

Overview

The KEMET electrostatic discharge (ESD) rated commercial and automotive grade surface mount capacitors in X7R dielectric are suited for a variety of applications where electrostatic discharge (ESD) events during assembly or operation could damage the capacitor or the circuit. These ESD rated capacitors provide the ability to design within a given ESD criteria per the human body model (HBM) AEC Q200–002 criteria. The KEMET automotive grade capacitors also meet the other demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

The X7R dielectric features a 125°C maximum operating temperature and is 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 and for frequency discriminating circuits, where Q and stability of capacitance characteristics are not critical. The X7R dielectric exhibits a predictable change in capacitance with respect to time and voltage, and boasts a minimal change in capacitance compared to its value at 25°C.

Benefits

- AEC-Q200 automotive qualified
- ESD qualified per HBM - AEC Q200-002
- Available in package size EIA 0402, 0603, 0805, 1206
- DC Voltage ratings of 16 V, 25 V, 50 V, 63 V, 100 V, 200 V and 250 V
- Capacitance range from 1 nF to 2.2 μ F
- –55°C to +125°C operating temperature range
- Lead (Pb)-free, RoHS and REACH compliant
- Available capacitance tolerances of $\pm 5\%$, $\pm 10\%$ and $\pm 20\%$
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- Non-polar devices, minimizing installation concerns
- Flexible termination option available



Ordering Information

C	0603	C	104	J	3	R	E	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish ²	Packaging/ Grade (C-Spec)
	0402 0603 0805 1206	C = Standard X = Flexible Termination	Two significant digits and number of zeros	J = ±5% K = ±10% M = ±20%	4 = 16 3 = 25 5 = 50 M = 63 1 = 100 2 = 200 A = 250	R = X7R	E = ESD	C = 100% Matte Sn	See "Packaging C-Spec Ordering Options Table" below

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.Applications

Table 1A – Capacitance Range/Selection Waterfall

Capacitance	Cap Code	Case Size/ Series	C0402C			C0603C					
		Rated Voltage (VDC)	16	25	50	16	25	50	63	100	200
		Voltage Code	4	3	5	4	3	5	M	1	2
		Cap Tolerance	ESD Level per AEC-Q200								
1.0 nF	102	J = ±5% K = ±10% M = ±20%	2 kV	2 kV	2 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
1.5 nF	152		4 kV	4 kV	4 kV	12 kV	12 kV	12 kV	12 kV	12 kV	12 kV
2.2 nF	222		6 kV	6 kV	6 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
3.3 nF	332		8 kV	8 kV	8 kV	12 kV	12 kV	12 kV	12 kV	12 kV	12 kV
4.7 nF	472		8 kV	8 kV	8 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV
6.8 nF	682		4 kV	4 kV	4 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
10 nF	103		6 kV	6 kV	6 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
15 nF	153		6 kV	6 kV	6 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV
22 nF	223		8 kV	8 kV	8 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV
33 nF	333		8 kV	8 kV		25 kV	25 kV	25 kV	25 kV	25 kV	
47 nF	473		12 kV	12 kV		25 kV	25 kV	25 kV	25 kV	25 kV	
68 nF	683		12 kV			25 kV	25 kV	25 kV			
100 nF	104		16 kV			25 kV	25 kV	25 kV			
150 nF	154					25 kV	25 kV	25 kV			
220 nF	224					25 kV	25 kV				

Table 1A – Capacitance Range/Selection Waterfall (cont.)

Capacitance	Cap Code	Case Size/ Series	C0805C							C1206C						
			Rated Voltage (VDC)	16	25	50	63	100	200	250	16	25	50	63	100	200
		Voltage Code	4	3	5	M	1	2	A	4	3	5	M	1	2	A
		Cap Tolerance	ESD Level per AEC-Q200													
1.0 nF	102	J = ±5% K = ±10% M = ±20%	12 kV	12 kV	12 kV	12 kV	12 kV	12 kV	12 kV	4 kV	4 kV	4 kV	4 kV	4 kV	4 kV	4 kV
1.5 nF	152		4 kV	4 kV	4 kV	4 kV	4 kV	4 kV	4 kV	6 kV	6 kV	6 kV	6 kV	6 kV	6 kV	6 kV
2.2 nF	222		4 kV	4 kV	4 kV	4 kV	4 kV	4 kV	4 kV	8 kV	8 kV	8 kV	8 kV	8 kV	8 kV	8 kV
3.3 nF	332		16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV	16 kV
4.7 nF	472		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
6.8 nF	682		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
10 nF	103		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
15 nF	153		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
22 nF	223		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
33 nF	333		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
47 nF	473		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
68 nF	683		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
100 nF	104		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
150 nF	154		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
220 nF	224		25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	25 kV
330 nF	334		25 kV	25 kV	25 kV					25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	
470 nF	474		25 kV	25 kV	25 kV					25 kV	25 kV	25 kV	25 kV	25 kV	25 kV	
680 nF	684		25 kV	25 kV	25 kV					25 kV	25 kV	25 kV				
1.0 µF	105		25 kV	25 kV						25 kV	25 kV	25 kV				
1.5 µF	155		25 kV							25 kV	25 kV	25 kV				
2.2 µF	225		25 kV							25 kV	25 kV	25 kV				

Packaging C-Spec Ordering Options Table

Automotive C-Spec Information

KEMET 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. These products are supported by a Product Change Notification (PCN) and Production Part Approval Process warrant (PPAP).

Automotive products offered through our distribution channel have been assigned an inclusive ordering code C-Spec, “AUTO.” This C-Spec was developed in order to better serve small and medium-sized companies that prefer an automotive grade component without the requirement to submit a customer Source Controlled Drawing (SCD) or specification for review by a KEMET engineering specialist. This C-Spec is therefore not intended for use by KEMET OEM automotive customers and are not granted the same “privileges” as other automotive C-Specs. Customer PCN approval and PPAP request levels are limited (see details below.)

Product Change Notification (PCN)

The KEMET product change notification system is used to communicate primarily the following types of changes:

- Product/process changes that affect product form, fit, function, and/or reliability
- Changes in manufacturing site
- Product obsolescence

KEMET Automotive C-Spec	Customer Notification Due To:		Days Prior To Implementation
	Process/Product change	Obsolescence*	
KEMET assigned ¹	Yes (with approval and sign off)	Yes	180 days minimum
AUTO	Yes (without approval)	Yes	90 days minimum

¹ KEMET assigned C-Specs require the submittal of a customer SCD or customer specification for review. For additional information contact KEMET.

Production Part Approval Process (PPAP)

The purpose of the Production Part Approval Process is:

- To ensure that supplier can meet the manufacturability and quality requirements for the purchased parts.
- To provide the evidence that all customer engineering design records and specification requirements are properly understood and fulfilled by the manufacturing organization.
- To demonstrate that the established manufacturing process has the potential to produce the part.

KEMET Automotive C-Spec	PPAP (Product Part Approval Process) Level				
	1	2	3	4	5
KEMET assigned ¹	●	●	●	●	●
AUTO	○		○		

¹ KEMET assigned C-Specs require the submittal of a customer SCD or customer specification for review. For additional information contact KEMET.

- Part number specific PPAP available
- Product family PPAP only

Qualification/Certification

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

Automotive grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC–Q200, please visit their website at www.aecouncil.com.

Environmental Compliance

Lead (Pb)-free, RoHS, and REACH compliant without exemptions.

Electrical Parameters/Characteristics

Post Environmental Limits

Post Environmental Limits					
Dielectric	Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
0603	< 16	All	7.5	±20%	10% of Initial limit
	16/25		5.0		
	> 25		3.0		

Dissipation Factor Limit Table

EIA Case Size	Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)
All	16/25	All	3.5
	> 25		2.5

Insulation Resistance (IR) Limits Table

EIA Case Size	1,000 megohm microfarads or 100 GΩ	500 megohm microfarads or 10 GΩ
0402	< .012 μF	≥ .012 μF
0603	< .047 μF	≥ .047 μF
0805	< 0.15 μF	≥ 0.15 μF
1206	< 0.47 μF	≥ 0.47 μF

Table 1B – Product Availability and Chip Thickness Waterfall – Standard Termination

Capacitance	Cap Code	Case Size/ Series	C0402C			C0603C					
		Rated Voltage (VDC)	16	25	50	16	25	50	63	100	200
		Voltage Code	4	3	5	4	3	5	M	1	2
		Cap Tolerance	Product Availability and Chip Thickness Codes – See Packaging Specs for Chip Thickness Dimensions								
1.0 nF	102	J = ±5% K = ±10% M = ±20%	BB	BB	BB	CF	CF	CF	CF	CF	CF
1.5 nF	152		BB	BB	BB	CF	CF	CF	CF	CF	CF
2.2 nF	222		BB	BB	BB	CF	CF	CF	CF	CF	CF
3.3 nF	332		BB	BB	BB	CF	CF	CF	CF	CF	CF
4.7 nF	472		BB	BB	BB	CF	CF	CF	CF	CF	CF
6.8 nF	682		BB	BB	BB	CF	CF	CF	CF	CF	CF
10 nF	103		BB	BB	BB	CF	CF	CF	CF	CF	CF
15 nF	153		BB	BB	BB	CF	CF	CF	CF	CF	CF
22 nF	223		BB	BB	BB	CF	CF	CF	CF	CF	CF
33 nF	333		BB	BB	BB	CF	CF	CF	CF	CF	CF
47 nF	473		BB	BB		CF	CF	CF	CF	CF	
68 nF	683		BB			CF	CF	CF			
100 nF	104		BB			CF	CF	CF			
150 nF	154					CF	CF	CF			
220 nF	224					CF	CF				

Table 1C – Product Availability and Chip Thickness Waterfall – Flexible Termination

Capacitance	Cap Code	Case Size/ Series	C0603C					
		Rated Voltage (VDC)	16	25	50	63	100	200
		Voltage Code	4	3	5	M	1	2
		Cap Tolerance	Product Availability and Chip Thickness Codes – See Packaging Specs for Chip Thickness Dimensions					
1.0 nF	102	J = ±5% K = ±10% M = ±20%	CJ	CJ	CJ	CJ	CJ	CJ
1.5 nF	152		CJ	CJ	CJ	CJ	CJ	CJ
2.2 nF	222		CJ	CJ	CJ	CJ	CJ	CJ
3.3 nF	332		CJ	CJ	CJ	CJ	CJ	CJ
4.7 nF	472		CJ	CJ	CJ	CJ	CJ	CJ
6.8 nF	682		CJ	CJ	CJ	CJ	CJ	CJ
10 nF	103		CJ	CJ	CJ	CJ	CJ	CJ
15 nF	153		CJ	CJ	CJ	CJ	CJ	CJ
22 nF	223		CJ	CJ	CJ	CJ	CJ	CJ
33 nF	333		CJ	CJ	CJ	CJ	CJ	CJ
47 nF	473		CJ	CJ	CJ	CJ	CJ	CJ
68 nF	683		CJ	CJ	CJ	CJ	CJ	CJ
100 nF	104		CJ	CJ	CJ	CJ	CJ	CJ
150 nF	154		CJ	CJ	CJ	CJ	CJ	CJ
220 nF	224		CJ	CJ	CJ	CJ	CJ	CJ

Capacitance	Cap Code	Case Size/ Series	C0805C							C1206C							
		Rated Voltage (VDC)	16	25	50	63	100	200	250	16	25	50	63	100	200	250	
		Voltage Code	4	3	5	M	1	2	A	4	3	5	M	1	2	A	
		Cap Tolerance	Product Availability and Chip Thickness Codes – See Packaging Specs for Chip Thickness Dimensions														
1.0 nF	102	J = ±5% K = ±10% M = ±20%	DR	DR	DR	DR	DR	DR	DR	DC	EQ	EQ	EQ	EQ	EQ	EQ	
1.5 nF	152		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
2.2 nF	222		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
3.3 nF	332		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
4.7 nF	472		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
6.8 nF	682		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
10 nF	103		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
15 nF	153		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
22 nF	223		DR	DR	DR	DR	DR	DR	DR	DR	EQ	EQ	EQ	EQ	EQ	EQ	EQ
33 nF	333		DS	DS	DS	DS	DS	DS	DS		EQ	EQ	EQ	EQ	EQ	EQ	EQ
47 nF	473		DH	DH	DH	DH	DH	DH			ES	ES	ES	ES	ES	ES	ES
68 nF	683		DS	DS	DS	DS	DS				ES	ES	ES	ES	ES	ES	ES
100 nF	104		DE	DE	DE	DE	DE				EM	EM	EM	EM	EM	EM	EM
150 nF	154		DG	DG	DG	DG	DG				EU	EU	EU	EU	EU	EU	EU
220 nF	224		DG	DG	DG	DG	DG				ER	ER	ER	ER	ER	ER	ER
330 nF	334		DD	DD	DD						EM	EM	EM	EM	EM		
470 nF	474	DS	DS	DS						EU	EU	EU	EU	EU			
680 nF	684	DG	DG	DG						ES	ES	ES					
1.0 µF	105	DG	DG							ES	ES	ES					
1.5 µF	155	DG								EU	EU	EU					
2.2 µF	225	DG								EU	EU	EU					

Table 2 – Chip Thickness/Tape & Reel Packaging Quantities

Thickness Code	Case Size ¹	Thickness ± Range (mm)	Paper Quantity ¹		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
BB	0402	0.50 ±0.05	10,000	50,000	0	0
CF	0603	0.80 ±0.07*	4,000	15,000	0	0
DN	0805	0.78 ±0.10*	4,000	15,000	0	0
DP	0805	0.90 ±0.10*	4,000	15,000	0	0
DE	0805	1.00 ±0.10	0	0	2,500	10,000
DG	0805	1.25 ±0.15	0	0	2,500	10,000
EB	1206	0.78 ±0.10	4,000	10,000	4,000	10,000
EC	1206	0.90 ±0.10	0	0	4,000	10,000
ED	1206	1.00 ±0.10	0	0	2,500	10,000
EM	1206	1.25 ±0.15	0	0	2,500	10,000
EG	1206	1.60 ±0.15	0	0	2,000	2,000
EH	1206					

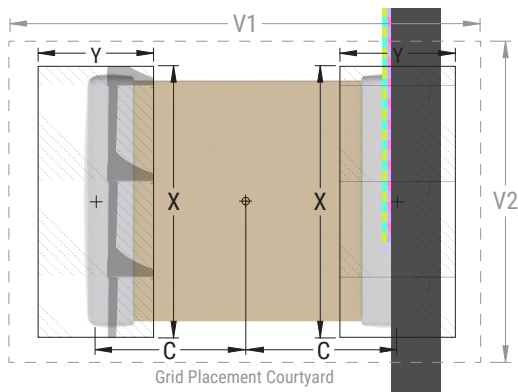
Table 4 – Land Pattern Design Recommendations per IPC–7351

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
Without Flexible Termination																
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
With Flexible Termination																
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	0.99	1.44	1.66	4.47	2.71	0.89	1.24	1.56	3.57	2.11	0.79	1.04	1.46	2.42	1.81
1206	3216	1.59	1.62	2.06	5.85	3.06	1.49	1.42	1.96	4.95	2.46	1.39	1.22	1.86	4.25	2.16

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

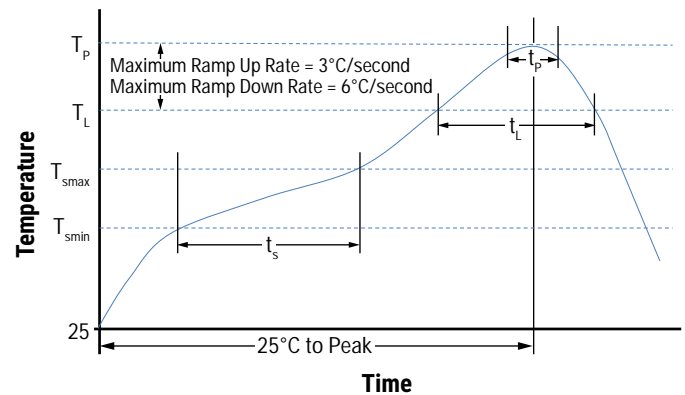
Recommended Soldering Technique

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

Recommended Reflow Soldering Profile

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

Profile Feature	Termination Finish
	100% Matte (Sn)
Preheat/Soak	
Temperature minimum (T_{smin})	150°C
Temperature maximum (T_{smax})	200°C
Time (t_s) from T_{smin} to T_{smax}	60 – 120 seconds
Ramp-up rate (T_L to T_p)	3°C/second maximum
Liquidous temperature (T_L)	217°C
Time above liquidous (t_L)	60 – 150 seconds
Peak temperature (T_p)	260°C
Time within 5°C of maximum peak temperature (t_p)	30 seconds maximum
Ramp-down rate (T_p to T_L)	6°C/second maximum
Time 25°C to peak temperature	8 minutes maximum

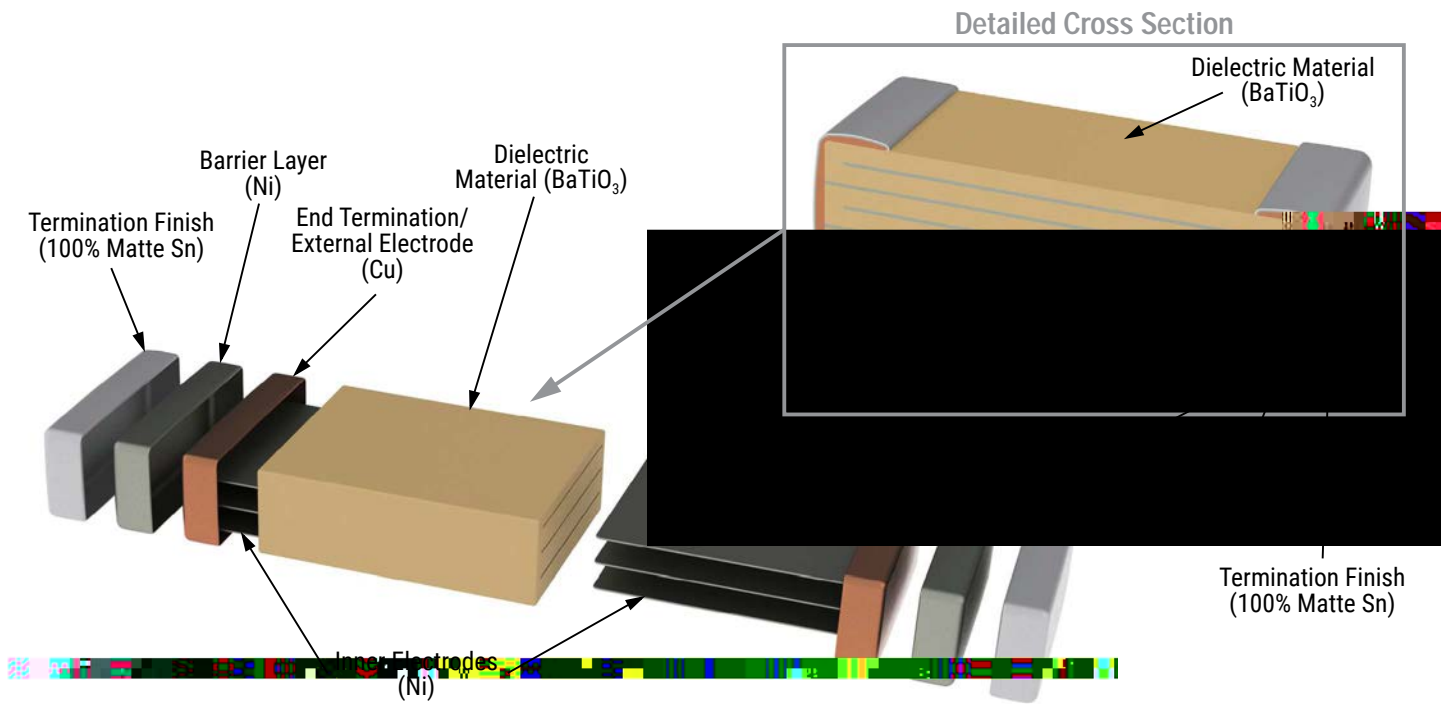


Note: All temperatures refer to the center of the package, measured on the capacitor body surface that is facing up during assembly re flow.

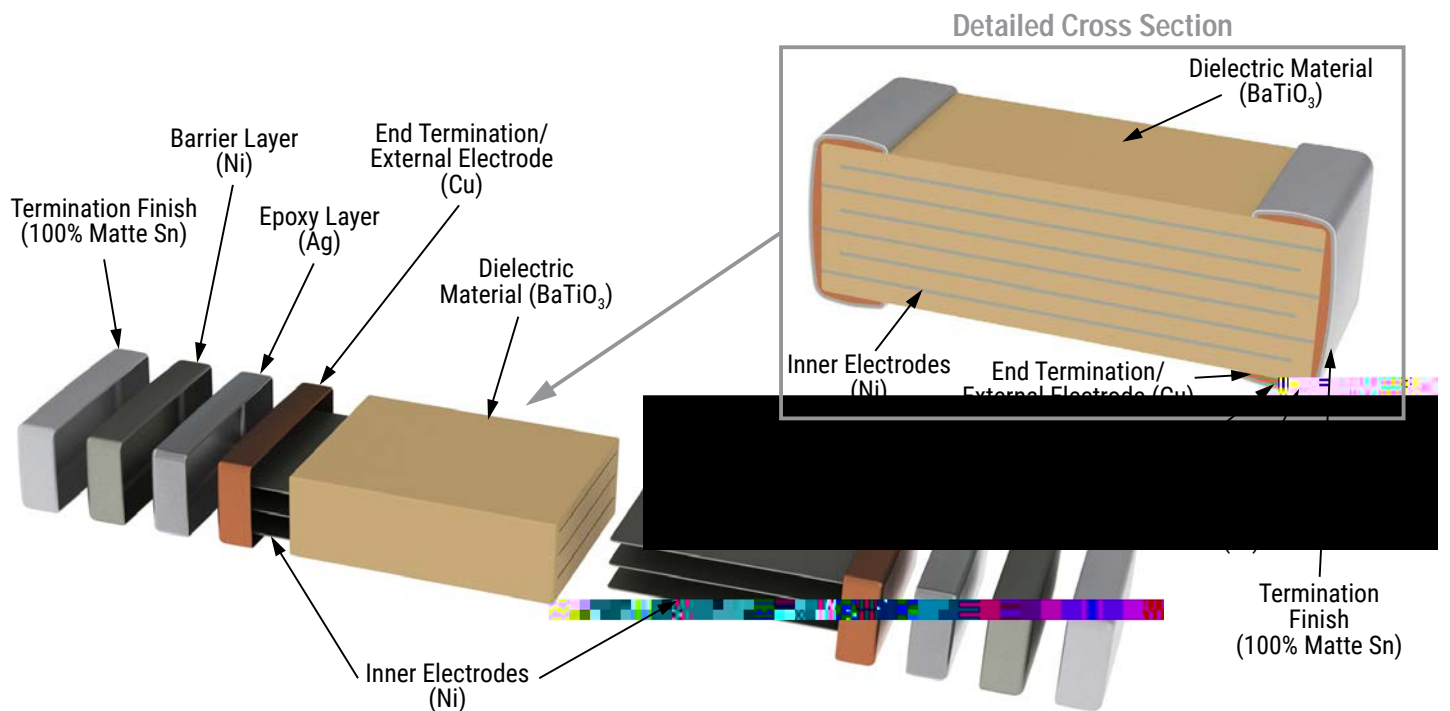
Table 5 – Performance & Reliability: Test Methods and Conditions

Stress	Reference	Test or Inspection Method
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note: Standard termination system – 2.0 mm (minimum) for all except 3 mm for COG. Flexible termination system – 3.0 mm (minimum).
Solderability	J-STD-002	Magnification 50 X. Conditions:
		a) Method B, 4 hours at 155°C, dry heat at 235°C
		b) Method B at 215°C,

Construction – Standard Termination



Construction – Flexible Termination



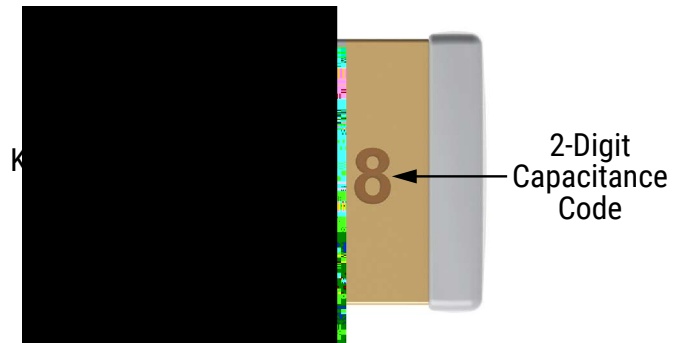
Capacitor Marking (Optional):

These surface mount multilayer ceramic capacitors are normally supplied unmarked. If required, they can be marked as an extra cost option. Marking is available on most KEMET devices, but must be requested using the correct ordering code identifier(s). If this option is requested, two sides of the ceramic body will be laser marked with a “K” to identify KEMET, followed by two characters (per EIA–198 - see table below) to identify the capacitance value. EIA 0603 case size devices are limited to the “K” character only.

Laser marking option is not available on:

- COG, ultra stable X8R and Y5V dielectric devices.
- EIA 0402 case size devices.
- EIA 0603 case size devices with flexible termination option.
- KPS commercial and automotive grade stacked devices.
- X7R dielectric products in capacitance values outlined below.

Marking appears in legible contrast. Illustrated below is an example of an MLCC with laser marking of “KA8”, which designates a KEMET device with rated capacitance of 100 μ F. Orientation of marking is vendor optional.



EIA Case Size	Metric Size Code	Capacitance
0603	1608	≤ 170 pF
0805	2012	≤ 150 pF
1206	3216	≤ 910 pF
1210	3225	$\leq 2,000$ pF
1808	4520	$\leq 3,900$ pF
1812	4532	$\leq 6,700$ pF
1825	4564	≤ 0.018 μ F
2220	5650	≤ 0.027 μ F
2225	5664	≤ 0.033 μ F

Capacitor Marking (Optional) cont'd

Capacitance (pF) For Various Alpha/Numeral Identifiers										
Alpha Character	Numeral									
	9	0	1	2	3	4	5	6	7	8
	Capacitance (pF)									
A	0.10	1.0	10	100	1,000	10,000	100,000	1,000,000	10,000,000	100,000,000
B	0.11	1.1	11	110	1,100	11,000	110,000	1,100,000	11,000,000	110,000,000
C	0.12	1.2	12	120	1,200	12,000	120,000	1,200,000	12,000,000	120,000,000
D	0.13	1.3	13	130	1,300	13,000	130,000	1,300,000		

Tape & Reel Packaging Information

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

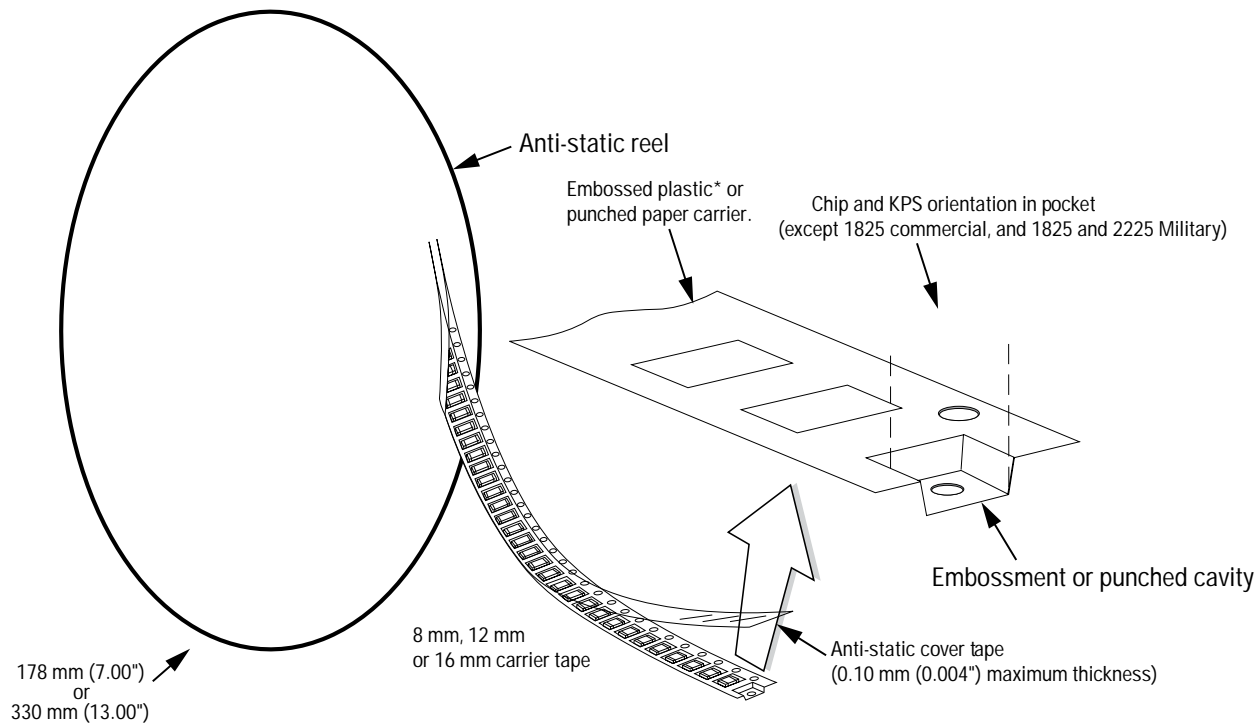


Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

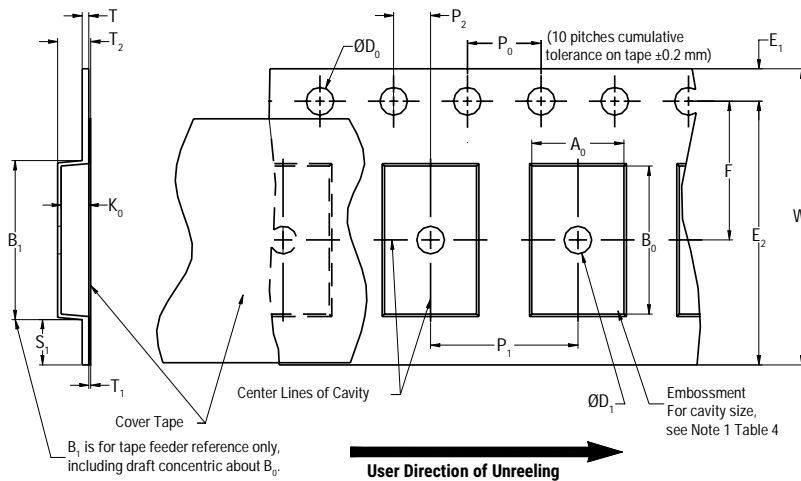


Table 7 – Embossed (Plastic) Carrier Tape Dimensions

Metric will govern

Constant Dimensions – Millimeters (Inches)									
Tape Size	D_0	D_1 Minimum Note 1	E_1	P_0	P_2	R Reference Note 2	S_1 Minimum Note 3	T Maximum	T_1 Maximum
8 mm	$1.5 +0.10/-0.0$ ($0.059 +0.004/-0.0$)	1.0 (0.039)	1.75 ± 0.10 (0.069 ± 0.004)	4.0 ± 0.10 (0.157 ± 0.004)	2.0 ± 0.05 (0.079 ± 0.002)	25.0 (0.984)	0.600 (0.024)	0.600 (0.024)	0.100 (0.004)
12 mm		1.5 (0.059)				30 (1.181)			
16 mm									
Variable Dimensions – Millimeters (Inches)									
Tape Size	Pitch	B_1 Maximum Note 4	E_2 Minimum	F	P_1	T_2 Maximum	W Maximum	A_0, B_0 & K_0	
8 mm	Single (4 mm)	4.35 (0.171)	6.25 (0.246)	3.5 ± 0.05 (0.138 ± 0.002)	4.0 ± 0.10 (0.157 ± 0.004)	2.5 (0.098)	8.3 (0.327)	Note 5	
12 mm	Single (4 mm) and Double (8 mm)	8.2 (0.323)	10.25 (0.404)	5.5 ± 0.05 (0.217 ± 0.002)	8.0 ± 0.10 (0.315 ± 0.004)	4.6 (0.181)	12.3 (0.484)		
16 mm	Triple (12 mm)	12.1 (0.476)	14.25 (0.561)	7.5 ± 0.05 (0.138 ± 0.002)	12.0 ± 0.10 (0.157 ± 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 6.)
- If $S_1 < 1.0$ mm, there may not be enough area for cover tape to be properly applied (see EIA Standard 481, paragraph 4.3, section b.)
- B_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 12 mm tapes, and 10° maximum for 16 mm tapes (see Figure 3.)
 - lateral movement of the component is restricted to 0.5 mm maximum for 8 and 12 mm wide tape, and to 1.0 mm maximum for 16 mm tape (see Figure 4.)
 - for KPS product, A_0 and B_0 are measured on a plane 0.3 mm above the bottom of the pocket.
 - see addendum in EIA Standard 481 for standards relating to more precise taping requirements.

Packaging Information Performance Notes

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

Tape Width	Peel Strength
8 mm	0.1 to 1.0 newton (10 to 100 gf)
12 and 16 mm	0.1 to 1.3 newton (10 to 130 gf)

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

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

Figure 3 – Maximum Component Rotation

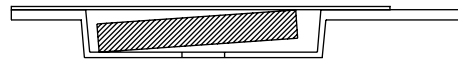
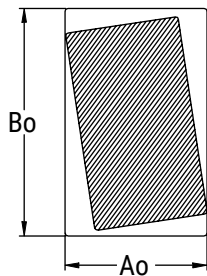


Figure 6 – Reel Dimensions

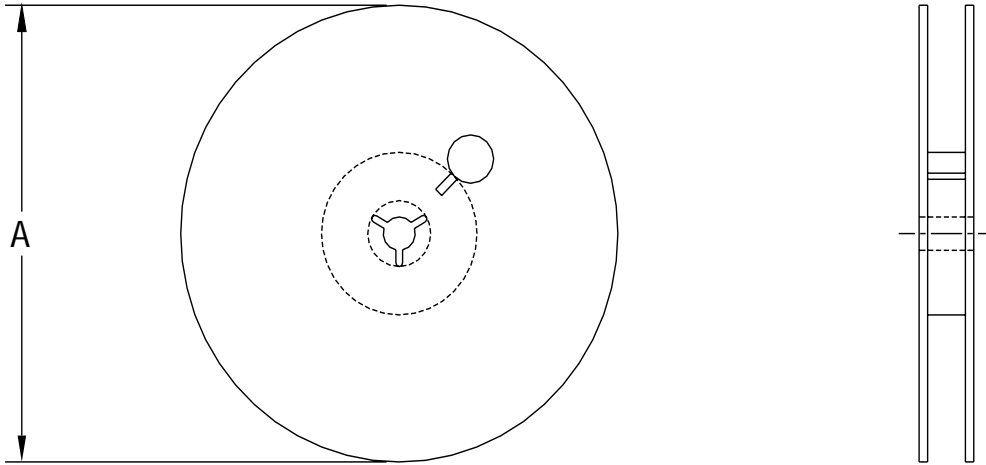
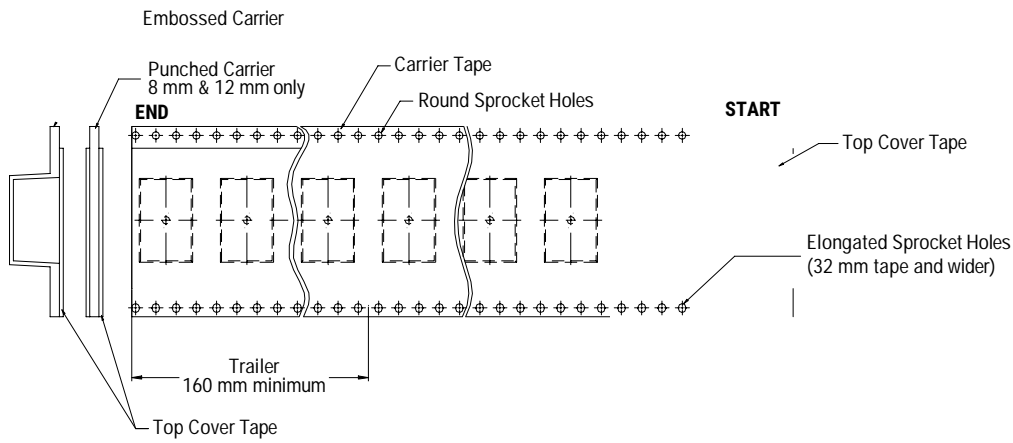


Figure 7 – Tape Leader & Trailer Dimensions



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