Aximax, 400 Series, Axial, Conformally Coated, Ultra-Stable X8R Dielectric, 50 – 200 VDC (Commercial & Automotive Grade)

Electronic Components
KEMET
CHARGED®

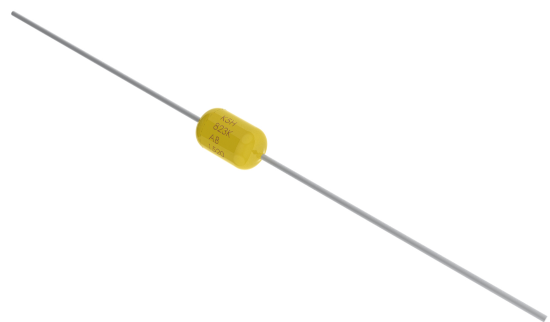
Overview

KEMET's Aximax conformally coated axial through-hole ceramic capacitors in Ultra-Stable X8R dielectric feature a 150°C maximum operating temperature, offering the latest in high temperature dielectric technology and reliability for extreme temperature applications. It offers the same temperature capability as conventional X8R, but without the capacitance loss due to applied DC voltage. Ultra-Stable X8R exhibits no change in capacitance with respect to voltage and boasts a minimal change in capacitance with reference to ambient temperature. It is a suitable replacement for higher capacitance and larger footprint devices that fail to offer capacitance stability. Capacitance change with respect to temperature is limited to ±15% from -55ºC to 150ºC.

Driven by the demand for a more robust and reliable component, the Ultra-Stable X8R dielectric Aximax though-hole capacitors were developed for critical applications where reliability and capacitance stability at higher operating temperatures are a concern. These capacitors are widely used in automotive circuits as well as general high temperature applications.

In addition to Commercial Grade, Automotive Grade devices are available and meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

These devices meet the flame test requirements outlined in UL Standard 94V-0.



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Ordering Information

C	410	C	472	J	5	H	5	T	A	7200
Ceramic	Style/Size	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance[1]	Rated Voltage (VDC)	Dielectric	Design	Lead Finish[2]	Failure Rate	Packaging/Grade (C-Spec)
	410 430	C = Standard	2 significant digits + number of zeros	F = ±1% G = ±2% J = ±5% K = ±10%	5 = 50 1 = 100 2 = 200	H = Ultra-Stable X8R	5 = Multilayer	T = 100% Matte Sn H = SnPb (60/40)	A = N/A	Blank = Bulk 7200 = 12" Reel 7293 = Ammo pack AUTO = Automotive grade

[1] *Additional capacitance Tolerance offerings may be available. Contact KEMET for details.*

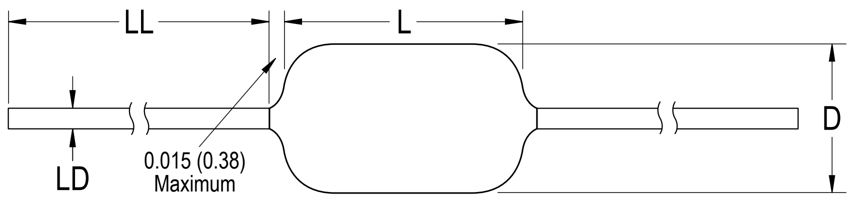
[2] *Lead materials:*

Standard: 100% matte tin (Sn) with nickel (Ni) underplate and steel core ("T" designation).

Alternative 1: 60% tin (Sn)/40% lead (Pb) finish with copper-clad steel core ("H" designation).

Additional lead finish options may be available. Contact KEMET for details

Dimensions – Millimeters (Inches)



Series	Style/Size	L Length Maximum	D Diameter Maximum	LD Lead Diameter	LL Lead Length Minimum
C41X	410	0.170 (4.32)	0.095 (2.31)	0.020 +0.001/ -0.003 (0.51 +0.025/ -0.076)	1.0 (25.4)
C43X	430	0.240 (6.10)	0.150 (3.81)		

Benefits

- Axial through-hole form factor
- Conformally coated
- Operating temperature range of -55°C to +150°C
- Lead (Pb)-Free, RoHS and REACH compliant
- DC voltage ratings of 50 V, 100 V, and 200 V
- Capacitance offerings ranging from 10 pF up to 0.082 µF
- Available capacitance tolerances of ±1%, ±2%, ±5%, and 10%
- Extremely low ESR & ESL
- High thermal stability
- High ripple current capability
- No capacitance change with respect to applied rated DC voltage
- Negligible capacitance change with respect to temperature from -55°C to +150°C
- No capacitance decay with time
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated lead finish allowing for excellent solderability
- SnPb-plated lead finish option available upon request (60/40)
- Encapsulation meets flammability standard UL 94V-0

Applications

Typical applications include decoupling, bypass and filtering in extreme environments such as down-hole oil exploration, under-hood automotive, aerospace and defense.

Application Notes

These devices are not recommended for use in overmold applications and/or processes.

Qualification/Certification

Commercial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 4, Performance & Reliability.

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. 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 (excluding SnPb termination finish option).

Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +150°C
Capacitance Change with Reference to +25°C and 0 VDC Applied (TCC)	±15%
Aging Rate (Maximum % Capacitance Loss/Decade Hour)	0%
Dielectric Withstanding Voltage (DWV)	250% of rated voltage (5 ±1 seconds and charge/discharge not exceeding 50 mA)
Dissipation Factor (DF) Maximum Limit @ 25ºC	2.5%
Insulation Resistance (IR) Limit @ 25°C	1,000 megohm microfarads or 100 GΩ (Rated voltage applied for 120 ±5 seconds @ 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 ±0.2 Vrms if capacitance ≤ 1,000 pF
1 kHz ±50 Hz and 1.0 ±0.2 Vrms 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."

Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance					
Dielectric	Rated DC Voltage	Capacitance Value	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
Ultra-Stable X8R	All	All	2.5	0.3% or ±0.25 pF	10% of Initial Limit

Table 1A - C410 Style/Size (0.095" Diameter x 0.170" L), Capacitance Range Waterfall

C410 Style/Size (0.095" Diameter x 0.170" L)				
Rated Voltage (VDC)		50	100	200
Voltage Code		5	1	2
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)		
100pF	F = ±1% G = ±2% J = ±5% K = ±10%	101	101	101
120pF		121	121	121
150pF		151	151	151
180pF		181	181	181
220pF		221	221	221
270pF		271	271	271
330pF		331	331	331
390pF		391	391	391
470pF		471	471	471
560pF		561	561	561
680pF		681	681	681
820pF		821	821	821
1000pF		102	102	102
1100pF		112	112	
1200pF		122	122	
1500pF		152	152	
1800pF		182	182	
2200pF		222	222	
2700pF		272	272	
3300pF		332	332	
3900pF		392	392	
4700pF		472	472	
5100pF		512	512	
5600pF		562	562	
6200pF		622	622	
6800pF		682	682	
7500pF		752	752	
8200pF		822	822	
9100pF		912	912	
0.01µF		103	103	
0.012µF		123	123	
0.015µF		153	153	
0.018µF		183		
0.022µF		223		
Rated Voltage (VDC)		**50**	**100**	**200**
Voltage Code		**5**	**1**	**2**

These products are protected under U.S .Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

Table 1B - C430 Style/Size (0.150" Diameter x 0.290" L), Capacitance Range Waterfall

C430 Style/Size (0.150" Diameter x 0.260" L)				
Rated Voltage (VDC)		50	100	200
Voltage Code		5	1	2
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)		
1100pF	F = ±1% G = ±2% J = ±5% K = ±10%			112
1200pF				122
1500pF				152
1800pF				182
2200pF				222
2700pF				272
0.018µF			183	
0.022µF			223	
0.027µF		273	273	
0.033µF		333	333	
0.039µF		393	393	
0.047µF		473	473	
0.056µF		563		
0.068µF		683		
0.082µF		823		
Rated Voltage (VDC)		**50**	**100**	**200**
Voltage Code		**5**	**1**	**2**

These products are protected under U.S .Patents 7172985 & 7670981, other patents pending, and any foreign counterparts.

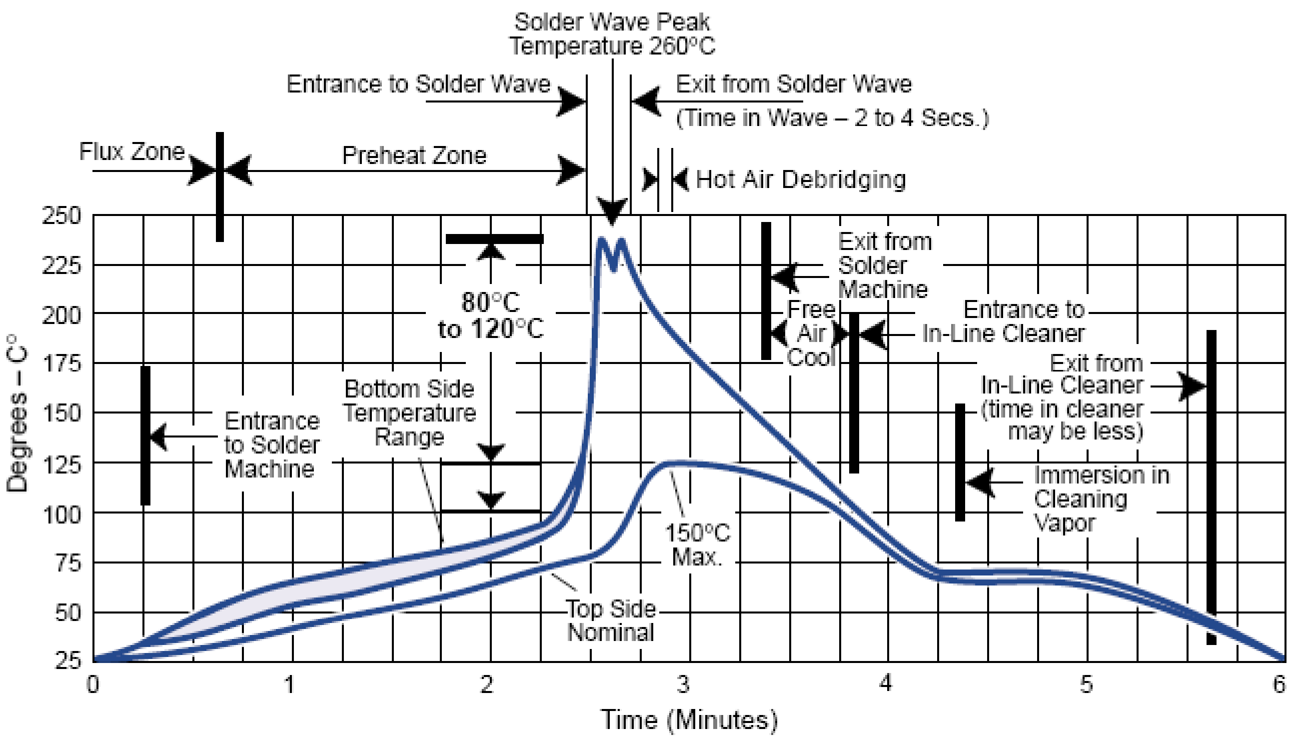
Soldering Process

Recommended Soldering Technique:

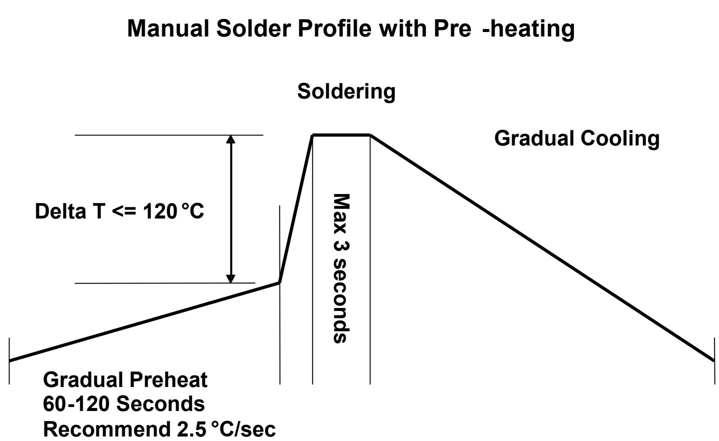
- Solder Wave
- Hand Soldering (Manual)

Recommended Soldering Profile:

- Optimum Wave Solder Profile



- Hand Soldering (Manual)



KEMET recommends following the guidelines and techniques outlined in technical bulletins F2103 and F9207.

Table 2 – Performance & Reliability: Test Methods and Conditions

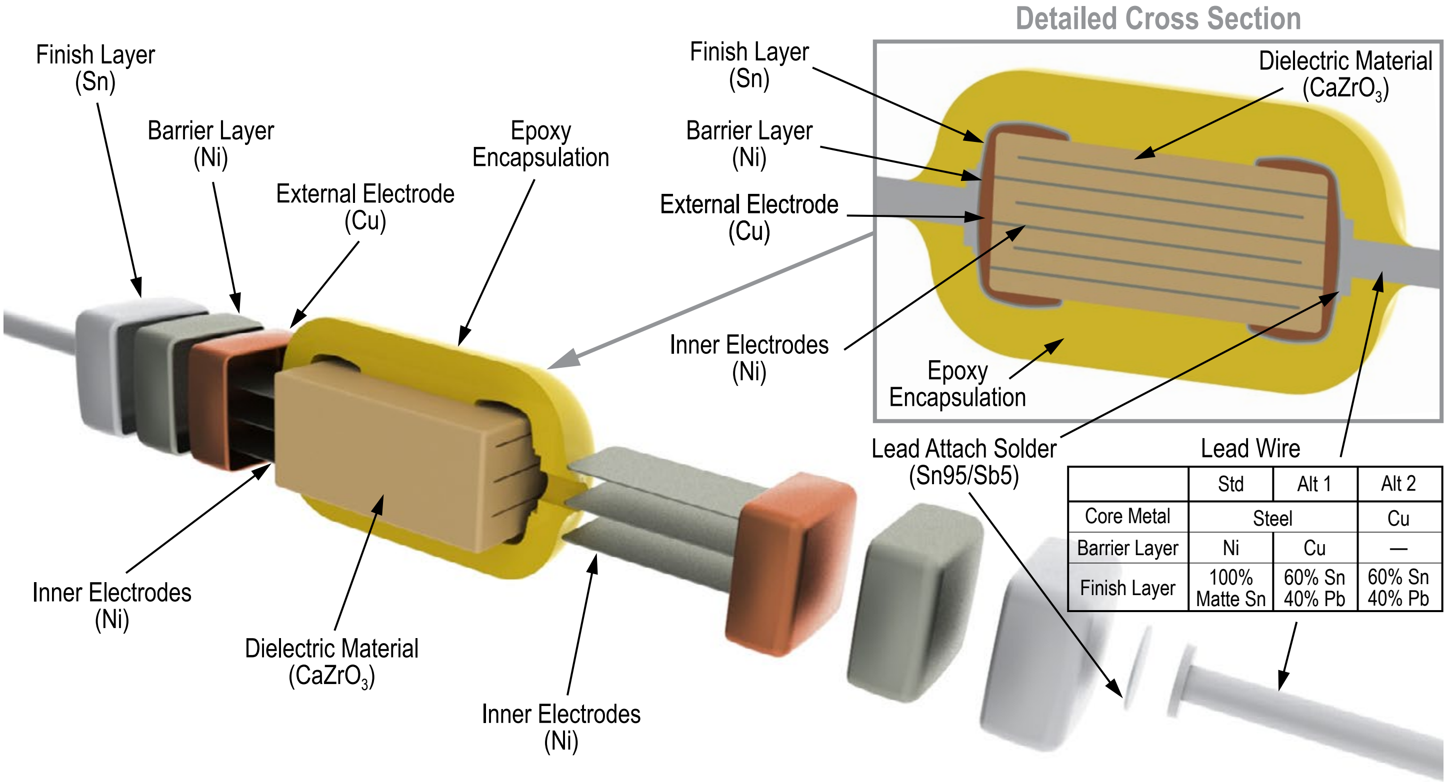
Stress	Reference	Test or Inspection Method
Solderability	J–STD–002	Magnification 50 X. Conditions:
		a) Method A, at 235°C, Category 3
Temperature Cycling	JESD22 Method JA–104	1,000 cycles (-55°C to +150°C), measurement at 24 hours ±2 hours after test conclusion.
Biased Humidity	MIL–STD–202 Method 103	Load humidity: 1,000 hours 85°C/85% RH and rated voltage. Add 100 K ohm resistor. Measurement at 24 hours ±2 hours after test conclusion.
		Low volt humidity: 1,000 hours 85°C/85% RH and 1.5 V. Add 100 K ohm resistor. Measurement at 24 hours ±2 hours after test conclusion.
Moisture Resistance	MIL–STD–202 Method 106	t = 24 hours/cycle. Steps 7a and 7b not required. Unpowered. Measurement at 24 hours ±2 hours after test conclusion.
Thermal Shock	MIL–STD–202 Method 107	-55°C/+150°C. Note: Number of cycles required = 300. Maximum transfer time = 20 seconds. Dwell time -15 minutes. Air-Air.
High Temperature Life	MIL–STD–202 Method 108 /EIA–198	1,000 hours at 150°C with 2 X rated voltage applied.
Storage Life	MIL–STD–202 Method 108	150°C, 0 VDC, for 1,000 hours.
Vibration	MIL–STD–202 Method 204	5 g for 20 minutes, 12 cycles each of 3 orientations. Note: Use 8"X5" PCB .031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10–2,000 Hz.
Resistance to Soldering Heat	MIL–STD–202 Method 210	Condition B. No preheat of samples. Note: single wave solder - procedure 2.
Terminal Strength	MIL–STD–202 Method 211	Conditions A (454g), Condition C (227g)
Mechanical Shock	MIL–STD–202 Method 213	Figure 1 of Method 213, Condition C.
Resistance to Solvents	MIL–STD–202 Method 215	Add aqueous wash chemical - OKEM Clean or equivalent.

Storage & Handling

The un-mounted storage life of a through-hole (leaded) ceramic capacitor is dependent upon storage and atmospheric conditions as well as packaging materials. While the ceramic chips enveloped under the epoxy coating themselves are quite robust in most environments, solderability of the wire lead on the final epoxy-coated product 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 and exposure to direct sunlight – reels may soften or warp, and tape peel force may increase.

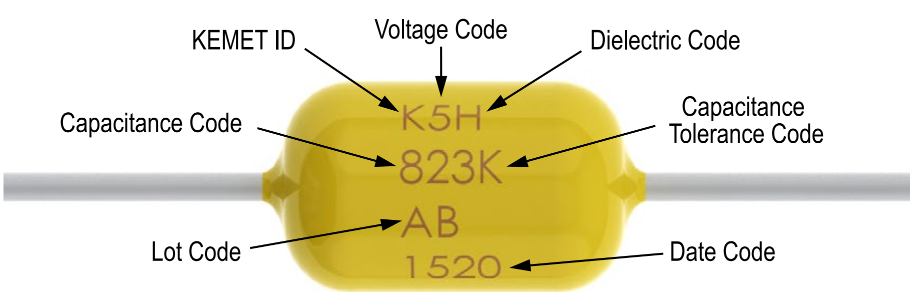
KEMET recommends storing the un-mounted capacitors in their original packaging, in a location away from direct sunlight, and where the temperature and relative humidity do not exceed 40 degrees centigrade and 70% respectively. For optimum solderability, capacitor stock should be used promptly, preferably within 18 months of receipt. For applications requiring pre-tinning of components, storage life may be extended if solderability is verified. Before cleaning, bonding or molding these devices, it is important to verify that your process does not affect product quality and performance. KEMET recommends testing and evaluating the performance of a cleaned, bonded or molded product prior to implementing and/or qualifying any of these processes.

Construction



	Std	Alt 1	Alt 2
Core Metal	Steel		Cu
Barrier Layer	Ni	Cu	—
Finish Layer	100% Matte Sn	60% Sn 40% Pb	60% Sn 40% Pb

Marking



15	20
Manufacturing Year: 15 = 2015	Manufacturing Week: 20 = Week 20 (of mfg. calendar year)

Packaging Quantities

Style/ Size	Standard Bulk Quantity	Ammo Pack Quantity Maximum	Reel Quantity Maximum (12" Reel)
410	300/Box	4000	5000
430	200/Box	2000	2500

Tape & Reel Packaging Information

KEMET offers standard reeling of molded and conformally coated axial leaded ceramic capacitors for automatic insertion or lead forming machines in accordance with EIA standard 296. KEMET's internal specification four-digit suffix, 7200, is placed at the end of the part number to designate tape and reel packaging, e.g., C410C104Z5U5CA7200.

Paper (50 lb.) test minimum is inserted between the layers of capacitors wound on reels for component pitch ≤ 0.400". Capacitor lead length may extend only a maximum of .0625" (1.59 mm) beyond the tapes' edges. Capacitors are centered in a row between the two tapes and will deviate only ± 0.031" (0.79 mm) from the row center. A minimum of 36" (91.5 cm) leader tape is provided at each finished length of taped components. Universal splicing clips are used to connect the tape.

Figure 1

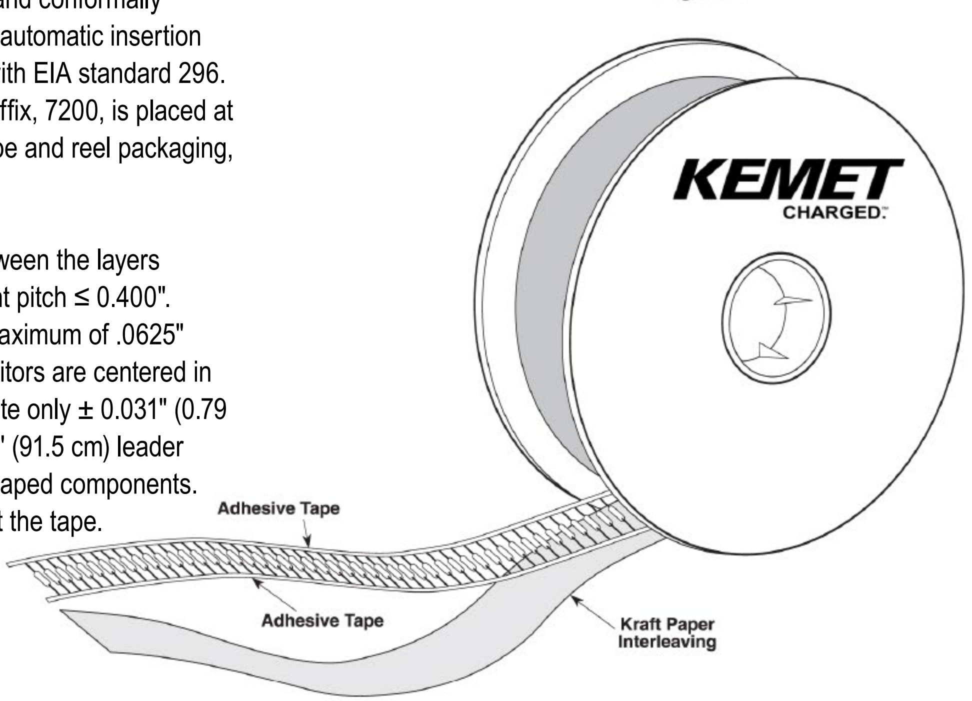


Figure 2

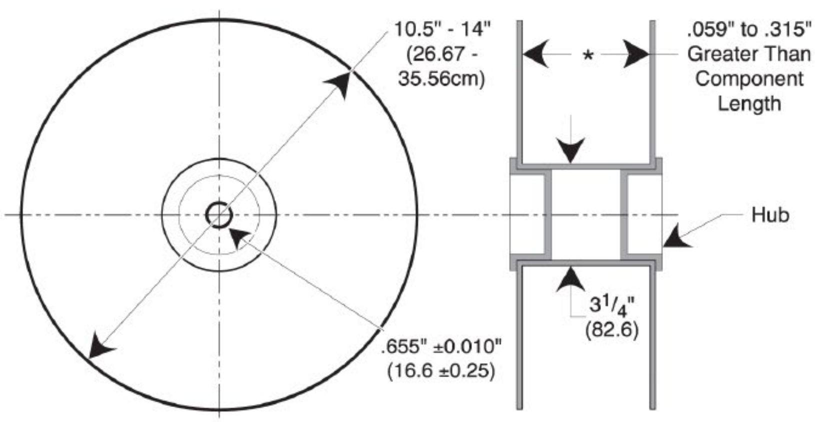


Figure 3

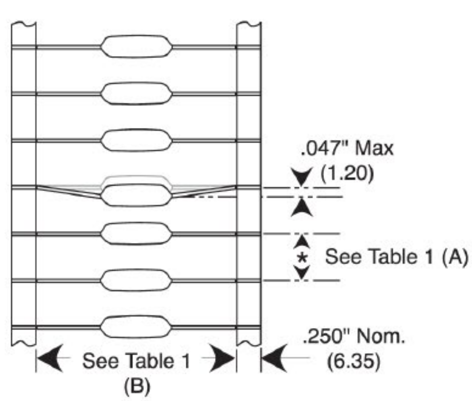


Table 3 – Ceramic Axial Tape and Reel Dimensions

Metric will govern

Dimensions — Millimeters (Inches)		
Axial Capacitor Body Diameter	A ±0.5 (0.020)	B ±1.5 (0.059)*
0.0 to 5.0 (0.0 to 0.197)	5.0 (0.197)	52.4 (2.062)

Symbol Reference Table	
A	Component Pitch
B	Inside Tape Spacing

** Inside tape spacing dimension (B) is determined by the body diameter of the capacitor.*

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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.