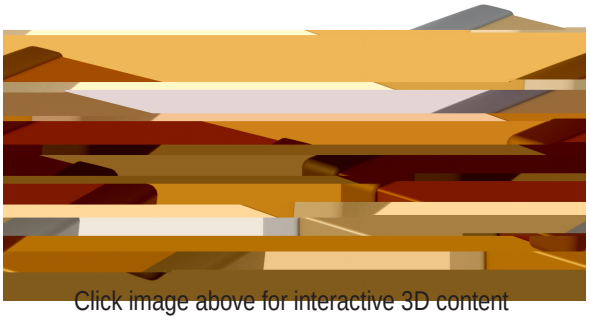
Flexible Termination System (FT-CAP), U2J Dielectric, 10 50 VDC (Commercial Grade)

Overview

KEMET's Flexible Termination (FT-CAP) Multilayer Ceramic Capacitor in U2J dielectric incorporates a unique, fexible termination system that is integrated with KEMET's standard termination materials. A conductive silver epoxy is utilized between the base metal and nickel barrier layers of KEMET's standard termination system in order to establish pliability while maintaining terminal strength, solderability and electrical performance. This technology was developed in order to address the primary failure mode of MLCCs—fex cracks, which are typically the result of excessive tensile and shear stresses produced during board fexure and thermal cycling. Flexible termination technology inhibits the transfer of board stress to the rigid ceramic body, therefore mitigating fex 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 fex performance over standard termination systems. FT-CAP complements KEMET's Open Mode, Floating Electrode (FE-CAP), Floating Electrode with Flexible Termination (FF-CAP), and KEMET Power Solutions (KPS) product lines by providing a complete portfolio of fex mitigation solutions. Combined with the stability of U2J dielectric and designed to accommodate all capacitance requirements, these fex-robust devices are RoH compliant, offer up to 5 mm of fex-bend capability and capacitance change limited to −750±120ppm/°C from −55°C to +125°C. These devices are Lead-free, RoHS and REACH compliant without exception and are capable of withstanding multiple passes through a Lead-free solder refow profle.



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Ordering Information

C	1206	X	104	J	3	J	A	C	TU
Ceramic	Case Size (L" x W")	Specifcation/ Series	Capacitance Code (pF)	Capacitance Tolerance[1]	Rated Voltage (VDC)	Dielectric	Failure Rate/ Design		

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Packaging C-Spec Ordering Options Table

Packaging Type[1]	Packaging/Grade Ordering Code (C-Spec)
Bulk Bag/Unmarked	Not required (Blank)
7" Reel/Unmarked	TU
13" Reel/Unmarked	7411 (EIA 0603 and smaller case sizes) 7210 (EIA 0805 and larger case sizes)
7" Reel/Unmarked / 2 mm pitch[2]	7081
13" Reel/Unmarked / 2 mm pitch[2]	7082

[1] Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging.

[1] The terms "Marked" and "Unmarked" pertain to laser marking option of capacitors. All packaging options labeled as "Unmarked" will contain capacitors that have not been laser marked. The option to laser mark is not available on these devices. For more information see "Capacitor Marking".

[2] The 2 mm pitch option allows for double the packaging quantity of capacitors on a given reel size. 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".

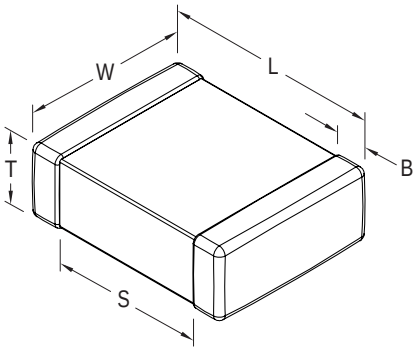
Benefits

- Low dissipation factor DF < 0.1%
- Low noise solution similar to C0G
- Low ESR and ESL
- High thermal stability
- High ripple current capability
- Preferred capacitance solution at line frequencies and into the MHz range
- Retains over 99% of nominal capacitance at full rated voltage
- Small predictable and linear capacitance change with respect to temperature
- Operating temperature range of −55°C to +125°C
- Capacitance up to 470 nF
- DC voltage ratings up to 50 V
- Lead (Pb)-free, RoHS and REACH compliant
- Non-polar device, minimizing installation concerns
- 100% pure matte Tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include critical timing, tuning, circuits requiring low loss, circuits with pulse, high current, decoupling, bypass, filtering, transient voltage suppression and blocking, as well as energy storage in critical and safety relevant circuits without (integrated) current limitation, including those subject to high levels of board flexure or temperature cycling.

Dimensions Millimeters (Inches)



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)	−750±120 ppm/°C
Aging Rate (Maximum % Capacitance Loss/Decade Hour)	0.1%
Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5±1 seconds and charge/discharge not exceeding 50 mA)
Dissipation Factor (DF) Maximum Limit at 25°C	0.1%
Insulation Resistance (IR) Limit at 25°C	1,000 megohm microfarads or 100 GΩ (Rated voltage applied for 120±5 seconds at 25°C)

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:

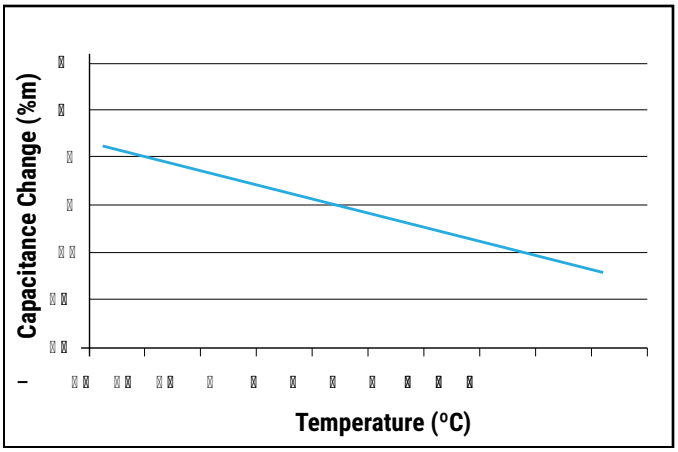
1 MHz ±100 kHz and 1.0 Vrms ±0.2 V if capacitance ≤ 1,000 pF

1 kHz ±50 Hz and 1.0 Vrms ±0.2 V if capacitance > 1,000 pF

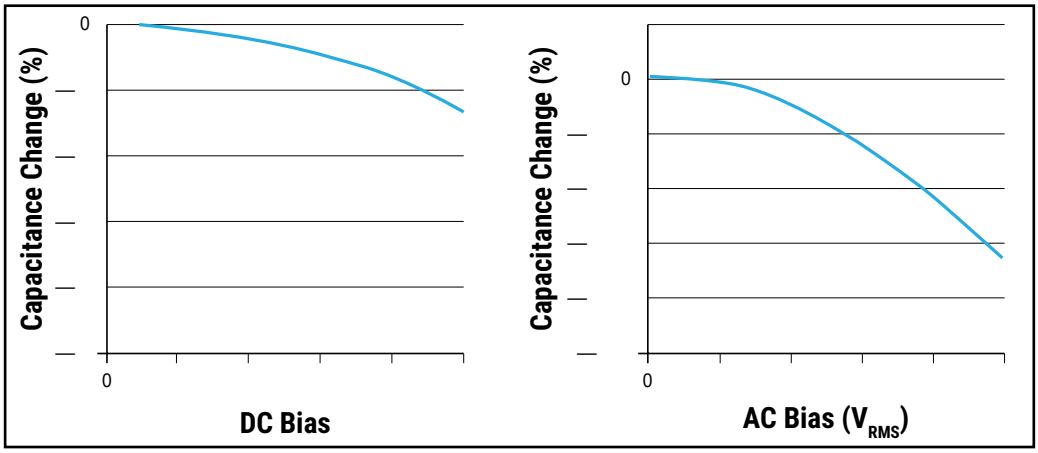
Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 and Agilent E4980 have a feature known as Automatic Level Control (ALC). The ALC feature should be switched to "ON."

Electrical Characteristics (Typical)

Capacitance vs. Temperature (TCC)



DC & AC Bias Effective Capacitance



Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance					
Dielectric	Rated DC Voltage	Capacitance Value	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
U2J	All	All	0.5	0.3% or ±0.25 pF	10% of Initial Limit

Table 1A Capacitance Range/Selection Waterfall (0603 1812 Case Sizes)

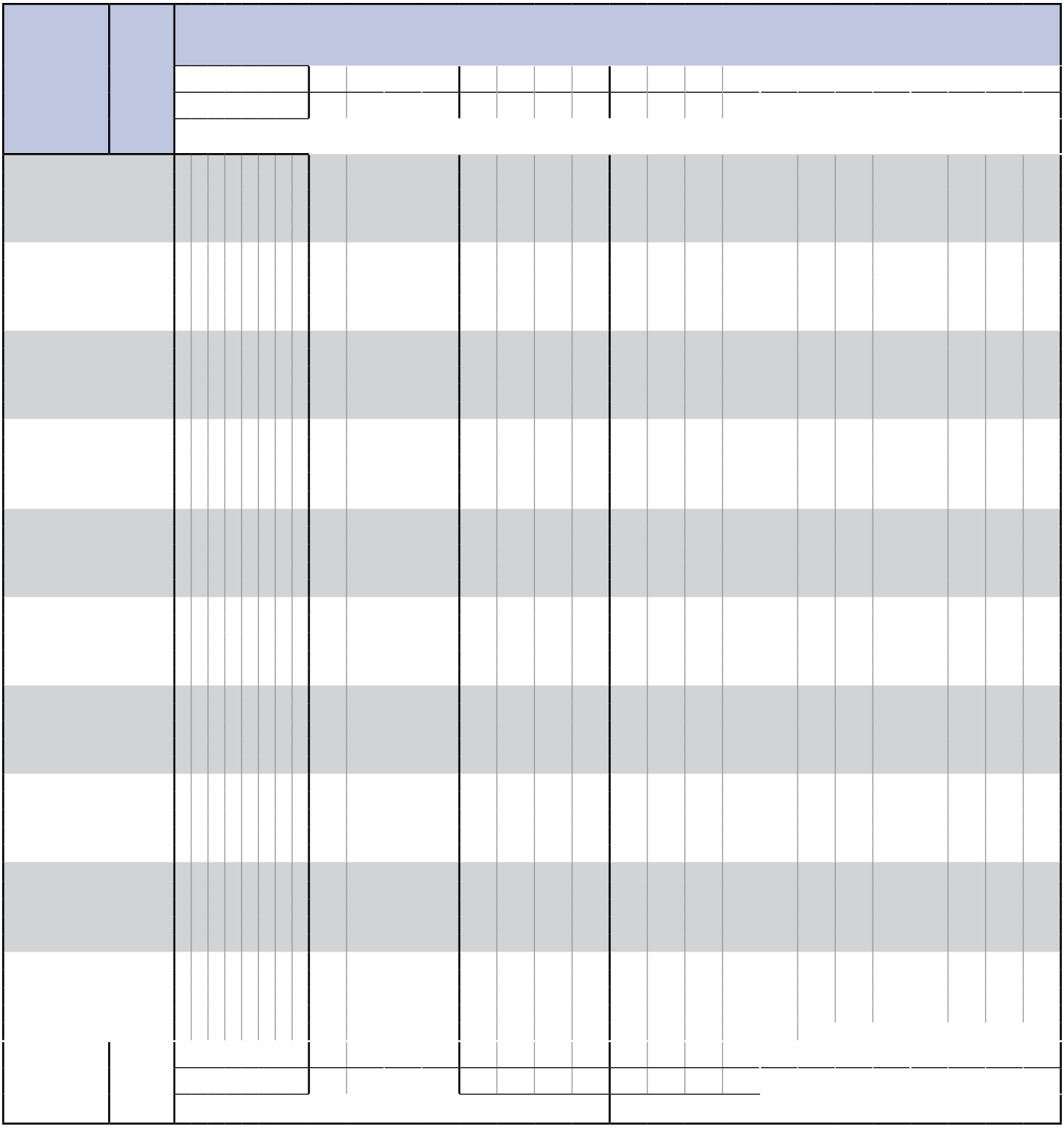


Table 1A Capacitance Range/Selection Waterfall (0603 1812 Case Sizes) cont'd

Capacitance	Cap Code	Case Size/ Series	C0603X				C0805X				C1206X				C1210X				C1812X			
		Voltage Code	8	4	3	5	8	4	3	5	8	4	3	5	8	4	3	5	8	4	3	5
		Rated Voltage (VDC)	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50
		Capacitance Tolerance	Product Availability and Chip Thickness Codes See Table 2 for Chip Thickness Dimensions																			
15,000 pF	153	F G J K M	CF	CF	CF		DC	DC	DC	DC	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
18,000 pF	183	F G J K M					DC	DC	DC	DC	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
22,000 pF	223	F G J K M					DC	DC	DC	DD	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
27,000 pF	273	F G J K M					DD	DD	DD	DD	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
33,000 pF	333	F G J K M					DD	DD	DD	DG	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
47,000 pF	393	F G J K M					DG	DG	DG	DG	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
47,000 pF	473	F G J K M					DG	DG	DG	DG	EB	EB	EB	EB	FB	FB	FB	FB	GB	GB	GB	
56,000 pF	563	F G J K M					DG	DG	DG		EB	EB	EB	EC	FB	FB	FB	FB	GB	GB	GB	
68,000 pF	683	F G J K M									EC	EC	EC	EC	FB	FB	FB	FB	GB	GB	GB	
82,000 pF	823	F G J K M									EC	EC	EC	EE	FB	FB	FB	FB	GB	GB	GB	
100,000 pF	104	F G J K M									EC	EC	EC	EF	FB	FB	FB	FC	GB	GB	GB	
120,000 pF	124	F G J K M									EF	EP	EF	EH	FC	FC	FC	FE	GB	GB	GB	
150,000 pF	154	F G J K M									EF	EF	EF	EH	FE	FE	FE	FG	GB	GB	GB	
180,000 pF	184	F G J K M									EH	EH	EH		FG	FG	FG	FG	GB	GB	GB	
220,000 pF	224	F G J K M									EH	EH	EH		FG	FG	FG	FH	GB	GB	GB	
270,000 pF	274	F G J K M													FH	FH	FH	FM	GB	GB	GB	
330,000 pF	334	F G J K M													FM	FM	FM		GC	GC	GC	
390,000 pF	394	F G J K M																	GH	GH	GH	
470,000 pF	474	F G J K M																	GK	GK	GK	
		Rated Voltage (VDC)	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	Cap Code	Voltage Code	8	4	3	5	8	4	3	5	8	4	3	5	8	4	3	5	8	4	3	5
		Case Size/Series	C0603X				C0805X				C1206X				C1210X				C1812X			

Table 2A Chip Thickness/Tape & Reel Packaging Quantities

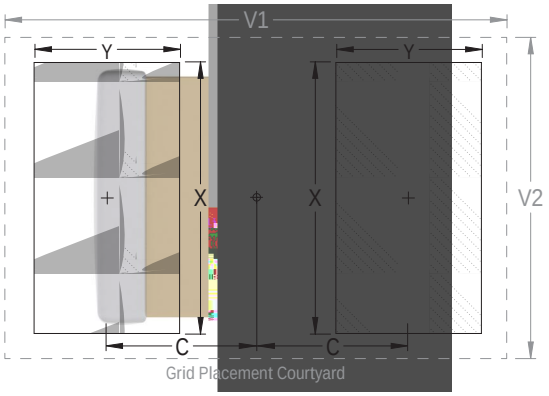
Thickness Code	Case Size[1]	Thickness ± Range (mm)	Paper Quantity[1]		Plastic Quantity	
			7" Reel	13" Reel	7" Reel	13" Reel
CF	0603	0.80 ± 0.07*	4,000	15,000	0	0
DC	0805	0.78 ± 0.10	0	0	4,000	10,000
DD	0805	0.90 ± 0.10	0	0	4,000	10,000
DG	0805	1.25 ± 0.15	0	0	2,500	10,000
EB	1206	0.78 ± 0.10	4,000	10,000	4,000	10,000
EC	1206	0.90 ± 0.10	0	0	4,000	10,000
EE	1206	1.10 ± 0.10	0	0	2,500	10,000
EF	1206	1.20 ± 0.15	0	0	2,500	10,000
EP	1206	1.20 ± 0.20	0	0	2,500	10,000
EH	1206	1.60 ± 0.20	0	0	2,000	8,000
FB	1210	0.78 ± 0.10	0	0	4,000	10,000
FC	1210	0.90 ± 0.10	0	0	4,000	10,000
FE	1210	1.00 ± 0.10	0	0	2,500	10,000
FG	1210	1.25 ± 0.15	0	0	2,500	10,000
FH	1210	1.55 ± 0.15	0	0	2,000	8,000
FM	1210	1.70 ± 0.20	0	0	2,000	8,000
GB	1812	1.00 ± 0.10	0	0	1,000	4,000
GC	1812	1.10 ± 0.10	0	0	1,000	4,000
GH	1812	1.40 ± 0.15	0	0	1,000	4,000
GK	1812	1.60 ± 0.20	0	0	1,000	4,000
Thickness Code	**Case Size[1]**	**Thickness ± Range (mm)**	**7**			

Table 3 Chip Capacitor Land Pattern Design Recommendations per IPC 7351 (mm)

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
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

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

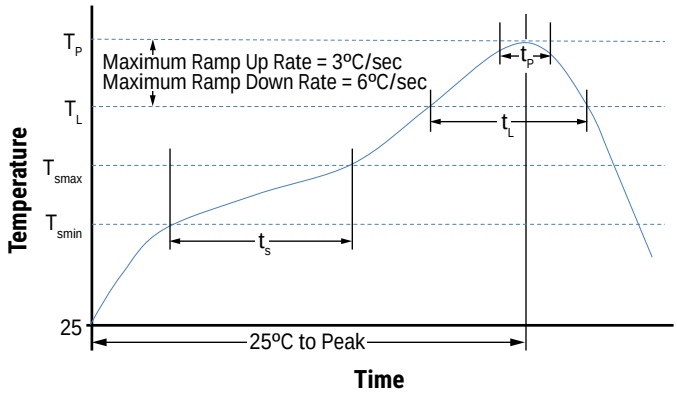
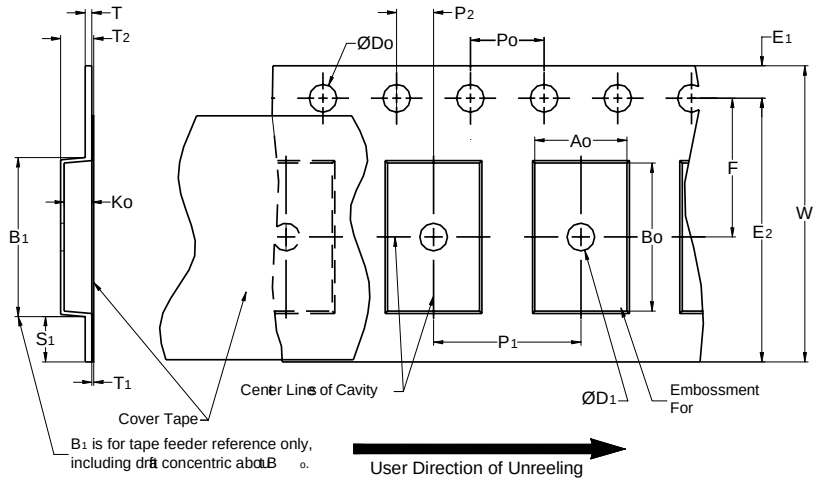


Figure 1 – Embossed (Plastic) Carrier Tape Dimensions



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

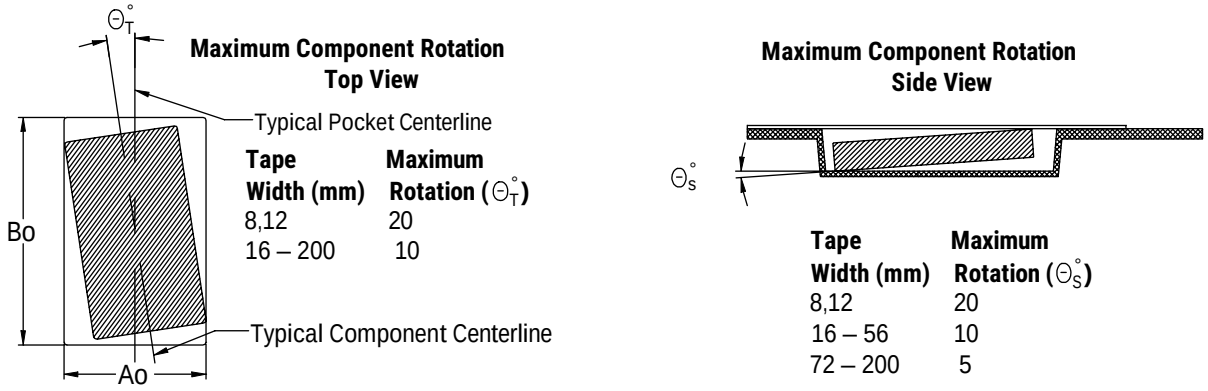


Figure 4 Maximum Lateral Movement

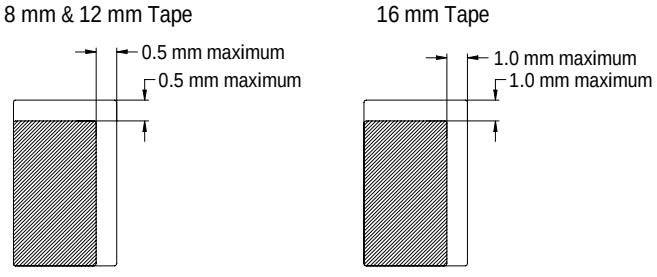


Figure 5 Bending Radius

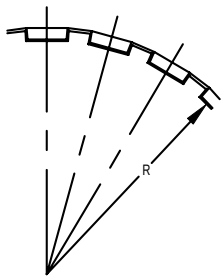
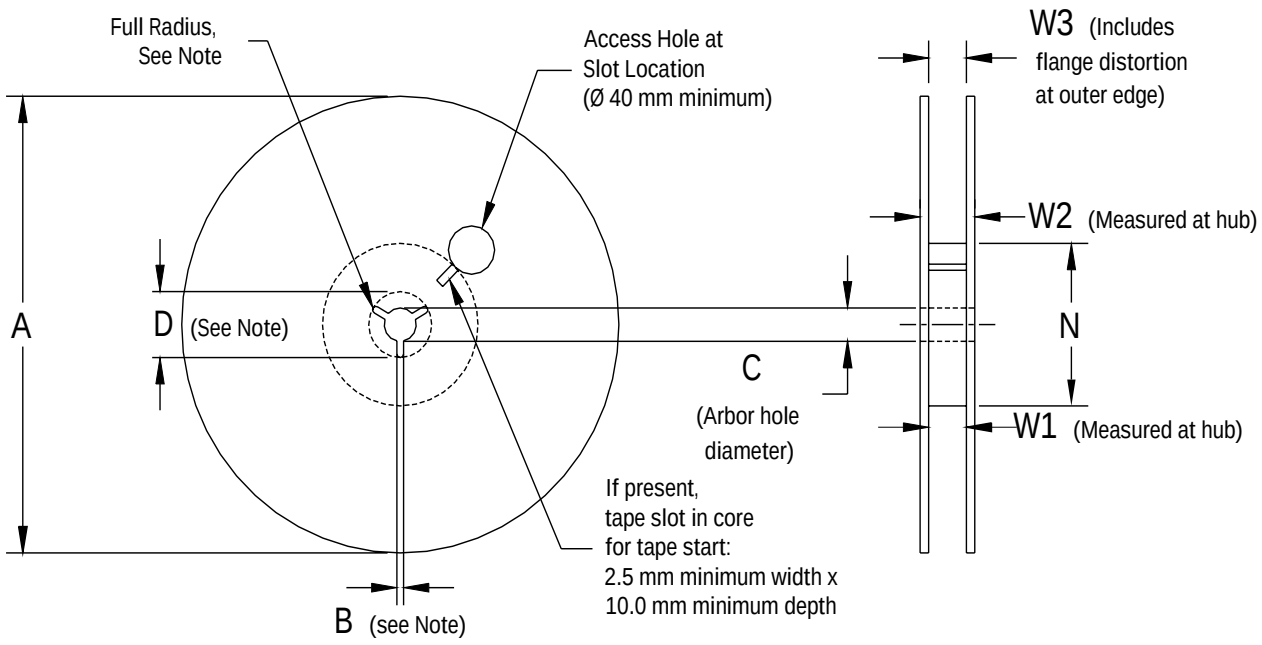


Figure 6 Reel Dimensions



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

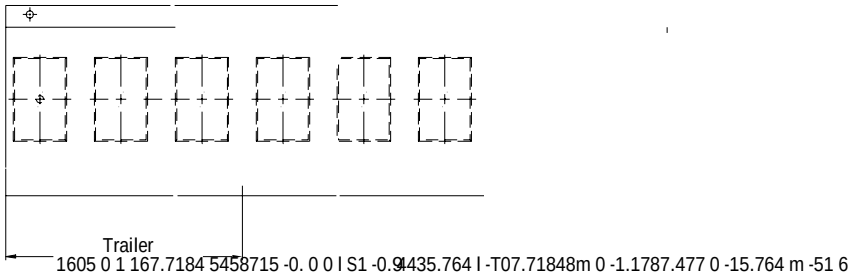
Table 8 Reel Dimensions

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				

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)	

Figure 7 Tape Leader & Trailer Dimensions



KEMET Corporation World Headquarters

2835 KEMET Way
Simpsonville, SC 29681

Mailing Address:
P.O. Box 5928
Greenville, SC 29606

www.kemet.com
Tel: 864-963-6300
Fax: 864-963-6521

Corporate Offices
Fort Lauderdale, FL
Tel: 954-766-2800

North America

Northeast
Wilmington, MA
Tel: 978-658-1663

Southeast
Lake Mary, FL
Tel: 407-855-8886

Central
Novi, MI
Tel: 248-994-1030

Irving, TX
Tel: 972-915-6041

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Southern Europe
Sasso Marconi, Italy
Tel: 39-051-939111

Skopje, Macedonia
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Central Europe
Landsberg, Germany
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Penang, Malaysia
Tel: 60-4-6430200

Bangalore, India
Tel: 91-806-53-76817

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