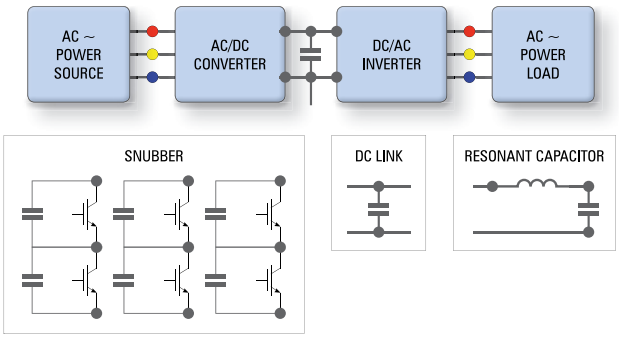
Surface Mount Multilayer Ceramic Chip Capacitors (SMD MLCCs)

KC-LINK™ for Fast Switching Semiconductor Applications DC Link, Snubber, Resonator Capacitor, 150°C (Commercial & Automotive Grade)

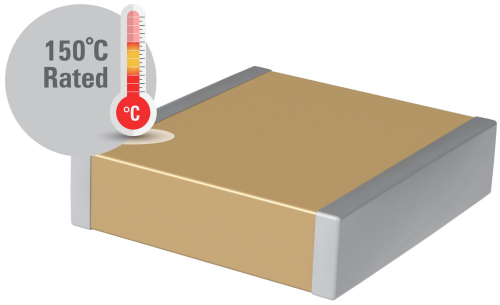
Overview

KEMET's KC-LINK surface mount capacitors are designed to meet the growing demand for fast switching wide bandgap (WBG) semiconductors that operate at higher voltages, temperatures, and frequencies. By utilizing KEMET's robust and proprietary C0G/NPO base metal electrode (BME) dielectric system, these capacitors are well suited for power converters, inverters, snubbers, and resonators, where high efficiency is a primary concern. With extremely low effective series resistance (ESR) and very low thermal resistance, KC-LINK capacitors can operate at very high ripple currents with no change in capacitance versus DC voltage, and negligible change in capacitance versus temperature. With an operating temperature of 150°C, these capacitors can be mounted close to fast switching semiconductors in high power density applications, which require minimal cooling.



KC-LINK C0G dielectric technology also exhibits high mechanical robustness compared to other dielectric technologies, allowing the capacitor to be mounted without the use of lead frames. This provides extremely low effective series inductance (ESL) increasing the operating frequency range allowing for further miniaturization. For added reliability, KC-LINK is now available with flexible termination technology that provides superior flex performance over standard termination systems, addressing the primary failure mode of MLCC's flex cracks.

In addition to commercial grade, automotive grade devices are available and meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.



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Benefits

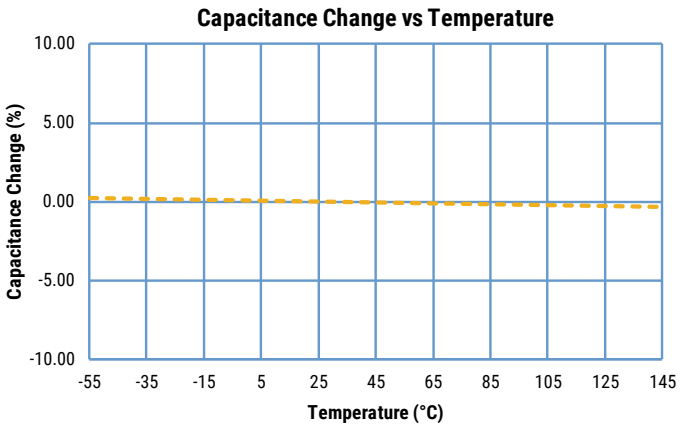
- EIA 1812, 2220, and 3640 case size
- AEC–Q200 automotive qualified
- Flexible termination option available
- Very high ripple current capability
- Extremely low equivalent series resistance (ESR)
- Extremely low equivalent series inductance (ESL)
- Operating temperature range of −55°C to +150°C
- High frequency operation (> 10 MHz)
- No capacitance shift with voltage
- No piezoelectric noise
- High thermal stability
- RoHS compliant and Pb-free

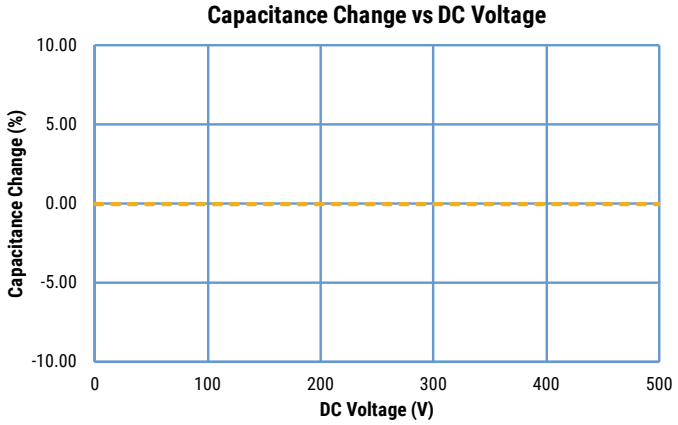
Applications

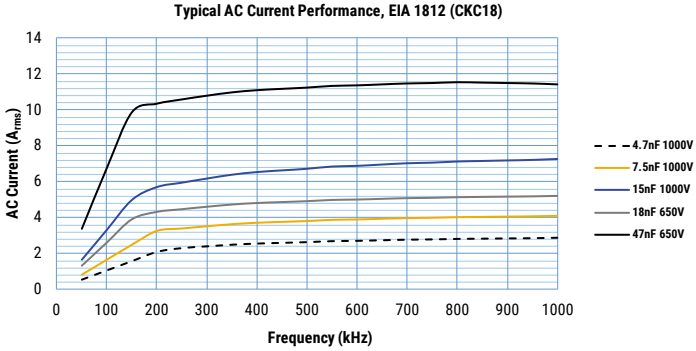
- Wide bandgap (WBG), silicon carbide (SiC) and gallium nitride (GaN) systems
- EV/HEV (drive systems, charging)
- Wireless charging
- Photovoltaic systems
- Power converters
- Inverters
- LLC resonant converters
- DC link
- Snubber

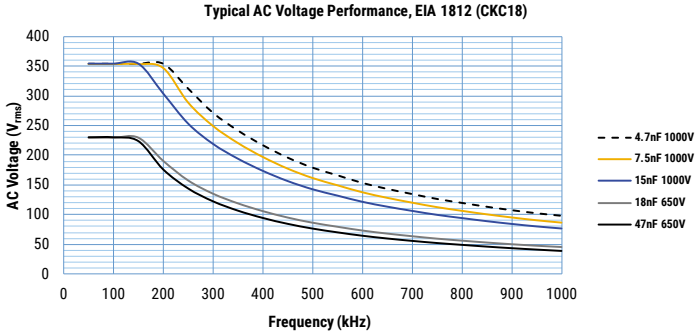
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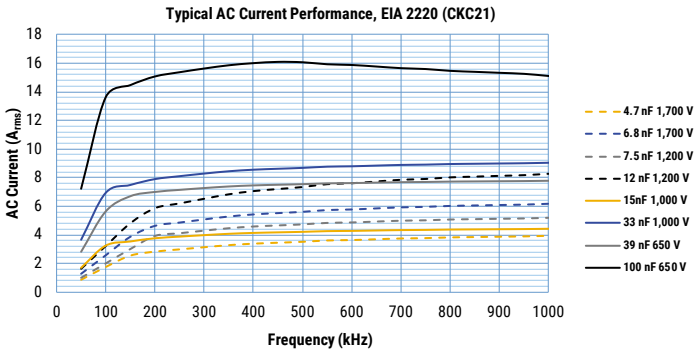
Typical Performance

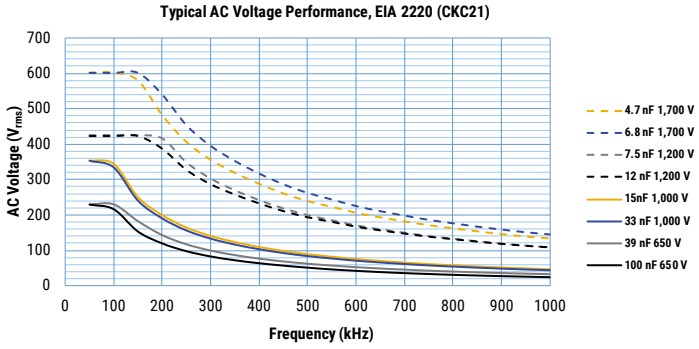


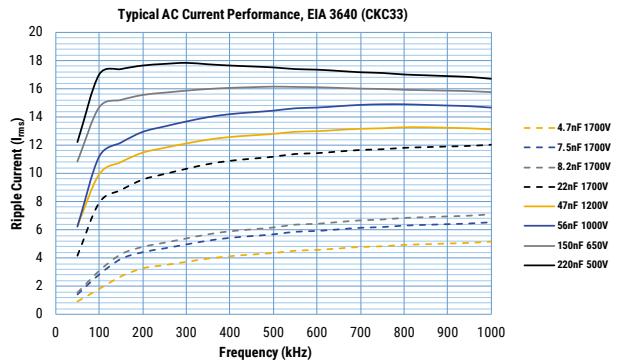


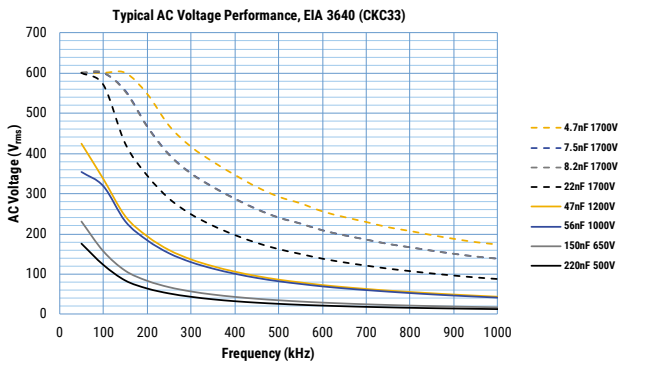












**Ripple current measurements conditions.- Ripple current measurement were took under ambient temperature. Ripple current measurements performed with a peak capacitor temperature of 150°C. Samples mounted to heat sink with no forced air cooling.*

Ordering Information

CKC	33	C	224	K	C	G	A	C	TU
Series	Case Size (L"x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Rated Voltage (V)	Dielectric	Subclass Designation	Termination Finish	Packaging (Suffix/C-Spec)
CKC = KC-LINK	18 = 1812 21 = 2220 33 = 3640	C = Standard X = Flex[1]	Two single digits and number of zeros. Use 9 for 1.0 – 9.9 pF e.g., 2.2 pF = 229	F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	C = 500 V W = 650 V D = 1,000 V E = 1,200 V J = 1,700 V G = 2,000 V	G = C0G	A = N/A	C = 100% matte Sn	See "Packaging C-Spec Ordering Options Table"

[1] Flexible termination is only available for EIA 1812 and 2220 case sizes.

Environmental Compliance

Lead (Pb)-free, RoHS, and REACH compliant without exemptions.

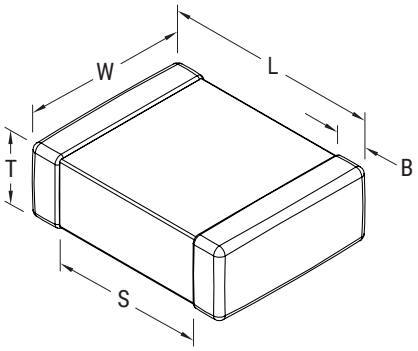
Packaging C-Spec Ordering Options Table

Packaging Type	Packaging/Grade Ordering Code (C-Spec)
Commercial Grade	
Bulk Bag[1]/Unmarked	Not required (Blank)
7" Reel/Unmarked	TU
13" Reel (Embossed Plastic Tape)/Unmarked	7210
Automotive Grade[2]	
7" Reel	AUTO
13" Reel (Embossed Plastic Tape)/Unmarked	AUTO7210

[1] Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging. "Bulk Bag" packaging option is not available for case sizes larger than 2225 (5664 Metric).

[2] For additional Information regarding "AUTO" C-Spec options, see "Automotive C-Spec Information."

Dimensions – Millimeters (Inches)



Standard Termination

KC-LINK CODE	EIA SIZE CODE	METRIC SIZE CODE	L LENGTH	W WIDTH	T THICKNESS	B BANDWIDTH	S SEPARATION Minimum	Mounting Technique
18	1812	4532	4.50 (0.177) ±0.30 (0.012)	3.20 (0.126) ±0.30 (0.012)	See Table 2 for Thickness	0.60 (0.024) ±0.35 (0.014)	N/A	Solder Reflow Only
21	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)		
33	3640	9210	9.30 (0.366) ±0.60 (0.024)	10.20 (0.402) ±0.40 (0.016)		1.27 (0.050) ±0.40 (0.016)		

Flex Termination

KC-LINK CODE	EIA SIZE CODE	METRIC SIZE CODE	L LENGTH	W WIDTH	T THICKNESS	B BANDWIDTH	S SEPARATION Minimum	Mounting Technique
18	1812	4532	4.50 (0.178) ±0.40 (0.016)	3.20 (0.126) ±0.30 (0.012)	See Table 2 for Thickness	0.70 (0.028) ±0.35 (0.014)	N/A	Solder Reflow Only
21	2220	5650	5.90 (0.232) ±0.75 (0.030)	5.00 (0.197) ±0.40 (0.016)		0.70 (0.028) ±0.35 (0.014)		

Table 1 – Capacitance Range/Selection Waterfall Standard Termination

Capacitance	Capacitance Code	Case Size/Series	CKC18C			CKC21C					CKC33C					
			1812			2220					3640					
		Voltage Code	C	W	D	C	W	D	E	J	C	W	D	E	J	G
		Rated Voltage (VDC)	500	650	1000	500	650	1000	1200	1700	500	650	1000	1200	1700	2000
		Capacitance Tolerance	Product Availability and Chip Thickness Codes See Packaging Specs for Chip Thickness Dimensions													
4,700 pF	472	F G J K M	GD	GD	GD	JK	JK	JK	JK	JK	MA	MA	MA	MA	MA	MA
5,100 pF	512	F G J K M	GD	GD	GD	JL	JL	JL	JL	JL	MA	MA	MA	MA	MA	MA
5,600 pF	562	F G J K M	GD	GD	GD	JL	JL	JL	JL	JL	MA	MA	MA	MA	MA	MA
6,200 pF	622	F G J K M	GH	GH	GH	JN	JN	JN	JN	JN	MA	MA	MA	MA	MA	MA
6,800 pF	682	F G J K M	GH	GH	GH	JN	JN	JN	JN	JN	MA	MA	MA	MA	MA	MA
7,500 pF	752	F G J K M	GK	GK	GK	JK	JK	JK	JK		MB	MB	MB	MB	MB	MB
8,200 pF	822	F G J K M	GK	GK	GK	JL	JL	JL	JL		MB	MB	MB	MB	MB	MB
9,100 pF	912	F G J K M	GM	GM	GM	JL	JL	JL	JL		MB	MB	MB	MB	MB	MB
10,000 pF	103	F G J K M	GM	GM	GM	JL	JL	JL	JL		MB	MB	MB	MB	MB	MB
12,000 pF	123	F G J K M	GO	GO	GO	JN	JN	JN	JN		MB	MB	MB	MB	MB	MB
15,000 pF	153	F G J K M	GO	GO	GO	JE	JE	JE			MC	MC	MC	MC	MC	MC
18,000 pF	183	F G J K M	GH	GH		JE	JE	JE			MC	MC	MC	MC	MC	
22,000 pF	223	F G J K M	GH	GH		JK	JK	JK			MC	MC	MC	MC	MC	
27,000 pF	273	F G J K M	GK	GK		JL	JL	JL			MB	MB	MB	MB		
33,000 pF	333	F G J K M	GM	GM		JN	JN	JN			MB	MB	MB	MB		
39,000 pF	393	F G J K M	GO	GO		JE	JE				MC	MC	MC	MC		
47,000 pF	473	F G J K M	GO	GO		JE	JE				MC	MC	MC	MC		
56,000 pF	563	F G J K M				JK	JK				MC	MC	MC			
68,000 pF	683	F G J K M				JL	JL				MC	MC				
82,000 pF	823	F G J K M				JL	JL				MB	MB				
0.1 µF	104	F G J K M				JN	JN				MB	MB				
0.12 µF	124	F G J K M									MB	MB				
0.15 µF	154	F G J K M									MC	MC				
0.18 µF	184	F G J K M									MC					
0.22 µF	224	F G J K M									MC					
Capacitance	Capacitance Code	Rated Voltage (VDC)	500	650	1000	500	650	1000	1200	1700	500	650	1000	1200	1700	2000
		Voltage Code	C	W	D	C	W	D	E	J	C	W	D	E	J	G
		Case Size/Series	1812			2220					3640					
			CKC18C			CKC22C					CKC33C					

Note: Flexible termination available only for EIA 1812 and 2220.

Table 2 – Chip Thickness/Tape & Reel Packaging Quantities

Thickness Code	Case Size[1]	Thickness ± Range (mm)	Plastic Quantity		Thickness Code	Case Size[1]	Thickness ± Range (mm)	Plastic Quantity	
			7" Reel	13" Reel				7" Reel	13" Reel
GD	1812	1.25 ± 0.15	1,000	4,000	JL	2220	2.00 ± 0.20	500	2,000
GH	1812	1.40 ± 0.15	1,000	4,000	JN	2220	2.50 ± 0.20	500	2,000
GK	1812	1.60 ± 0.20	1,000	4,000	MA	3640	1.40 ± 0.15	250	1,000
GM	1812	2.00 ± 0.20	500	2,000	MB	3640	2.00 ± 0.20	250	1,000
GO	1812	2.50 ± 0.20	500	2,000	MC	3640	2.50 ± 0.20	250	1,000
JE	2220	1.40 ± 0.15	1,000	4,000					
JK	2220	1.60 ± 0.20	1,000	4,000					
Thickness Code	Case Size[1]	Thickness ± Range (mm)	7" Reel	13" Reel	Thickness Code	Case Size[1]	Thickness ± Range (mm)	7" Reel	13" Reel
			Plastic Quantity					Plastic Quantity	

Package quantity based on finished chip thickness specifications.

Table 3 – Performance & Reliability: Test Methods and Conditions

<table>
<tr><th>Test</th><th>Reference</th><th>Test Condition</th><th>Limits</th></tr>
<tr><td>Visual and Mechanical</td><td>KEMET Internal</td><td>No defects that may affect performance (10X)</td><td>Dimensions according KEMET Spec Sheet</td></tr>
<tr><td>Capacitance (Cap)</td><td>KEMET Internal</td><td>1 kHz ±50 Hz and 1.0 ±0.2 V_{rms} if capacitance

Capacitance measurements (including tolerance) are indexed to a referee time of 1,000 hours</td><td>Within Tolerance</td></tr>
<tr><td>Dissipation Factor (DF)</td><td>KEMET Internal</td><td>1 kHz ±50 Hz and 1.0 ±0.2 V_{rms}</td><td>Dissipation factor (DF) maximum limit at 25°C = 0.1%</td></tr>
<tr><td>Insulation Resistance (IR)</td><td>KEMET Internal</td><td>500 VDC applied for 120±5 seconds at 25°C</td><td>Within Specification
To obtain IR limit, divide MΩ-µF value by the capacitance and compare to GΩ limit. Select the lower of the two limits.

1,000 MΩ-µF or 100 GΩ</td></tr>
<tr><td>Temperature Coefficient of Capacitance (TCC)</td><td>KEMET Internal</td><td>Frequency: 1 kHz ±50 Hz
Capacitance change with reference to +25°C and 0 VDC applied.
* See part number specification sheet for voltage
<table>
<tr><th>Step</th><th>Temperature (°C)</th></tr>
<tr><td>1</td><td>+25°C</td></tr>
<tr><td>2</td><td>−55°C</td></tr>
<tr><td>3</td><td>+25°C (Reference)</td></tr>
<tr><td>4</td><td>+150°C</td></tr>
</table></td><td>±30 PPM / °C</td></tr>
<tr><td>Dielectric Withstanding Voltage (DWV)</td><td>KEMET Internal</td><td>
<table>
<tr><th>Rated DC Voltage</th><th>DWV Voltage (% of Rated)</th></tr>
<tr><td>500 V</td><td>150%</td></tr>
<tr><td>650 V</td><td>130%</td></tr>
<tr><td>≥ 1,000 V</td><td>120%</td></tr>
</table>
(5 ±1 seconds and charge/discharge not exceeding 50 mA)</td><td>Cap: Initial Limit
DF: Initial Limit
IR: Initial Limit

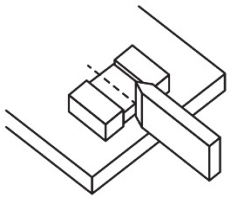
Withstand test voltage without insulation breakdown or damage.</td></tr>
<tr><td>Aging Rate (Maximum % Capacitance Loss/Decade Hour)</td><td>KEMET Internal</td><td>Maximum % capacitance loss/decade hour</td><td>0% Loss/Decade Hour</td></tr>
<tr><td>Terminal Strength</td><td>Kemet Internal</td><td>Shear stress test per specific case size,
Time: 60±1 seconds
<table>
<tr><th>Case Size</th><th>Force</th></tr>
<tr><td>3640</td><td>18N</td></tr>
</table>
</td><td>No evidence of mechanical damage</td></tr>
</table>

Table 3 – Performance & Reliability: Test Methods and Conditions cont.

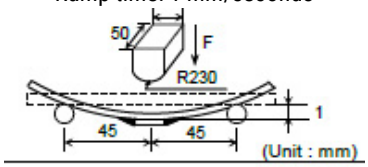
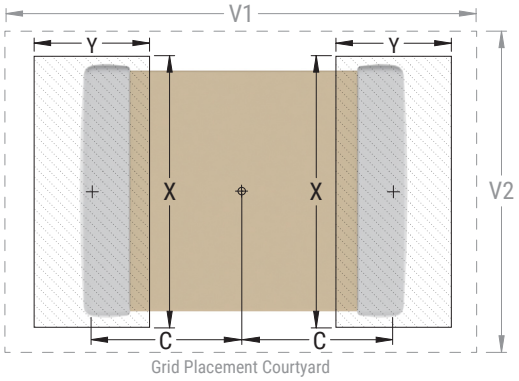
Test	Reference	Test Condition	Limits
Board Flex	AEC-Q200-005	Standard Termination system 3.0 mm Test time: 60±5 seconds Ramp time: 1 mm/seconds 	No evidence of mechanical damage
Solderability	J-STD-002	Magnification 50X. Conditions: a) Method B, 4 hours at 155°C, dry heat at 235°C b) Method B at 215°C category 3 c) Method D, category 3 at 260°C	Visual Inspection. 95% coverage on termination. No leaching
Temperature Cycling	JESD22 Method JA-104	1,000 cycles (−55°C to +150°C) 2-3 cycles per hour Soak Time 1 or 5 minutes	Measurement at 24 hours ±4 hours after test conclusion. Cap: Initial Limit DF: Initial Limit IR: Initial Limit
Biased Humidity	MIL-STD-202 Method 103	Load Humidity: 1,000 hours 85°C/85% RH and 200 VDC. Add 100 K Ω resistor. Low Volt Humidity: 1,000 hours 85°C/85% RH and 1.5 V. Add 100 K Ω resistor.	Measurement at 24 hours ±4 hours after test conclusion. Within Post Environmental Limits Cap: ±0.3% or ±0.25 pF shift IR: 10% of Initial Limit DF Limits Maximum: 0.5%
Moisture Resistance	MIL-STD-202 Method 106	Number of cycles required 10, 24 hours per cycle. Steps 7a and 7b not required	Measurement at 24 hours ±4 hours after test conclusion. Within Post Environmental Limits Cap: ±0.3% or ±0.25 pF shift IR: 10% of Initial Limit DF Limits Maximum: 0.5%
Thermal Shock	MIL-STD-202 Method 107	Number of cycles required 5, (−55°C to 125°C) Dwell time 15 minutes.	Cap: Initial Limit DF: Initial Limit IR: Initial Limit
High Temperature Life	MIL-STD-202 Method 108	1,000 hours at 150°C with 1.0 X rated voltage applied.	Within Post Environmental Limits Cap: ±0.3% or ±0.25 pF shift IR: 10% of Initial Limit DF Limits Maximum: 0.5%
Storage Life		1,000 hours at 150°C, Unpowered	
Vibration	MIL-STD-202 Method 204	5 g's for 20 minutes, 12 cycles each of 3 orientations. Test from 10 – 2,000 Hz	Cap: Initial Limit DF: Initial Limit IR: Initial Limit
Mechanical Shock	MIL-STD-202 Method 213	1,500 g's 0.5ms Half-sine, Velocity Change 15.4 ft/second (Condition F)	Cap: Initial Limit DF: Initial Limit IR: Initial Limit
Resistance to Solvents	MIL-STD-202 Method 215	Add Aqueous wash chemical OKEMCLEAN (A 6% concentrated Oakite cleaner) or equivalent. Do not use banned solvents	Visual Inspection 10X Readable marking, no decoloration or stains. No physical damage.

Table 4 – Chip Capacitor Land Pattern Design Recommendations per IPC–7351

KC-LINK CODE	EIA SIZE CODE	METRIC SIZE CODE	Density Level A: Maximum (Most) Land Protrusion					Density Level B: Median (Nominal) Land Protrusion					Density Level C: Minimum (Least) Land Protrusion				
			C	Y	X	V1	V2	C	Y	X	V1	V2	C	Y	X	V1	V2
18	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
21	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
33	3640	9210	4.45	1.70	10.70	11.60	11.70	4.35	1.50	10.60	10.70	11.10	4.25	1.30	10.50	10.00	10.80

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.



Automotive C-Spec Information

KEMET automotive grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. These products are supported by a Product Change Notification (PCN) and Production Part Approval Process warrant (PPAP).

Automotive products offered through our distribution channel have been assigned an inclusive ordering code C-Spec, "AUTO." This C-Spec was developed in order to better serve small and medium-sized companies that prefer an automotive grade component without the requirement to submit a customer Source Controlled Drawing (SCD) or specification for review by a KEMET engineering specialist. This C-Spec is therefore not intended for use by KEMET OEM automotive customers and are not granted the same "privileges" as other automotive C-Specs. Customer PCN approval and PPAP request levels are limited (see details below.)

Product Change Notification (PCN)

The KEMET product change notification system is used to communicate primarily the following types of changes:

- Product/process changes that affect product form, fit, function, and/or reliability
- Changes in manufacturing site
- Product obsolescence

KEMET Automotive C-Spec	Customer Notification Due To:		Days Prior To Implementation
	Process/Product change	Obsolescence*	
KEMET assigned[1]	Yes (with approval and sign off)	Yes	180 days minimum
AUTO	Yes (without approval)	Yes	90 days minimum

[1] *KEMET assigned C-Specs require the submittal of a customer SCD or customer specification for review. For additional information contact KEMET.*

Production Part Approval Process (PPAP)

The purpose of the Production Part Approval Process is:

- To ensure that supplier can meet the manufacturability and quality requirements for the purchased parts.
- To provide the evidence that all customer engineering design records and specification requirements are properly understood and fulfilled by the manufacturing organization.
- To demonstrate that the established manufacturing process has the potential to produce the part.

KEMET Automotive C-Spec	PPAP (Product Part Approval Process) Level				
	1	2	3	4	5
KEMET assigned[1]	●	●	●	●	●
AUTO			○		

[1] *KEMET assigned C-Specs require the submittal of a customer SCD or customer specification for review. For additional information contact KEMET.*

● Part number specific PPAP available
○ Product family PPAP only

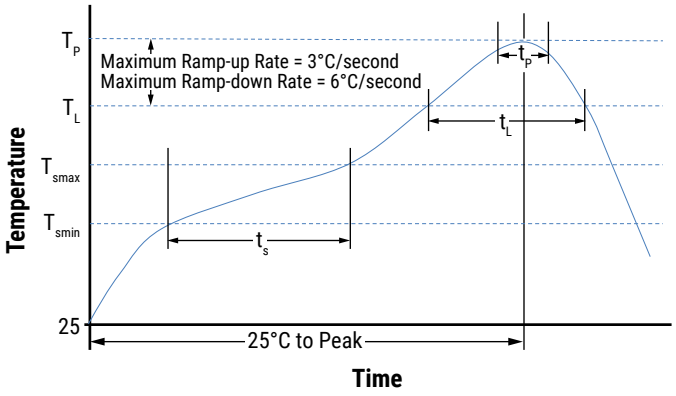
Soldering Process

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
	100% matte Sn
Preheat/Soak	
Temperature Minimum (T_{Smin})	150°C
Temperature Maximum (T_{Smax})	200°C
Time (t_S) from T_{Smin} to T_{Smax}	60 – 120 seconds
Ramp-Up Rate (T_L to T_P)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time Above Liquidous (t_L)	60 – 150 seconds
Peak Temperature (T_P)	260°C
Time Within 5°C of Maximum Peak Temperature (t_P)	30 seconds maximum
Ramp-Down Rate (T_P to T_L)	6°C/second maximum
Time 25°C to Peak Temperature	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.

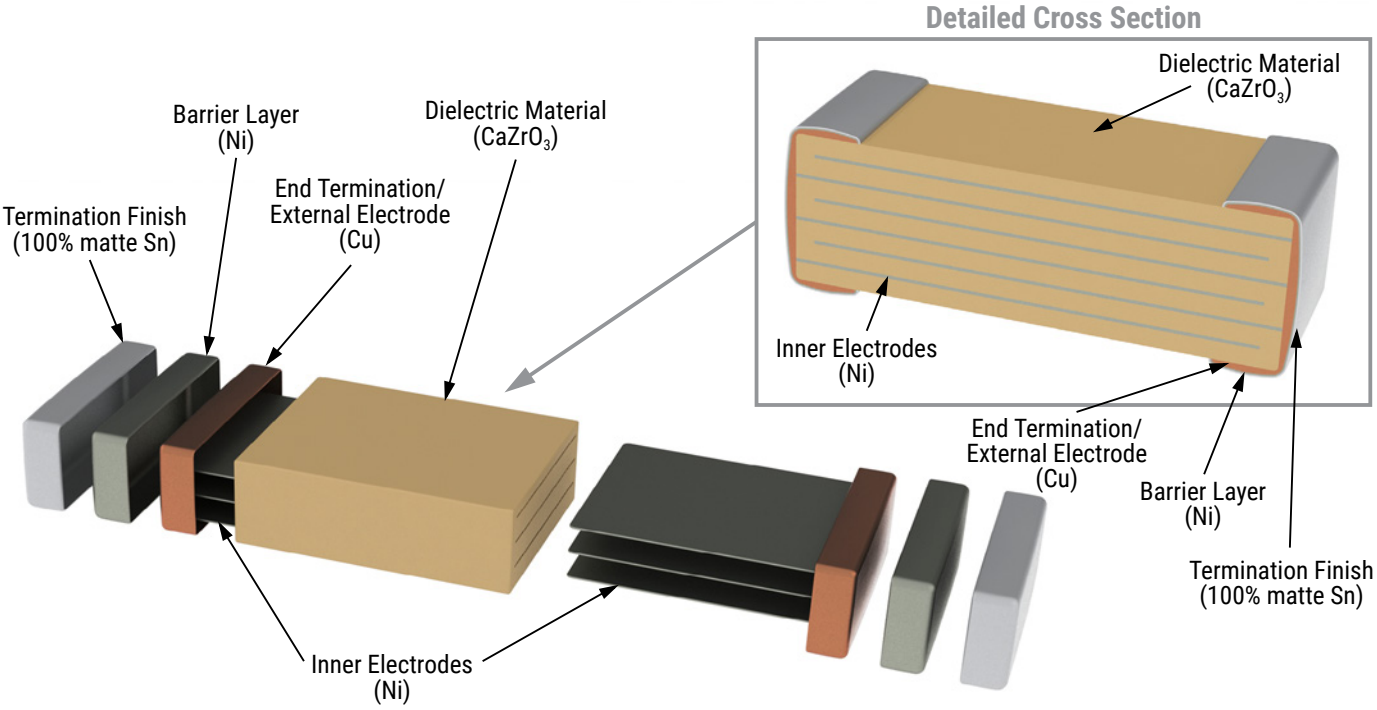


Storage & Handling

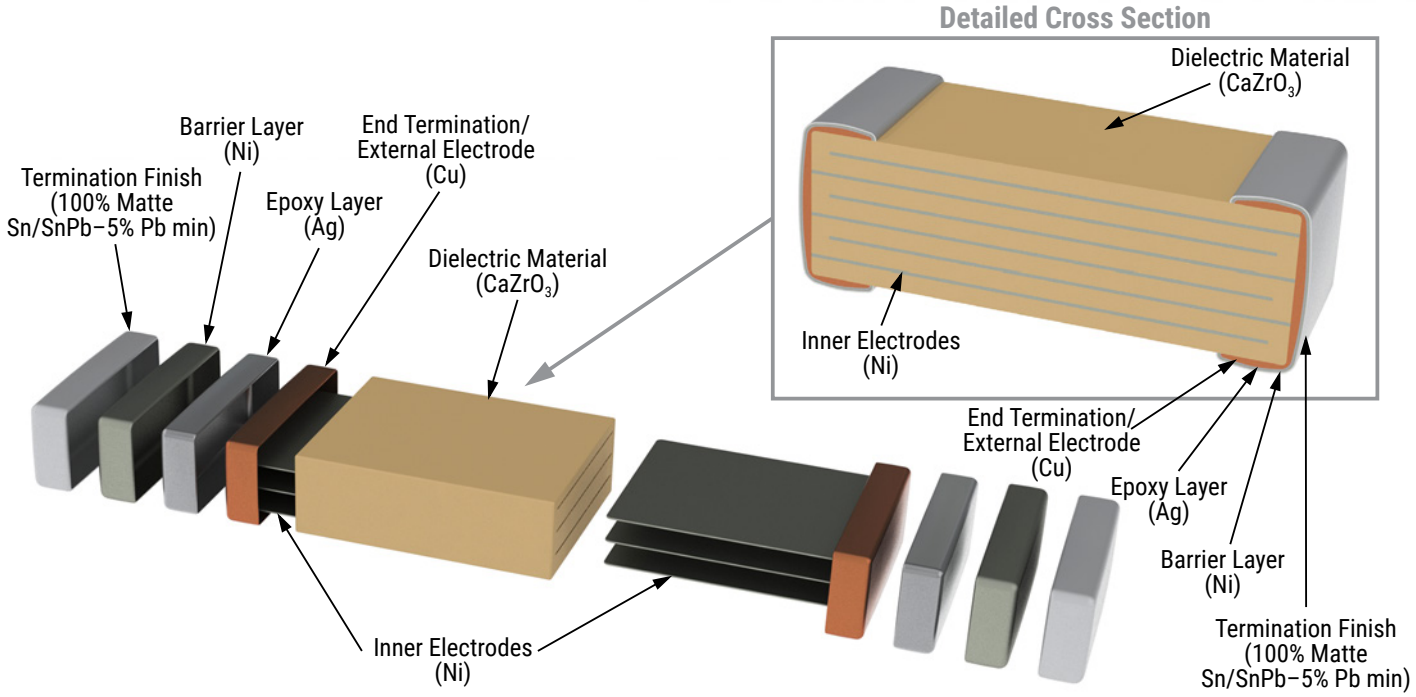
Ceramic chip capacitors should be stored in normal working environments. While the chips themselves are quite robust in other environments, solderability will be degraded by exposure to high temperatures, high humidity, corrosive atmospheres, and long term storage. In addition, packaging materials will be degraded by high temperature – reels may soften or warp and tape peel force may increase. KEMET recommends that maximum storage temperature not exceed 40°C and maximum storage humidity not exceed 70% relative humidity. In addition, temperature fluctuations should be minimized to avoid condensation on the parts and atmospheres should be free of chlorine and sulfur bearing compounds. For optimized solderability chip stock should be used promptly, preferably within 1.5 years upon receipt.

Construction

Standard Termination



Flex Termination



Tape & Reel Packaging Information

KEMET offers multilayer ceramic chip capacitors packaged in 8, 12, 16 and 24 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.

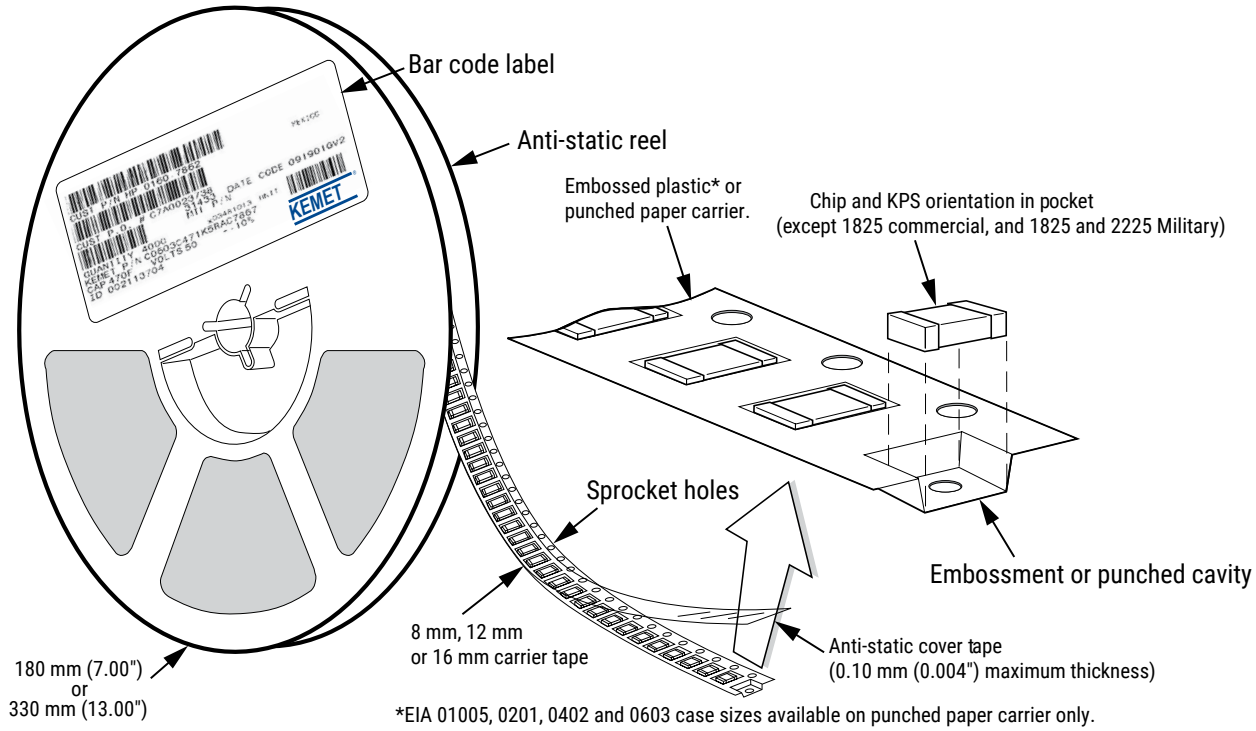


Table 5 – Carrier Tape Configuration, Embossed Plastic (mm)

EIA Case Size	Tape Size (W)*	Embossed Plastic	
		7" Reel	13" Reel
		Pitch (P_1)*	
1812, 2220	12	8	8
3640	24	16	16

**Refer to Figure 1 for W and P_1 carrier tape reference locations.*
**Refer to Tables 4 and 5 for tolerance specifications.*

Figure 1 – Embossed (Plastic) Carrier Tape Dimensions

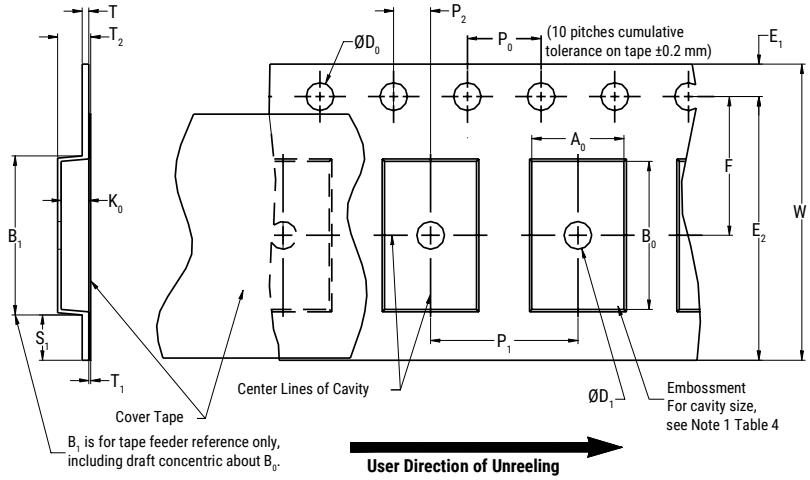


Table 6 – Embossed (Plastic) Carrier Tape Dimensions

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	S1 Minimum Note 3	T Maximum	T_1 Maximum
12 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±0.05 (0.079±0.002)	30 (1.181)	0.600 (0.024)	0.600 (0.024)	0.600 (0.024)
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 and K_0
12 mm	Single (4 mm) and Double (8 mm)		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)	Note 5
24 mm	16 mm	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)	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 S1 < 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. B1 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 mm and 12 mm wide tape and to 1.0 mm maximum for 16 mm tape (see Figure 4)
(e) For KPS Series product, A0 and B0 are measured on a plane 0.3 mm above the bottom of the pocket.
(f) see Addendum in EIA Document 481 for standards relating to more precise taping requirements.

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)
24 mm	0.1 to 1.6 Newton (10 to 160 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 2 – Maximum Component Rotation

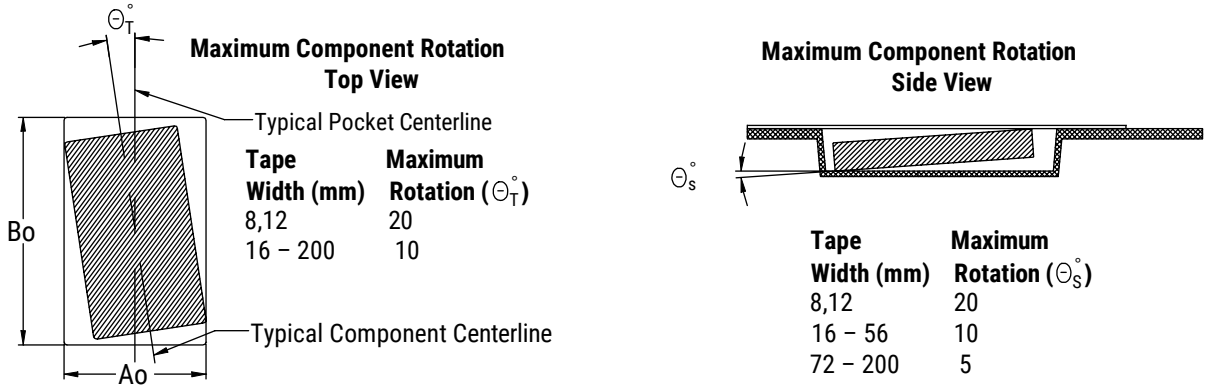


Figure 3 – Maximum Lateral Movement

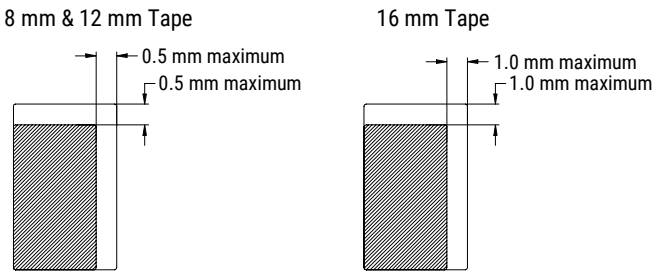


Figure 4 – Bending Radius

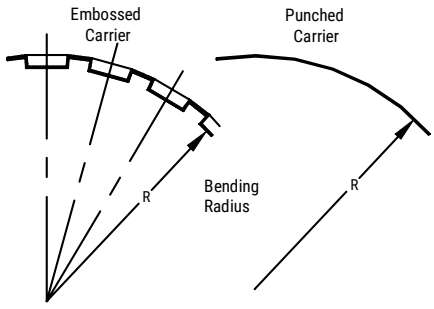
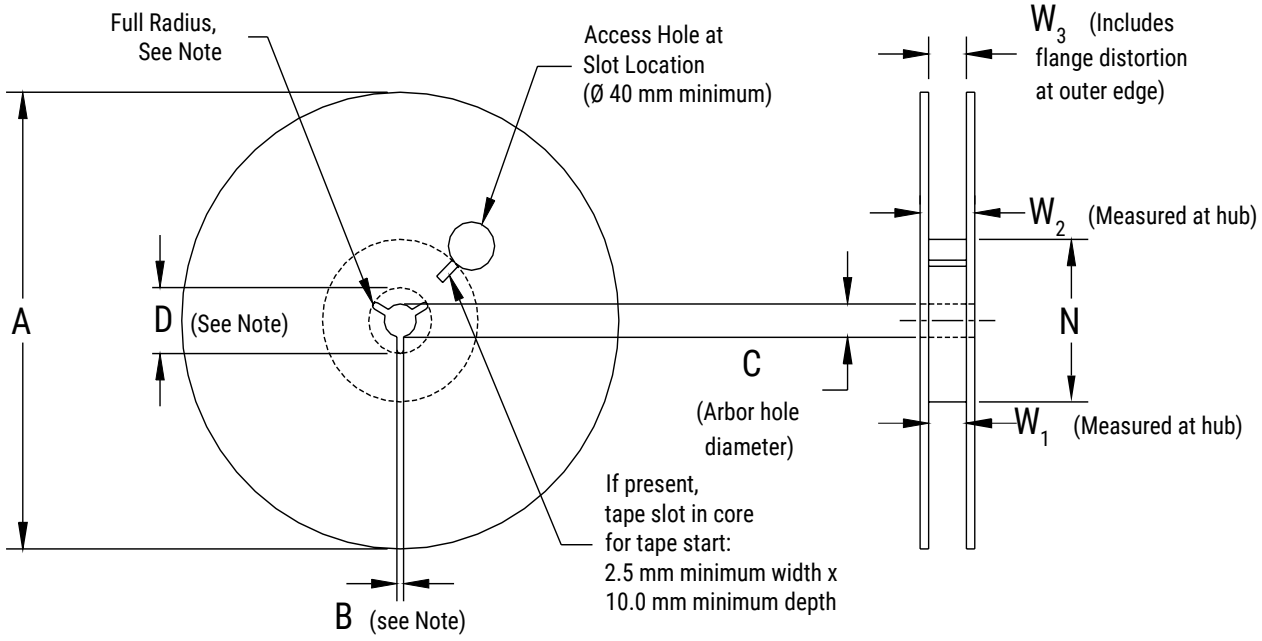


Figure 5 – Reel Dimensions



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

Table 7 – Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)				
Tape Size	A	B Minimum	C	D Minimum
12 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)
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
12 mm	50 (1.969)	12.4+2.0/−0.0 (0.488+0.078/−0.0)	18.4 (0.724)	Shall accommodate tape width without interference
24 mm		25 +1.0/−0.0 (0.984 +0.039/−0.0)	27.4 ±1.0 (1.078 ±0.039)	

Figure 6 – Tape Leader & Trailer Dimensions

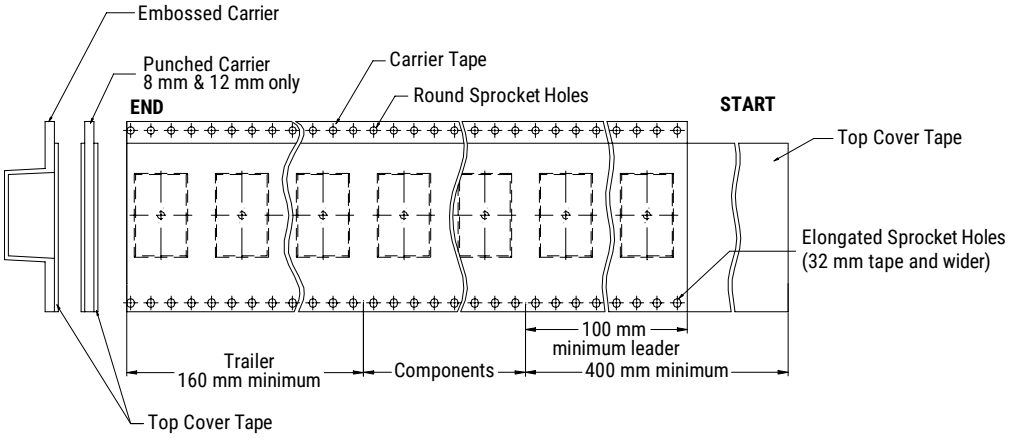
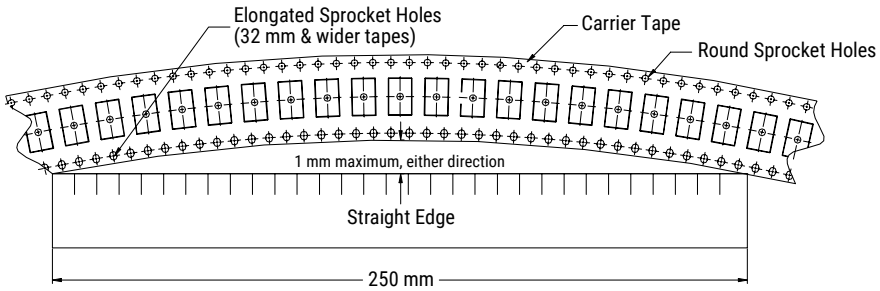


Figure 7 – Maximum Camber



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