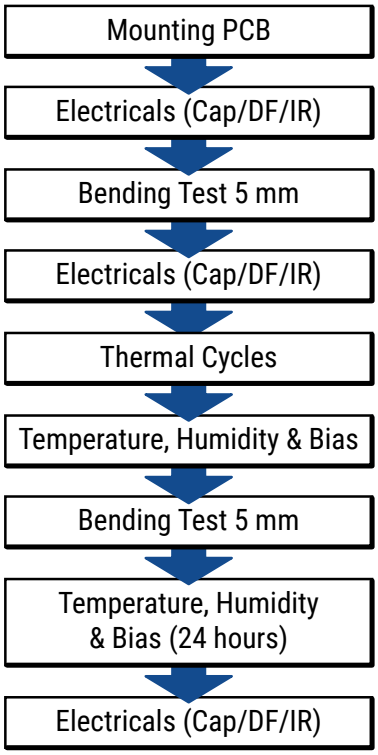
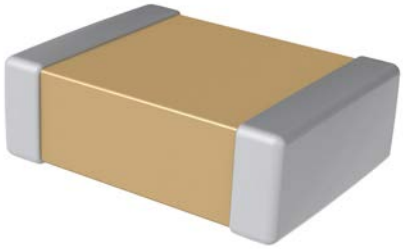
Flexible Termination System (FT-CAP), X7R Dielectric, 6.3 – 250 VDC, VW 80808 Specification

Overview

The KEMET VW80808 Automotive Grade Flexible Termination (FT-CAP) multilayer ceramic capacitors in X7R dielectric are suited for a variety of applications requiring proven, reliable performance in harsh-environment conditions. Whether automotive under hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety of critical automotive subsystems and are compliant with AEC-Q200 and VW80808 specifications.



These devices use flexible termination technology that inhibits the transfer of board stress to the rigid ceramic body, therefore mitigating flex cracks, which can result in low IR or short circuit failures. Although this technology does not eliminate the potential for mechanical damage that may propagate during extreme environmental and handling conditions, it does provide superior flex performance over standard termination systems. Combined with the stability of an X7R dielectric and designed to accommodate all capacitance requirements, these flex-robust devices are RoHS-compliant, offer up to 5 mm of flex-bend capability and exhibit a predictable change in capacitance with respect to time and voltage.



Benefits

- VW 80808 Specification Compliant
- AEC–Q200 automotive qualified.
- Superior flex performance (5 mm)
- DC voltage ratings up to 250 V
- Capacitance offerings ranging from 180 pF – 10 µF
- Non-polar device, minimizing installation concerns
- Lead (Pb)-Free, RoHS and REACH compliant

Applications

- High current applications (automobile battery line)
- Circuits (direct battery/power connection)
- Control units, sensors, and actuators in motor vehicles
- Filtering (power plane/bus)
- Electronic and Electrical subsystems

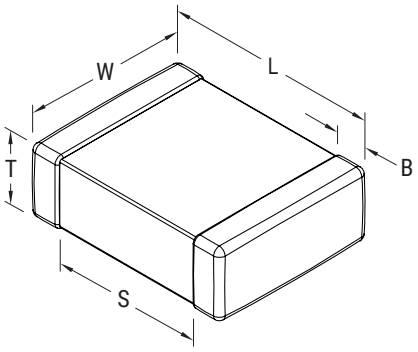
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Ordering Information

C	1210	X	106	K	8	R	A	C	3316
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design	Termination Finish[1]	Packaging/Grade (C-Spec)
	0603 0805 1206 1210	X = Flexible Termination	Two significant digits and number of zeros	J = ±5% K = ±10% M = ±20%	9 = 6.3 8 = 10 4 = 16 3 = 25 5 = 50 1 = 100 2 = 200 A = 250	R = X7R	A = N/A	C = 100% Matte Sn	3316 = 7" Reel Unmarked (VW80808 & AEC-Q200) 3317 = 13" Reel Unmarked (VW80808 & AEC-Q200)

[1] 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	T Thickness	B Bandwidth	S Separation Minimum	Mounting Technique
[1]0603	1608	1.60 (0.063) ±0.17 (0.007)	0.80 (0.032) ±0.15 (0.006)	See Table 2 for Thickness	0.45 (0.018) ±0.15 (0.006)	0.58 (0.023)	Solder wave or solder reflow
[2]0805	2012	2.00 (0.079) ±0.30 (0.012)	1.25 (0.049) ±0.30 (0.012)		0.50 (0.02) ±0.25 (0.010)	0.75 (0.030)	
1206	3216	3.30 (0.130) ±0.40 (0.016)	1.60 (0.063) ±0.35 (0.013)		0.60 (0.024) ±0.25 (0.010)	N/A	
1210	3225	3.30 (0.130) ±0.40 (0.016)	2.60 (0.102) ±0.30 (0.012)		0.60 (0.024) ±0.25 (0.010)		Solder reflow only

[1] For capacitance values ≥ 0.56 µF add 0.03 (0.001) to length tolerance dimension.
[2] For capacitance values ≥ 2.7 µF add 0.05 (0.002) to length tolerance dimension.

Qualification/Certification

This product is VW 80808 Specification Compliant and AEC-Q200 automotive qualified. 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

Item	Parameters/Characteristics
Operating Temperature Range	−55°C to +125°C
Capacitance Change with Reference to +25°C and 0 VDC Applied (TCC)	±15%
[1]Aging Rate (Maximum % Capacitance Loss/Decade Hour)	3.0%
[2]Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5 ±1 seconds and charge/discharge not exceeding 50 mA)
[3]Dissipation Factor (DF) Maximum Limit at 25°C	5% (6.3 V and 10 V), 3.5% (16 V and 25 V) and 2.5% (50 V to 250 V)
[4]Insulation Resistance (IR) Minimum Limit at 25°C	See Insulation Resistance Limit table (Rated voltage applied for 120 ±5 seconds at 25°C)

[1] Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1,000 hours.

[2] 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.

[3] Capacitance and dissipation factor (DF) measured under the following conditions:
1 kHz ±50 Hz and 1.0 ±0.2 V_{rms} if capacitance ≤ 10 µF
120 Hz ±10 Hz and 0.5 ±0.1 V_{rms} if capacitance > 10 µF

[4] 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."

Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance					
EIA Case Size	Rated DC Voltage	Capacitance	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
X7R	> 25	All	3.0	±20%	10% of Initial Limit
	16/25		5.0		
	< 16		7.5		

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
0603	< 200 V	< 0.047 µF	≥ 0.047 µF	N/A
	≥ 200 V	< 1.0nF	N/A	≥ 1.0nF
0805	< 200 V	< 0.15 µF	≥ 0.15 µF	N/A
	≥ 200 V	< 0.0039µF	N/A	≥ 0.0039µF
1206	< 200 V	< 0.47 µF	≥ 0.47 µF	N/A
	≥ 200 V	< 0.012µF	N/A	≥ 0.012µF
1210	< 200 V	< 0.39 µF	≥ 0.39 µF	N/A
	≥ 200 V	< 0.047µF	N/A	≥ 0.047µF

Table 1 – Capacitance Range/Selection Waterfall (0603 – 1210 Case Sizes)

Capacitance (pF)	Cap Code	Case Size/ Series	C0603X								C0805X								C1206X								C1210X							
		Rated Voltage (VDC)	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250
		Voltage Code	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A
180pF	181		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
220pF	221		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
270pF	271		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
330pF	331		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
390pF	391		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
470pF	471		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
560pF	561		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
680pF	681		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
820pF	821		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR																
1.0 nF	102		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU								
1.2 nF	122		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU								
1.5 nF	152		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU								
1.8 nF	182		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU								
2.2 nF	222		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU	FN	FN	FN	FN	FN	FN	FM	FM
2.7 nF	272		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU	FN	FN	FN	FN	FN	FN	FM	FM
3.3 nF	332		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU	FN	FN	FN	FN	FN	FN	FM	FM
3.9 nF	392		CJ	CJ	CJ	CJ	CJ	CJ	CG	CG	DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU	FN	FN	FN	FN	FN	FN	FK	FK
4.7 nF	472		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EU	EU	FN	FN	FN	FN	FN	FN	FK	FK
5.6 nF	562		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EF	EF	FN	FN	FN	FN	FN	FN	FK	FK
6.8 nF	682		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR	DG	EQ	EQ	EQ	EQ	EQ	EQ	EF	EF	FN	FN	FN	FN	FN	FN	FS	FS
8.2 nF	822	Capacitance Tolerances:	CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR		EQ	EQ	EQ	EQ	EQ	EQ	EF	EF	FN	FN	FN	FN	FN	FN	FK	FK
10 nF	103		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR	DR		EQ	EQ	EQ	EQ	EQ	EQ	EU	EU	FN	FN	FN	FN	FN	FN	FK	FK
12 nF	123	J = ±5%	CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DR	DR			EQ	EQ	EQ	EQ	EQ	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FK	FK
15 nF	153	K = ±10%	CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DD	DR			EQ	EQ	EQ	EQ	EQ	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FL	FL
18 nF	183	M = ±20%	CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DD	DR			EQ	EQ	EQ	EQ	EQ	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FM	FM
22 nF	223		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DD	DR			EQ	EQ	EQ	EQ	EQ	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FM	FM
27 nF	273		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DD	DS			EQ	EQ	EQ	EQ	EQ	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FK	FK
33 nF	333		CJ	CJ	CJ	CJ	CJ	CJ			DR	DR	DR	DR	DD	DS			EQ	EQ	EQ	EQ	EQ	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FS	FS
39 nF	393		CJ	CJ	CJ	CJ	CJ				DR	DR	DR	DR	DD	DS			EQ	EQ	EQ	EQ	ER	EQ	EJ	EJ	FN	FN	FN	FN	FN	FN	FS	FS
47 nF	473		CJ	CJ	CJ	CJ	CJ				DR	DR	DR	DR	DS	DG			EQ	EQ	EQ	EQ	ER	ES	EJ	EJ	FN	FN	FN	FN	FN	FQ	FK	FK
56 nF	563		CJ	CJ	CJ	CJ	CJ				DD	DD	DD	DD	DS	DD			EQ	EQ	EQ	EQ	EQ	ES	EJ	EJ	FN	FN	FN	FN	FN	FQ	FK	FK
68 nF	683		CJ	CJ	CJ	CJ	CJ				DD	DD	DD	DD	DS	DD			EQ	EQ	EQ	EQ	EQ	ES	EJ	EJ	FN	FN	FN	FN	FN	FQ	FS	FS
82 nF	823		CJ	CJ	CJ	CJ	CJ				DD	DD	DD	DD	DS	DD			EQ	EQ	EQ	EQ	EQ	ES			FN	FN	FN	FN	FQ	FA	FK	FK
100 nF	104		CJ	CJ	CJ	CJ	CJ				DR	DR	DR	DR	DS	DD			EQ	EQ	EQ	EQ	EQ	EM			FN	FN	FN	FN	FX	FZ	FS	FS
120 nF	124		CJ	CJ	CJ	CJ					DD	DD	DD	DD	DG				ER	ER	ER	ER	ER	EU			FN	FN	FN	FN	FX	FU	FK	FK
150 nF	154		CJ	CJ	CJ	CJ					DD	DD	DD	DD	DG				ER	ER	ER	ER	ER	EU			FQ	FQ	FQ	FQ	FX	FM	FK	FK
180 nF	184		CJ	CJ	CJ						DD	DD	DD	DD	DD				ER	ER	ER	ER	ER	ER			FQ	FQ	FQ	FQ	FX	FK		
220 nF	224										DD	DD	DD	DD	DD				ER	ER	ER	ER	ER	ER			FQ	FQ	FQ	FQ	FX	FK		
270 nF	274										DD	DD	DD	DD	DD				ER	ER	ER	ER	EM	EM			FQ	FQ	FQ	FQ	FX	FX		
330 nF	334										DD	DD	DD	DD	DD				ER	ER	ER	ER	EU	EU			FX	FX	FX	FX	FX	FX		
390 nF	394										DS	DS	DS	DS					ER	ER	ER	ER	ER	EU			FX	FX	FX	FX	FX	FX		
470 nF	474										DS	DS	DS	DS					ER	ER	ER	ER	ER	EU			FX	FX	FX	FX	FX	FX		
560 nF	564										DG	DG	DG	DG					ER	ER	ER	ER	ER				FX	FX	FX	FX	FA	FA		
680 nF	684										DG	DG	DG	DG					ES	ES	ES	ES	ES				FX	FX	FX	FX	FZ	FZ		
820 nF	824										DG	DG	DG	DG					ES	ES	ES	ES	ES				FA	FA	FA	FA	FL	FL		
Capacitance (pF)	Cap Code	Voltage Code	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A
		Rated Voltage (VDC)	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250
		Case Size/Series	C0603X								C0805X								C1206X								C1210X							

For an extended AEC-Q200 flexible termination offering please visit: https://content.kemet.com/datasheets/KEM_C1078_X7R_FT-CAP_AUTO_SMD.pdf

Table 1 – Capacitance Range/Selection Waterfall (0603 – 1210 Case Sizes) cont.

Capacitance (pF)	Cap Code	Case Size/ Series	C0603X								C0805X								C1206X								C1210X							
		Rated Voltage (VDC)	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250
		Voltage Code	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A
1.0 µF	105	Capacitance Tolerances: J = ±5% K = ±10% M = ±20%									DG	DG	DG	DG					ES	ES	ES	ES	ES				FU	FU	FU	FU	FM	FM		
1.2 µF	125																		EH	EH	EH	EH	EH				FZ	FZ	FZ	FZ	FZ			
1.5 µF	155																		EH	EH	EH	EH	EH				FZ	FZ	FZ	FZ	FZ			
1.8 µF	185																		EH	EH	EH	EH	EH				FZ	FZ	FZ	FZ	FZ			
2.2 µF	225																		EH	EH	EH	EH	EH				FZ	FZ	FZ	FZ	FZ			
2.7 µF	275																		EH	EH	EH						FZ	FZ	FZ	FU	FU			
3.3 µF	335																		EH	EH	EH						FM	FM	FM	FM	FM			
3.9 µF	395																										FK	FK	FK	FK				
4.7 µF	475																										FS	FS	FS	FS				
5.6 µF	565																										FU	FU	FU					
6.8 µF	685																										FM	FM	FM					
8.2 µF	825																										FK	FK						
10 µF	106																										FS	FS						
Capacitance (pF)	Cap Code	Voltage Code	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A	9	8	4	3	5	1	2	A
		Rated Voltage (VDC)	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250
		Case Size/Series	C0603X								C0805X								C1206X								C1210X							

For an extended AEC-Q200 flexible termination offering please visit: https://content.kemet.com/datasheets/KEM_C1078_X7R_FT-CAP_AUTO_SMD.pdf

Table 2 – Chip Thickness/Tape & Reel Packaging Quantities

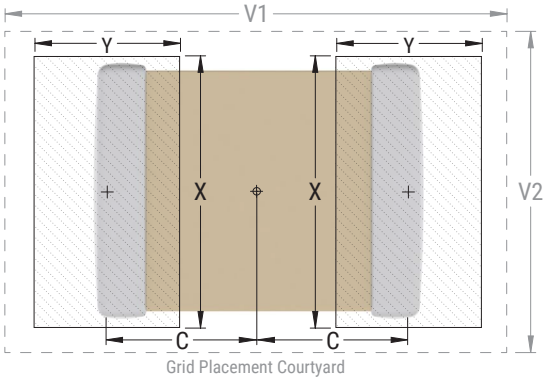
Thickness Code	Case Size	Thickness ± Range (mm)	Paper Quantity[1]		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
CG	0603	0.80 ± 0.10	4,000	15,000	0	0
CJ	0603	0.80 ± 0.15	4,000	15,000	0	0
DR	0805	0.78 ± 0.20	0	0	4,000	10,000
DD	0805	0.90 ± 0.10	0	0	4,000	10,000
DS	0805	1.00 ± 0.20	0	0	2,500	10,000
DG	0805	1.25 ± 0.15	0	0	2,500	10,000
EQ	1206	0.78 ± 0.20	0	0	4,000	10,000
ER	1206	0.90 ± 0.20	0	0	4,000	10,000
ES	1206	1.00 ± 0.20	0	0	2,500	10,000
EF	1206	1.20 ± 0.15	0	0	2,500	10,000
EM	1206	1.25 ± 0.15	0	0	2,500	10,000
EH	1206	1.60 ± 0.20	0	0	2,000	8,000
EU	1206	1.60 ± 0.25	0	0	2,000	8,000
EJ	1206	1.70 ± 0.20	0	0	2,000	8,000
FN	1210	0.78 ± 0.20	0	0	4,000	10,000
FQ	1210	0.90 ± 0.20	0	0	4,000	10,000
FX	1210	0.95 ± 0.20	0	0	4,000	10,000
FA	1210	1.10 ± 0.15	0	0	2,500	10,000
FZ	1210	1.25 ± 0.20	0	0	2,500	10,000
FL	1210	1.40 ± 0.15	0	0	2,000	8,000
FU	1210	1.55 ± 0.20	0	0	2,000	8,000
FM	1210	1.70 ± 0.20	0	0	2,000	8,000
FK	1210	2.10 ± 0.20	0	0	2,000	8,000
FS	1210	2.50 ± 0.30	0	0	1,000	4,000
FK	1210	2.10 ± 0.20	0	0	2,000	8,000
FS	1210	2.50 ± 0.30	0	0	1,000	4,000
Thickness Code	Case Size	Thickness ± Range (mm)	7" Reel	13" Reel	7" Reel	13" Reel
			Paper Quantity[1]		Plastic Quantity	

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
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
1210	3225	1.59	1.62	3.01	5.90	4.01	1.49	1.42	2.91	4.95	3.41	1.39	1.22	2.81	4.25	3.11
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	2.10	1.80	3.60	7.00	4.60	2.00	1.60	3.50	6.10	4.00	1.90	1.40	3.40	5.40	3.70
1825	4564	2.15	1.80	6.90	7.10	7.90	2.05	1.60	6.80	6.20	7.30	1.95	1.40	6.70	5.50	7.00
2220	5650	2.85	2.10	5.50	8.80	6.50	2.75	1.90	5.40	7.90	5.90	2.65	1.70	5.30	7.20	5.60
2225	5664	2.85	2.10	6.90	8.80	7.90	2.75	1.90	6.80	7.90	7.30	2.65	1.70	6.70	7.20	7.00

Density Level A: *For low-density product applications. Recommended for wave solder applications and provides a wider process window for reflow solder processes. KEMET only recommends wave soldering of EIA 0603, 0805 and 1206 case sizes.*
Density Level B: *For products with a moderate level of component density. Provides a robust solder attachment condition for reflow solder processes.*
Density Level C: *For high component density product applications. Before adapting the minimum land pattern variations the user should perform qualification testing based on the conditions outlined in IPC Standard 7351 (IPC–7351).*

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



Soldering Process

Recommended Soldering Technique:

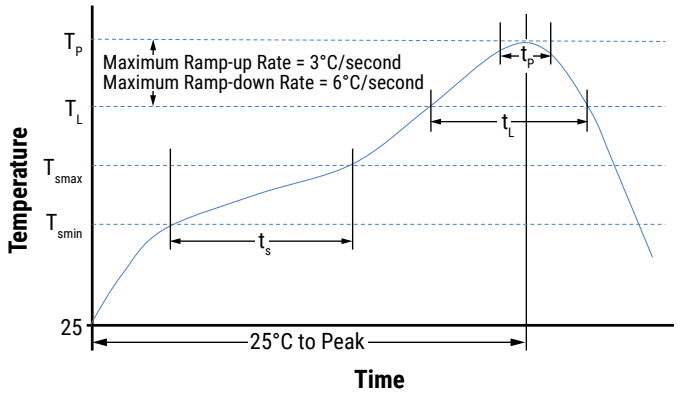
- Solder wave or solder reflow for EIA case sizes 0603, 0805 and 1206
- All other EIA case sizes are limited to solder reflow only

Recommended Reflow Soldering Profile:

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

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

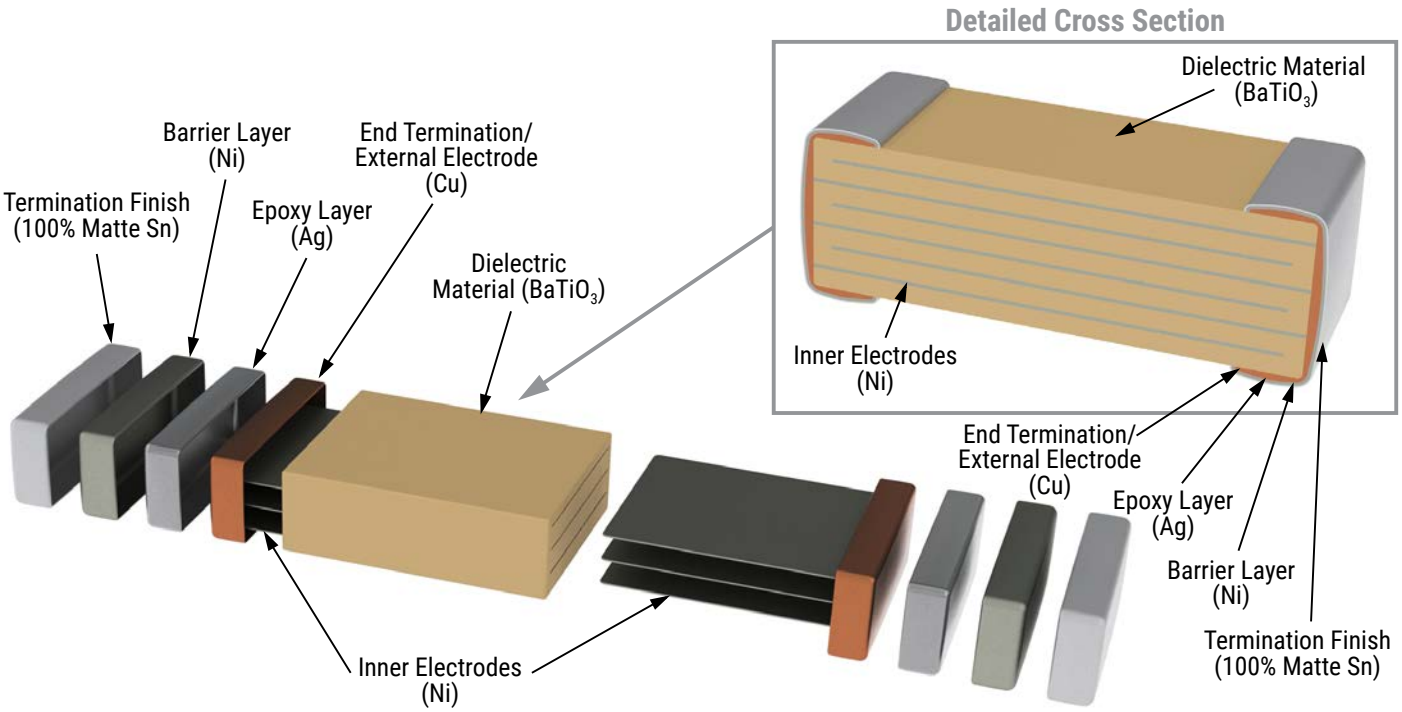
Note: All temperatures refer to the center of the package, measured on the capacitor body surface that is facing up during assembly reflow.



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 40ºC and maximum storage humidity not exceed 70% relative humidity. 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.

Construction



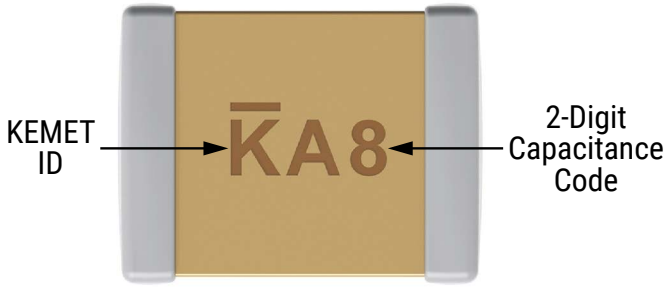
Capacitor Marking (Optional)

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:
- C0G, 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.

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

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 µF. Orientation of marking is vendor optional.



Capacitor Marking (Optional) cont.

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

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.

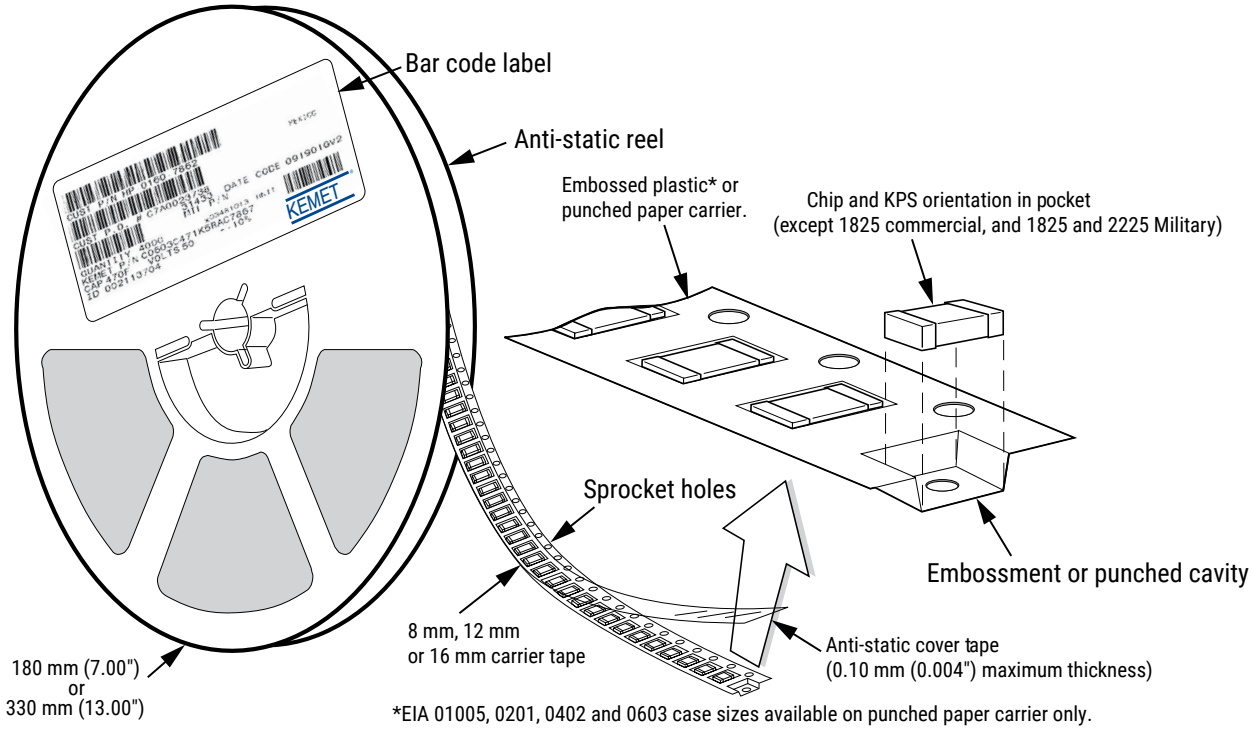


Table 4 – Carrier Tape Configuration, Embossed Plastic & Punched Paper (mm)

EIA Case Size	Tape Size (W)*	Embossed Plastic		Punched Paper	
		7" Reel	13" Reel	7" Reel	13" Reel
		Pitch (P_1)*		Pitch (P_1)*	
01005 – 0402	8			2	2
0603	8			2/4	2/4
0805	8	4	4	4	4
1206 – 1210	8	4	4	4	4
1805 – 1808	12	4	4		
≥ 1812	12	8	8		
KPS 1210	12	8	8		
KPS 1812 and 2220	16	12	12		
Array 0612	8	4	4		

**Refer to Figures 1 and 2 for W and P_1 carrier tape reference locations.*
**Refer to Tables 5 and 6 for tolerance specifications.*

New 2 mm Pitch Reel Options*

Packaging Ordering Code (C-Spec)	Packaging Type/Options
C-3190	Automotive grade 7" reel unmarked
C-3191	Automotive grade 13" reel unmarked
C-7081	Commercial grade 7" reel unmarked
C-7082	Commercial grade 13" reel unmarked

** 2 mm pitch reel only available for 0603 EIA case size.*
2 mm pitch reel for 0805 EIA case size under development.

Benefits of Changing from 4 mm to 2 mm Pitching Spacing

- Lower placement costs.
- Double the parts on each reel results in fewer reel changes and increased efficiency.
- Fewer reels result in lower packaging, shipping and storage costs, reducing waste.

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

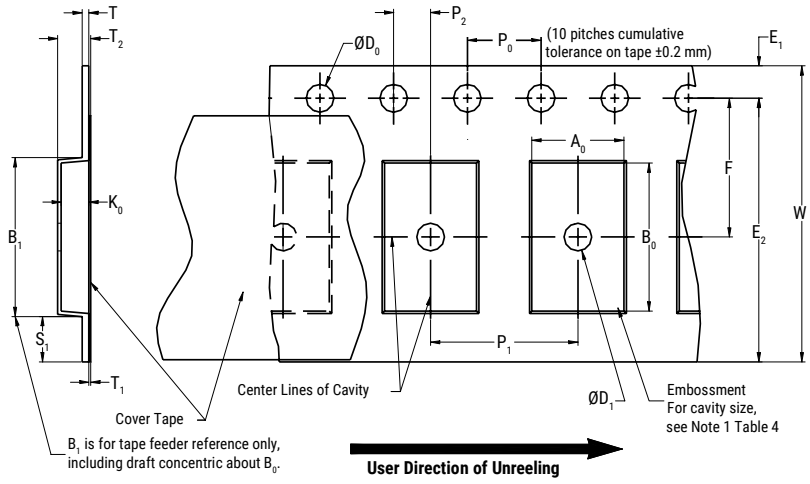


Table 5 – Embossed (Plastic) Carrier Tape Dimensions

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									
24 mm	1.5 +0.10/−0.0 (0.059 +0.004/−0.0)	1.5 (0.059)	1.75 ±0.10 (0.069 ±0.004)	4.0 ±0.10 (0.157 ±0.004)	2.0 ±0.10 (0.078 ±0.003)	30 (1.181)	5 (0.196)	0.250 (0.009)	0.350 (0.013)

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)	
24 mm	16 mm	11.5 (0.452)	22.25 (0.875)	11.5 ±0.10 (0.452 ±0.003)	16.0 ±0.10 (0.629 ±0.004)	3 (0.118)	24.3 (0.956)	

1. 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.
2. The tape with or without components shall pass around R without damage (see Figure 6).
3. 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).
4. B_1 dimension is a reference dimension for tape feeder clearance only.
5. The cavity defined by A_0, B_0 and K_0 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 and 10° maximum for 16 mm tapes (see Figure 3).
(d) 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).
(e) for KPS product, A_0 and B_0 are measured on a plane 0.3 mm above the bottom of the pocket.
(f) see addendum in EIA Standard 481 for standards relating to more precise taping requirements.

Figure 2 – Punched (Paper) Carrier Tape Dimensions

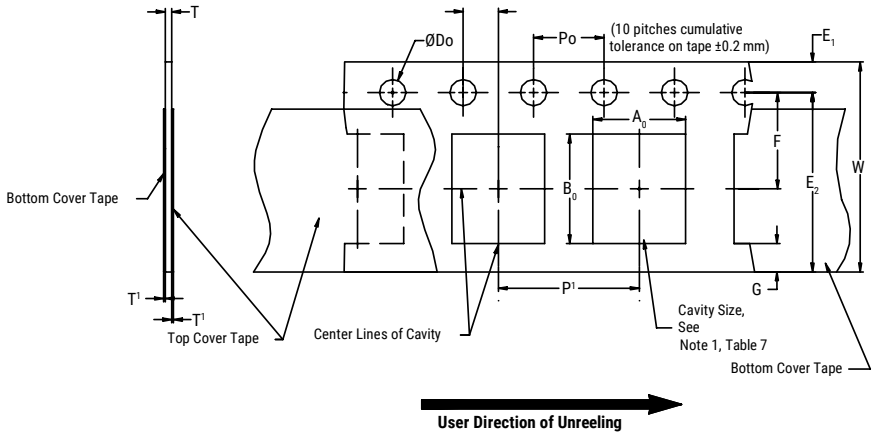


Table 6 – Punched (Paper) Carrier Tape Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)							
Tape Size	D_0	E_1	P_0	P_2	T_1 Maximum	G Minimum	R Reference Note 2
8 mm	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 (0.004) Maximum	0.75 (0.030)	25 (0.984)

Variable Dimensions — Millimeters (Inches)							
Tape Size	Pitch	E2 Minimum	F	P_1	T Maximum	W Maximum	A_0 B_0
8 mm	Half (2 mm)	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 1
8 mm	Single (4 mm)			4.0 ±0.10 (0.157 ±0.004)		8.3 (0.327)	

1. The cavity defined by A_0, B_0 and T shall surround the component with sufficient clearance that:
a) the component does not protrude beyond either 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 (see Figure 3).
d) lateral movement of the component is restricted to 0.5 mm maximum (see Figure 4).
e) see addendum in EIA Standard 481 for standards relating to more precise taping requirements.
2. The tape with or without components shall pass around R without damage (see Figure 6).

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

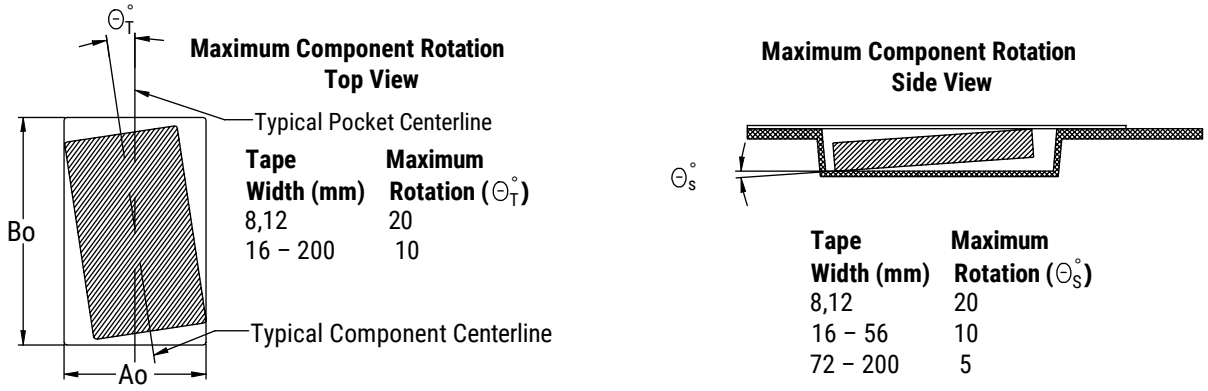


Figure 4 – Maximum Lateral Movement

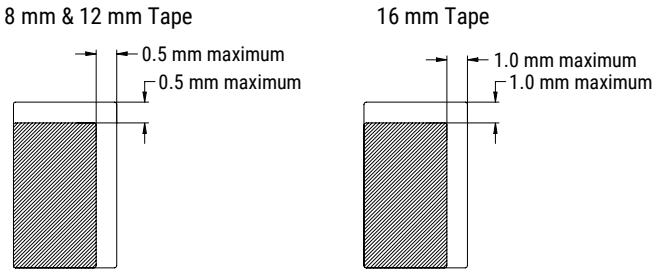


Figure 5 – Bending Radius

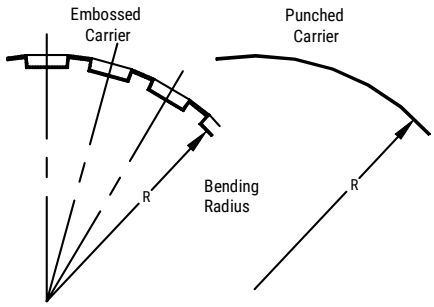
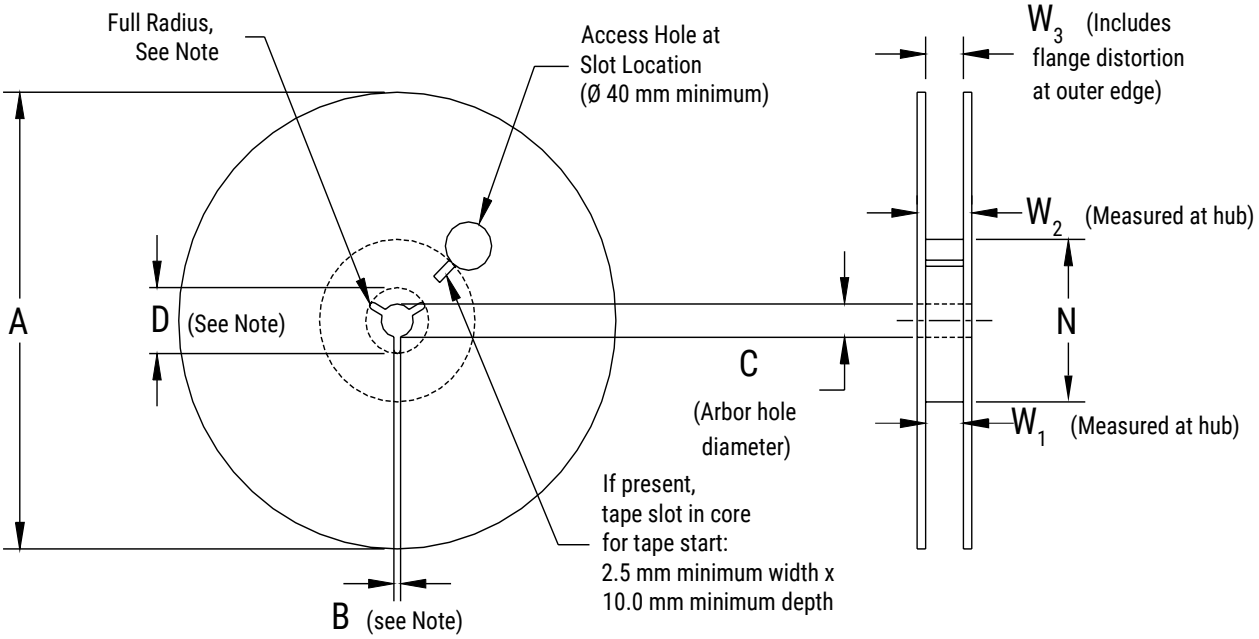


Figure 6 – Reel Dimensions



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

Table 7 – Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Minimum	C	D Minimum
8 mm	178 ±0.20 (7.008 ±0.008) or 330 ±0.20 (13.000 ±0.008)	1.5 (0.059)	13.0 +0.5/−0.2 (0.521 +0.02/−0.008)	20.2 (0.795)
12 mm				
16 mm				
24 mm		1.2 (0.047)	13.0 ±0.2 (0.521 ±0.008)	21 (0.826)

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)	
24 mm		25 +1.0/−0.0 (0.984 +0.039/−0.0)	27.4 ±1.0 (1.078 ±0.039)	

Figure 7 – Tape Leader & Trailer Dimensions

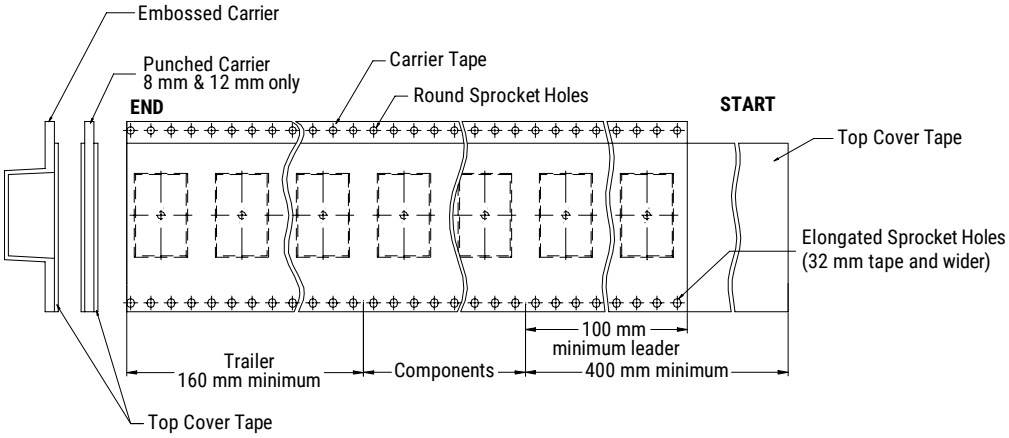
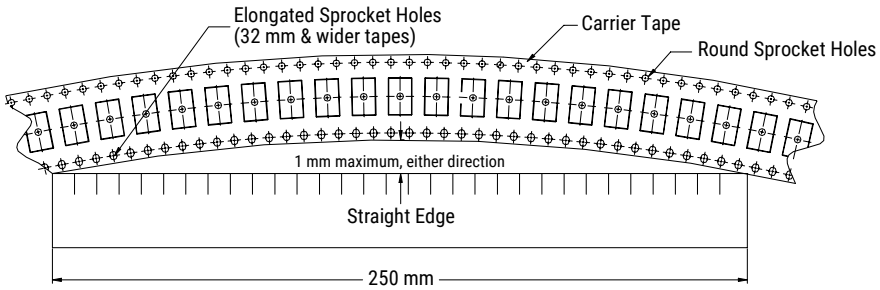


Figure 8 – Maximum Camber



KEMET Electronics Corporation Sales Offices

For a complete list of our global sales offices, please visit www.kemet.com/sales.

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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product–related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.

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