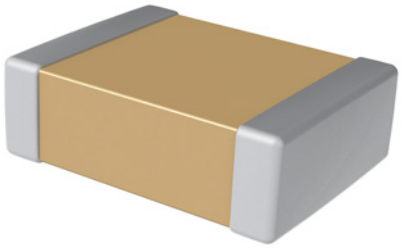
Overview

KEMET's High Voltage surface mount MLCCs in X7R Dielectric feature a 125°C maximum operating temperature and are considered "temperature stable." The Electronics Industries Alliance (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 ±15% from −55°C to +125°C.

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

Applications

- Charging stations
- LCD fluorescent backlight ballasts
- Voltage multiplier circuits
- DC/DC converters
- Power supply
- LAN/WAN interface
- High voltage decoupling
- Filters
- DC blocking
- ESD Protection



Ordering Information

C	1210	C	154	K	C	R	A	C	TU
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Dielectric	Failure Rate/Design	Termination Finish[1]	Packaging/ Grade (C-Spec)
	0402 0603 0805 1206 1210 1808 1812 1825 2220 2225	C = Standard	Two significant digits and number of zeros.	J = ±5% K = ±10% M = ±20%	C = 500 B = 630 D = 1,000 F = 1,500 G = 2,000 Z = 2,500 H = 3,000	R = X7R	A = N/A	C = 100% Matte Sn L = SnPb (5% Pb minimum)	See "Packaging C-Spec Ordering Options Table"

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

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Packaging C-Spec Ordering Options Table

Packaging Type[1]	Packaging/Grade Ordering Code (C-Spec)
Bulk Bag/Unmarked	Not required (Blank)
7" Reel/Unmarked	TU
13" Reel/Unmarked	7411 (EIA 0603 and smaller case sizes) 7210 (EIA 0805 and larger case sizes)
7" Reel/Marked	TM
13" Reel/Marked	7040 (EIA 0603) 7215 (EIA 0805 and largSer case sizes)

[1] Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging.

[1] The terms "Marked" and "Unmarked" pertain to laser marking option of capacitors. All packaging options labeled as "Unmarked" will contain capacitors that have not been laser marked. Please contact KEMET if you require a laser marked option. For more information see "Capacitor Marking".

Benefits

- −55°C to +125°C operating temperature range
- Industry-leading CV values
- Exceptional performance at high frequencies
- Lead (Pb)-free, RoHS and REACH compliant
- EIA 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, and 2225 case sizes
- DC voltage ratings of 500 V, 630 V, 1 KV, 1.5 KV, 2 KV, 2.5 KV, and 3 KV
- Capacitance offerings ranging from 10 pF to 560 nF
- Available capacitance tolerances of ±5%, ±10%, and ±20%
- Low ESR and ESL
- Non-polar device, minimizing installation concerns
- Automotive (AEC–Q200) Grade available
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb plated termination finish option available upon request (5% Pb minimum)

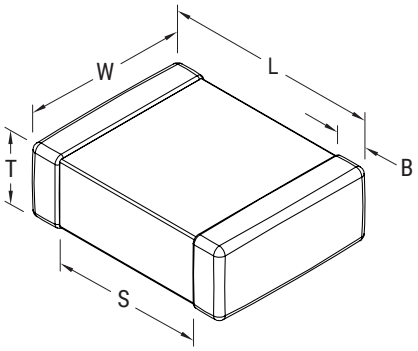
Applications

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

Application Note

X7R dielectric is not recommended for AC line filtering or pulse applications. These capacitors and/or the assembled circuit board containing these capacitors may require a protective surface coating to prevent external surface arcing.

Dimensions – Millimeters (Inches)



EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	B Bandwidth	S Separation Minimum	Mounting Technique
0402	1005	1.00 (0.040) ±0.05 (0.002)	0.50 (0.020) ±0.05 (0.002)	See Table 2 for Thickness	0.30 (0.012) ±0.10 (0.004)	0.30 (0.012)	Solder Reflow Only
0603	1608	1.60 (0.063) ±0.15 (0.006)	0.80 (0.032) ±0.15 (0.006)		0.35 (0.014) ±0.15 (0.006)	0.50 (0.020)	Solder Wave or Solder Reflow
0805	2012	2.00 (0.079) ±0.20 (0.008)	1.25 (0.049) ±0.20 (0.008)		0.50 (0.02) ±0.25 (0.010)	0.70 (0.028)	
1206	3216	3.20 (0.126) ±0.20 (0.008)	1.60 (0.063) ±0.20 (0.008)		0.50 (0.02) ±0.25 (0.010)	1.50 (0.060)	
1210	3225	3.20 (0.126) ±0.20 (0.008)	2.50 (0.098) ±0.20 (0.008)		0.50 (0.02) ±0.25 (0.010)	1.50 (0.060)	Solder Reflow Only
1808	4520	4.70 (0.185) ±0.50 (0.020)	2.00 (0.079) ±0.20 (0.008)		0.60 (0.024) ±0.35 (0.014)	2.90 (0.114)	
1812	4532	4.50 (0.177) ±0.30 (0.012)	3.20 (0.126) ±0.30 (0.012)		0.60 (0.024) ±0.35 (0.014)	2.30 (0.091)	
1825	4564	4.50 (0.177) ±0.30 (0.012)	6.40 (0.252) ±0.40 (0.016)		0.60 (0.024) ±0.35 (0.014)	2.30 (0.091)	
2220	5650	5.70 (0.224) ±0.40 (0.016)	5.00 (0.197) ±0.40 (0.016)		0.60 (0.024) ±0.35 (0.014)	3.50 (0.138)	
2225	5664	5.60 (0.220) ±0.40 (0.016)	6.40 (0.248) ±0.40 (0.016)		0.60 (0.024) ±0.35 (0.014)	3.20 (0.126)	

Qualification/Certification

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

Environmental Compliance

Lead (Pb)-free, RoHS, and REACH compliant without exemptions (excluding SnPb termination finish option).

Table 1A – Capacitance Range/Selection Waterfall (0603 – 1812 Case Sizes)

Cap	Cap Code	Case Size/ Series	C0402C	C0603C			C0805C			C1206C					C1210C					C1808C							C1812C[2]						
		Voltage Code	C	C	B	D	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
		Rated Voltage (VDC)	500	500	630	1000	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
		Capacitance Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																														
10 pF	100	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
11 pF	110	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
12 pF	120	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
13 pF	130	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
15 pF	150	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
16 pF	160	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
18 pF	180	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
20 pF	200	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
22 pF	220	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
24 pF	240	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
27 pF	270	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
30 pF	300	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
33 pF	330	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
36 pF	360	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
39 pF	390	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
43 pF	430	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
47 pF	470	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
51 pF	510	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
56 pF	560	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
62 pF	620	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
68 pF	680	J K M					DG	DG	DG	ED	ED	ED	ED	ED	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
75 pF	750	J K M					DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
82 pF	820	J K M					DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
91 pF	910	J K M					DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LB	LB	GK	GK	GK	GK	GK	GK	GK
100 pF	101	J K M					DG	DG	DG	ED	ED	ED	ED	EF	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
110 pF	111	J K M					DG	DG	DG	ED	ED	ED	ED	EG	FM	FM	FM	FM	FM	LB	LB	LB	LB	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
120 pF	121	J K M					DG	DG	DG	ED	ED	ED	ED	EG	FM	FM	FM	FM	FM	LA	LA	LA	LA	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
130 pF	131	J K M					DG	DG	DG	ED	ED	ED	ED	EG	FG	FG	FG	FM	FM	LA	LA	LA	LA	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
150 pF	151	J K M					DG	DG	DG	ED	ED	ED	EF	EG	FG	FG	FG	FM	FM	LA	LA	LA	LA	LB	LC	LB	GK	GK	GK	GK	GK	GK	GK
180 pF	181	J K M					DG	DG	DG	ED	ED	ED	EF	EG	FG	FG	FG	FM	FM	LA	LA	LA	LA	LC	LC	LB	GK	GK	GK	GK	GK	GK	GK
220 pF	221	J K M					DG	DG	DG	ED	ED	ED	EF	EF	FG	FG	FG	FM	FM	LA	LA	LA	LA	LC	LC	LB	GH	GH	GH	GH	GH	GK	GK
270 pF	271	J K M					DG	DG	DG	ED	ED	ED	EF	EF	FG	FG	FG	FK	FK	LA	LA	LA	LB	LC	LC	LC	GH	GH	GH	GH	GH	GK	GK
330 pF	331	J K M					DG	DG	DG	ED	ED	EF	EF	EF	FG	FG	FG	FK	FK	LA	LA	LA	LB	LC	LC	LC	GH	GH	GH	GH	GH	GK	GK
390 pF	391	J K M					DG	DG	DG	ED	ED	EF	EF	EF	FG	FG	FG	FK	FS	LA	LA	LA	LB	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK
470 pF	471	J K M					DG	DG	DG	ED	ED	EF	EF	EF	FG	FM	FM	FS	FS	LA	LB	LB	LC	LB	LB	LC	GK	GK	GK	GK	GK	GK	GK
560 pF	561	J K M					DG	DG	DG	ED	ED	EF	EF	EF	FG	FM	FM	FS	FL	LA	LB	LB	LC	LB	LB	LC	GH	GH	GH	GK	GH	GK	GK
680 pF	681	J K M					DG	DG	DG	ED	ED	EF	EF	EF	FG	FM	FM	FS	FL	LB	LB	LB	LA	LB	LC	LC	GH	GH	GH	GK	GH	GK	GK
820 pF	821	J K M					DG	DG	DG	ED	ED	ED	EF	EF	FG	FM	FM	FL	FL	LB	LB	LB	LA	LB	LC	LC	GH	GH	GH	GK	GH	GK	GK
1,000 pF	102	J K M	BB	CG	CG	CG	DG	DG	DG	ED	ED	ED	EF	EF	FM	FM	FM	FL	FL	LB	LB	LB	LA	LB	LC	LC	GH	GH	GH	GH	GH	GK	GK
1,200 pF	122	J K M	BB	CG	CG		DG	DG	DG	ED	ED	ED	EG	EG	FM	FK	FK	FL	FM	LC	LC	LC	LB	LC	LA		GH	GK	GK	GH	GH	GK	GK
1,500 pF	152	J K M	BD	CG	CG		DG	DG	DG	ED	ED	ED	EG	EG	FK	FS	FS	FL	FM	LC	LC	LC	LB	LC	LB		GK	GK	GK	GH	GH	GK	
1,800 pF	182	J K M		CG			DG	DG	DG	ED	ED	ED	EG	EG	FK	FS	FS	FL	FM	LC	LC	LC	LB	LC	LC		GK	GK	GK	GH	GH	GK	
2,200 pF	222	J K M		CG			DG	DG	DG	ED	ED	ED	EG	EG	FK	FL	FL	FL	FM	LC	LA	LA	LB	LC	LC		GK	GK	GK	GH	GH	GK	
2,700 pF	272	J K M		CG			DG	DG	DG	ED	ED	ED	EG		FS	FL	FL	FL	FM	LC	LA	LA	LB	LC			GK	GH	GH	GH	GK	GM	
3,300 pF	332	J K M		CG			DG	DG	DG	ED	ED	ED	EG		FS	FL	FL	FL	FM	LA	LA	LA	LB	LA			GK	GH	GH	GH	GK	GM	
3,900 pF	392	J K M		CG			DG	DG	DG	ED	ED	ED	EG		FL	FL	FL	FL	FK	LA	LA	LA	LB	LB			GK	GH	GH	GH	GM	GO	
4,700 pF	472	J K M					DG	DG	DG	ED	ED	ED	EG		FL	FL	FL	FL	FK	LA	LA	LA	LB	LC			GH	GH	GH	GH	GH	GO	
5,600 pF	562	J K M					DG	DG		ED	EF	EF	EF		FL	FL	FL	FM	FK	LA	LB	LB	LC				GH	GH	GH	GK	GK		
6,800 pF	682	J K M					DG	DG		EF	EF	EF	EF		FL	FL	FL	FM	FS	LA	LB	LB	LC				GH	GH	GH	GK	GM		
8,200 pF	822	J K M					DG	DG		EF	EG	EG	EF		FL	FL	FL	FK		LA	LB	LB	LC				GH	GH	GH	GK	GM		
10,000 pF	103	J K M					DG	DG		EF	EG	EG	EG		FL	FL	FL	FK		LA	LB	LB	LC				GH	GH	GH	GK	GO		
Cap	Cap Code	Rated Voltage (VDC)	500	500	630	1000	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	C	B	D	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
		Case Size/ Series	C0402C	C0603C			C0805C			C1206C					C1210C					C1808C							C1812C[2]						

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).

[2] *Available capacitance values available in X7R with KONNEKT Technology.*

Table 1A – Capacitance Range/Selection Waterfall (0603 – 1812 Case Sizes) cont.

Cap	Cap Code	Case Size/ Series	C0402C	C0603C			C0805C			C1206C					C1210C					C1808C							C1812C[2]						
		Voltage Code	C	C	B	D	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
		Rated Voltage (VDC)	500	500	630	1000	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
		Capacitance Tolerance	Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																														
12,000 pF	123	J K M					DG	DG		EG	EJ	EJ			FL	FL	FL	FK		LA	LC	LC	LB				GH	GK	GK	GK			
15,000 pF	153	J K M					DG			EG	EJ	EJ			FL	FL	FL	FL		LA	LC	LC	LC				GH	GK	GK	GH			
18,000 pF	183	J K M					DG			EJ	EJ	EJ			FL	FL	FL	FM		LA	LE	LE					GH	GK	GK	GM			
22,000 pF	223	J K M					DG			EJ	EJ	EJ			FL	FM	FM	FM		LA	LE	LE					GH	GK	GK	GM			
27,000 pF	273	J K M								EJ	EJ				FM	FK	FK	FK		LA	LA	LA					GH	GB	GB	GO			
33,000 pF	333	J K M								EJ	EJ				FM	FG	FH	FS		LC	LA	LA					GH	GB	GB	GO			
39,000 pF	393	J K M								EJ					FK	FG	FH	FS		LC	LA	LA					GH	GB	GB				
47,000 pF	473	J K M								EJ					FK	FH	FK			LC	LA	LB					GH	GB	GC				
56,000 pF	563	J K M								EJ					FG	FH	FK			LC	LA	LB					GH	GB	GE				
68,000 pF	683	J K M								EJ					FG	FK	FS			LA	LA	LC					GE	GE	GE				
82,000 pF	823	J K M													FH	FK				LA	LC						GB	GE	GK				
0.10 µF	104	J K M													FK	FS				LA	LC						GB	GH	GJ				
0.12 µF	124	J K M													FK					LA							GE	GK					
0.15 µF	154	J K M													FK					LB							GE	GN					
0.18 µF	184	J K M																									GF						
0.22 µF	224	J K M																									GJ						
0.27 µF	274	J K M																									GL						
0.33 µF	334	J K M																									GS						
		Rated Voltage (VDC)	500	500	630	1000	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	Cap Code	Voltage Code	C	C	B	D	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
		Case Size/ Series	C0402C	C0603C			C0805C			C1206C					C1210C					C1808C							C1812C[2]						

Table 1B – Capacitance Range/Selection Waterfall (1825–2225 Case Sizes)

Capacitance	Cap Code	Case Size/ Series	C1825C							C2220C							C2225C						
		Voltage Code	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H
		Rated Voltage (VDC)	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Capacitance 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	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
110 pF	111	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
120 pF	121	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
130 pF	131	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
150 pF	151	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
180 pF	181	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
220 pF	221	J K M	HE	HE	HE	HE	HE	HE	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KF	KF	KF
270 pF	271	J K M	HE	HE	HE	HE	HE	HE	HG	JK	JK	JK	JK	JK	JK	JK	KE	KE	KE	KE	KE	KE	KF
330 pF	331	J K M								JE	JE	JE	JE	JE	JK	JK	KE	KE	KE	KE	KE	KE	KF
390 pF	391	J K M								JE	JE	JE	JE	JE	JK	JK	KE	KE	KE	KE	KE	KE	KF
470 pF	471	J K M	HG	HG	HG	HG	HG	HG	HG	JE	JE	JE	JE	JE	JK	JK	KF	KF	KF	KF	KE	KE	KF
560 pF	561	J K M	HG	HG	HG	HG	HG	HG	HG	JK	JK	JK	JK	JK	JK	JK	KF	KF	KF	KF	KE	KE	KF
680 pF	681	J K M	HG	HG	HG	HG	HG	HG	HG	JE	JE	JE	JK	JK	JK	JK	KF	KF	KF	KF	KE	KF	KF
820 pF	821	J K M	HG	HG	HG	HG	HG	HG	HG	JE	JE	JE	JK	JK	JK	JK	KE	KE	KE	KF	KE	KF	KF
		Rated Voltage (VDC)	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
Capacitance	Cap Code	Voltage Code	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H
		Case Size/ Series	C1825C							C2220C							C2225C						

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).

[2] *Available capacitance values available in X7R with KONNEKT Technology.*

Table 1B – Capacitance Range/Selection Waterfall (1825 – 2225 Case Sizes) cont.

Capacitance	Cap Code	Case Size/ Series			C1825C							C2220C							C2225C						
		Voltage Code			C	B	D	F	G	Z	H	C	B	D	F	G	Z	H	C	B	D	F	G	Z	H
		Rated Voltage (VDC)			500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000	500	630	1000	1500	2000	2500	3000
		Capacitance Tolerance			Product Availability and Chip Thickness Codes – See Table 2 for Chip Thickness Dimensions																				
1,000 pF	102	J	K	M	HG	HG	HG	HG	HG	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KE	KF	KF
1,200 pF	122	J	K	M	HG	HG	HG	HG	HG	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KF	KF	KF
1,500 pF	152	J	K	M	HG	HG	HG	HG	HG	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KF	KF	KF
1,800 pF	182	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JK	JK	JK	JK	JK	JK	KE	KE	KE	KF	KF	KF	KF
2,200 pF	222	J	K	M	HE	HE	HE	HE	HE	HG	HG	JE	JK	JK	JE	JE	JK	JK	KF	KE	KE	KF	KF	KF	KF
2,700 pF	272	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JE	JK	JK	KE	KE	KE	KE	KE	KF	KE
3,300 pF	332	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JE	JK	JE	KE	KE	KE	KE	KE	KF	KE
3,900 pF	392	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JE	JK	JE	KE	KF	KF	KE	KE	KF	KE
4,700 pF	472	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JK	JE	JE	KE	KF	KF	KE	KE	KF	KE
5,600 pF	562	J	K	M	HE	HE	HE	HE	HE	HG		JK	JK	JK	JE	JK	JE	JE	KE	KF	KF	KE	KE	KF	KE
6,800 pF	682	J	K	M	HE	HE	HE	HE	HE	HJ		JK	JE	JE	JE	JK	JE	JE	KE	KF	KF	KE	KF	KE	KE
8,200 pF	822	J	K	M	HE	HE	HE	HE	HE	HJ		JK	JE	JE	JE	JK	JK	JK	KF	KE	KE	KE	KF	KF	KF
10,000 pF	103	J	K	M	HE	HE	HE	HE	HJ	HK		JE	JE	JE	JE	JL	JL	JL	KF	KE	KE	KE	KF	KH	KH
12,000 pF	123	J	K	M	HE	HE	HE	HG	HJ			JE	JK	JK	JK	JL	JL	JL	KE	KE	KE	KE	KF	KH	KH
15,000 pF	153	J	K	M	HE	HE	HE	HG	HK			JE	JK	JK	JK	JL	JN	JN	KE	KE	KE	KE	KF	KJ	KJ
18,000 pF	183	J	K	M	HE	HE	HE	HG				JE	JK	JK	JK	JN			KE	KE	KE	KE	KH		
22,000 pF	223	J	K	M	HE	HG	HG	HG				JE	JK	JK	JK	JN			KE	KF	KF	KF	KJ		
27,000 pF	273	J	K	M	HE	HG	HG	HG				JE	JK	JK	JK				KE	KF	KF	KF	KJ		
33,000 pF	333	J	K	M	HE	HG	HG	HE				JE	JK	JK	JK				KE	KF	KF	KF			
39,000 pF	393	J	K	M	HE	HG	HG	HG				JE	JK	JK	JE				KE	KF	KF	KF			
47,000 pF	473	J	K	M	HE	HG	HG	HJ				JE	JK	JK	JK				KE	KF	KF	KF			
56,000 pF	563	J	K	M	HE	HG	HG	HJ				JE	JE	JE	JL				KE	KF	KF	KF			
68,000 pF	683	J	K	M	HG	HJ	HJ	HK				JE	JK	JK	JL				KE	KF	KF	KJ			
82,000 pF	823	J	K	M	HG	HJ	HJ					JE	JL	JL	JN				KE	KF	KF	KJ			
0.10 µF	104	J	K	M	HG	HK	HK					JE	JN	JN					KE	KH	KH	KJ			
0.12 µF	124	J	K	M	HG	HE						JE	JN	JN					KE	KH	KH				
0.15 µF	154	J	K	M	HG	HE						JK	JE						KF	KJ	KJ				
0.18 µF	184	J	K	M	HG	HG						JK	JE						KF	KE					
0.22 µF	224	J	K	M	HG	HJ						JK	JK						KF	KF					
0.27 µF	274	J	K	M	HJ	HJ						JK	JL						KF	KH					
0.33 µF	334	J	K	M	HJ							JL	JN						KF	KH					
0.39 µF	394	J	K	M	HK							JN							KH	KJ					
0.47 µF	474	J	K	M								JN							KH	KJ					
0.56 µF	564	J	K	M															KJ						
Capacitance	Cap Code	Rated Voltage (VDC)			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
		Case Size/ Series			C1825C							C2220C							C2225C						

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 2A – Chip Thickness/Tape & Reel Packaging Quantities

Thickness Code	Case Size[1]	Thickness ± Range (mm)	Paper Quantity		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
BB	0402	0.50 ± 0.05	10000	50000	0	0
BD	0402	0.55 ± 0.05	10000	50000	0	0
CG	0603	0.80 ± 0.10	4,000	15,000	0	0
DG	0805	1.25 ± 0.15	0	0	2,500	10,000
ED	1206	1.00 ± 0.10	0	0	2,500	10,000
EF	1206	1.20 ± 0.15	0	0	2,500	10,000
EG	1206	1.60 ± 0.15	0	0	2,000	8,000
EJ	1206	1.70 ± 0.20	0	0	2,000	8,000
FG	1210	1.25 ± 0.15	0	0	2,500	10,000
FL	1210	1.40 ± 0.15	0	0	2,000	8,000
FH	1210	1.55 ± 0.15	0	0	2,000	8,000
FM	1210	1.70 ± 0.20	0	0	2,000	8,000
FK	1210	2.10 ± 0.20	0	0	2,000	8,000
FS	1210	2.50 ± 0.30	0	0	1,000	4,000
LE	1808	1.00 ± 0.10	0	0	2,500	10,000
LA	1808	1.40 ± 0.15	0	0	1,000	4,000
LB	1808	1.60 ± 0.15	0	0	1,000	4,000
LC	1808	2.00 ± 0.15	0	0	1,000	4,000
GB	1812	1.00 ± 0.10	0	0	1,000	4,000
GC	1812	1.10 ± 0.10	0	0	1,000	4,000
GE	1812	1.30 ± 0.10	0	0	1,000	4,000
GH	1812	1.40 ± 0.15	0	0	1,000	4,000
GF	1812	1.50 ± 0.10	0	0	1,000	4,000
GK	1812	1.60 ± 0.20	0	0	1,000	4,000
GJ	1812	1.70 ± 0.15	0	0	1,000	4,000
GN	1812	1.70 ± 0.20	0	0	1,000	4,000
GL	1812	1.90 ± 0.20	0	0	500	2,000
GM	1812	2.00 ± 0.20	0	0	500	2,000
GS	1812	2.10 ± 0.20	0	0	500	2,000
GO	1812	2.50 ± 0.20	0	0	500	2,000
HE	1825	1.40 ± 0.15	0	0	1,000	4,000
HG	1825	1.60 ± 0.20	0	0	1,000	4,000
HJ	1825	2.00 ± 0.20	0	0	500	2,000
HK	1825	2.50 ± 0.20	0	0	500	2,000
JE	2220	1.40 ± 0.15	0	0	1,000	4,000
JK	2220	1.60 ± 0.20	0	0	1,000	4,000
JL	2220	2.00 ± 0.20	0	0	500	2,000
JN	2220	2.50 ± 0.20	0	0	500	2,000
KE	2225	1.40 ± 0.15	0	0	1,000	4,000
KF	2225	1.60 ± 0.20	0	0	1,000	4,000
KH	2225	2.00 ± 0.20	0	0	500	2,000
KJ	2225	2.50 ± 0.20	0	0	500	2,000
Thickness Code	**Case Size[1]**	**Thickness ± Range (mm)**	**7" Reel**	**13" Reel**	**7" Reel**	**13" Reel**
			Paper Quantity[1]		**Plastic Quantity**	

Package quantity based on finished chip thickness specifications.

Table 2B – Bulk Packaging Quantities

Packaging Type		Loose Packaging	
		Bulk Bag (default)	
Packaging C-Spec[1]		N/A[2]	
Case Size		Packaging Quantities (pieces/unit packaging)	
EIA (in)	Metric (mm)	Minimum	Maximum
0402	1005	1	50,000
0603	1608		
0805	2012		
1206	3216		
1210	3225		
1808	4520		20,000
1812	4532		
1825	4564		
2220	5650		
2225	5664		

[1] *The "Packaging C-Spec" is a 4 to 8 digit code which identifies the packaging type and/or product grade. When ordering, the proper code must be included in the 15th through 22nd character positions of the ordering code. See "Ordering Information" section of this document for further details. Commercial Grade product ordered without a packaging C-Spec will default to our standard "Bulk Bag" packaging. Contact KEMET if you require a bulk bag packaging option for Automotive Grade products.*

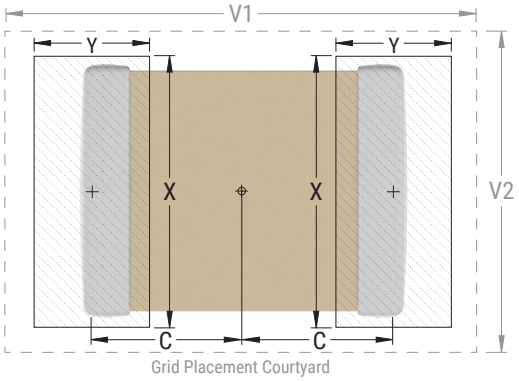
[2] *A packaging C-Spec (see note 1 above) is not required for "Bulk Bag" packaging (excluding Anti-Static Bulk Bag and Automotive Grade products). The 15th through 22nd character positions of the ordering code should be left blank. All product ordered without a packaging C-Spec will default to our standard "Bulk Bag" packaging.*

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
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	1.50	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).*

Image below based on Density Level B for an EIA 1210 case size.



Soldering Process

Recommended Soldering Technique:

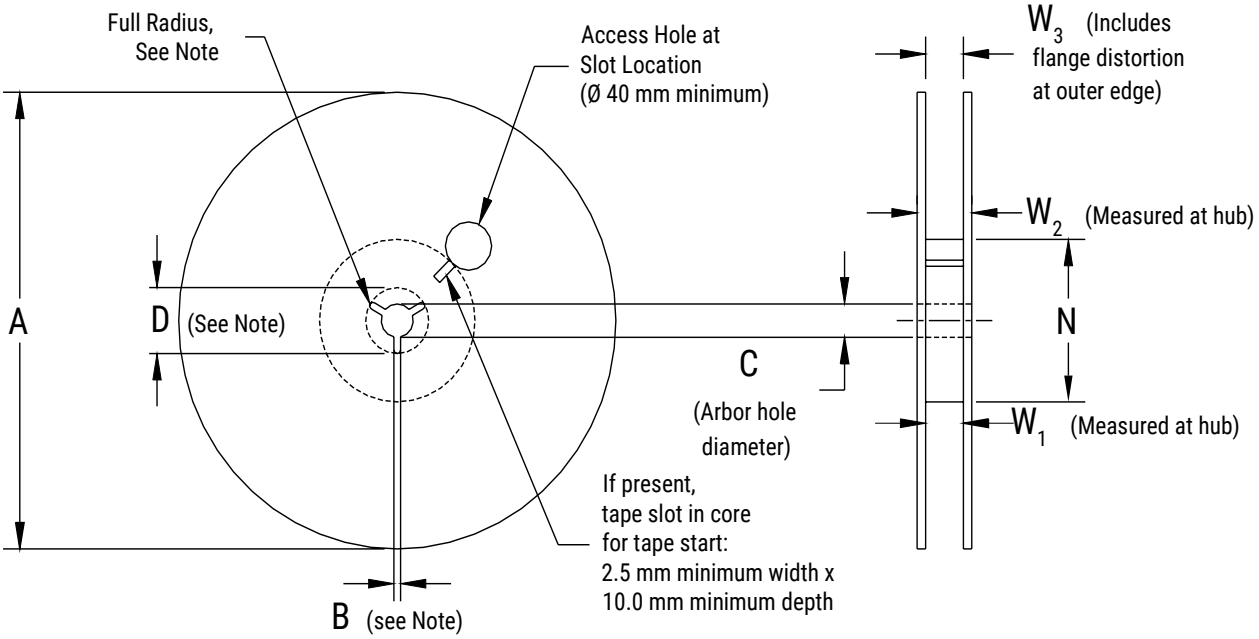
- Solder wave or solder reflow for EIA case sizes 0603, 0805 and 1206
- All other EIA case sizes are limited to solder reflow only

Recommended Reflow Soldering Profile:

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

Profile Feature	Termination Finish	
	SnPb	100% Matte Sn
Preheat/Soak		
Temperature Minimum (T_{Smin})	100°C	150°C
Temperature Maximum (T_{Smax})	150°C	200°C
Time (t_S) from T_{Smin} to T_{Smax}	60 – 120 seconds	60 – 120 seconds
Ramp-Up Rate (T_L to T_P)	3°C/second maximum	3°C/second maximum
Liquidous Temperature (T_L)	183°C	217°C
Time Above Liquidous (t_L)	60 – 150 seconds	60 – 150 seconds
Peak Temperature (T_P)	235°C	260°C

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 Minimum	C	D Minimum
8 mm	178 ±0.20 (7.008 ±0.008) or 330 ±0.20 (13.000 ±0.008)	1.5 (0.059)	13.0 +0.5/−0.2 (0.521 +0.02/−0.008)	20.2 (0.795)
12 mm				
16 mm				

Variable Dimensions — Millimeters (Inches)				
Tape Size	N Minimum	W_1	W_2 Maximum	W_3
8 mm	50 (1.969)	8.4 +1.5/−0.0 (0.331 +0.059/−0.0)	14.4 (0.567)	Shall accommodate tape width without interference
12 mm		12.4 +2.0/−0.0 (0.488 +0.078/−0.0)	18.4 (0.724)	
16 mm		16.4 +2.0/−0.0 (0.646 +0.078/−0.0)	22.4 (0.882)	

Figure 7 – Tape Leader & Trailer Dimensions

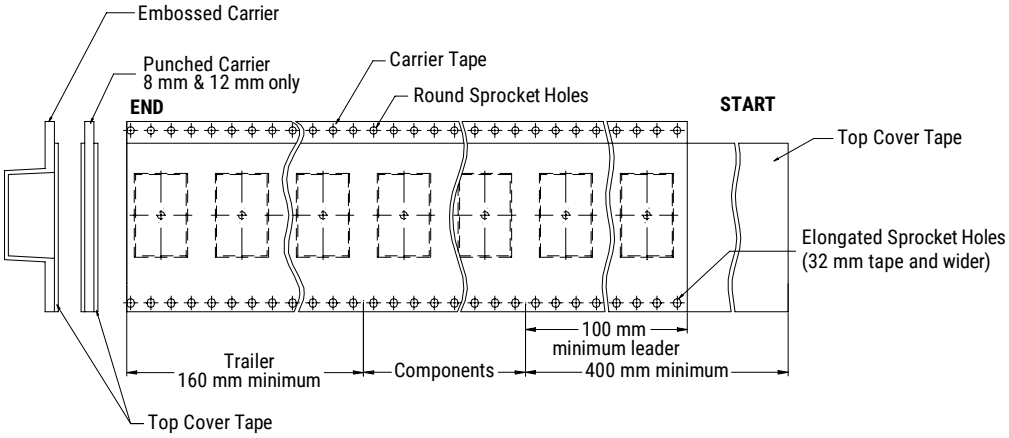
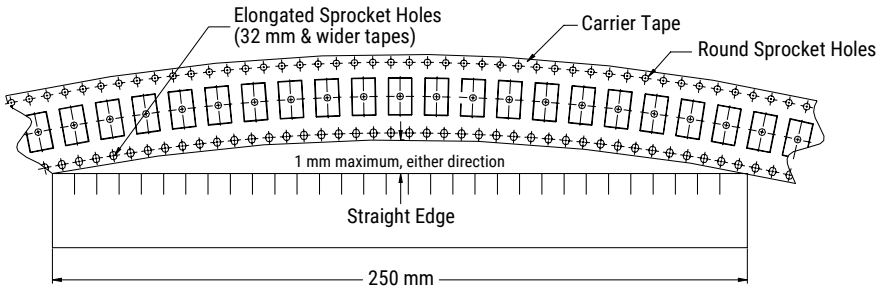


Figure 8 – Maximum Camber



Application Guide

Solder Fluxes and Cleaning

The use of water-soluble fluxes provides advantages of excellent solderability due to high activation. However, these fluxes contain organic acids that can induce arcing under high DC or AC voltages. Notable problem areas are underneath the MLCC where flux can be trapped between the ceramic material and PCB. It is therefore critical that PCBs are properly cleaned to remove all flux residue to maintain reliability.

Coating for High Voltage MLCCs

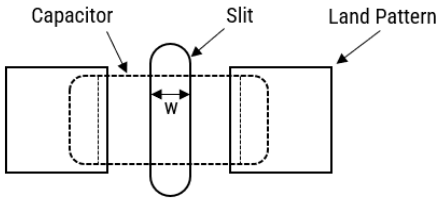
For MLCC ratings ≥1500V, it is recommended to apply a conformal coating to MLCC to prevent surface arcing. To reduce possibility of inducing cracks in the MLCC, select a coating with thermal expansions close to that of the MLCC.

Dielectric	CTE (ppm/°C)
Class II $BaTiO_3$	10.7
Class I $CaZrO_3$	9.8

Slits in PCB

It is recommended to apply a slit in the PCB under the MLCC to improve washing of flux residue that may get trapped underneath. In some cases, it is not possible to slit entirely through the PCB due to underlying metal planes. It is also acceptable to apply a recessed slit under the MLCC which will also promote cleaning.

- Recommended for case sizes ≥1206
- The width (w) of the slit should be 1mm
- Length of the slit should be as short as possible to prevent damaging the MLCC due to mechanical stress of the PCB.
- Slits also reduce the risk of solder balls under MLCC which decreased the creepage distance.



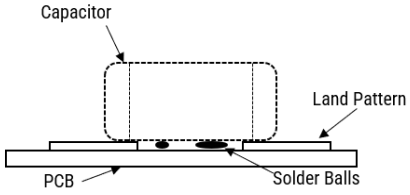
Solder Resist

If a slit cannot be applied as above, it is recommended to not use solder resist directly under the MLCC. The use of solder resist material reduces the distance between MLCC ceramic material and PCB thus making it difficult to clean.

Solder Balls

Improper reflow techniques and/or improper washing can induce solder balls under or adjacent to the MLCC. Solder balls reduce the creepage distance between the MLCC terminations and increase the risk of arcing or damage to the ceramic material. To reduce the risk of solder balls:

- Follow KEMET's solder recommendations as outlined in the datasheet.
- If performing a cleaning procedure, properly clean the PCB per KEMET's cleaning recommendations.
- Add slit to the PCB as shown above.



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