

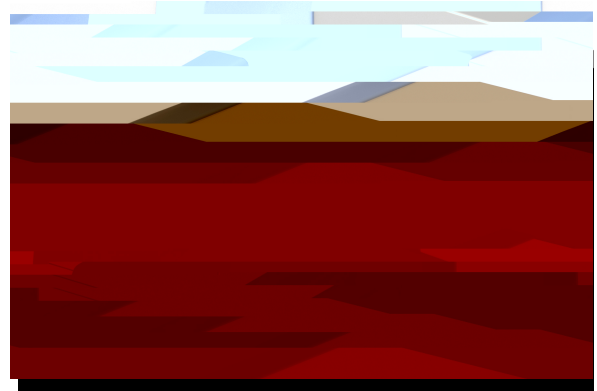
## Overview

KEMET's X7R dielectric features a 125°C maximum operating temperature and is considered temperature stable. The Electronics Components, Assemblies and 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, boasting a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to  $\pm 15\%$  from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

## Benefits

- $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  operating temperature range
- Lead (Pb)-free, RoHS, and REACH Compliant
- Temperature stable dielectric
- EIA 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, and 2225 case sizes
- DC voltage ratings of 6.3 V, 10 V, 16 V, 25 V, 35 V, 50 V, 100 V, 200 V, and 250 V
- Capacitance offerings ranging from 10 pF to 47  $\mu\text{F}$
- Available capacitance tolerances of  $\pm 5\%$ ,  $\pm 10\%$  and  $\pm 20\%$
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability
- SnPb termination finish option available upon request (5% Pb minimum)

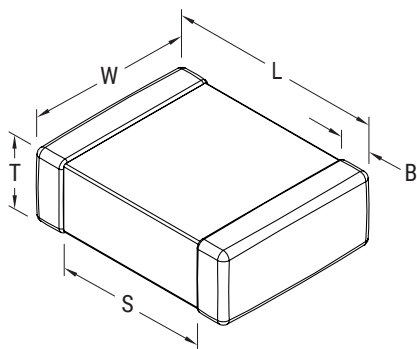


## Applications

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

## Ordering Information

## 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 re flow 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)	0.70 (0.028)	Solder wave or Solder re flow
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)	0.75 (0.030)	
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)	N/A	Solder re flow only
1210 <sup>1</sup>	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)		
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)		
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)		
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)		
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)		
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)		

<sup>1</sup>For capacitance values  $\geq 4.7 \mu\text{F}$  add 0.02 (0.001) to the width tolerance dimension and 0.10 (0.004) to the length tolerance dimension.

## 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.

## 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%
<sup>1</sup> Aging Rate (Maximum % Capacitance Loss/Decade Hour)	3.0%
<sup>2</sup> Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5 ±1 seconds and charge/discharge not exceeding 50mA)
<sup>3</sup> Dissipation Factor (DF) Maximum Limit at 25°C	See Dissipation Factor Limit Table
<sup>4</sup> Insulation Resistance (IR) Minimum Limit at 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ±5 seconds at 25°C)

<sup>1</sup>Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 48 or 1,000 hours. Please refer to a part number specific datasheet for referee time details.

<sup>2</sup>DWV is the voltage a capacitor can withstand (survive) for a short period of time. It exceeds the nominal and continuous working voltage of the capacitor.

<sup>3</sup>Capacitance and dissipation factor (DF) measured under the following conditions:

1 kHz ±50 Hz and  $1.0 \pm 0.2 V_{rms}$  if capacitance  $\leq 10 \mu F$

120 Hz ±10 Hz and  $0.5 \pm 0.1 V_{rms}$  if capacitance  $> 10 \mu F$

<sup>4</sup>To obtain IR limit, divide MΩ-μF value by the capacitance and compare to GΩ limit. Select the lower of the two limits.

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

## Insulation Resistance Limit Table

EIA Case Size	Rated DC Voltage	1,000 megohm microfarads or 100 GΩ	500 megohm microfarads or 10 GΩ	100 megohm microfarads or 10 GΩ
0402	ALL	< 0.012 μF	≥ 0.012 μF	N/A
0603	≤ 200 V	< 0.047 μF	≥ 0.047 μf < 0.47 μf	≥ 0.47 μf
	250 V	N/A	N/A	ALL
0805	≤ 200 V	< 0.15 μF	≥ 0.15 μF < 2.2 μf	≥ 2.2 μf
	250 V	< .027 μF	N/A	≥ .027 μF
1206	≤ 200 V	< 0.47 μF	≥ 0.47 μF < 4.7 μf	≥ 4.7 μf
	250 V	< 0.12 μF	N/A	≥ 0.12 μF
1210	≤ 200 V	< 0.39 μF	≥ 0.39 μF < 10 μf	≥ 10 μf
	250 V	< 0.27 μF	N/A	≥ 0.27 μF
1808	ALL	ALL	N/A	N/A
1812	ALL	< 2.2 μF	≥ 2.2 μF	N/A
1825	ALL	ALL	N/A	N/A
2220	ALL	< 10 μF	≥ 10 μF	N/A
2225	ALL	ALL	N/A	N/A

## Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance							
Dielectric	Case Size	Rated DC V					

## Dissipation Factor (DF) Limit Table

EIA Case Size	Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)
0402	< 16	All	5.0
	16		3.5
	25	< 0.1 $\mu\text{F}$	3.5
	25	$\geq 0.1 \mu\text{F}$	10.0
	> 25	All	2.5
0603	< 16	< 1.0 $\mu\text{F}$	5.0
	16/25		3.5
	> 25		2.5
	< 16	$\geq 1.0 \mu\text{F}$	10.0
	16/25		
0805	< 16	< 2.2 $\mu\text{F}$	5.0
	16/25		3.5
	> 25	< 1.0 $\mu\text{F}$	2.5
	< 16	$\geq 2.2 \mu\text{F}$	10.0
	16/25		
	> 25	$\geq 1.0 \mu\text{F}$	
1206	< 16	< 10 $\mu\text{F}$	5.0
	16/25		3.5
	> 25		2.5
	35/50	$\geq 2.2 \mu\text{F}$	10.0
	< 16	$\geq 10 \mu\text{F}$	10.0
	16/25		
1210	< 16	< 22 $\mu\text{F}$	5.0
	16/25		3.5
	> 25		2.5
	< 16	$\geq 22 \mu\text{F}$	10.0
	16/25		
1808–2225	< 16	All	5.0
	16/25		3.5
	> 25		2.5

**Table 1A – Capacitance Range/Selection Waterfall (0402 – 1206 Case Sizes)**

Case Size	Capacitance Range (pF)											
	10	12	15	18	22	27	33	39	47	56	68	82
0402	10	12	15	18	22	27	33	39	47	56	68	82
0603	10	12	15	18	22	27	33	39	47	56	68	82
0805	10	12	15	18	22	27	33	39	47	56	68	82
1206	10	12	15	18	22	27	33	39	47	56	68	82

\*Capacitance range Includes E24 decade values only. (i.e., 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, and 91).

\*\*Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

xx<sup>1</sup> Available only in K and M tolerance.







**Table 1B – Capacitance Range/Selection Waterfall (1210 – 2225 Case Sizes) cont'd**

Cap	Cap Code	Case Size/ Series			C1210C					C1808C			C1812C					C1825C				C2220C					C2225C												
		Voltage Code			9	8	4	3	5	1	2	A	5	1	2	3	5	1	2	A	5	1	2	A	3	5	1	2	A	5	1	2	A						
		Rated Voltage (VDC)			6.3	10	16	25	50	100	200	250	50	100	200	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																																		
0.56 µF	564	J	K	M	FD	FD	FD	FD	FD	FF									GC	GC	GG						HB	HD	HD	HD	JC	JC	JC	JD	JD	KB	KC	KD	KD
0.68 µF	684	J	K	M	FD	FD	FD	FD	FD	FG									GC	GC	GG						HB	HD	HD	HD	JC	JC	JD	JD	JD	KB	KC	KD	KD
0.82 µF	824	J	K	M	FF	FF	FF	FF	FF	FL									GE	GE	GG						HB	HF	HF	HF	JC	JC	JF	JF	JF	KB	KC	KE	KE
1.0 µF	105	J	K	M	FH	FH	FH	FH	FH	FM									GE	GE	GG						HB	HF	HF	HF	JC	JC	JF	JF	JF	KB	KD	KE	KE
1.2 µF	125	J	K	M	FH	FH	FH	FH	FG	FH									GB	GB	GB						HB				JC	JC				KB	KE	KE	KE
1.5 µF	155	J	K	M	FH	FH	FH	FH	FG	FM									GC	GC	GC						HC				JC	JC				KC			
1.8 µF	185	J	K	M	FH	FH	FH	FH	FG	FJ									GE	GE	GE						HD				JD	JD				KD			
2.2 µF	225	J	K	M	FJ	FJ	FJ	FJ	FG	FT <sup>1</sup>									GO	GO	GO <sup>1</sup>						HF				JF	JF				KD			
2.7 µF	275	J	K	M	FE	FE	FE	FG	FH										GJ	GJ	GJ																		
3.3 µF	335	J	K	M	FF	FF	FF	FM	FM										GL	GL	GL																		
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										JF	JF								
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	FT <sup>1</sup>	FT <sup>1</sup>	FT <sup>1</sup>	FS <sup>1</sup>	FS <sup>1</sup>										GK											JF	JO								
12 µF	126	J	K	M																																			
15 µF	156	J	K	M	FM	FM																									JO	JO							
18 µF	186	J	K	M																																			
22 µF	226	J	K	M	FS	FS	FS <sup>1</sup>	FS <sup>1</sup>																							JO								
47 µF	476	J	K	M	FS <sup>1</sup>	FS <sup>1</sup>																																	

\*Capacitance range Includes E24 decade values only. (i.e., 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, and 91).

\*\*Capacitance range Includes E12 decade values only. (i.e., 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, and 82).

xx<sup>1</sup> Available only in K and M tolerance.

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## Table 2A – Chip Thickness/Tape & Reel Packaging Quantities

## Table 2A – Chip Thickness/Tape & Reel Packaging Quantities cont'd



Package quantity based on finished chip thickness specifications.

<sup>1</sup> If ordering using the 2 mm Tape and Reel pitch option, the packaging quantity outlined in the table above will be doubled. This option is limited to EIA 0603 (1608 metric) case size devices. For more information regarding 2 mm pitch option see "Tape & Reel Packaging Information."

## Table 2B – Bulk Packaging Quantities

Packaging Type		Loose Packaging	
		Bulk Bag (default)	
Packaging C-Spec <sup>1</sup>		N/A <sup>2</sup>	
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		

<sup>1</sup> 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.

<sup>2</sup> 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	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
1210 <sup>1</sup>	3225	1.50	1.60	2.90	5.60	3.90	1.40	1.40	2.80	4.70	3.30	1.30	1.20	2.70	4.00	3.00
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

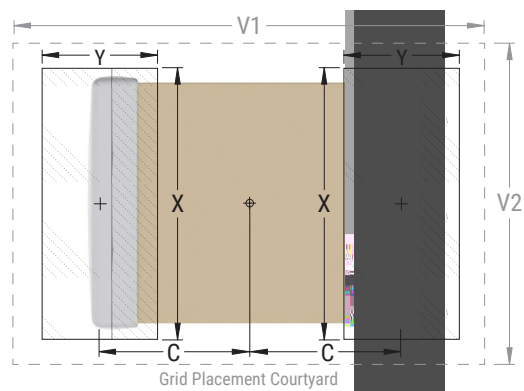
<sup>1</sup> Only for capacitance values  $\geq 22 \mu\text{F}$

**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

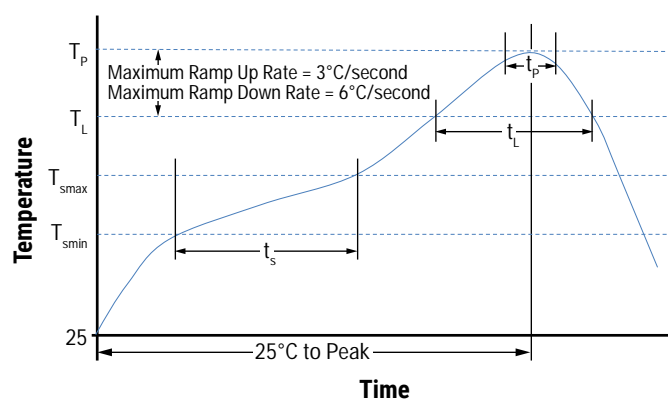
### Recommended Soldering Technique:

- 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
<b>Preheat/Soak</b>		
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
Time Within 5°C of Maximum Peak Temperature ( $t_p$ )	20 seconds maximum	30 seconds maximum
Ramp-Down Rate ( $T_p$ to $T_L$ )	6°C/second maximum	6°C/second maximum
Time 25°C to Peak Temperature	6 minutes maximum	8 minutes maximum

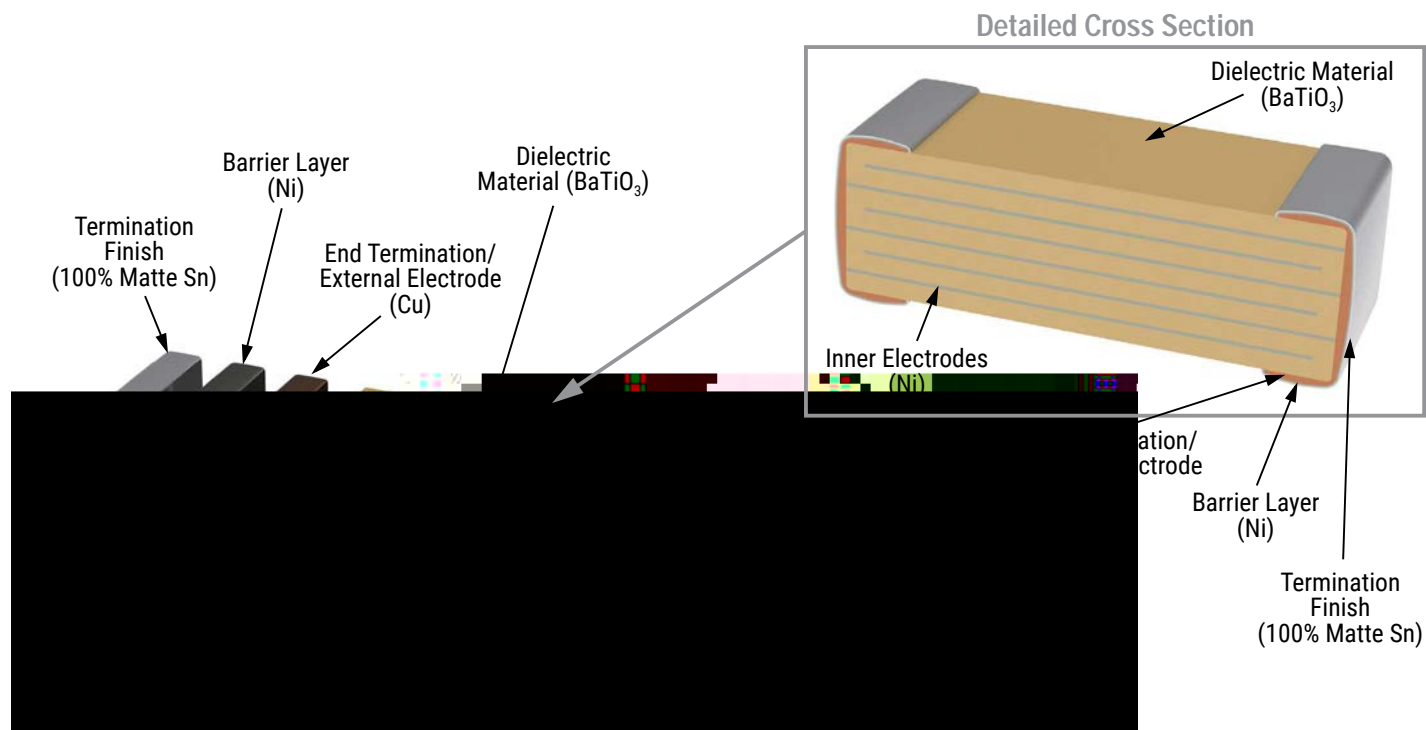


*Note 1: All temperatures refer to the center of the package, measured on the capacitor body surface that is facing up during assembly reflow.*

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

Stress	Reference	Test or Inspection Method
Terminal Strength	JIS-C-6429	Appendix 1, Note: Force of 1.8 kg for 60 seconds.
Board Flex	JIS-C-6429	Appendix 2, Note:

## Construction (Typical)





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## 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.

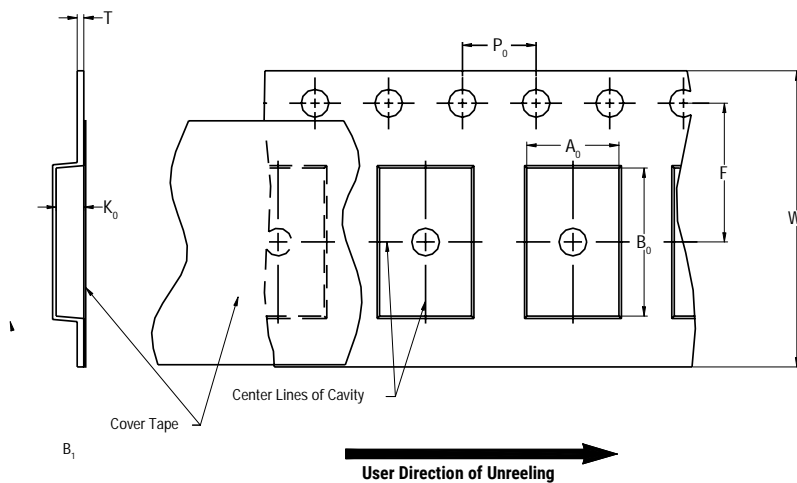
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## Capacitor Marking (Optional) cont'd

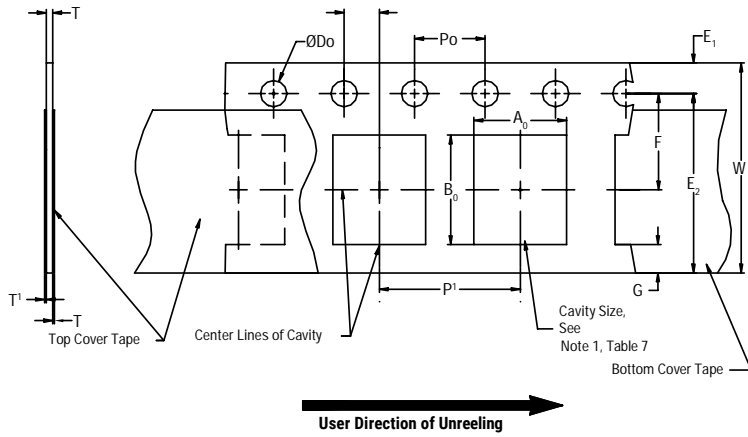
Capacitance (pF) For Various Alpha/Numeral Identifiers										
Alpha Character	Numeral									
	9	0	1	2	3	4	5	6	7	8
	Capacitance (pF)									
A	0.10	1.0	10	100	1,000	10,000	100,000	1,000,000	10,000,000	100,000,000
B	0.11	1.1	11	110	1,100	11,000	110,000	1,100,000	11,000,000	110,000,000
C	0.12	1.2	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	13,000,000	130,000,000
E	0.15	1.5	15	150	1,500	15,000	150,000	1,500,000	15,000,000	150,000,000
F	0.16	1.6	16	160	1,600	16,000	160,000	1,600,000	16,000,000	160,000,000
G	0.18	1.8	18	180	1,800	18,000	180,000	1,800,000	18,000,000	180,000,000
H	0.20	2.0	20	200	2,000	20,000	200,000	2,000,000	20,000,000	200,000,000
J	0.22	2.2	22	220	2,200	22,000	220,000	2,200,000	22,000,000	220,000,000
K	0.24	2.4	24	240	2,400	24,000	240,000	2,400,000	24,000,000	240,000,000
L	0.27	2.7	27	270	2,700	27,000	270,000	2,700,000	27,000,000	270,000,000
M	0.30	3.0	30	300	3,000	30,000	300,000	3,000,000	30,000,000	300,000,000
N	0.33	3.3	33	330	3,300	33,000	330,000	3,300,000	33,000,000	330,000,000
P	0.36	3.6	36	360	3,600	36,000	360,000	3,600,000	36,000,000	360,000,000
Q	0.39	3.9	39	390	3,900	39,000	390,000	3,900,000	39,000,000	390,000,000
R	0.43	4.3	43	430	4,300	43,000	430,000	4,300,000	43,000,000	430,000,000
S	0.47	4.7	47	470	4,700	47,000	470,000	4,700,000	47,000,000	470,000,000
T	0.51	5.1	51	510	5,100	51,000	510,000	5,100,000	51,000,000	510,000,000
U	0.56	5.6	56	560	5,600	56,000	560,000	5,600,000	56,000,000	560,000,000
V	0.62	6.2	62	620	6,200	62,000	620,000	6,200,000	62,000,000	620,000,000
W	0.68	6.8	68	680	6,800	68,000	680,000	6,800,000	68,000,000	680,000,000
X	0.75	7.5	75	750	7,500	75,000	750,000	7,500,000	75,000,000	750,000,000
Y	0.82	8.2	82	820	8,200	82,000	820,000	8,200,000	82,000,000	820,000,000
Z	0.91	9.1	91	910	9,100	91,000	910,000	9,100,000	91,000,000	910,000,000
a	0.25	2.5	25	250	2,500	25,000	250,000	2,500,000	25,000,000	250,000,000
b	0.35	3.5	35	350	3,500	35,000	350,000	3,500,000	35,000,000	350,000,000
d	0.40	4.0	40	400	4,000	40,000	400,000	4,000,000	40,000,000	400,000,000
e	0.45	4.5	45	450	4,500	45,000	450,000	4,500,000	45,000,000	450,000,000
f	0.50	5.0	50	500	5,000	50,000	500,000	5,000,000	50,000,000	500,000,000
m	0.60	6.0	60	600	6,000	60,000	600,000	6,000,000	60,000,000	600,000,000
n	0.70	7.0	70	700	7,000	70,000	700,000	7,000,000	70,000,000	700,000,000
t	0.80	8.0	80	800	8,000	80,000	800,000	8,000,000	80,000,000	800,000,000
y	0.90	9.0	90	900	9,000	90,000	900,000	9,000,000	90,000,000	900,000,000



**Figure 1 – Embossed (Plastic) Carrier Tape Dimensions**



**Figure 2 – Punched (Paper) Carrier Tape Dimensions**



## Packaging Information Performance Notes

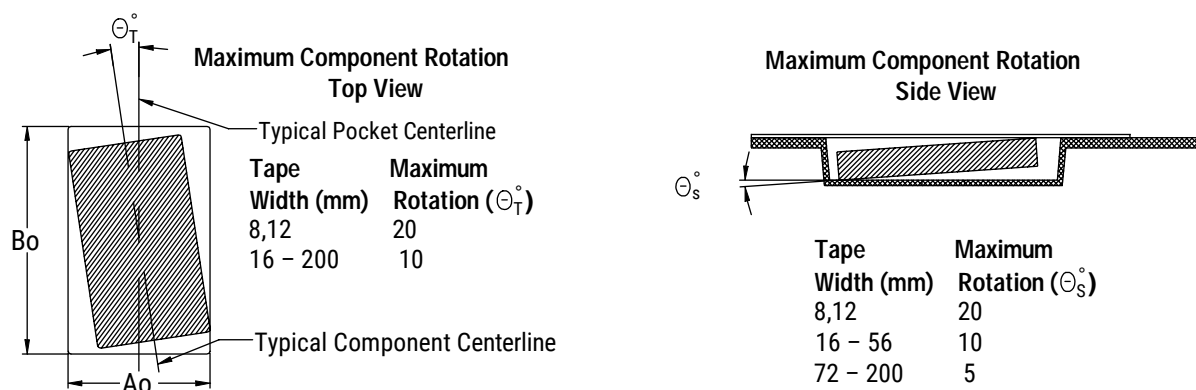
- Cover Tape Break Force:** 1.0 kg minimum.
- Cover Tape Peel Strength:** The total peel strength of the cover tape from the carrier tape shall be:

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)

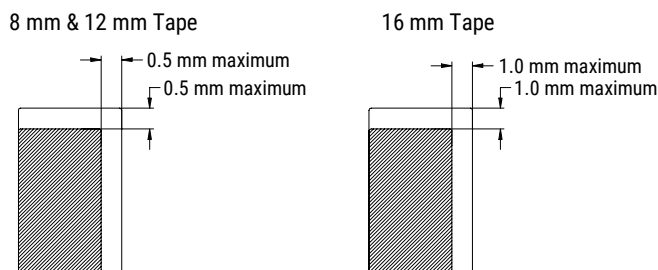
The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ±10 mm/minute.

- 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

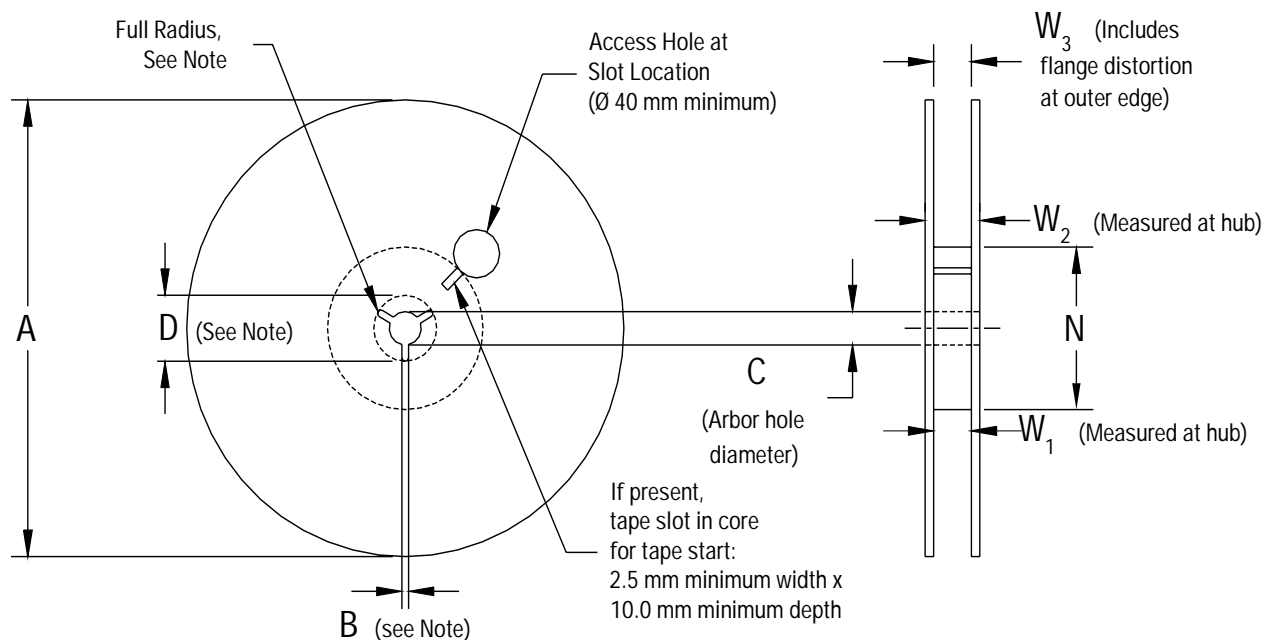


### Figure 4 – Maximum Lateral Movement



### 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 Minimum	C	D Minimum
8 mm	$178 \pm 0.20$ (7.008 ± 0.008) or $330 \pm 0.20$ (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)	

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## Figure 7 – Tape Leader & Trailer Dimensions



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