

## Overview

KEMET's Goldmax conformally coated radial 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 suitable replacement for higher capacitance and larger footprint devices that fail to offer capacitance stability. Capacitance change with respect to temperature is limited to  $\pm 15\%$  from -55°C to +150°C. Driven

by the demand for a more robust and reliable component, ultra-stable X8R dielectric Goldmax 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.

## Benefits

- Radial 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 25, 50, 100, and 200 V
- Capacitance offerings ranging from 1 pF up to 0.22  $\mu$ F
- Available capacitance tolerances of  $\pm 0.5$  pF,  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$ ,  $\pm 10\%$ , and  $\pm 20\%$
- Extremely low ESR and 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



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

## Axial Through-Hole Multilayer Ceramic Capacitors

### Ordering Information

C	320	C	104	J	5	H	5	T	A	7301
Ceramic	Style/Size	Specification/Series	Capacitance Code (pF)	Capacitance Tolerance <sup>1</sup>	Rated Voltage (VDC)	Dielectric	Design	Lead Finish <sup>2</sup>	Failure Rate	Packaging (C-Spec)
	315 322 328 316 323 330 317 324 331 318 325 333 320 326 335 321 327 336	C = Standard	First two digits represent significant figures. Third digit specifies number of zeros.	D = $\pm 0.5\%$ F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	3 = 25 5 = 50 1 = 100 2 = 200	H = Ultra-Stable X8R	5 = Multilayer	T = 100% Matte Sn H = SnPb (60/40)*	A = N/A	See "Packaging C-Spec Ordering Options Table" below

<sup>1</sup> Additional capacitance Tolerance offerings may be available. Contact KEMET for details.

<sup>2</sup> Lead wire 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). KEMET does not recommend the usage of this termination for Automotive applications.

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

\* Only available as Commercial Grade.

### Applications

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

### Application Notes

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

### Packaging C-Spec Ordering Options Table

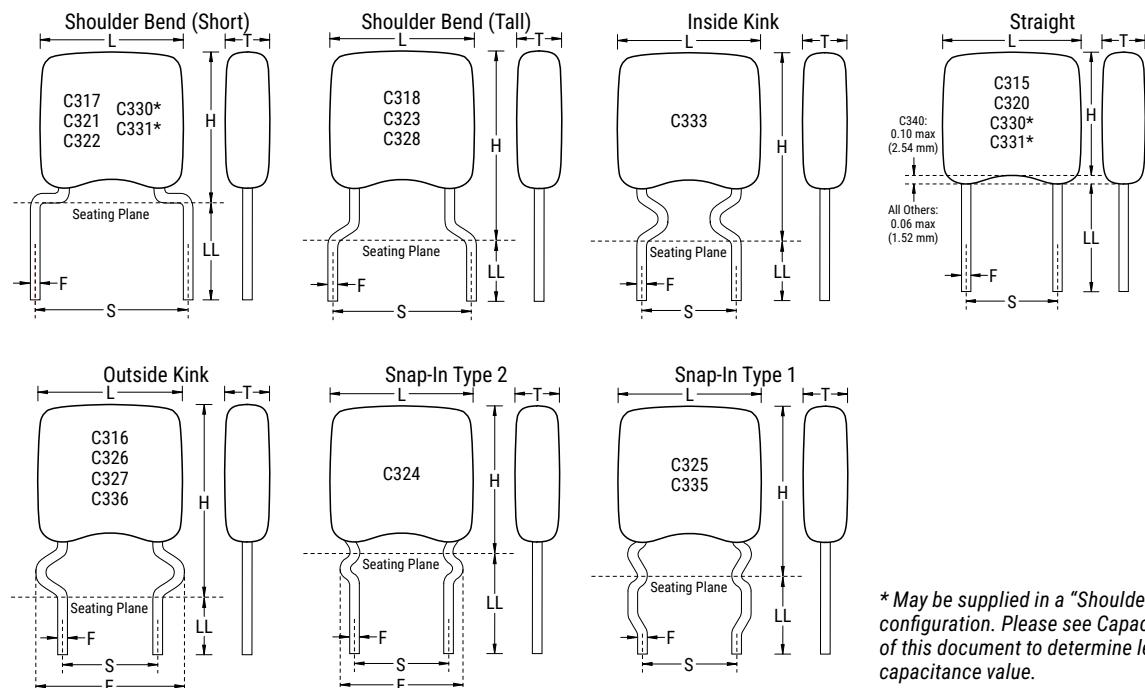
Packaging Type <sup>1</sup>	Packaging/Grade Ordering Code (C-Spec)
Commercial Grade	
Bulk Bag	Not required (Blank)
12" Tape & Reel (16.0 $\pm$ 0.5 mm lead length)	7301
12" Tape & Reel (18.0 mm minimum lead length)	7303
Ammo Pack (16.0 $\pm$ 0.5 mm lead length)	7305
Ammo Pack (18.0 mm minimum lead length)	7317
Automotive Grade	
Bulk Bag Automotive Grade	9170
12" Tape & Reel (16.0 $\pm$ 0.5 mm lead length)	9170 7301
12" Tape & Reel (18.0 mm minimum lead length)	9170 7303
Ammo Pack (16.0 $\pm$ 0.5 mm lead length)	9170 7305
Ammo Pack (18.0 mm minimum lead length)	9170 7317

<sup>1</sup> Bulk bag option is required for Size/Style C321 and C331.

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

## Axial Through-Hole Multilayer Ceramic Capacitors

### Dimensions – Inches (Millimeters)



\* May be supplied in a "Shoulder Bend" or "Straight" Lead configuration. Please see Capacitance Range Waterfall section of this document to determine lead configuration availability by capacitance value.

Series	Style / Size	S Lead Spacing ± 0.030 (0.78)	L Length Maximum	H Height Maximum	T Thickness Maximum	F Lead Diameter +0.004 (0.10), -0.001 (0.025)	LL Lead Length Minimum
C31X	315		0.150 (3.81)	0.120 (3.14)	0.100 (2.54)		0.276 (7.00)
	316		0.150 (3.81)	0.230 (5.08)	0.100 (2.54)		0.200 (5.08)
C32X	324	0.100 (2.54)	0.200 (5.08)	0.230 (5.84)	0.125 (3.18) <sup>1</sup>		0.276 (7.00)
	320		0.200 (5.08)	0.230 (5.84)	0.125 (3.18) <sup>1</sup>		0.276 (7.00)
C31X	326		0.200 (5.08)	0.300 (7.62)	0.125 (3.18) <sup>1</sup>		0.200 (5.08)
	317	0.200 (5.08)	0.150 (3.81)	0.200 (5.08)	0.100 (2.54)		0.276 (7.00)
C32X	318		0.150 (3.81)	0.235 (5.97)	0.100 (2.54)		0.276 (7.00)
	321	0.250 (6.35)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18) <sup>1</sup>		0.276 (7.00)
C32X	322	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.125 (3.18) <sup>1</sup>	0.020 (0.51)	0.276 (7.00)
	323		0.200 (5.08)	0.300 (7.62)	0.125 (3.18) <sup>1</sup>		0.276 (7.00)
	325		0.200 (5.08)	0.300 (7.62)	0.125 (3.18) <sup>1</sup>		0.276 (7.00)
	328		0.200 (5.08)	0.300 (7.62)	0.125 (3.18) <sup>1</sup>		0.276 (7.00)
	327		0.200 (5.08)	0.320 (8.13)	0.125 (3.18) <sup>1</sup>		0.200 (5.08)
C33X	330	0.250 (6.35)	0.280 (7.11)	0.360 (9.14)	0.160 (4.07)		0.276 (7.00)
	331		0.290 (7.36)	0.360 (9.14)	0.160 (4.07)		0.276 (7.00)
	333	0.200 (5.08)	0.280 (7.11)	0.400 (10.16)	0.160 (4.07)		0.276 (7.00)
	335		0.280 (7.11)	0.400 (10.16)	0.160 (4.07)		0.276 (7.00)
	336		0.280 (7.11)	0.400 (10.16)	0.160 (4.07)		0.200 (5.08)

<sup>1</sup> Thickness maximum (T) = 0.160" (4.07 mm) for capacitance values greater than or equal to 4.7  $\mu$ F

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

## Axial Through-Hole Multilayer Ceramic Capacitors

### Automotive C-Spec Information

KEMET Automotive Grade products meet or exceed the requirements outlined by the Automotive Electronics Council. The details regarding test methods and conditions are referenced in the 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, "9170." 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's 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 <sup>1</sup>	Yes (with approval and sign off)	Yes	180 days Minimum
9170	Yes (without approval)	Yes	90 days Minimum

<sup>1</sup> 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 record 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 Level				
	1	2	3	4	5
KEMET assigned <sup>1</sup>	•	•	•	•	•
9170			○		

<sup>1</sup> 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 with customer information included.
- Product family PPAP only

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

## Axial Through-Hole Multilayer Ceramic Capacitors

### Qualification/Certification

Commercial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 2, 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](http://www.aecouncil.com).

### Environmental Compliance

Lead (Pb)-free, REACH and RoHS compliant without exemptions when ordered with a 100% tin (Sn) wire lead finish. Product ordered with tin/ lead (Sn60/Pb40) wire lead finish do not meet RoHS criteria.

Series	Termination Finish (Wire Lead)	RoHS Compliant	RoHS Exemption Code	REACH Compliant <sup>1</sup>	Halogen Free
300 (C3XX)	100% Matte Sn	Yes	n/a	Yes	Yes
	Sn60/Pb40	No	n/a	Yes	Yes

<sup>1</sup> REACH compliance indicates product does not contain Substance/s of Very High Concern (SVHC

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

## Axial Through-Hole Multilayer Ceramic Capacitors

### 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 % Cap Loss/Decade Hour):	0%
Dielectric Withstanding Voltage:	250% of rated voltage (5±1 seconds and charge/discharge not exceeding 50 mA)
Dissipation Factor (DF) Maximum Limit at +25°C:	2.5%
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  $M\Omega \cdot \mu F$  value by the capacitance and compare to  $G\Omega$  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  $V_{rms}$  ±0.2 V if capacitance ≤ 1,000 pF

1 kHz ±50 Hz and 1.0  $V_{rms}$  ±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."

### Post Environmental Limits

High Temperature Life, Biased Humidity and Storage Life					
Dielectric	Rated DC Voltage	Capacitance Value	DF (%)	Capacitance Shift	IR
Ultra-Stable X8R	All	All	3.0	±20%	10% of initial limit

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1A - C31X Style/Size (0.100" & 0.200" Lead Spacing), Capacitance Range Waterfall**

C315, C316, C317, C318 Style/Size (0.100" & 0.200" Lead Spacing)				
Rated Voltage (VDC)	25	50	100	200
Voltage Code	3	5	1	2
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)		
1pF	D = $\pm 0.5\text{pF}$	109	109	109
1.1pF		119	119	119
1.2pF		129	129	129
1.3pF		139	139	139
1.5pF		159	159	159
1.6pF		169	169	169
1.8pF		189	189	189
2.0pF		209	209	209
2.2pF		229	229	229
2.4pF		249	249	249
2.7pF		279	279	279
3.0pF		309	309	309
3.3pF		339	339	339
3.6pF		369	369	369
3.9pF		399	399	399
4.3pF		439	439	439
4.7pF		479	479	479
5.1pF		519	519	519
5.6pF		569	569	569
6.2pF		629	629	629
6.8pF		689	689	689
7.5pF		759	759	759
8.2pF		829	829	829
9.1pF		919	919	919
10pF	F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	100	100	100
11pF		110	110	110
12pF		120	120	120
13pF		130	130	130
15pF		150	150	150
16pF		160	160	160
18pF		180	180	180
20pF		200	200	200
22pF		220	220	220
24pF		240	240	240
27pF	M = $\pm 20\%$	270	270	270
30pF		300	300	300
33pF		330	330	330
36pF		360	360	360
39pF		390	390	390
43pF		430	430	430
47pF		470	470	470
51pF		510	510	510
56pF		560	560	560
62pF		620	620	620
68pF	M = $\pm 20\%$	680	680	680
75pF		750	750	750
82pF		820	820	820
91pF		910	910	910
100pF		101	101	101
110pF		111	111	111
120pF		121	121	121
130pF		131	131	131
150pF		151	151	151
160pF		161	161	161
180pF		181	181	181
Rated Voltage (VDC)	25	50	100	200
Voltage Code	3	5	1	2

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1A - C31X Style/Size (0.100" & 0.200" Lead Spacing), Capacitance Range Waterfall cont.**

C315, C316, C317, C318 Style/Size (0.100" & 0.200" Lead Spacing)				
Rated Voltage (VDC)	25	50	100	200
Voltage Code	3	5	1	2
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)		
200pF		201	201	201
220pF		221	221	221
240pF		241	241	241
270pF		271	271	271
300pF		301	301	301
330pF		331	331	331
360pF		361	361	361
390pF		391	391	391
430pF		431	431	431
470pF		471	471	471
510pF		511	511	511
560pF		561	561	561
620pF		621	621	621
680pF		681	681	681
750pF		751	751	751
820pF		821	821	821
910pF		911	911	911
1000pF		102	102	102
1100pF		112	112	112
1200pF		122	122	122
1300pF		132	132	132
1500pF		152	152	152
1600pF	F = ±1%	162	162	162
1800pF	G = ±2%	182	182	182
2000pF	J = ±5%	202	202	202
2200pF	K = ±10%	222	222	222
2400pF	M = ±20%	242	242	242
2700pF		272	272	272
3000pF		302	302	302
3300pF		332	332	332
3600pF		362	362	362
3900pF		392	392	392
4300pF		432	432	432
4700pF		472	472	472
5100pF		512	512	512
5600pF		562	562	562
6200pF		622	622	622
6800pF		682	682	682
7500pF		752	752	752
8200pF		822	822	822
9100pF		912	912	912
0.01μF		103	103	103
0.012μF		123	123	123
0.015μF		153	153	153
0.018μF		183	183	
0.022μF		223	223	
0.027μF		273		
0.033μF		333		
Rated Voltage (VDC)	25	50	100	200
Voltage Code	3	5	1	2

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1B - C32X Style/Size (0.100" & 0.200" Lead Spacing) Capacitance Range Waterfall**

C320, C322, C323, C326, C328 Style/Size (0.100" & 0.200" Lead Spacing)					
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)			
10pF	F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	100	100	100	100
11pF		110	110	110	110
12pF		120	120	120	120
13pF		130	130	130	130
15pF		150	150	150	150
16pF		160	160	160	160
18pF		180	180	180	180
20pF		200	200	200	200
22pF		220	220	220	220
24pF		240	240	240	240
27pF		270	270	270	270
30pF		300	300	300	300
33pF		330	330	330	330
36pF		360	360	360	360
39pF		390	390	390	390
43pF		430	430	430	430
47pF		470	470	470	470
51pF		510	510	510	510
56pF		560	560	560	560
62pF		620	620	620	620
68pF		680	680	680	680
75pF		750	750	750	750
82pF		820	820	820	820
91pF		910	910	910	910
100pF		101	101	101	101
110pF		111	111	111	111
120pF		121	121	121	121
130pF		131	131	131	131
150pF		151	151	151	151
160pF		161	161	161	161
180pF		181	181	181	181
200pF		201	201	201	201
220pF		221	221	221	221
240pF		241	241	241	241
270pF		271	271	271	271
300pF		301	301	301	301
330pF		331	331	331	331
360pF		361	361	361	361
390pF		391	391	391	391
430pF		431	431	431	431
470pF		471	471	471	471
510pF		511	511	511	511
560pF		561	561	561	561
620pF		621	621	621	621
680pF		681	681	681	681
750pF		751	751	751	751
820pF		821	821	821	821
910pF		911	911	911	911
1000pF		102	102	102	102
1100pF		112	112	112	112
1200pF		122	122	122	122
1300pF		132	132	132	132
1500pF		152	152	152	152
1600pF		162	162	162	162
1800pF		182	182	182	182
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1B - C32X Style/Size (0.100" & 0.200" Lead Spacing) Capacitance Range Waterfall cont.**

C320, C322, C323, C326, C328 Style/Size (0.100" & 0.200" Lead Spacing)					
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)			
2000pF	F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	202	202	202	202
2200pF		222	222	222	222
2400pF		242	242	242	242
2700pF		272	272	272	272
3000pF		302	302	302	302
3300pF		332	332	332	332
3600pF		362	362	362	362
3900pF		392	392	392	392
4300pF		432	432	432	432
4700pF		472	472	472	472
5100pF		512	512	512	512
5600pF		562	562	562	562
6200pF		622	622	622	622
6800pF		682	682	682	682
7500pF		752	752	752	752
8200pF		822	822	822	822
9100pF		912	912	912	912
0.01 $\mu$ F		103	103	103	103
0.012 $\mu$ F		123	123	123	123
0.015 $\mu$ F		153	153	153	153
0.018 $\mu$ F		183	183	183	183
0.022 $\mu$ F		223	223	223	223
0.027 $\mu$ F		273	273	273	273
0.033 $\mu$ F		333	333	333	333
0.039 $\mu$ F		393	393	393	393
0.047 $\mu$ F		473	473	473	473
0.056 $\mu$ F		563	563	563	563
0.068 $\mu$ F		683	683	683	683
0.082 $\mu$ F		823	823	823	823
0.100 $\mu$ F		104	104	104	
0.120 $\mu$ F		124	124		
0.150 $\mu$ F		154	154		
0.180 $\mu$ F		184			
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1C - C32X Style/Size (0.100" & 0.250" Lead Spacing) Capacitance Range Waterfall**

C321, C324, C325, C327 Style/Size (0.100" & 0.200" Lead Spacing)					
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)			
10pF	F = ±1% G = ±2% J = ±5% K = ±10% M = ±20%	100	100	100	100
11pF		110	110	110	110
12pF		120	120	120	120
13pF		130	130	130	130
15pF		150	150	150	150
16pF		160	160	160	160
18pF		180	180	180	180
20pF		200	200	200	200
22pF		220	220	220	220
24pF		240	240	240	240
27pF		270	270	270	270
30pF		300	300	300	300
33pF		330	330	330	330
36pF		360	360	360	360
39pF		390	390	390	390
43pF		430	430	430	430
47pF		470	470	470	470
51pF		510	510	510	510
56pF		560	560	560	560
62pF		620	620	620	620
68pF		680	680	680	680
75pF		750	750	750	750
82pF		820	820	820	820
91pF		910	910	910	910
100pF		101	101	101	101
110pF		111	111	111	111
120pF		121	121	121	121
130pF		131	131	131	131
150pF		151	151	151	151
160pF		161	161	161	161
180pF		181	181	181	181
200pF		201	201	201	201
220pF		221	221	221	221
240pF		241	241	241	241
270pF		271	271	271	271
300pF		301	301	301	301
330pF		331	331	331	331
360pF		361	361	361	361
390pF		391	391	391	391
430pF		431	431	431	431
470pF		471	471	471	471
510pF		511	511	511	511
560pF		561	561	561	561
620pF		621	621	621	621
680pF		681	681	681	681
750pF		751	751	751	751
820pF		821	821	821	821
910pF		911	911	911	911
1000pF		102	102	102	102
1100pF		112	112	112	112
1200pF		122	122	122	122
1300pF		132	132	132	132
1500pF		152	152	152	152
1600pF		162	162	162	162
1800pF		182	182	182	182
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1C - C32X Style/Size (0.100" & 0.250" Lead Spacing) Capacitance Range Waterfall cont.**

C321, C324, C325, C327 Style/Size (0.100" & 0.200" Lead Spacing)					
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)			
2000pF	F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	202	202	202	202
2200pF		222	222	222	222
2400pF		242	242	242	242
2700pF		272	272	272	272
3000pF		302	302	302	302
3300pF		332	332	332	332
3600pF		362	362	362	362
3900pF		392	392	392	392
4300pF		432	432	432	432
4700pF		472	472	472	472
5100pF		512	512	512	512
5600pF		562	562	562	562
6200pF		622	622	622	622
6800pF		682	682	682	682
7500pF		752	752	752	752
8200pF		822	822	822	822
9100pF		912	912	912	912
0.01 $\mu$ F		103	103	103	103
0.012 $\mu$ F		123	123	123	123
0.015 $\mu$ F		153	153	153	153
0.018 $\mu$ F		183	183	183	183
0.022 $\mu$ F		223	223	223	223
0.027 $\mu$ F		273	273	273	273
0.033 $\mu$ F		333	333	333	333
0.039 $\mu$ F		393	393	393	393
0.047 $\mu$ F		473	473	473	473
0.056 $\mu$ F		563	563	563	563
0.068 $\mu$ F		683	683	683	683
0.082 $\mu$ F		823	823	823	823
0.100 $\mu$ F		104	104	104	
0.120 $\mu$ F		124	124		
0.150 $\mu$ F		154	154		
0.180 $\mu$ F		184			
Rated Voltage (VDC)	25	50	100	200	
Voltage Code	3	5	1	2	

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

Axial Through-Hole Multilayer Ceramic Capacitors

**Table 1D - C33X Style/Size (0.200" & 0.250" Lead Spacing), Capacitance Range Waterfall**

C330, C331, C333, C335, C336 Style/Size (0.100" & 0.200" Lead Spacing)				
Rated Voltage (VDC)	25	50	100	200
Voltage Code	3	5	1	2
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)		
0.056 $\mu$ F				563
0.068 $\mu$ F				683
0.082 $\mu$ F	F = $\pm$ 1%			823
0.100 $\mu$ F	G = $\pm$ 2%			104
0.120 $\mu$ F	J = $\pm$ 5%			
0.150 $\mu$ F	K = $\pm$ 10%		124	
0.180 $\mu$ F	M = $\pm$ 20%		154	
0.220 $\mu$ F		184		
		224	224	
Rated Voltage (VDC)	25	50	100	200
Voltage Code	3	5	1	2

\* Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C330 and C331.

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

## Axial Through-Hole Multilayer Ceramic Capacitors

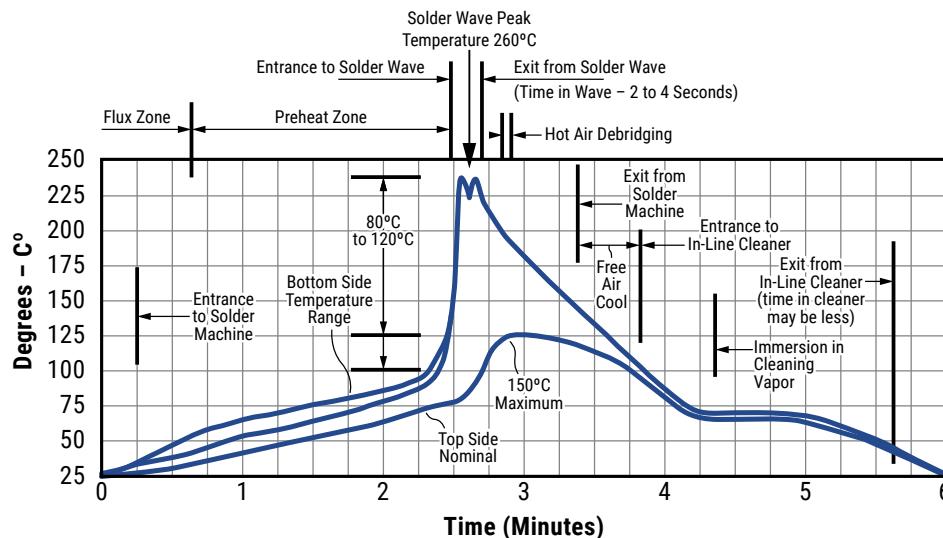
### Soldering Process

#### Recommended Soldering Methods:

- Solder Wave
- Hand Soldering (Manual)

#### Recommended Soldering Profile:

- Optimum Wave Solder Profile



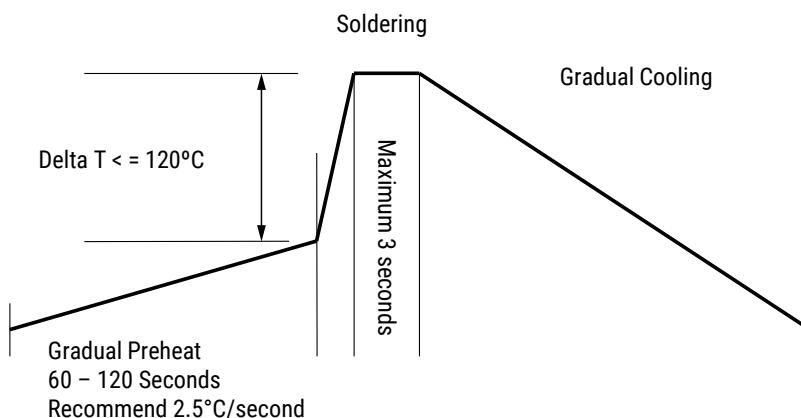
#### Mounting

All encased capacitors will pass the Resistance to Soldering Heat of MIL-STD-202, Method 210, Condition B. This test simulates wave solder topside board mount product. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. More severe treatment must be considered reflective of an improper soldering process.

The above figure is a recommended solder wave profile for both axial and radial leaded ceramic capacitors.

- Hand Soldering (Manual)

#### with Pre-heating



**Table 2 – Performance & Reliability: Test Methods and Conditions**

Stress	Reference	Test or Inspection Method
Solderability	J-STD-002	Magnification 50X. Conditions: a) Method A, at 235°C, Category 3
Temperature Cycling	JESD22 Method JA-104	5 cycles (-55°C to +125°C), measurement at 24 hours +/-4 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 +/-4 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 +/-4 hours after test conclusion.
Moisture Resistance	MIL-STD-202 Method 106	t = 24 hours/cycle. Steps 7a & 7b not required. Unpowered. Measurement at 24 hours +/-4 hours after test conclusion.
Thermal Shock	MIL-STD-202 Method 107	-55°C to +125°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 125°C (85°C for Z5U) with 1 X rated voltage applied.
Storage Life	MIL-STD-202 Method 108	125°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 10–2000 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

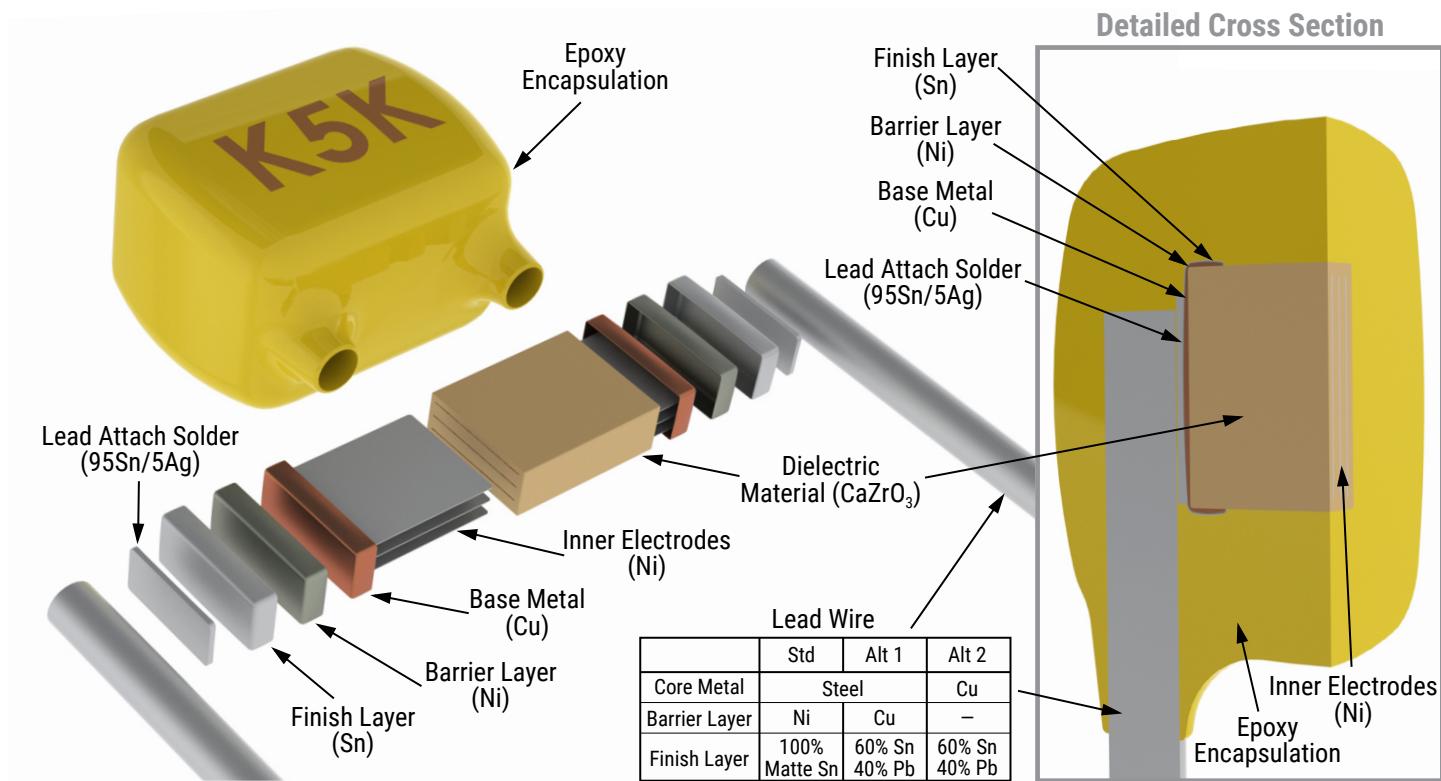
The un-mounted storage life of a leaded ceramic capacitor is dependent upon storage and atmospheric conditions as well as packaging materials. While the ceramic chips enveloped under the epoxy coating themselves are quite robust in most environments, solderability of the wire lead on the final epoxy-coated 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.

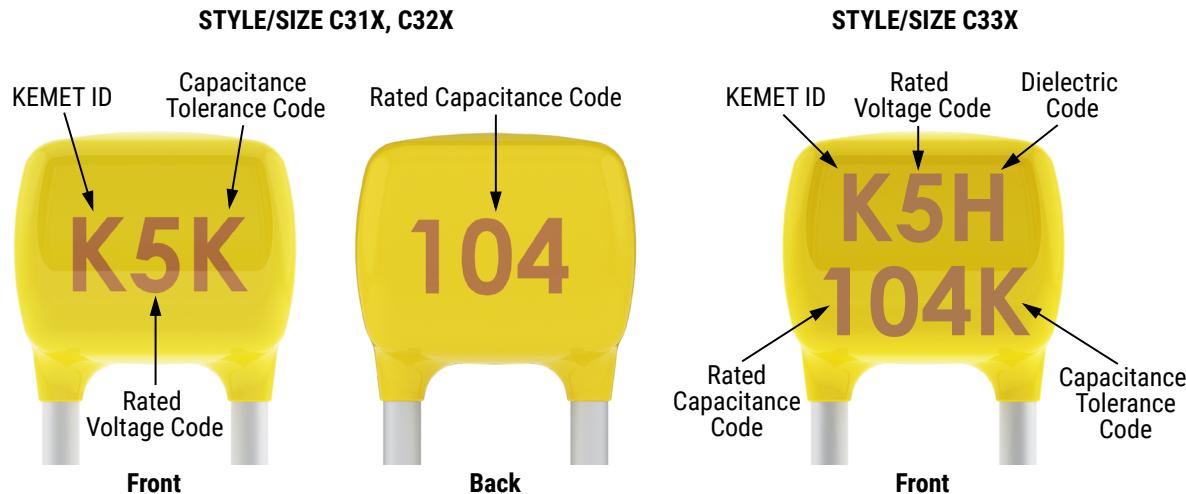
# Aximax, 400 Series, Axial, Conformally Coated, Ultra-Stable X8R Dielectric, 50 – 200 VDC (Commercial & Automotive Grade)

## Axial Through-Hole Multilayer Ceramic Capacitors

### Construction



### Marking



<sup>1</sup> To properly request the inclusion of the date code in the marking ordering code please contact your KEMET representative.

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

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

Axial Through-Hole Multilayer Ceramic Capacitors

### Packaging Quantities

Style/ Size	Standard Bulk Quantity	Ammo Pack Quantity Maximum	Reel Quantity Maximum (12" Reel)
315	500/Bag	2,500	2,500
316			
317			
318			
320			
321		N/A	N/A
322		2,500	2,500
323			
324			
325			
326			
327	250/Bag	1,500	1,500
328			
330			
331		N/A	N/A
333		1,500	1,500
335			
336			

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

## Axial Through-Hole Multilayer Ceramic Capacitors

### Tape & Reel Packaging Information

KEMET offers standard reeling of Molded and Conformally Coated Radial Leaded Capacitors in accordance with EIA standard 468. Parts are taped to a tagboard carrier strip, and wound on a reel as shown in Figure 1. Kraft paper interleaving is inserted between the layers of capacitors on the reel. Ammopack is also available, with the same lead tape configuration and package quantities.

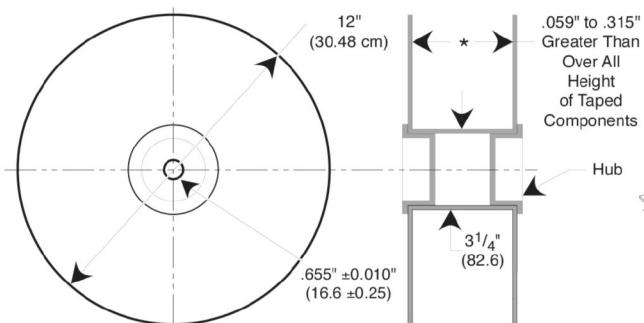
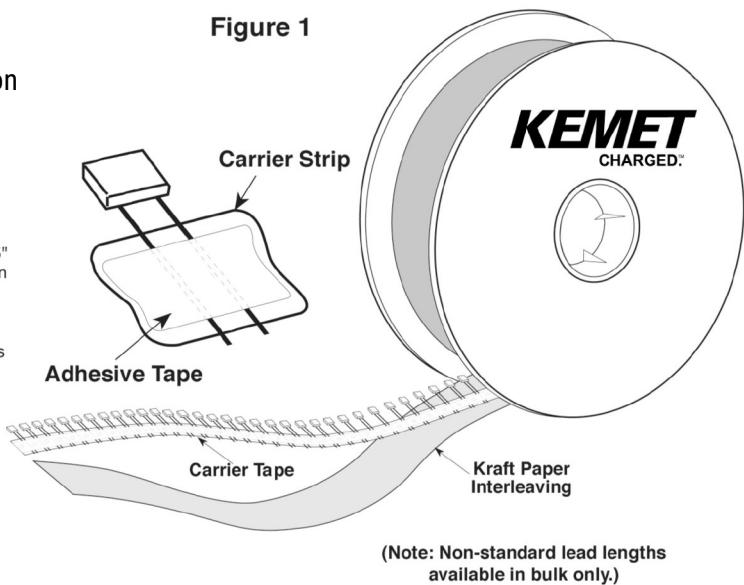


Figure 3: Standard Reel

Figure 1



(Note: Non-standard lead lengths available in bulk only.)

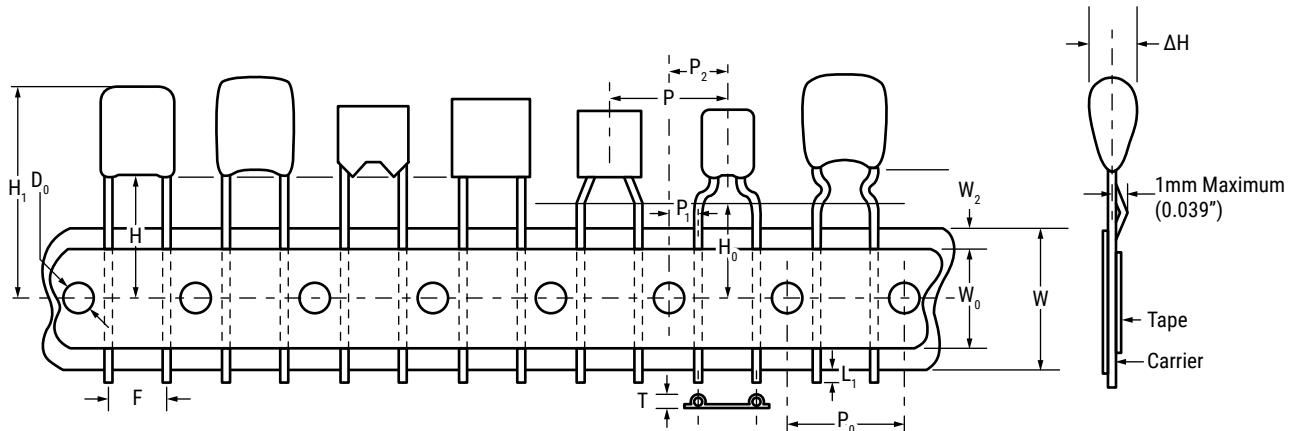


Figure 2: Lead Tape Configuration (See Table Below)

### Ceramic Radial Tape and Reel Dimensions

Metric will govern

Constant Dimensions – Millimeters (Inches)								
$D_0$ $\pm 0.2$ (0.008)	$P_0$ $\pm 0.3$ (0.012)	$\Delta H$ $\pm 0.2$ (0.008)	$L_1$ Maximum	$t$ $\pm 0.2$ (0.008)	$T$ Maximum	$W$ $+1.0/-0.5$ (+0.039/-0.020)	$W_0$ Minimum	$W_2$ Maximum
4.00 (0.157)	12.7 (0.500)	4.0 (0.157)	1.0 (0.039)	0.7 (0.051)	1.5 (0.059)	18.0 (0.709)	5.0 (0.197)	3.0 (0.118)

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

**Axial Through-Hole Multilayer Ceramic Capacitors**

**Ceramic Radial Tape and Reel Dimensions cont.**

Metric will govern

Variable Dimensions – Millimeters (Inches)							
F ±0.78 (0.030) <sup>1</sup>	P <sub>1</sub> ±0.30 (0.012) <sup>1</sup>	P ±0.3 (0.012)	P <sub>2</sub> ±1.3 (0.051)	H		H <sub>0</sub>	
				Straight Lead Configuration		Formed Lead Configuration <sup>2</sup>	
				Packaging C-Spec <sup>3</sup>			
				7301/7305	7303/7317	7301/7305	7303/7317
2.54 (0.100)	5.08 (0.200)	12.7 (0.500)	6.35 (0.250)	16.0±0.5 (0.630±0.020)	18.0 (0.709) Minimum	16.0±0.5 (0.630±0.020)	18.0 (0.709) Minimum
4.32 (0.170)	3.89 (0.153)	12.7 (0.500)	6.35 (0.250)				
5.08 (0.200)	3.81 (0.150)	12.7 (0.500)	6.35 (0.250)				
5.59 (0.220)	3.25 (0.128)	12.7 (0.500)	6.35 (0.250)				
6.98 (0.275)	2.54 (0.100)	12.7 (0.500)	6.35 (0.250)				
7.62 (0.300)	2.24 (0.088)	12.7 (0.500)	6.35 (0.250)				
9.52 (0.375)	7.62 (0.300)	12.7 (0.500)	6.35 (0.250)				
10.16 (0.400)	7.34 (0.290)	25.4 (1.000)	N/A				
12.06 (0.475)	6.35 (0.250)	25.4 (1.000)	N/A				
14.60 (0.575)	5.08 (0.200)	25.4 (1.000)	N/A				
17.14 (0.675)	3.81 (0.15)	25.4 (1.000)	N/A				

<sup>1</sup> Measured at the egress from the carrier tape, on the component side.

<sup>2</sup> Formed lead configuration includes: "shoulder bend", "inside kink", "outside kink", and "snap-in". For more information regarding available lead configurations see "Dimensions" section of this document.

<sup>3</sup> The "Packaging C-Spec" is a 4 digit code which identifies the packaging type, lead length and/or lead material. When ordering, the proper code must be included in the 15th through 18th character positions of the ordering code. See "Ordering Information" section of this document for further details.

Symbol Reference Table	
D <sub>0</sub>	Sprocket Hole Diameter
P <sub>0</sub>	Sprocket Hole Pitch
P	Component Pitch
F	Lead Spacing
P <sub>1</sub>	Sprocket Hole Center to Lead Center
P <sub>2</sub>	Sprocket Hole Center To Component Center
H	Height to Seating Plane (Straight Leads Only)
H <sub>0</sub>	Height to Seating Plane (Formed Leads Only)
H <sub>1</sub>	Component Height Above Tape Center
ΔH	Component Alignment
L <sub>1</sub>	Lead Protrusion
t	Composite Tape Thickness
W	Carrier Tape Width
W <sub>0</sub>	Hold-Down Tape Width
W <sub>2</sub>	Hold-Down Tape Location

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

## Axial Through-Hole Multilayer Ceramic Capacitors

### KEMET Electronics Corporation Sales Offices

For a complete list of our global sales offices, please visit [www.kemet.com/sales](http://www.kemet.com/sales).

### Disclaimer

YAGEO Corporation and its affiliates do not recommend the use of commercial or automotive grade products for high reliability applications or manned space flight.

All product specifications, statements, information and data (collectively, the "Information") in this datasheet are subject to change. The customer is responsible for checking and verifying the extent to which the Information contained in this publication is applicable to an order at the time the order is placed. All Information given herein is believed to be accurate and reliable, but it is presented without guarantee, warranty, or responsibility of any kind, expressed or implied.

Statements of suitability for certain applications are based on KEMET Electronics Corporation's ("KEMET") knowledge of typical operating conditions for such applications, but are not intended to constitute – and KEMET specifically disclaims – any warranty concerning suitability for a specific customer application or use. The Information is intended for use only by customers who have the requisite experience and capability to determine the correct products for their application. Any technical advice inferred from this Information or otherwise provided by KEMET with reference to the use of KEMET's products is given gratis, and KEMET assumes no obligation or liability for the advice given or results obtained.

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.

*KEMET* is a registered trademark of KEMET Electronics Corporation.