

## Established Reliability Surface Mount Capacitors, MIL-PRF-123, 50 – 100 VDC (BP & BX Dielectric)

### Overview

The KEMET MIL-PRF-123 BP and BX surface mount capacitors are designed, tested and screened to meet demanding high reliability defense and aerospace applications. Being renowned in the industry, the MIL-PRF-123 is legacy specification created by the Defense Logistics Agency's (DLA) with its proven flight hours. Qualified under performance specification MIL-PRF-123 and QPL listed, this series meets or exceeds the requirements outlined by DLA and is currently available in A and T product levels. Although, the A product level insinuated space grade

through its existence, the T level provides an option for additional ultrasonic screening. This PME (precious metal electrode) product series complements the other popular DLA specifications such as the MIL-PRF-55681 (PME) and MIL-PRF-32535 (BME) offering a wider breadth of products making it easier for designers to choose the best solution.

### Benefits

- PME (Precious Metal Electrode) technology
- Qualified per MIL-PRF-123 (QPL)
- Standard MIL-PRF-123 capacitors (A Level)
- Non-leaded capacitors with additional screening (T Level)
- EIA 0805, 1206, 1210, 1808, 1812, 1825, and 2225 case sizes
- DC voltage ratings of 50 V and 100 V
- BP Capacitance offerings ranging from 1.0 pF up to 10 nF
- BX Capacitance offerings ranging from 330 pF up to 1  $\mu$ F
- Available capacitance tolerances of  $\pm 0.25$  pF,  $\pm 0.5$  pF,  $\pm 1\%$ ,  $\pm 5\%$ , and  $10\%$
- Non-polar device, minimizing installation concerns

### Applications

- Critical timing
- Tuning
- Circuits requiring low loss
- Circuits with pulse
- High current
- Decoupling
- Bypass
- Filtering
- Transient voltage suppression
- Blocking



## MIL-PRF-123 Ordering Information

M123	A	10	BX	B	472	K	Z
MIL Prefix	Product Level	Slash Sheet (MIL-PRF-123 Style)	Temperature Characteristic	Rated Voltage	Capacitance	Tolerance	Termination
M123	A = Standard MIL-PRF-123 capacitors T = Non-leaded capacitors with additional screening	10 = 0805 (CKS51) 21 = 1206 (CKS55) 11 = 1210 (CKS52) 12 = 1808 (CKS53) 22 = 1812 (CKS56) 23 = 1825 (CKS57) 13 = 2225 (CKS54)	BP BX	B = 50 V C = 100 V	Two significant digits and number of zeroes.  Use R as decimal for 1.0 - 9.9 pF e.g., 2.2 pF = 2R2	C = ±0.25 pF D = ±0.5 pF F = ±1% J = ±5% K = ±10%	S = Nickel guarded solder-coated (Sn60) Z = 70/30 SnPb Plated

## KEMET Part Number Equivalent (For Reference Only)

(Do not use this ordering code if a QPL MIL-SPEC part type is required. Please order using MIL-SPEC ordering code. Details regarding MIL-PRF-123 QPL ordering information is outlined above.)

C	0805	Z	101	K	5	G	A	L
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Dielectric	Product Level	Termination Finish
	0805 1206 1210 1808 1812 1825 2225	Z = MIL-PRF-123	Two significant digits and number of zeroes.  Use 9 for 1.0 - 9.9 pF e.g., 2.2 pF = 229	C = ±0.25 pF D = ±0.5 pF F = ±1% J = ±5% K = ±10%	5 = 50 V 1 = 100 V	G = BP X = BX	A = Standard MIL-PRF-123 capacitors T = Non-leaded capacitors with additional screening	H = Nickel guarded solder-coated (Sn60) L = 70/30 SnPb Plated

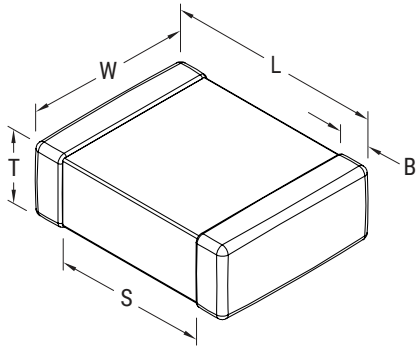
## Packaging C-Spec Ordering Options Table

Packaging Type <sup>1</sup>	Packaging/Grade Ordering Code (C-Spec)
Standard Packaging (Waffle Tray)	Not required (blank)
7" Tape & Reel	Contact Sales

<sup>1</sup> Default packaging with no C-Spec is "Waffle Tray," and is recommended for order quantities of less than 250 pieces. See Waffle Tray packaging information section for additional details.

<sup>1</sup> See Tape & Reel Packaging information section of the datasheet for additional details.

## Dimensions per MIL-PRF-32535 – Inches (Millimeters)



Chip Size	Military Equivalent Styles	Length (L)	Width (W)	Thickness (T) Maximum	Bandwidth (B)
0805	CKS51	0.080 ± 0.015	0.050 ± 0.015	0.055	0.020 ± 0.010
1206	CKS55	0.120 ± 0.015	0.060 ± 0.015	0.065	0.020 ± 0.010
1210	CKS52	0.120 ± 0.015	0.100 ± 0.015	0.065	0.020 ± 0.010
1808	CKS53	0.180 ± 0.015	0.080 ± 0.015	0.065	0.020 ± 0.010
1812	CKS56	0.180 ± 0.015	0.125 ± 0.015	0.080	0.020 ± 0.010
1825	CKS57	0.180 ± 0.015	0.250 ± 0.015	0.080	0.020 ± 0.010
2225	CKS54	0.220 ± 0.015	0.250 ± 0.015	0.070	0.020 ± 0.010

## Environmental Compliance

These PME (precious metal electrode) devices are not 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)	BP: ±30 ppm/°C BX: ±15%
Aging rate (maximum % capacitance loss/decade hour)	BP: 0% BX: 1%
<sup>1</sup> Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5 ±1 seconds and charge/discharge not exceeding 50 mA)
<sup>2</sup> Dissipation Factor (DF) maximum limit at 25°C	BP: Cap < 10 pF: 0.25% Cap ≥ 10 pF: 0.15% BX: 2.5%
<sup>3</sup> Insulation Resistance (IR) minimum limit at 25°C	At +25°C: 100,000 megaohms or 1,000 megaohm-microfarads, whichever is less. At +125°C: 10,000 megaohms or 100 megaohm-microfarads, whichever is less.

<sup>1</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>2</sup> Capacitance and dissipation factor (DF) measured under the following conditions:

1 MHz ±100 kHz and 1.0 V<sub>rms</sub> ±0.2 V if capacitance ≤ 1,000 pF

1 kHz ±50 Hz and 1.0 V<sub>rms</sub> ±0.2 V if capacitance > 1,000 pF

<sup>3</sup> 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:

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."

**Table 1A - Product Ordering Codes & Ratings (BP Dielectric)**

Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Case Size	0805 (CKS51)		1206 (CKS55)		1210 (CKS52)		1808 (CKS53)		1812 (CKS56)		1825 (CKS57)		2225 (CKS54)			
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
Product Availability																			
1.0 pF	1R0	109	(1)	(1)		(4)													
1.1 pF	1R1	119	(1)	(1)		(4)													
1.2 pF	1R2	129	(1)	(1)		(4)													
1.3 pF	1R3	139	(1)	(1)		(4)													
1.5 pF	1R5	159	(1)	(1)		(4)													
1.6 pF	1R6	169	(1)	(1)		(4)													
1.8 pF	1R8	189	(1)	(1)		(4)													
2.0 pF	2R0	209	(1)	(1)		(4)													
2.2 pF	2R2	229	(1)	(1)		(4)													
2.4 pF	2R4	249	(1)	(1)		(4)													
2.7 pF	2R7	279	(1)	(1)		(5)													
3.0 pF	3R0	309	(1)	(1)		(5)													
3.3 pF	3R3	339	(1)	(1)		(5)													
3.6 pF	3R6	369	(1)	(1)		(5)													
3.9 pF	3R9	399	(1)	(1)		(5)													
4.3 pF	4R3	439	(1)	(1)		(5)													
4.7 pF	4R7	479	(1)	(1)		(5)													
5.1 pF	5R1	519	(1)	(1)		(5)													
5.6 pF	5R6	569	(1)	(1)		(5)													
6.2 pF	6R2	629	(1)	(1)		(5)													
6.8 pF	6R8	689	(1)	(1)		(5)													
7.5 pF	7R5	759	(1)	(1)		(5)													
8.2 pF	8R2	829	(1)	(1)		(5)													
9.1 pF	9R1	919	(1)	(1)		(5)													
10 pF	100	100	(2)	(2)		(3)													
11 pF	110	110	(2)	(2)		(3)													
12 pF	120	120	(2)	(2)		(3)													
13 pF	130	130	(2)	(2)		(3)													
15 pF	150	150	(2)	(2)		(3)													
16 pF	160	160	(2)	(2)		(3)													
18 pF	180	180	(2)	(2)		(3)													
20 pF	200	200	(2)	(2)		(3)													
22 pF	220	220	(2)	(2)		(3)													
24 pF	240	240	(2)	(2)		(3)													
27 pF	270	270	(3)	(3)		(3)													
Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
			Case Size	0805 (CKS51)		1206 (CKS55)		1210 (CKS52)		1808 (CKS53)		1812 (CKS56)		1825 (CKS57)		2225 (CKS54)			

To complete the KEMET part numbers, insert the following tolerance:

- (1) C = ±0.25 pF, D = ±0.5 pF
- (2) C = ±0.25 pF, J = ±5%, K = ±10%
- (3) F = ±1%, J = ±5%, K = ±10%
- (4) B = ±0.1 pF, C = ±0.25 pF
- (5) B = ±0.1 pF, C = ±0.25 pF, D = ±0.5 pF
- (6) K = ±10%, M = ±20%
- (7) K = ±10%

**Table 1A - Product Ordering Codes & Ratings (BP Dielectric) cont.**

Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Case Size	0805 (CKS51)		1206 (CKS55)		1210 (CKS52)		1808 (CKS53)		1812 (CKS56)		1825 (CKS57)		2225 (CKS54)			
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
Product Availability																			
30 pF	300	300		(3)	(3)														
33 pF	330	330		(3)	(3)		(3)												
36 pF	360	360		(3)	(3)		(3)												
39 pF	390	390		(3)	(3)		(3)												
43 pF	430	430		(3)	(3)		(3)												
47 pF	470	470		(3)	(3)		(3)												
51 pF	510	510		(3)	(3)		(3)												
56 pF	560	560		(3)	(3)		(3)												
62 pF	620	620		(3)	(3)		(3)												
68 pF	680	680		(3)	(3)		(3)												
75 pF	750	750		(3)	(3)		(3)												
82 pF	820	820		(3)	(3)		(3)												
91 pF	910	910		(3)	(3)		(3)												
100 pF	101	101		(3)	(3)		(3)												
110 pF	111	111		(3)	(3)		(3)												
120 pF	121	121		(3)	(3)		(3)												
130 pF	131	131		(3)	(3)		(3)												
150 pF	151	151		(3)	(3)		(3)												
160 pF	161	161		(3)	(3)		(3)												
180 pF	181	181		(3)	(3)		(3)												
200 pF	201	201		(3)	(3)		(3)												
220 pF	221	221		(3)	(3)		(3)												
240 pF	241	241		(3)	(3)		(3)												
270 pF	271	271		(3)	(3)		(3)												
300 pF	301	301		(3)	(3)		(3)	(3)	(3)	(3)	(3)								
330 pF	331	331		(3)	(3)		(3)	(3)	(3)	(3)	(3)								
360 pF	361	361		(3)	(3)		(3)	(3)	(3)	(3)	(3)								
390 pF	391	391		(3)	(3)		(3)	(3)	(3)	(3)	(3)								
430 pF	431	431		(3)	(3)		(3)	(3)	(3)	(3)	(3)								
470 pF	471	471		(3)	(3)		(3)	(3)	(3)	(3)	(3)								
510 pF	511	511		(3)			(3)	(3)	(3)	(3)	(3)								
560 pF	561	561		(3)			(3)	(3)	(3)	(3)	(3)								
620 pF	621	621		(3)			(3)	(3)	(3)	(3)	(3)								
680 pF	681	681		(3)			(3)	(3)	(3)	(3)	(3)								
750 pF	751	751		(3)			(3)	(3)	(3)	(3)	(3)								
Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
			Case Size	0805 (CKS51)		1206 (CKS55)		1210 (CKS52)		1808 (CKS53)		1812 (CKS56)		1825 (CKS57)		2225 (CKS54)			

To complete the KEMET part numbers, insert the following tolerance:

- (1) C = ±0.25 pF, D = ±0.5 pF
- (2) C = ±0.25 pF, J = ±5%, K = ±10%
- (3) F = ±1%, J = ±5%, K = ±10%
- (4) B = ±0.1 pF, C = ±0.25 pF
- (5) B = ±0.1 pF, C = ±0.25 pF, D = ±0.5 pF
- (6) K = ±10%, M = ±20%
- (7) K = ±10%

**Table 1A - Product Ordering Codes & Ratings (BP Dielectric) cont.**

Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Case Size	0805 (CKS51)		1206 (CKS55)		1210 (CKS52)		1808 (CKS53)		1812 (CKS56)		1825 (CKS57)		2225 (CKS54)			
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
Product Availability																			
820 pF	821	821				(3)	(3)	(3)	(3)	(3)									
910 pF	911	911				(3)	(3)	(3)	(3)	(3)									
1,000 pF	102	102				(3)	(3)	(3)	(3)	(3)									
1,100 pF	112	112				(3)	(3)	(3)	(3)	(3)							(3)		
1,200 pF	122	122				(3)	(3)	(3)	(3)	(3)		(3)					(3)		
1,300 pF	132	132				(3)	(3)	(3)	(3)	(3)							(3)		
1,500 pF	152	152				(3)	(3)	(3)	(3)	(3)		(3)					(3)		
1,600 pF	162	162				(3)	(3)	(3)	(3)	(3)							(3)		
1,800 pF	182	182				(3)	(3)	(3)	(3)	(3)		(3)					(3)		
2,000 pF	202	202				(3)	(3)	(3)	(3)	(3)							(3)		
2,200 pF	222	222				(3)	(3)	(3)	(3)	(3)		(3)					(3)		
2,400 pF	242	242						(3)	(3)	(3)		(3)					(3)		
2,700 pF	272	272						(3)	(3)	(3)		(3)					(3)		
3,000 pF	302	302						(3)	(3)	(3)		(3)					(3)		
3,300 pF	332	332						(3)	(3)	(3)		(3)					(3)		
3,600 pF	362	362										(3)					(3)		
3,900 pF	392	392										(3)		(3)			(3)		
4,300 pF	432	432										(3)		(3)			(3)		
4,700 pF	472	472										(3)		(3)			(3)		
5,100 pF	512	512										(3)		(3)			(3)		
5,600 pF	562	562										(3)		(3)			(3)		
6,200 pF	622	622										(3)		(3)			(3)		
6,800 pF	682	682										(3)		(3)			(3)		
7,500 pF	752	752										(3)		(3)			(3)		
8,200 pF	822	822										(3)		(3)			(3)		
9,100 pF	912	912										(3)		(3)			(3)		
10,000 pF	103	103										(3)		(3)			(3)		
11,000 pF	113	113										(3)		(3)			(3)		
12,000 pF	123	123										(3)		(3)			(3)		
13,000 pF	133	133										(3)		(3)			(3)		
15,000 pF	153	153										(3)		(3)			(3)		
16,000 pF	163	163										(3)		(3)			(3)		
18,000 pF	183	183										(3)		(3)			(3)		
20,000 pF	203	203										(3)		(3)			(3)		
22,000 pF	223	223										(3)		(3)			(3)		
Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1		
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C		
			Case Size	0805 (CKS51)	1206 (CKS55)	1210 (CKS52)	1808 (CKS53)	1812 (CKS56)	1825 (CKS57)	2225 (CKS54)									

To complete the KEMET part numbers, insert the following tolerance:

- (1) C = ±0.25 pF, D = ±0.5 pF
- (2) C = ±0.25 pF, J = ±5%, K = ±10%
- (3) F = ±1%, J = ±5%, K = ±10%
- (4) B = ±0.1 pF, C = ±0.25 pF
- (5) B = ±0.1 pF, C = ±0.25 pF, D = ±0.5 pF
- (6) K = ±10%, M = ±20%
- (7) K = ±10%

**Table 1B - Product Ordering Codes & Ratings (BX Dielectric)**

Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Case Size	0805 (CKS51)		1206 (CKS55)		1210 (CKS52)		1808 (CKS53)		1812 (CKS56)		1825 (CKS57)		2225 (CKS54)			
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100	50	100
Product Availability																			
330 pF	331	331	(7)	(7)															
390 pF	391	391	(7)	(7)															
470 pF	471	471	(7)	(7)															
560 pF	561	561	(7)	(7)															
680 pF	681	681	(7)	(7)															
820 pF	821	821	(7)	(7)															
1,000 pF	102	102	(7)	(7)															
1,200 pF	122	122	(7)	(7)															
1,500 pF	152	152	(7)	(7)															
1,800 pF	182	182	(7)	(7)															
2,200 pF	222	222	(7)	(7)															
2,700 pF	272	272	(7)	(7)															
3,300 pF	332	332	(7)	(7)															
3,900 pF	392	392	(7)	(7)															
4,700 pF	472	472	(7)	(7)			(6)												
5,600 pF	562	562	(7)				(6)	(6)	(6)	(7)	(7)								
6,800 pF	682	682	(7)				(6)	(6)	(6)	(7)	(7)								
8,200 pF	822	822	(7)				(6)	(6)	(6)	(7)	(7)								
10,000 pF	103	103	(7)				(6)	(6)	(6)	(7)	(7)								
12,000 pF	123	123	(7)				(6)	(6)	(6)	(7)	(7)								
15,000 pF	153	153	(7)				(6)	(6)	(6)	(7)	(7)								
18,000 pF	183	183	(7)				(6)	(6)	(6)	(7)	(7)								
22,000 pF	223	223	(7)				(6)	(6)	(6)	(7)	(7)								
27,000 pF	273	273	(7)				(6)	(6)	(6)	(7)	(7)		(6)						
33,000 pF	333	333					(6)	(6)	(6)	(7)	(7)		(6)						
39,000 pF	393	393					(6)			(6)			(6)						
47,000 pF	473	473						(6)		(6)			(6)						
56,000 pF	563	563						(6)		(6)			(6)		(6)				
68,000 pF	683	683						(6)		(6)			(6)		(6)				
82,000 pF	823	823						(6)		(6)			(6)		(6)				
100,000 pF	104	104						(6)		(6)			(6)		(6)				
120,000 pF	124	124								(6)			(6)		(6)		(7)		
150,000 pF	154	154								(6)			(6)		(6)		(7)		
180,000 pF	184	184								(6)			(6)		(6)		(7)		
220,000 pF	224	224								(6)			(6)		(6)		(7)		
270,000 pF	274	274								(6)			(6)		(6)		(7)		
330,000 pF	334	334								(6)			(6)		(6)		(7)		
390,000 pF	394	394								(6)			(6)		(6)		(7)		
470,000 pF	474	474								(6)			(6)		(6)		(7)		
1,000,000 pF	105	105								(6)			(6)		(6)		(7)		
Capacitance	Cap Code (MIL-PRF-123 Part Number)	Cap Code (KEMET Part Number)	Rated Voltage (VDC)	50	100	50	100	50	100	50	100	50	100	50	100	50	100		
			Voltage Code (KEMET)	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
			Voltage Code (MIL)	B	C	B	C	B	C	B	C	B	C	B	C	B	C	B	C
			Case Size	0805 (CKS51)	1206 (CKS55)	1210 (CKS52)	1808 (CKS53)	1812 (CKS56)	1825 (CKS57)	2225 (CKS54)									

To complete the KEMET part numbers, insert the following tolerance:

- (1) C = ±0.25 pF, D = ±0.5 pF
- (2) C = ±0.25 pF, J = ±5%, K = ±10%
- (3) F = ±1%, J = ±5%, K = ±10%
- (4) B = ±0.1 pF, C = ±0.25 pF
- (5) B = ±0.1 pF, C = ±0.25 pF, D = ±0.5 pF
- (6) K = ±10%, M = ±20%
- (7) K = ±10%





## Legacy Ratings and Part Number Reference cont.

CAP. pF	KEMET PART NUMBER	MIL-PRF-123 PART NUMBER	CAP. pF	KEMET PART NUMBER	MIL-PRF-123 PART NUMBER	CAP. pF	KEMET PART NUMBER	MIL-PRF-123 PART NUMBER
<b>100 VOLT - BP - C1206 SIZE (MILITARY CKS55)</b>			<b>50 VOLT-BP-C1206 SIZE (MILITARY CKS55)</b>			<b>100 VOLT-BP-C1825 SIZE (MILITARY CKS57)</b>		
1.0	C1206Z109(4)1GA(9)	M123A21BPC1R0(4)(10)	1,100.0	C1206Z112(3)5GA(9)	M123A21BPB112(3)(10)	3,900.0	C1825Z392(3)1GA(9)	M123A23BPC392(3)(10)
1.1	C1206Z119(4)1GA(9)	M123A21BPC1R1(4)(10)	1,200.0	C1206Z122(3)5GA(9)	M123A21BPB122(3)(10)	4,700.0	C1825Z472(3)1GA(9)	M123A23BPC472(3)(10)
1.2	C1206Z129(4)1GA(9)	M123A21BPC1R2(4)(10)	1,300.0	C1206Z132(3)5GA(9)	M123A21BPB132(3)(10)	5,100.0	C1825Z512(3)1GA(9)	M123A23BPC512(3)(10)
1.3	C1206Z139(4)1GA(9)	M123A21BPC1R3(4)(10)	1,500.0	C1206Z152(3)5GA(9)	M123A21BPB152(3)(10)	5,600.0	C1825Z562(3)1GA(9)	M123A23BPC562(3)(10)
1.5	C1206Z159(4)1GA(9)	M123A21BPC1R5(4)(10)	1,600.0	C1206Z162(3)5GA(9)	M123A21BPB162(3)(10)	6,200.0	C1825Z622(3)1GA(9)	M123A23BPC622(3)(10)
1.6	C1206Z169(4)1GA(9)	M123A21BPC1R6(4)(10)	1,800.0	C1206Z182(3)5GA(9)	M123A21BPB182(3)(10)	6,800.0	C1825Z682(3)1GA(9)	M123A23BPC682(3)(10)
1.8	C1206Z189(4)1GA(9)	M123A21BPC1R8(4)(10)	2,000.0	C1206Z202(3)5GA(9)	M123A21BPB202(3)(10)	7,500.0	C1825Z752(3)1GA(9)	M123A23BPC752(3)(10)
2.0	C1206Z209(4)1GA(9)	M123A21BPC2R0(4)(10)	2,200.0	C1206Z222(3)5GA(9)	M123A21BPB222(3)(10)	8,200.0	C1825Z822(3)1GA(9)	M123A23BPC822(3)(10)
2.2	C1206Z229(4)1GA(9)	M123A21BPC2R2(4)(10)				9,100.0	C1825Z912(3)1GA(9)	M123A23BPC912(3)(10)
2.4	C1206Z249(4)1GA(9)	M123A21BPC2R4(4)(10)				10,000.0	C1825Z103(3)1GA(9)	M123A23BPC103(3)(10)
2.7	C1206Z279(5)1GA(9)	M123A21BPC2R7(5)(10)	4,700.0	C1206Z472(6)1XA(9)	M123A21BXC472(6)(10)			
3.0	C1206Z309(5)1GA(9)	M123A21BPC3R0(5)(10)	5,600.0	C1206Z562(6)1XA(9)	M123A21BXC562(6)(10)			
3.3	C1206Z339(5)1GA(9)	M123A21BPC3R3(5)(10)	6,800.0	C1206Z682(6)1XA(9)	M123A21BXC682(6)(10)			
3.6	C1206Z369(5)1GA(9)	M123A21BPC3R6(5)(10)	8,200.0	C1206Z822(6)1XA(9)	M123A21BXC822(6)(10)			
3.9	C1206Z399(5)1GA(9)	M123A21BPC3R9(5)(10)	10,000.0	C1206Z103(6)1XA(9)	M123A21BXC103(6)(10)			
4.3	C1206Z439(5)1GA(9)	M123A21BPC4R3(5)(10)	12,000.0	C1206Z123(6)1XA(9)	M123A21BXC123(6)(10)			
4.7	C1206Z479(5)1GA(9)	M123A21BPC4R7(5)(10)	15,000.0	C1206Z153(6)1XA(9)	M123A21BXC153(6)(10)			
5.1	C1206Z519(5)1GA(9)	M123A21BPC5R1(5)(10)						
5.6	C1206Z569(5)1GA(9)	M123A21BPC5R6(5)(10)						
6.2	C1206Z629(5)1GA(9)	M123A21BPC6R2(5)(10)						
6.8	C1206Z689(5)1GA(9)	M123A21BPC6R8(5)(10)						
7.5	C1206Z759(5)1GA(9)	M123A21BPC7R5(5)(10)						
8.2	C1206Z829(5)1GA(9)	M123A21BPC8R2(5)(10)						
9.1	C1206Z919(5)1GA(9)	M123A21BPC9R1(5)(10)						
10.0	C1206Z100(3)1GA(9)	M123A21BPC100(3)(10)						
11.0	C1206Z110(3)1GA(9)	M123A21BPC110(3)(10)						
12.0	C1206Z120(3)1GA(9)	M123A21BPC120(3)(10)						
13.0	C1206Z130(3)1GA(9)	M123A21BPC130(3)(10)						
15.0	C1206Z150(3)1GA(9)	M123A21BPC150(3)(10)						
16.0	C1206Z160(3)1GA(9)	M123A21BPC160(3)(10)						
18.0	C1206Z180(3)1GA(9)	M123A21BPC180(3)(10)						
20.0	C1206Z200(3)1GA(9)	M123A21BPC200(3)(10)						
24.0	C1206Z240(3)1GA(9)	M123A21BPC240(3)(10)						
27.0	C1206Z270(3)1GA(9)	M123A21BPC270(3)(10)						
33.0	C1206Z330(3)1GA(9)	M123A21BPC330(3)(10)						
36.0	C1206Z360(3)1GA(9)	M123A21BPC360(3)(10)						
39.0	C1206Z390(3)1GA(9)	M123A21BPC390(3)(10)						
43.0	C1206Z430(3)1GA(9)	M123A21BPC430(3)(10)						
47.0	C1206Z470(3)1GA(9)	M123A21BPC470(3)(10)						
51.0	C1206Z510(3)1GA(9)	M123A21BPC510(3)(10)						
56.0	C1206Z560(3)1GA(9)	M123A21BPC560(3)(10)						
62.0	C1206Z620(3)1GA(9)	M123A21BPC620(3)(10)						
68.0	C1206Z680(3)1GA(9)	M123A21BPC680(3)(10)						
75.0	C1206Z750(3)1GA(9)	M123A21BPC750(3)(10)						
82.0	C1206Z820(3)1GA(9)	M123A21BPC820(3)(10)						
91.0	C1206Z910(3)1GA(9)	M123A21BPC910(3)(10)						
100.0	C1206Z101(3)1GA(9)	M123A21BPC101(3)(10)						
110.0	C1206Z111(3)1GA(9)	M123A21BPC111(3)(10)						
120.0	C1206Z121(3)1GA(9)	M123A21BPC121(3)(10)						
130.0	C1206Z131(3)1GA(9)	M123A21BPC131(3)(10)						
150.0	C1206Z151(3)1GA(9)	M123A21BPC151(3)(10)						
160.0	C1206Z161(3)1GA(9)	M123A21BPC161(3)(10)						
180.0	C1206Z181(3)1GA(9)	M123A21BPC181(3)(10)						
200.0	C1206Z201(3)1GA(9)	M123A21BPC201(3)(10)						
220.0	C1206Z221(3)1GA(9)	M123A21BPC221(3)(10)						
240.0	C1206Z241(3)1GA(9)	M123A21BPC241(3)(10)						
270.0	C1206Z271(3)1GA(9)	M123A21BPC271(3)(10)						
300.0	C1206Z301(3)1GA(9)	M123A21BPC301(3)(10)						
330.0	C1206Z331(3)1GA(9)	M123A21BPC331(3)(10)						
360.0	C1206Z361(3)1GA(9)	M123A21BPC361(3)(10)						
390.0	C1206Z391(3)1GA(9)	M123A21BPC391(3)(10)						
430.0	C1206Z431(3)1GA(9)	M123A21BPC431(3)(10)						
470.0	C1206Z471(3)1GA(9)	M123A21BPC471(3)(10)						
510.0	C1206Z511(3)1GA(9)	M123A21BPC511(3)(10)						
560.0	C1206Z561(3)1GA(9)	M123A21BPC561(3)(10)						
620.0	C1206Z621(3)1GA(9)	M123A21BPC621(3)(10)						
680.0	C1206Z681(3)1GA(9)	M123A21BPC681(3)(10)						
750.0	C1206Z751(3)1GA(9)	M123A21BPC751(3)(10)						
820.0	C1206Z821(3)1GA(9)	M123A21BPC821(3)(10)						
910.0	C1206Z911(3)1GA(9)	M123A21BPC911(3)(10)						
1000.0	C1206Z102(3)1GA(9)	M123A21BPC102(3)(10)						

To complete the KEMET part numbers, insert the following tolerance:

- (1) C = ±0.25pF; D = ±0.5pF
- (2) C = ±0.25pF; J = ±5%; K = ±10%
- (3) F = ±1%; J = ±5%; K = ±10%
- (4) B = ±0.1pF; C = ±0.25pF
- (5) B = ±0.1pF; C = 0.25pF; D = 0.50pF
- (6) K = ±10%; M = ±20%

To complete the KEMET part numbers, insert the following voltage:

- (7) B = 50 volts; C = 100 volts
- (8) 5 = 50 volts; 1 = 100 volts

To complete the KEMET part numbers, insert termination designation:

- (9) H = Nickel Guarded, Solder Coated (Sn60); L = 70/30 Tin/Lead Plated
- (10) S = Nickel Guarded, Solder Coated (Sn60); Z = 70/30 Tin/Lead Plated

**Table 2 – Chip Capacitor Land Pattern Design Recommendations per IPC-7351**

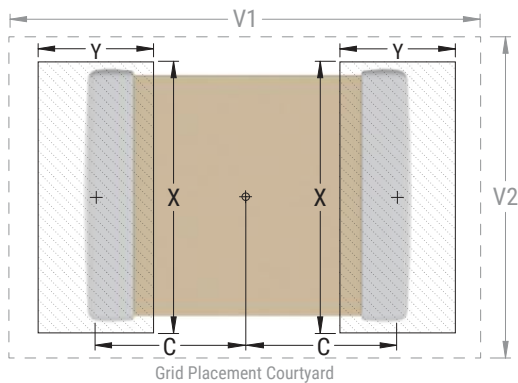
EIA Size Code	Metric Size Code	Density Level A: Maximum (Most) Land Protrusion (mm)					Density Level B: Median (Nominal) Land Protrusion (mm)					Density Level C: Minimum (Least) Land Protrusion (mm)				
		C	Y	X	V1	V2	C	Y	X	V1	V2	C	Y	X	V1	V2
0805	2012	1.00	1.35	1.55	4.40	2.60	0.90	1.15	1.45	3.50	2.00	0.75	0.95	1.35	2.80	1.70
1206	3216	1.60	1.35	1.90	5.60	2.90	1.50	1.15	1.80	4.70	2.30	1.40	0.95	1.70	4.00	2.00
1210	3225	1.60	1.35	2.80	5.65	3.80	1.50	1.15	2.70	4.70	3.20	1.40	0.95	2.60	4.00	2.90
1808	4520	2.30	1.75	2.30	7.40	3.30	2.20	1.55	2.20	6.50	2.70	2.10	1.35	2.10	5.80	2.40
1812	4532	2.15	1.60	3.60	6.90	4.60	2.05	1.40	3.50	6.00	4.00	1.95	1.20	3.40	5.30	3.70
1825	4564	2.15	1.60	6.90	6.90	7.90	2.05	1.40	6.80	6.00	7.30	1.95	1.20	6.70	5.30	7.00
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. It is 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. It 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

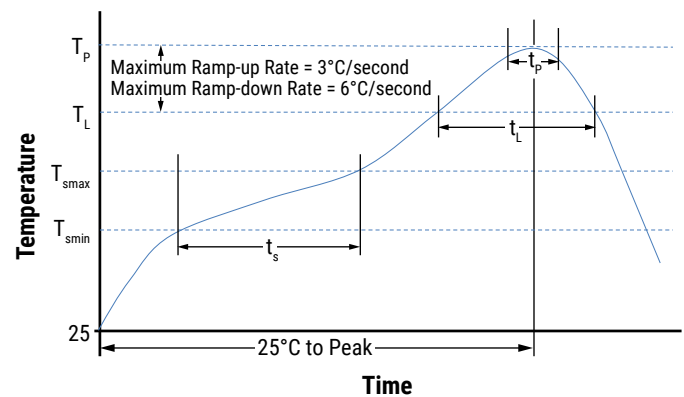
### Recommended Soldering Technique:

- 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 3 – Performance & Reliability: Test Methods and Conditions**

Inspection	Test Method	MIL-PRF-123 M-Level	MIL-PRF-123 T-Level
<b>In-Process Inspection</b>			
Ultrasonic inspection (pre-termination)	MIL-PRF-123 Method 4.6.1	Yes (100 %)	Yes (100 %)
Pre-termination destructive physical analysis	MIL-PRF-123 Method 4.6.2	Yes (Sample)	Yes (Sample)
Visual examination (post termination for non-leaded capacitors or post lead attachment for leaded capacitors)	MIL-PRF-123 Method 4.6.3.1	Yes (100 %)	Yes (100 %)
Pre-encapsulation terminal strength (leaded capacitors only)	MIL-PRF-123 Method 4.6.4	Yes (Sample)	Yes (Sample)
<b>Group A Inspection</b>			
Thermal shock	MIL-PRF-123 Method 4.6.6.1	Yes (100 %)	Yes (100 %)
Ultrasonic inspection (T level ≥ 0805 only)	MIL-PRF-123 Method 4.6.1	Not Required	Yes (100 %)
Voltage conditioning	MIL-PRF-123 Method 4.6.6.2	Yes (100 %)	Yes (100 %)
Radiographic inspection (encapsulated capacitors only)	MIL-PRF-123 Method 4.6.5	Yes (100 %)	Yes (100 %)
Visual and mechanical inspection; material, physical dimensions, design, construction, marking, and workmanship	MIL-PRF-123 Method 4.6.3.2	Yes (Sample)	Yes (Sample)
Destructive physical analysis (DPA)	MIL-PRF-123 Method 4.6.11	Yes (5 Pieces)	Yes (5 Pieces)
<b>Group B Inspection</b>			
Thermal shock	MIL-PRF-123 Method 4.6.6.1	Yes (Sample)	Yes (Sample)
Life	MIL-PRF-123 Method 4.6.19	Yes (Sample)	Yes (Sample)
Humidity, steady-state, low voltage	MIL-PRF-123 Method 4.6.16.1	Yes (Sample)	Yes (Sample)
Voltage - temperature limits	MIL-PRF-123 Method 4.6.15	Yes (Sample)	Yes (Sample)
Moisture resistance	MIL-PRF-123 Method 4.6.16.2	Yes (Sample)	Yes (Sample)
<b>Group C Inspection (Subgroup 2: Chip Devices)</b>			
Terminal Strength	MIL-PRF-123 Method 4.6.12.2.1	Yes (Military Monitoring Program, periodic)	
Board flex	MIL-PRF-123 Method 4.6.12.2.1		
Shear stress	MIL-PRF-32535 Method 4.6.12.2.2		
Solderability (terminations S and Z only)	MIL-PRF-123 Method 4.6.13.1.2		
Bond strength (wire) (termination G only)	MIL-PRF-123 Method 4.6.13.2		
Resistance to soldering heat (terminations S and Z only)	MIL-PRF-32535 Method 4.6.14.2		
Resistance to solvents (chips with markings other than laser marking)	MIL-PRF-32535 Method 4.6.18		

## Storage and Handling

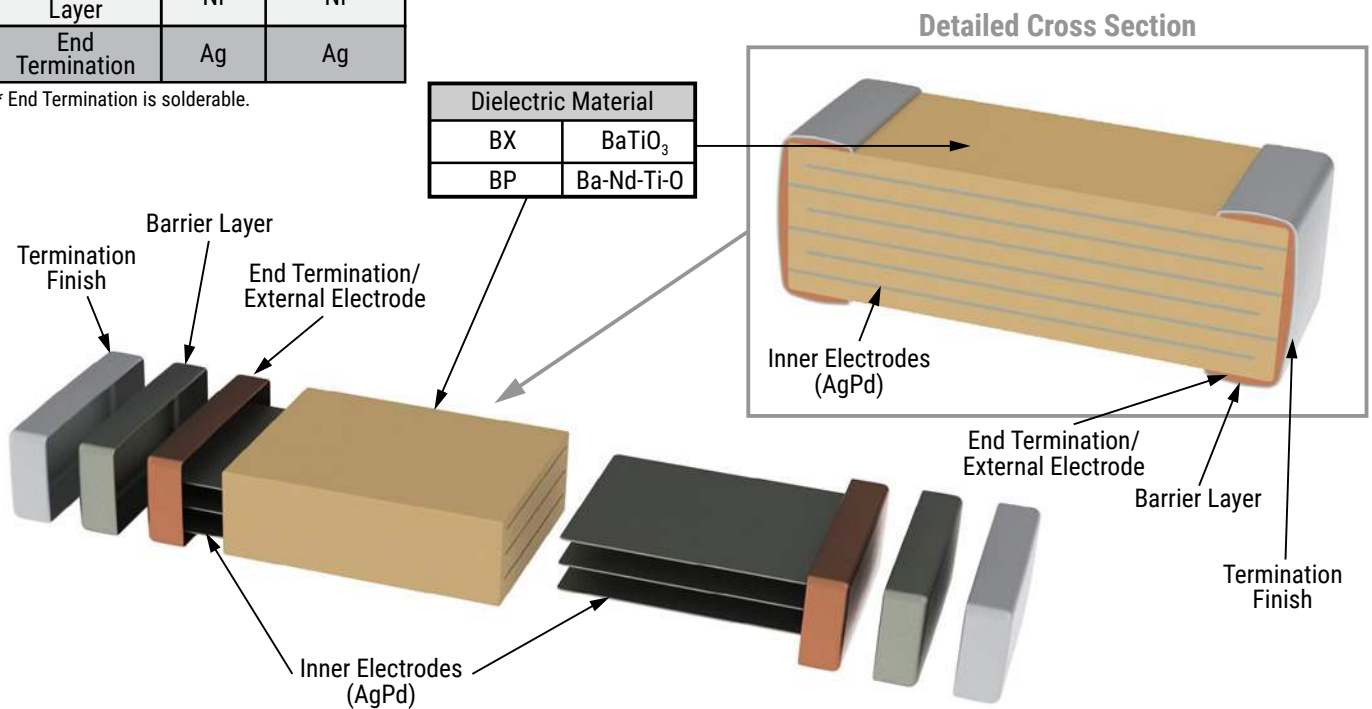
Ceramic chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will 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. The atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability chip stock should be used promptly, preferably within 1.5 years upon receipt.

## Construction

MIL Finish	S	Z
KEMET Finish	H	L
Termination Finish	Sn60 (Coated)	70/30 SnPb (Plated)
Barrier Layer	Ni	Ni
End Termination	Ag	Ag

\* End Termination is solderable.

Dielectric Material	
BX	BaTiO <sub>3</sub>
BP	Ba-Nd-Ti-O



## Capacitor Marking

KEMET MIL-PRF-123 ceramic capacitors will be marked in accordance with the military specification on case sizes  $\geq$  0805. Case sizes below 0805 will not be marked. Two sides of the ceramic body will be laser marked with a “K” to identify KEMET, followed by two characters to identify the capacitance value.

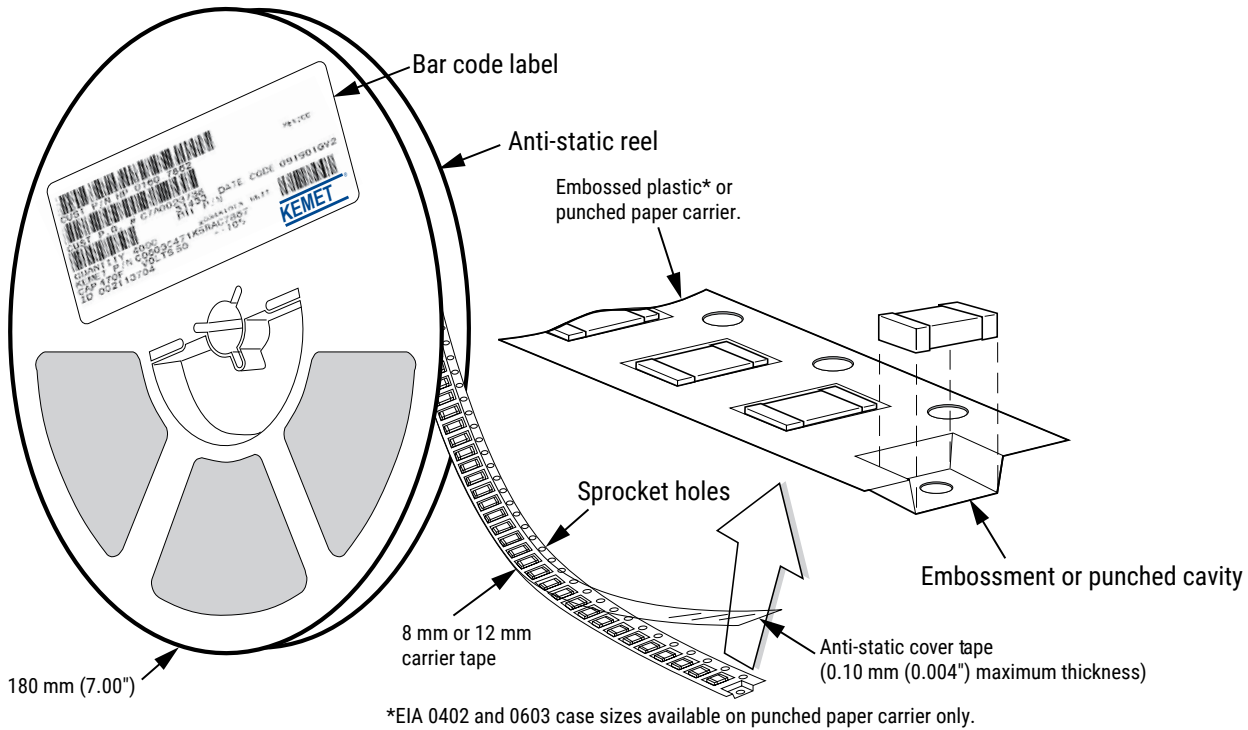


The marking appears in legible contrast. Illustrated below is an example of an MLCC with laser the marking of “KA5”, which designates a KEMET device with the rated capacitance of 100 nF.

Capacitance (pF) For Various Alpha/Numeral Identifiers								
Alpha Character	Numeral							
	9	0	1	2	3	4	5	6
Capacitance (pF)								
A	0.1	1.0	10	100	1,000	10,000	100,000	1,000,000
B	0.11	1.1	11	110	1,100	11,000	110,000	1,100,000
C	0.12	1.2	12	120	1,200	12,000	120,000	1,200,000
D	0.13	1.3	13	130	1,300	13,000	130,000	1,300,000
E	0.15	1.5	15	150	1,500	15,000	150,000	1,500,000
F	0.16	1.6	16	160	1,600	16,000	160,000	1,600,000
G	0.18	1.8	18	180	1,800	18,000	180,000	1,800,000
H	0.2	2.0	20	200	2,000	20,000	200,000	2,000,000
J	0.22	2.2	22	220	2,200	22,000	220,000	2,200,000
K	0.24	2.4	24	240	2,400	24,000	240,000	2,400,000
L	0.27	2.7	27	270	2,700	27,000	270,000	2,700,000
M	0.3	3.0	30	300	3,000	30,000	300,000	3,000,000
N	0.33	3.3	33	330	3,300	33,000	330,000	3,300,000
P	0.36	3.6	36	360	3,600	36,000	360,000	3,600,000
Q	0.39	3.9	39	390	3,900	39,000	390,000	3,900,000
R	0.43	4.3	43	430	4,300	43,000	430,000	4,300,000
S	0.47	4.7	47	470	4,700	47,000	470,000	4,700,000
T	0.51	5.1	51	510	5,100	51,000	510,000	5,100,000
U	0.56	5.6	56	560	5,600	56,000	560,000	5,600,000
V	0.62	6.2	62	620	6,200	62,000	620,000	6,200,000
W	0.68	6.8	68	680	6,800	68,000	680,000	6,800,000
X	0.75	7.5	75	750	7,500	75,000	750,000	7,500,000
Y	0.82	8.2	82	820	8,200	82,000	820,000	8,200,000
Z	0.91	9.1	91	910	9,100	91,000	910,000	9,100,000
a	0.25	2.5	25	250	2,500	25,000	250,000	2,500,000
b	0.35	3.5	35	350	3,500	35,000	350,000	3,500,000
d	0.4	4.0	40	400	4,000	40,000	400,000	4,000,000
e	0.45	4.5	45	450	4,500	45,000	450,000	4,500,000
f	0.5	5.0	50	500	5,000	50,000	500,000	5,000,000
m	0.6	6.0	60	600	6,000	60,000	600,000	6,000,000
n	0.7	7.0	70	700	7,000	70,000	700,000	7,000,000
t	0.8	8.0	80	800	8,000	80,000	800,000	8,000,000
y	0.9	9.0	90	900	9,000	90,000	900,000	9,000,000

## Tape & Reel Packaging Information

KEMET offers multilayer ceramic chip capacitors packaged in 8 and 12 mm tape on 7" reels in accordance with EIA Standard 481. This packaging system is compatible with all tape-fed automatic pick and place systems.



**Table 4 – Carrier Tape Configuration, Embossed Plastic & Punched Paper (mm)**

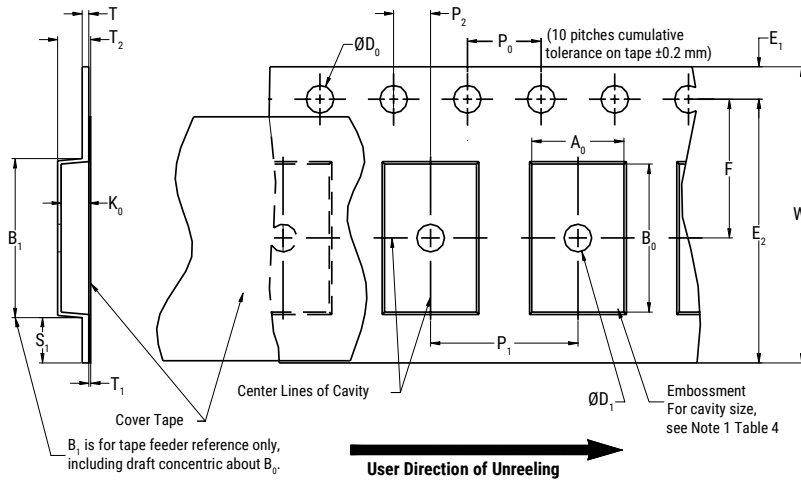
EIA Case Size	Tape size (W)*	Embossed Plastic
		7" Reel
		Pitch (P1)*
0805 – 1210	8	4
≥ 1808	12	8

\*Refer to Figures 1 and 2 for W and P<sub>1</sub> carrier tape reference locations.

\*Refer to Tables 6 and 7 for tolerance specifications.



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



**Table 5 – Embossed (Plastic) Carrier Tape Dimensions**

Metric will govern

Constant Dimensions – Millimeters (Inches)									
Tape Size	D <sub>0</sub>	D <sub>1</sub> Minimum Note 1	E <sub>1</sub>	P <sub>0</sub>	P <sub>2</sub>	R Reference Note 2	S <sub>1</sub> Minimum Note 3	T Maximum	T <sub>1</sub> 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)			
Variable Dimensions – Millimeters (Inches)									
Tape Size	Pitch	B <sub>1</sub> Maximum Note 4	E <sub>2</sub> Minimum	F	P <sub>1</sub>	T <sub>2</sub> Maximum	W Maximum	A <sub>0</sub> , B <sub>0</sub> and K <sub>0</sub>	
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)		

1. The embossment hole location shall be measured from the sprocket hole controlling the location of the embossment. Dimensions of the embossment location and the hole location shall be applied independent of each other.
2. The tape with or without components, shall pass around R without damage (see Figure 6).
3. If S<sub>1</sub> < 1.0 mm, there may not be enough area for cover tape to be properly applied (see EIA Document 481 paragraph 4.3 (b)).
4. B<sub>1</sub> dimension is a reference dimension for a tape feeder clearance only.
5. The cavity defined by A<sub>0</sub>, B<sub>0</sub> and K<sub>0</sub> shall surround the component with sufficient clearance that:
  - (a) The component does not protrude above the top surface of the carrier tape.
  - (b) The component can be removed from the cavity in a vertical direction without mechanical restriction, after the top cover tape has been removed.
  - (c) Rotation of the component is limited to 20° maximum for 8 and 12 mm tapes; 10° maximum for 16 mm tapes (see Figure 3).
  - (d) Lateral movement of the component is restricted to 0.5 mm maximum for 8 mm and 12 mm wide tape; to 1.0 mm maximum for 16 mm tape (see Figure 4).
  - (e) See addendum in EIA Document 481 for standards relating to more precise taping requirements.

## Packaging Information Performance Notes

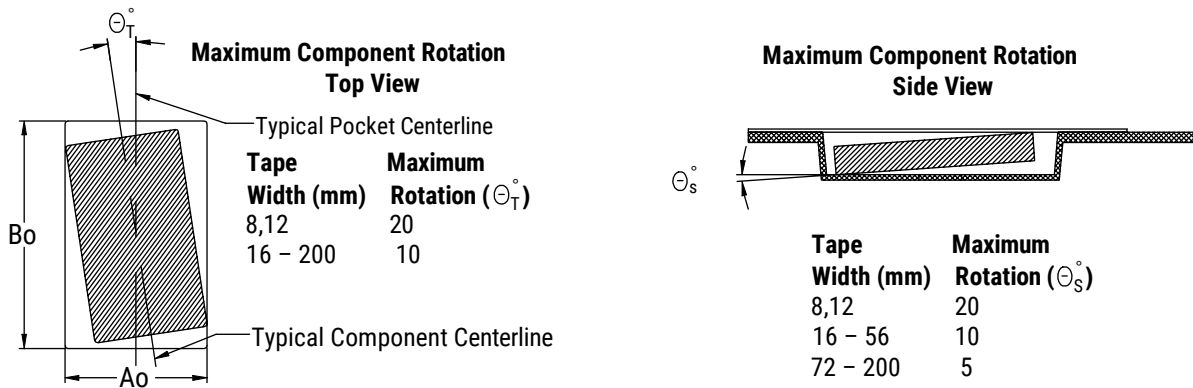
- Cover Tape Break Force:** 1.0 kg minimum.
- Cover Tape Peel Strength:** The total peel strength of the cover tape from the carrier tape shall be:

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)

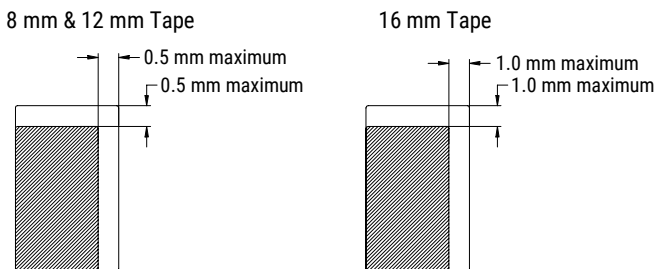
The direction of the pull shall be opposite the direction of the carrier tape travel. The pull angle of the carrier tape shall be 165° to 180° from the plane of the carrier tape. During peeling, the carrier and/or cover tape shall be pulled at a velocity of 300 ±10 mm/minute.

- 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.

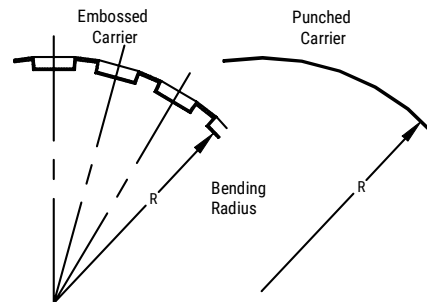
### Figure 2 – Maximum Component Rotation



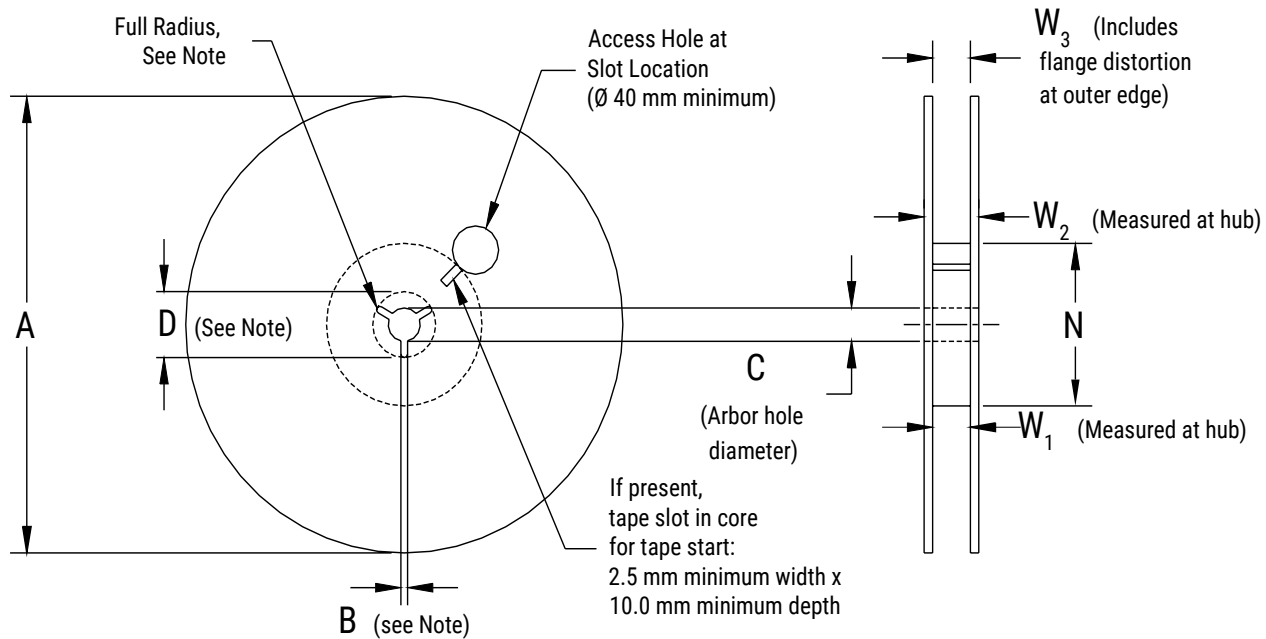
### Figure 3 – Maximum Lateral Movement



### Figure 4 – Bending Radius



## Figure 5 – Reel Dimensions



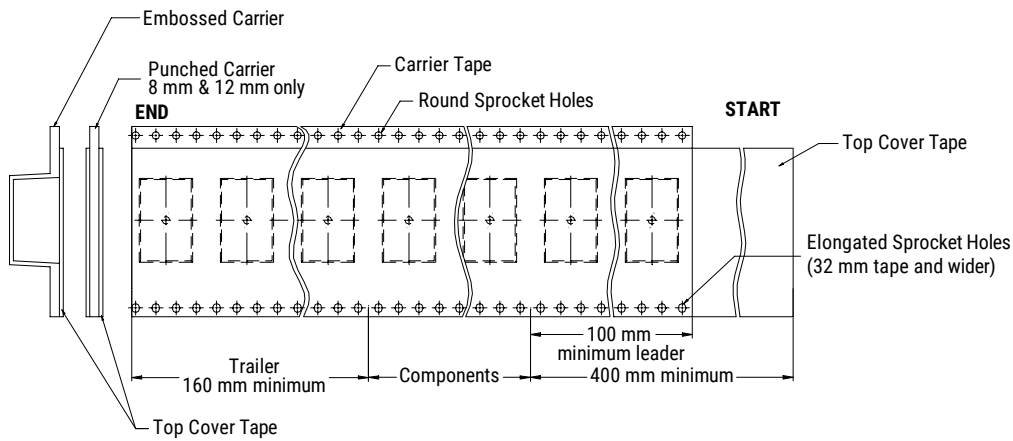
Note: Drive spokes optional; if used, dimensions B and D shall apply.

## Table 6 – Reel Dimensions

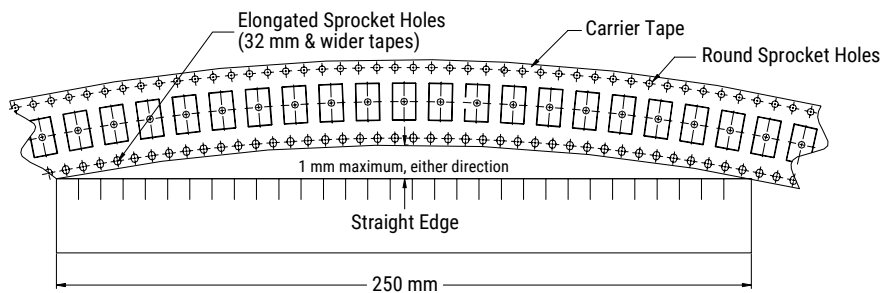
Metric will govern

Constant Dimensions – Millimeters (Inches)				
Tape Size	A	B Minimum	C	D Minimum
8 mm	178±0.20 (7.008±0.008)	1.5 (0.059)	13.0 + 0.5/-0.2 (0.521 + 0.02/-0.008)	20.2 (0.795)
12 mm	330±0.20 (13.000±0.008)			
Variable Dimensions – Millimeters (Inches)				
Tape Size	N Minimum See Note 2, Tables 2–3	$W_1$	$W_2$ 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)	

**Figure 7 – Tape Leader & Trailer Dimensions**

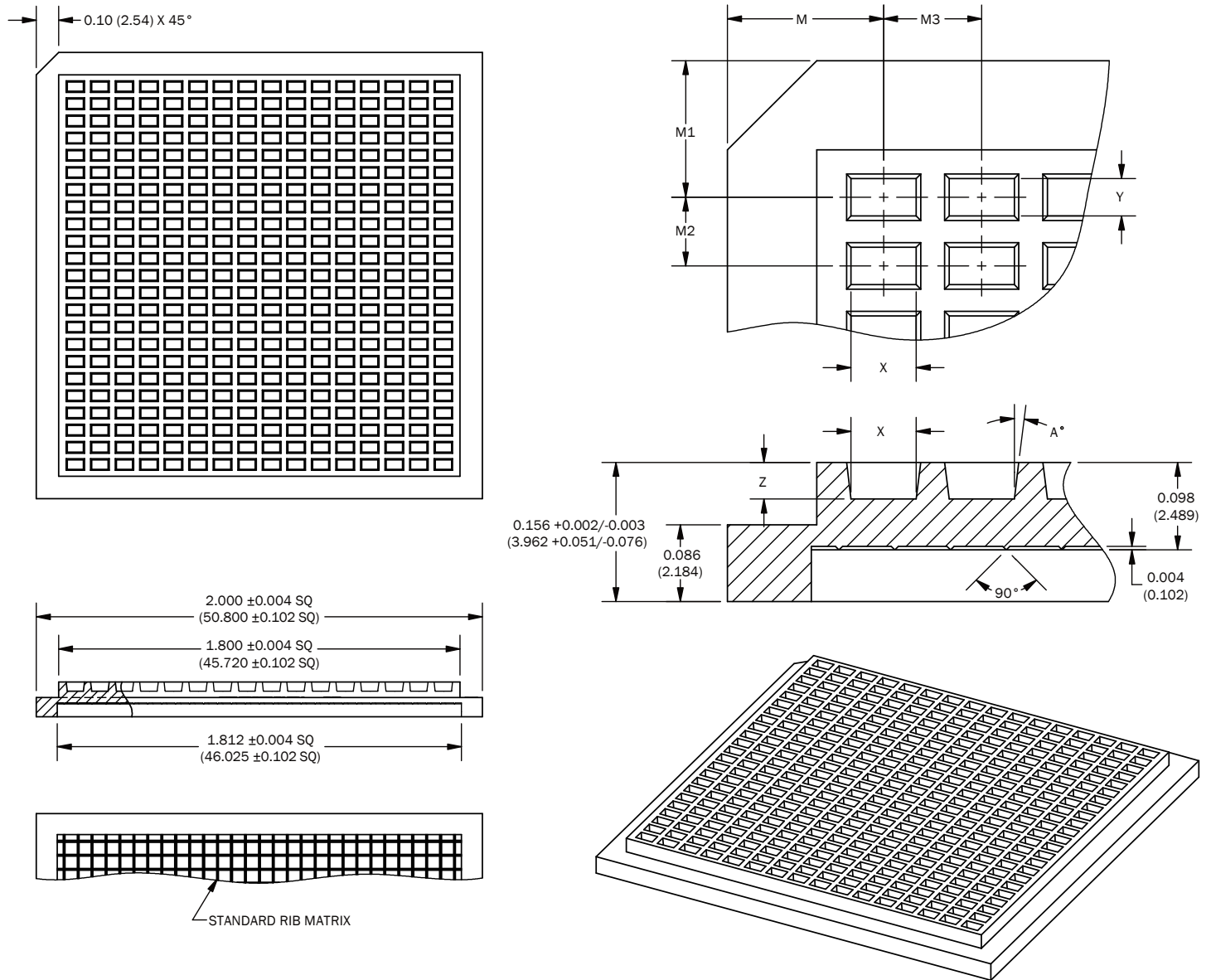


**Figure 8 – Maximum Camber**



## Waffle Tray Packaging Information – 2" x 2" w/ Static Protection

**Figure 9 – Waffle Tray Dimensions – Inches (Millimeters)**



**Table 7A – Waffle Tray Dimensions – Inches**

Case Size		2" x 2" Waffle Tray Dimensions – Inches									Packaging Quantity (pcs/unit packaging)
		M	M1	M2	M3	X	Y	Z	A°	MATRIX	
EIA (in)	Metric (mm)	±0.003	±0.003	±0.002	±0.002	±0.002	±0.002	±0.003	±1/2°	(X x Y)	
0402	1005	0.175	0.153	0.077	0.110	0.073	0.042	0.041	7	16 X 23	368
0603	1608	0.175	0.153	0.077	0.110	0.073	0.042	0.041	7	16 X 23	368
0805	2012	0.232	0.186	0.181	0.171	0.062	0.092	0.036	10	10 X 10	100
1206	3216	0.194	0.228	0.193	0.124	0.067	0.130	0.065	5	14 X 9	126
1210	3225	0.217	0.244	0.215	0.174	0.110	0.145	0.080	5	10 X 8	80
1812	4532	0.271	0.285	0.286	0.243	0.150	0.200	0.075	5	7 X 6	42
2220	5650	0.318	0.362	0.424	0.34	0.24	0.32	0.032	5	5 X 4	20

**Table 7B – Waffle Tray Dimensions – Millimeters**

Case Size		2" x 2" Waffle Tray Dimensions – Millimeters									Packaging Quantity (pcs/unit packaging)
		M	M1	M2	M3	X	Y	Z	A°	MATRIX	
EIA (in)	Metric (mm)	±0.08	±0.08	±0.05	±0.05	±0.05	±0.05	±0.08	±1/2°	(X x Y)	
0402	1005	4.45	3.89	1.96	2.79	1.85	1.07	1.04	7	16 X 23	368
0603	1608	4.45	3.89	1.96	2.79	1.85	1.07	1.04	7	16 X 23	368
0805	2012	5.89	4.72	4.60	4.34	1.57	2.34	0.91	10	10 X 10	100
1206	3216	4.93	5.79	4.90	3.15	1.70	3.30	1.65	5	14 X 9	126
1210	3225	5.51	6.20	5.46	4.42	2.79	3.68	2.03	5	10 X 8	80
1812	4532	6.88	7.24	7.26	6.17	3.81	5.08	1.91	5	7 X 6	42
2220	5650	8.08	9.19	10.77	8.64	6.10	8.13	0.81	5	5 X 4	20

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