

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)

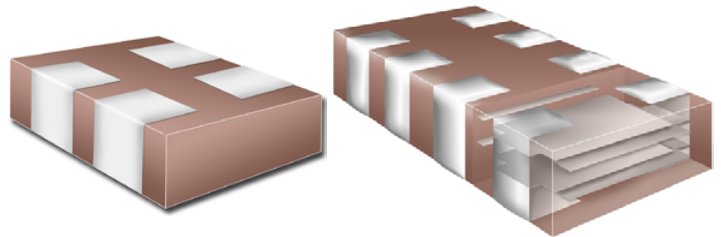
characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a 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 $+125^{\circ}\text{C}$.

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	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

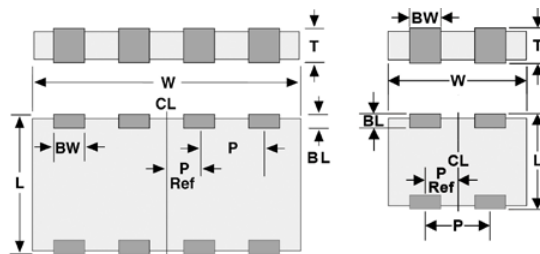
¹ All previous reference to metric case dimension "1632" has been replaced with an inch standard reference of "0612". Please reference all new designs using the "0612" nomenclature. "CA064" replaces "C1632" in the ordering code.

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 – (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

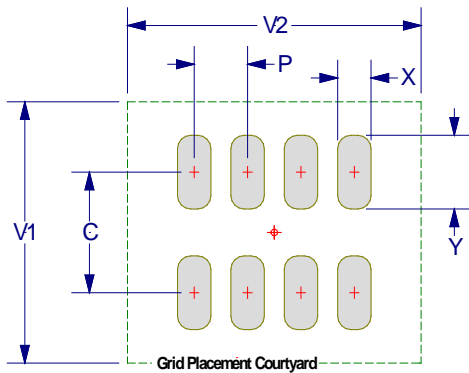
Table 3 – Chip Capacitor Array Land Pattern Design Recommendations per IPC-7351

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 COG.
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.

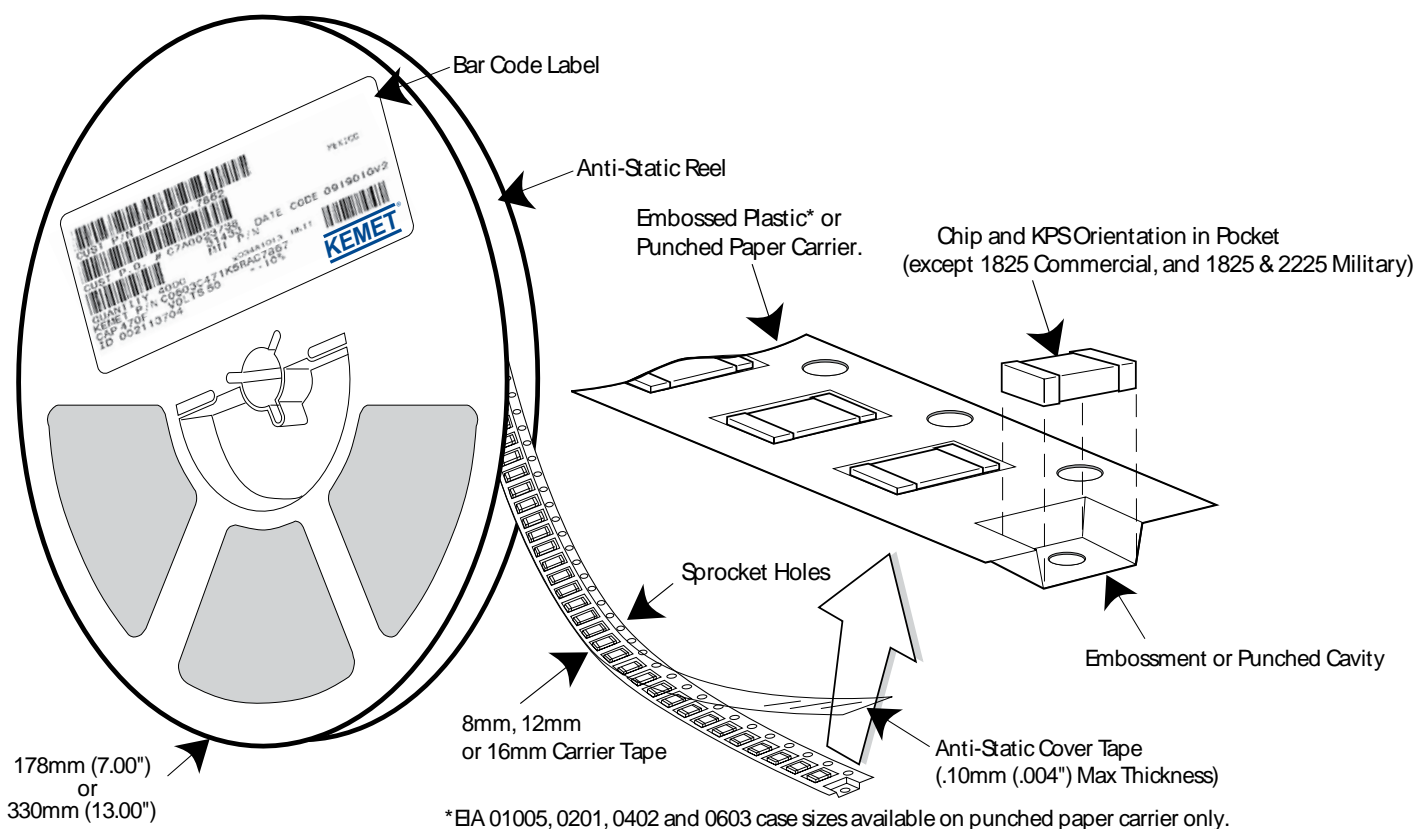


Table 5 – Carrier Tape Configuration (mm)

EIA Case Size	Tape size (W)*	Pitch (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 P₁ carrier tape reference locations.

*Refer to Table 6 for tolerance specifications.

Figure 2 – Punched (Paper) Carrier Tape Dimensions

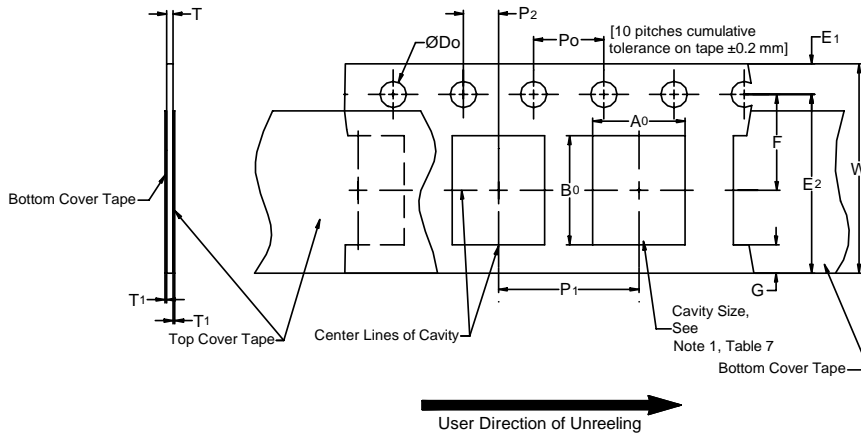


Table 7 – Punched (Paper) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)							
Tape Size	D ₀	E ₁	P ₀	P ₂	T ₁ Max	G Min	R Ref. Note 2
8mm	1.5 +0.10-0.0 (0.059 +0.004, -0.0)	1.75 ±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)	

- The cavity defined by A₀, B₀ and T shall surround the component with sufficient clearance that:
 - the component does not protrude beyond either surface of the carrier tape.
 - the component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
 - lateral movement of the component is restricted to 0.5 mm maximum (see Figure 4).
 - see Addendum in EIA Document 481 for standards relating to more precise taping requirements.
- The tape with or without components shall pass around R without damage (see Figure 5).

Packaging Information Performance Notes

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

Tape Width	Peel Strength
8mm	0.1 Newton to 1.0 Newton (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

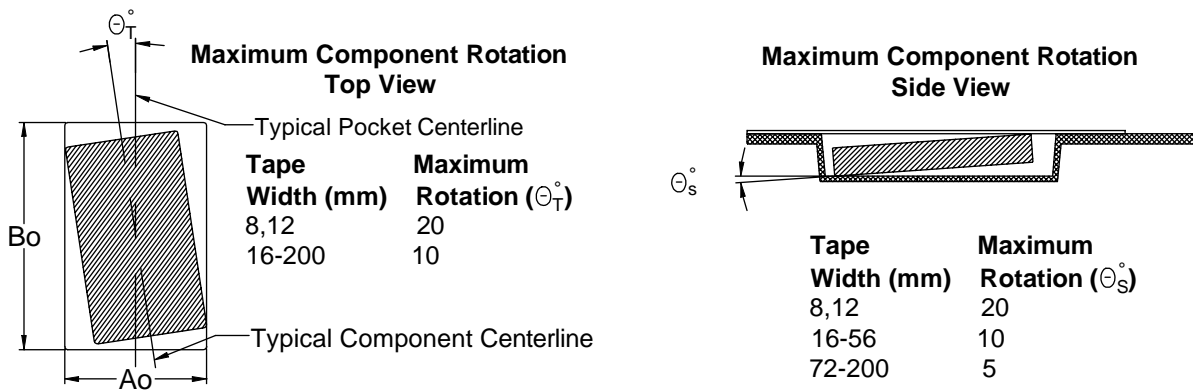


Figure 4 – Maximum Lateral Movement

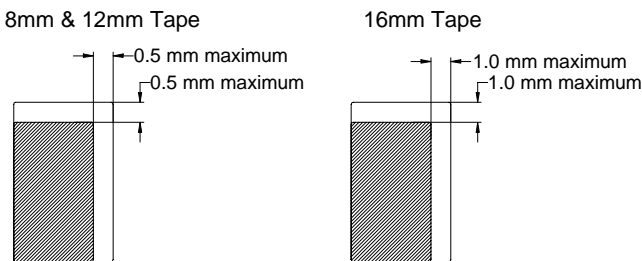


Figure 5 – Bending Radius

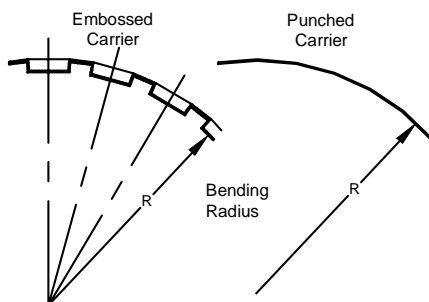
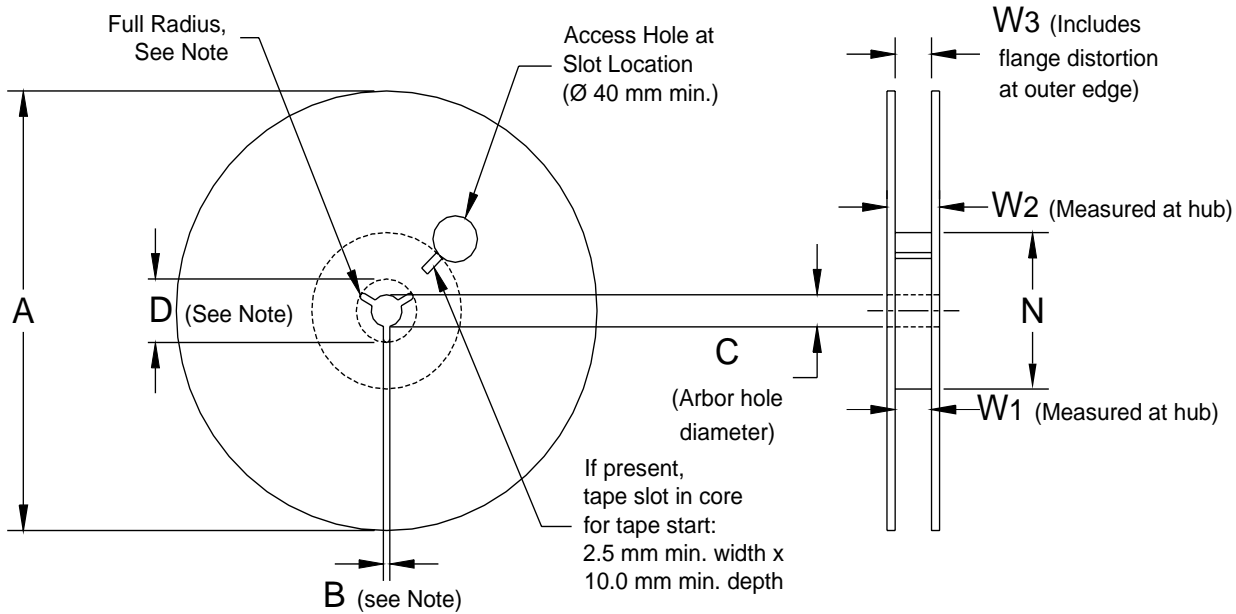


Figure 6 – Reel Dimensions



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

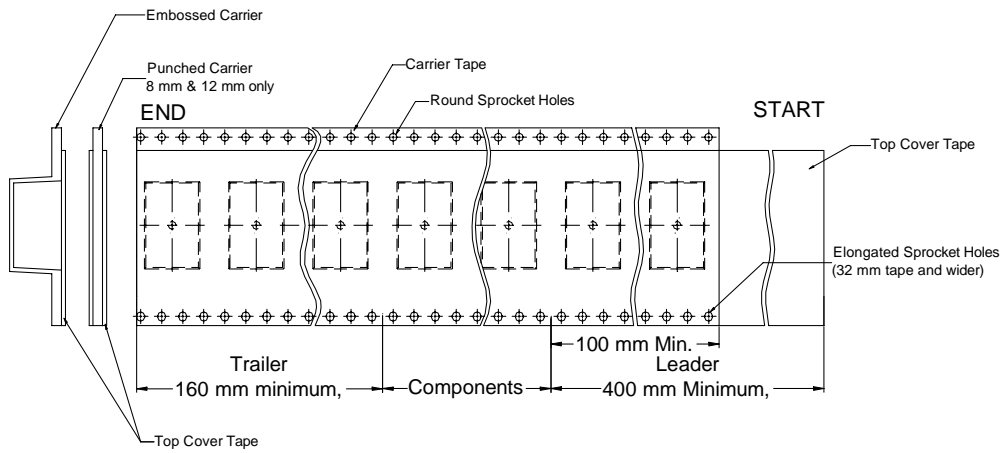


Figure 8 – Maximum Camber

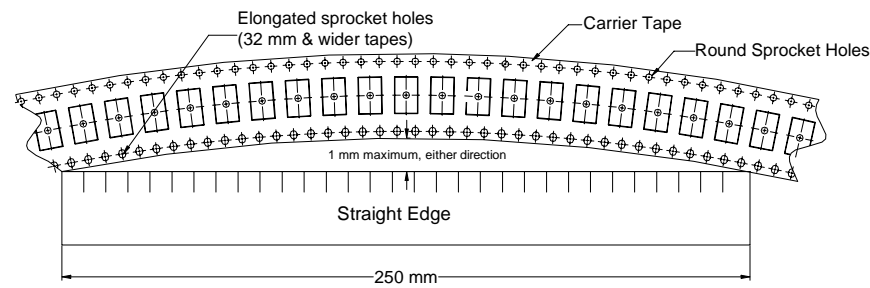


Figure 9 – Bulk Cassette Packaging (Ceramic Chips Only)

Meets Dimensional Requirements IEC-286 and EIAJ 7201

Unit mm *Reference

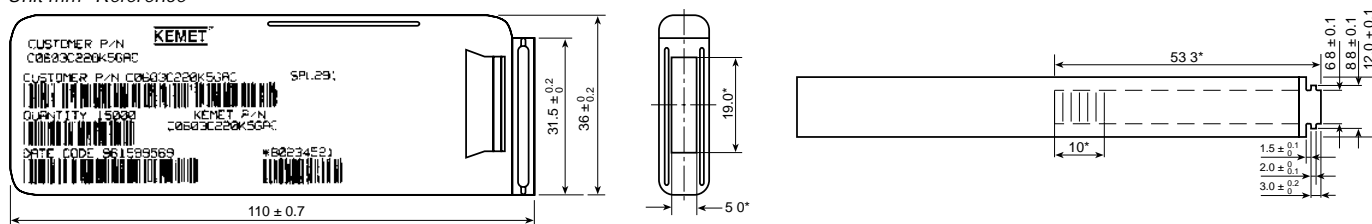


Table 9 – Capacitor Dimensions for Bulk Cassette

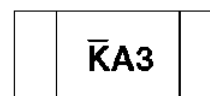
Cassette Packaging – Millimeters

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

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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
Contact Us	http://www.kemet.com/contact
Investor Relations	http://www.kemet.com/ir
Call Us	1-877-MyKEMET
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