Radial Leaded Multilayer Ceramic Capacitors

High Voltage Goldmax, 300 Series, Conformally Coated, C0G Dielectric, 500 – 3,000 VDC (Commercial Grade)

Overview

KEMET's 300 Series High Voltage Goldmax conformally coated radial leaded ceramic capacitors in C0G dielectric feature a 125°C maximum operating temperature. The Electronics Industries Alliance (EIA) characterizes C0G dielectric as a Class I "stable" material. Components of this classification are temperature compensating and are suited for resonant circuit applications or those where Q and stability of capacitance characteristics are required. C0G exhibits no change in capacitance with respect to time and voltage and boasts a negligible change in capacitance with reference to ambient temperature. Capacitance change is limited to ±30 ppm/°C from −55°C to +125°C.

These devices exhibit low ESR at high frequencies and find conventional use as snubbers or filters in applications such as switching power supplies and lighting ballasts. Their exceptional performance at high frequencies has made them a preferred choice of design engineers worldwide. In addition to their use in power supplies, these capacitors are widely used in industries related to telecommunications, medical, military, aerospace, semiconductors and test/diagnostic equipment.

Ordering Information

C	320			C	332	J	C	G	5	T	A	7301
Ceramic	Style/Size			Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance[1]	Rated Voltage (VDC)	Dielectric	Design	Lead Finish[2]	Failure Rate	Packaging (C-Spec)
	315 316 317 318 320 321 322 323	324 325 326 327 328 330 331 333	335 336 340 346 350 356	C = Standard	First two digits represent significant figures. Third digit specifies number of zeros.	D = ±0.5 pF F = ±1% G = ±2% J = ±5% K = ±10%	C = 500 B = 630 D = 1,000 F = 1,500 G = 2,000 Z = 2,500 H = 3,000	G = C0G	5 = Multilayer	T = 100% Matte Sn H = SnPb (60/40)	A = N/A	See "Packaging C-Spec Ordering Options Table"

[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).

Alternative 2: 60% tin (Sn)/40% lead (Pb) finish with 100% copper core (available with "H" designation code with C-Spec). Contact KEMET for C-Spec details.

Benefits

- Radial leaded form factor
- Conformally coated
- 0.100", 0.200", 0.250", and 0.400" lead spacing
- Operating temperature range of −55°C to +125°C
- Lead (Pb)-free, RoHS and REACH compliant
- DC voltage ratings of 500 V, 630 V, 1 KV, 1.5 KV, 2 KV, 2.5 KV, and 3 KV
- Capacitance offerings ranging from 1.0 pF up to 0.039 µF
- Available capacitance tolerances of ±0.5 pF, ±1%, ±2%, ±5%, and ±10%
- High temperature solder lead attach
- 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 +125°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 (Sn60/Pb40)
- Encapsulation meets flamability standard UL 94V–0

Applications

Typical applications include switch mode power supplies (input filters, resonators, tank circuits, snubbed circuits, output filters), high voltage coupling and DC blocking, lighting ballasts, voltage multiplier circuits, DC/DC converters and coupling capacitors in Ćuk converters. Markets include power supply, LCD fluorescent backlight ballasts, HID lighting, telecom equipment, industrial and medical equipment/control, LAN/WAN interface, analog and digital modems, and automotive.

Application Notes

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

Packaging C-Spec Ordering Options Table

Packaging Type[1]	Packaging/Grade Ordering Code (C-Spec)
Bulk Bag	Not required (Blank)
12" Tape & Reel (16.0 ±0.5 mm lead length)	7301
12" Tape & Reel (18.0 mm minimum lead length)	7303 and TR
Ammo Pack (16.0 ±0.5 mm lead length)	7305
Ammo Pack (18.0 mm minimum lead length)	7317

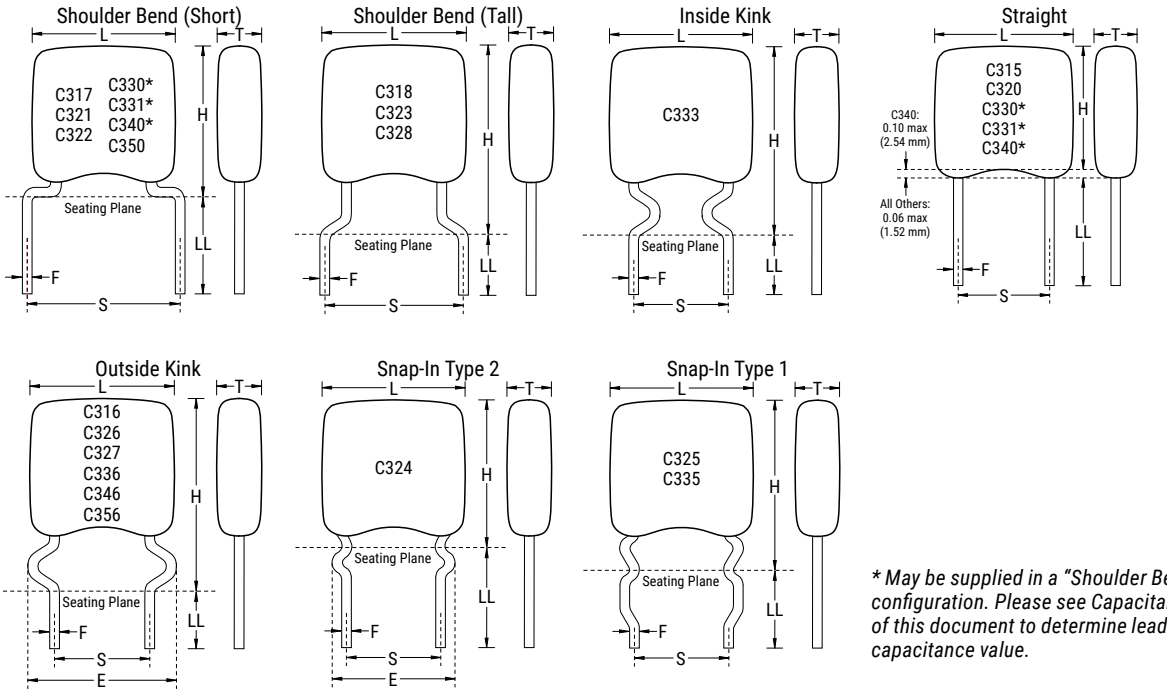
[1] Default packaging is "Bulk Bag". An ordering code C-Spec is not required for "Bulk Bag" packaging. Bulk bag option is required for Size/Style C321 and C331.

[1] "Tape & Reel" packaging option is not available for Size/Style C321 and C331. For more information see "Packaging Quantities".

[1] "Ammo Pack" packaging option is not available for Size/Style C321, C331, C350, and C356. For more information see "Packaging Quantities".

[1] "Ammo Pack" and "Tape & Reel" packaging options have the same lead tape configuration. For more information see "Tape & Reel Packaging Information".

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	0.100 (2.54)	0.150 (3.81)	0.130 (3.30)	0.120 (3.14)	0.020 (0.51)	0.276 (7.00)
	316		0.150 (3.81)	0.230 (5.84)	0.150 (3.81)		0.200 (5.08)
C32X	324		0.200 (5.08)	0.260 (6.60)	0.200 (5.08)		0.276 (7.00)
	320		0.200 (5.08)	0.230 (5.84)	0.150 (3.81)		0.276 (7.00)
	326		0.200 (5.08)	0.350 (8.89)	0.200 (5.08)		0.200 (5.08)
C31X	317	0.200 (5.08)	0.150 (3.81)	0.200 (5.08)	0.120 (3.14)		0.276 (7.00)
	318		0.150 (3.81)	0.235 (5.97)	0.150 (3.81)		0.276 (7.00)
C32X	321	0.250 (6.35)	0.200 (5.08)	0.260 (6.60)	0.200 (5.08)		0.276 (7.00)
	322	0.200 (5.08)	0.200 (5.08)	0.260 (6.60)	0.150 (3.81)		0.276 (7.00)
	323		0.200 (5.08)	0.300 (7.62)	0.150 (3.81)		0.276 (7.00)
	325		0.200 (5.08)	0.320 (8.13)	0.200 (5.08)		0.276 (7.00)
	328		0.200 (5.08)	0.325 (8.26)	0.200 (5.08)		0.276 (7.00)
	327		0.200 (5.08)	0.350 (8.89)	0.200 (5.08)		0.200 (5.08)
C33X	330		0.300 (7.62)	0.360 (9.14)	0.200 (5.08)		0.276 (7.00)
	331	0.250 (6.35)	0.300 (7.62)	0.360 (9.14)	0.250 (6.35)		0.276 (7.00)
	333	0.200 (5.08)	0.300 (7.62)	0.420 (10.67)	0.200 (5.08)		0.276 (7.00)
	335		0.300 (7.62)	0.420 (10.67)	0.250 (6.35)		0.276 (7.00)
	336		0.300 (7.62)	0.450 (11.43)	0.250 (6.35)		0.200 (5.08)
C34X	340		0.400 (10.16)	0.460 (11.68)	0.270 (6.85)		0.276 (7.00)
	346		0.400 (10.16)	0.590 (14.97)	0.270 (6.85)		0.200 (5.08)
C35X	350	0.400 (10.16)	0.500 (12.70)	0.560 (14.22)	0.270 (6.85)	0.025 (0.64)	0.276 (7.00)
	356		0.500 (12.70)	0.670 (17.02)	0.270 (6.85)		0.200 (5.08)

Qualification/Certification

Commercial Grade products are subject to internal qualification. Details regarding test methods and conditions are referenced in Table 2, Performance & Reliability.

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[1]	Halogen Free
300 (C3XX)	100% Matte Sn	Yes	n/a	Yes	Yes
	Sn60/Pb40	No	n/a	Yes	Yes

[1] *REACH compliance indicates product does not contain Substance/s of Very High Concern (SVHC)*

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)	±30 ppm/°C
Aging Rate (Maximum % Cap Loss/Decade Hour)	0%
Dielectric Withstanding Voltage	150% of rated voltage for voltage rating of < 1,000 V 120% of rated voltage for voltage rating of ≥ 1,000 V (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 (500 VDC 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 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					
Style/Size	Rated DC Voltage	Capacitance Value	Dissipation Factor (Maximum %)	Capacitance Shift	Insulation Resistance
C0G	All	All	0.5	0.3% or ±0.25 pF	10% of Initial Limit

Table 1A – C31X Style/Size, Capacitance Range Waterfall

C315, C316, C317, C318 Style/Size (0.100" and 0.200" Lead Spacing)				
Rated Voltage (VDC)		**500**	**630**	**1000**
Voltage Code		**C**	**B**	**D**
Capacitance	**Capacitance Tolerance**	**Capacitance Code (Available Capacitance)**		
1pF	D = ±0.5pF	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 = ±1% G = ±2% J = ±5% K = ±10%	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		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		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
200pF		201	201	201
Rated Voltage (VDC)		**500**	**630**	**1,000**
Voltage Code		**C**	**B**	**D**

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

Table 1A – C31X Style/Size, Capacitance Range Waterfall cont.

C315, C316, C317, C318 Style/Size (0.100" and 0.200" Lead Spacing)				
Rated Voltage (VDC)		**500**	**630**	**1000**
Voltage Code		**C**	**B**	**D**
Capacitance	**Capacitance Tolerance**	**Capacitance Code (Available Capacitance)**		
220pF	F = ±1% G = ±2% J = ±5% K = ±10%	221	221	221
240pF		241	241	241
270pF		271	271	271
300pF		301	301	
330pF		331	331	
360pF		361	361	
390pF		391	391	
430pF		431	431	
470pF		471	471	
510pF		511	511	
560pF		561	561	
620pF		621		
680pF		681		
750pF		751		
820pF		821		
Rated Voltage (VDC)		**500**	**630**	**1,000**
Voltage Code		**C**	**B**	**D**

Table 1B – C32X Style/Size, Capacitance Range Waterfall

C320, C322, C323, C326, C328 Style/Size (0.100" and 0.200" Lead Spacing)						
Rated Voltage (VDC)		**500**	**630**	**1000**	**1500**	**2000**
Voltage Code		**C**	**B**	**D**	**F**	**G**
Capacitance	**Capacitance Tolerance**	**Capacitance Code (Available Capacitance)**				
1pF	D = ±0.5pF	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		100	100	100	100	100
Rated Voltage (VDC)		**500**	**630**	**1000**	**1500**	**2000**
Voltage Code		**C**	**B**	**D**	**F**	**G**

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

Table 1B – C32X Style/Size, Capacitance Range Waterfall cont.

C320, C322, C323, C326, C328 Style/Size (0.100" and 0.200" Lead Spacing)						
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)				
11pF	F = ±1% G = ±2% J = ±5% K = ±10%	110	110	110	110	110
12pF		120	120	120	120	120
13pF		130	130	130	130	130
15pF		150	150	150	150	150
16pF		160	160	160	160	160
18pF		180	180	180	180	180
20pF		200	200	200	200	200
22pF		220	220	220	220	220
24pF		240	240	240	240	240
27pF		270	270	270	270	270
30pF		300	300	300	300	300
33pF		330	330	330	330	330
36pF		360	360	360	360	360
39pF		390	390	390	390	390
43pF		430	430	430	430	430
47pF		470	470	470	470	470
51pF		510	510	510	510	510
56pF		560	560	560	560	560
62pF		620	620	620	620	620
68pF		680	680	680	680	680
75pF		750	750	750	750	750
82pF		820	820	820	820	820
91pF		910	910	910	910	910
100pF		101	101	101	101	101
110pF		111	111	111	111	111
120pF		121	121	121	121	121
130pF		131	131	131	131	131
150pF		151	151	151	151	151
160pF		161	161	161	161	161
180pF		181	181	181	181	181
200pF		201	201	201	201	201
220pF		221	221	221	221	221
240pF		241	241	241	241	241
270pF		271	271	271	271	271
300pF		301	301	301	301	301
330pF		331	331	331	331	331
360pF		361	361	361	361	361
390pF		391	391	391	391	391
430pF		431	431	431	431	431
470pF		471	471	471	471	471
510pF		511	511	511	511	511
560pF		561	561	561	561	561
620pF		621	621	621	621	621
680pF		681	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		
1500pF		152	152	152		
1600pF		162	162	162		
1800pF		182	182	182		
2000pF		202	202	202		
2200pF		222	222	222		
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

Table 1B – C32X Style/Size, Capacitance Range Waterfall cont.

C320, C322, C323, C326, C328 Style/Size (0.100" and 0.200" Lead Spacing)						
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)				
2400pF	F = ±1% G = ±2% J = ±5% K = ±10%	242	242	242		
2700pF		272	272	272		
3000pF		302	302			
3300pF		332	332			
3600pF		362	362			
3900pF		392	392			
4300pF		432	432			
4700pF		472	472			
5100pF		512	512			
5600pF		562	562			
6200pF		622	622			
6800pF		682	682			
7500pF		752				
8200pF		822				
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G

Table 1C – C32X Style/Size, Capacitance Range Waterfall

C321, C324, C325, C327 Style/Size (0.100", 0.200" & 0.250" Lead Spacing)						
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)				
10pF	F = ±1% G = ±2% J = ±5% K = ±10%	100	100	100	100	100
11pF		110	110	110	110	110
12pF		120	120	120	120	120
13pF		130	130	130	130	130
15pF		150	150	150	150	150
16pF		160	160	160	160	160
18pF		180	180	180	180	180
20pF		200	200	200	200	200
22pF		220	220	220	220	220
24pF		240	240	240	240	240
27pF		270	270	270	270	270
30pF		300	300	300	300	300
33pF		330	330	330	330	330
36pF		360	360	360	360	360
39pF		390	390	390	390	390
43pF		430	430	430	430	430
47pF		470	470	470	470	470
51pF		510	510	510	510	510
56pF		560	560	560	560	560
62pF		620	620	620	620	620
68pF		680	680	680	680	680
75pF		750	750	750	750	750
82pF		820	820	820	820	820
91pF		910	910	910	910	910
100pF		101	101	101	101	101
110pF		111	111	111	111	111
120pF		121	121	121	121	121
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

Table 1C – C32X Style/Size, Capacitance Range Waterfall cont.

C321, C324, C325, C327 Style/Size (0.100", 0.200" & 0.250" Lead Spacing)						
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)				
130pF		131	131	131	131	131
150pF		151	151	151	151	151
160pF		161	161	161	161	161
180pF		181	181	181	181	181
200pF		201	201	201	201	201
220pF		221	221	221	221	221
240pF		241	241	241	241	241
270pF		271	271	271	271	271
300pF		301	301	301	301	301
330pF		331	331	331	331	331
360pF		361	361	361	361	361
390pF		391	391	391	391	391
430pF		431	431	431	431	431
470pF		471	471	471	471	471
510pF		511	511	511	511	511
560pF		561	561	561	561	561
620pF		621	621	621	621	621
680pF		681	681	681	681	681
750pF		751	751	751	751	
820pF		821	821	821	821	
910pF	F = ±1%	911	911	911	911	
1000pF	G = ±2%	102	102	102	102	
1100pF	J = ±5%	112	112	112	112	
1200pF	K = ±10%	122	122	122	122	
1300pF		132	132	132		
1500pF		152	152	152		
1600pF		162	162	162		
1800pF		182	182	182		
2000pF		202	202	202		
2200pF		222	222	222		
2400pF		242	242	242		
2700pF		272	272	272		
3000pF		302	302			
3300pF		332	332			
3600pF		362	362			
3900pF		392	392			
4300pF		432	432			
4700pF		472	472			
5100pF		512	512			
5600pF		562	562			
6200pF		622	622			
6800pF		682	682			
7500pF		752				
8200pF		822				
Rated Voltage (VDC)		500	630	1000	1500	2000
Voltage Code		C	B	D	F	G

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

Table 1D – C33X Style/Size, Capacitance Range Waterfall

C330, C331, C333, C335, C336 Style/Size (0.200" and 0.250" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
10pF	F = ±1% G = ±2% J = ±5% K = ±10%	100*	100*	100*	100*	100*	100	100
11pF		110*	110*	110*	110*	110*	110	110
12pF		120*	120*	120*	120*	120*	120	120
13pF		130*	130*	130*	130*	130*	130	130
15pF		150*	150*	150*	150*	150*	150	150
16pF		160*	160*	160*	160*	160*	160	160
18pF		180*	180*	180*	180*	180*	180	180
20pF		200*	200*	200*	200*	200*	200	200
22pF		220*	220*	220*	220*	220*	220	220
24pF		240*	240*	240*	240*	240*	240	240
27pF		270*	270*	270*	270*	270*	270	270
30pF		300*	300*	300*	300*	300*	300	300
33pF		330*	330*	330*	330*	330*	330	330
36pF		360*	360*	360*	360*	360*	360	360
39pF		390*	390*	390*	390*	390*	390	390
43pF		430*	430*	430*	430*	430*	430	430
47pF		470*	470*	470*	470*	470*	470	470
51pF		510*	510*	510*	510*	510*	510	510
56pF		560*	560*	560*	560*	560*	560	560
62pF		620*	620*	620*	620*	620*	620	620
68pF		680*	680*	680*	680*	680*	680	680
75pF		750*	750*	750*	750*	750*	750	750
82pF		820*	820*	820*	820*	820*	820	820
91pF		910*	910*	910*	910*	910*	910	910
100pF		101*	101*	101*	101*	101*	101	101
110pF		111*	111*	111*	111*	111*	111	111
120pF		121*	121*	121*	121*	121*	121	121
130pF		131*	131*	131*	131*	131*	131	131
150pF		151*	151*	151*	151*	151*	151	151
160pF		161*	161*	161*	161*	161*	161	161
180pF		181*	181*	181*	181*	181*	181	181
200pF		201*	201*	201*	201*	201*	201	201
220pF		221*	221*	221*	221*	221*	221	221
240pF		241*	241*	241*	241*	241*	241	241
270pF		271*	271*	271*	271*	271*	271	271
300pF		301*	301*	301*	301*	301*	301	301
330pF		331*	331*	331*	331*	331*	331	331
360pF		361*	361*	361*	361*	361*	361	361
390pF		391*	391*	391*	391*	391*	391	391
430pF		431*	431*	431*	431*	431*	431	431
470pF		471*	471*	471*	471*	471*	471	471
510pF		511*	511*	511*	511*	511*	511	511
560pF		561*	561*	561*	561*	561*	561	561
620pF		621*	621*	621*	621*	621*	621	621
680pF		681*	681*	681*	681*	681*	681	681
750pF		751*	751*	751*	751*	751	751	
820pF		821*	821*	821*	821*	821	821	
910pF		911*	911*	911*	911*	911	911	
1000pF		102*	102*	102*	102*	102	102	
1100pF		112*	112*	112*	112*	112	112	
1200pF		122*	122*	122*	122*	122	122	
1300pF		132*	132*	132*	132	132	132	
1500pF		152*	152*	152*	152	152	152	
1600pF		162*	162*	162*	162	162	162	
1800pF		182*	182*	182*	182	182	182	
2000pF		202*	202*	202*	202	202		
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

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

Table 1D – C33X Style/Size (0.200" Lead Spacing), Capacitance Range Waterfall cont.

C330, C331, C333, C335, C336 Style/Size (0.200" and 0.250" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
2200pF	F = ±1% G = ±2% J = ±5% K = ±10%	222*	222*	222*	222	222		
2400pF		242*	242*	242*	242	242		
2700pF		272*	272*	272*	272	272		
3000pF		302*	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				
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					
0.018µF		183	183					
0.022µF		223						
0.027µF		273						
0.033µF		333						
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.
** Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C330 and C331.*

Table 1E – C34X Style/Size, Capacitance Range Waterfall

C340, C346 Style/Size (0.200" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
10pF	F = ±1% G = ±2% J = ±5% K = ±10%	100*	100*	100*	100*	100*	100	100
11pF		110*	110*	110*	110*	110*	110	110
12pF		120*	120*	120*	120*	120*	120	120
13pF		130*	130*	130*	130*	130*	130	130
15pF		150*	150*	150*	150*	150*	150	150
16pF		160*	160*	160*	160*	160*	160	160
18pF		180*	180*	180*	180*	180*	180	180
20pF		200*	200*	200*	200*	200*	200	200
22pF		220*	220*	220*	220*	220*	220	220
24pF		240*	240*	240*	240*	240*	240	240
27pF		270*	270*	270*	270*	270*	270	270
30pF		300*	300*	300*	300*	300*	300	300
33pF		330*	330*	330*	330*	330*	330	330
36pF		360*	360*	360*	360*	360*	360	360
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.
** Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C340.*

Table 1E – C34X Style/Size, Capacitance Range Waterfall cont.

C340, C346 Style/Size (0.200" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
39pF	F = ±1% G = ±2% J = ±5% K = ±10%	390*	390*	390*	390*	390*	390	390
43pF		430*	430*	430*	430*	430*	430	430
47pF		470*	470*	470*	470*	470*	470	470
51pF		510*	510*	510*	510*	510*	510	510
56pF		560*	560*	560*	560*	560*	560	560
62pF		620*	620*	620*	620*	620*	620	620
68pF		680*	680*	680*	680*	680*	680	680
75pF		750*	750*	750*	750*	750*	750	750
82pF		820*	820*	820*	820*	820*	820	820
91pF		910*	910*	910*	910*	910*	910	910
100pF		101*	101*	101*	101*	101*	101	101
110pF		111*	111*	111*	111*	111*	111	111
120pF		121*	121*	121*	121*	121*	121	121
130pF		131*	131*	131*	131*	131*	131	131
150pF		151*	151*	151*	151*	151*	151	151
160pF		161*	161*	161*	161*	161*	161	161
180pF		181*	181*	181*	181*	181*	181	181
200pF		201*	201*	201*	201*	201*	201	201
220pF		221*	221*	221*	221*	221*	221	221
240pF		241*	241*	241*	241*	241*	241	241
270pF		271*	271*	271*	271*	271*	271	271
300pF		301*	301*	301*	301*	301*	301	301
330pF		331*	331*	331*	331*	331*	331	331
360pF		361*	361*	361*	361*	361*	361	361
390pF		391*	391*	391*	391*	391*	391	391
430pF		431*	431*	431*	431*	431*	431	431
470pF		471*	471*	471*	471*	471*	471	471
510pF		511*	511*	511*	511*	511*	511	511
560pF		561*	561*	561*	561*	561*	561	561
620pF		621*	621*	621*	621*	621*	621	621
680pF		681*	681*	681*	681*	681*	681	681
750pF		751*	751*	751*	751*	751	751	
820pF		821*	821*	821*	821*	821	821	
910pF		911*	911*	911*	911*	911	911	
1000pF		102*	102*	102*	102*	102	102	
1100pF		112*	112*	112*	112*	112	112	
1200pF		122*	122*	122*	122*	122	122	
1300pF		132*	132*	132*	132	132	132	
1500pF		152*	152*	152*	152	152	152	
1600pF		162*	162*	162*	162	162	162	
1800pF		182*	182*	182*	182	182	182	
2000pF		202*	202*	202*	202	202		
2200pF		222*	222*	222*	222	222		
2400pF		242*	242*	242*	242	242		
2700pF		272*	272*	272*	272	272		
3000pF		302*	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				
6800pF		682*	682*	682				
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

** Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C340.*

Table 1E – C34X Style/Size, Capacitance Range Waterfall cont.

C340, C346 Style/Size (0.200" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
7500pF	F = ±1% G = ±2% J = ±5% K = ±10%	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					
0.018µF		183	183					
0.022µF		223						
0.027µF		273						
0.033µF		333						
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.
** Capacitor is supplied with a "Shoulder-Bend" lead configuration in Style/Size C340.*

Table 1F – C35X Style/Size, Capacitance Range Waterfall

C350, C356 Style/Size (0.400" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
10pF	F = ±1% G = ±2% J = ±5% K = ±10%	100	100	100	100	100	100	100
11pF		110	110	110	110	110	110	110
12pF		120	120	120	120	120	120	120
13pF		130	130	130	130	130	130	130
15pF		150	150	150	150	150	150	150
16pF		160	160	160	160	160	160	160
18pF		180	180	180	180	180	180	180
20pF		200	200	200	200	200	200	200
22pF		220	220	220	220	220	220	220
24pF		240	240	240	240	240	240	240
27pF		270	270	270	270	270	270	270
30pF		300	300	300	300	300	300	300
33pF		330	330	330	330	330	330	330
36pF		360	360	360	360	360	360	360
39pF		390	390	390	390	390	390	390
43pF		430	430	430	430	430	430	430
47pF		470	470	470	470	470	470	470
51pF		510	510	510	510	510	510	510
56pF		560	560	560	560	560	560	560
62pF		620	620	620	620	620	620	620
68pF		680	680	680	680	680	680	680
75pF		750	750	750	750	750	750	750
82pF		820	820	820	820	820	820	820
91pF		910	910	910	910	910	910	910
100pF		101	101	101	101	101	101	101
110pF		111	111	111	111	111	111	111
120pF		121	121	121	121	121	121	121
130pF		131	131	131	131	131	131	131
150pF		151	151	151	151	151	151	151
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

Table 1F – C35X Style/Size, Capacitance Range Waterfall cont.

C350, C356 Style/Size (0.400" Lead Spacing)								
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H
Capacitance	Capacitance Tolerance	Capacitance Code (Available Capacitance)						
160pF	F = ±1% G = ±2% J = ±5% K = ±10%	161	161	161	161	161	161	161
180pF		181	181	181	181	181	181	181
200pF		201	201	201	201	201	201	201
220pF		221	221	221	221	221	221	221
240pF		241	241	241	241	241	241	241
270pF		271	271	271	271	271	271	271
300pF		301	301	301	301	301	301	301
330pF		331	331	331	331	331	331	331
360pF		361	361	361	361	361	361	361
390pF		391	391	391	391	391	391	391
430pF		431	431	431	431	431	431	431
470pF		471	471	471	471	471	471	471
510pF		511	511	511	511	511	511	511
560pF		561	561	561	561	561	561	561
620pF		621	621	621	621	621	621	621
680pF		681	681	681	681	681	681	681
750pF		751	751	751	751	751	751	751
820pF		821	821	821	821	821	821	821
910pF		911	911	911	911	911	911	911
1000pF		102	102	102	102	102	102	102
1100pF		112	112	112	112	112	112	
1200pF		122	122	122	122	122	122	
1300pF		132	132	132	132	132	132	
1500pF		152	152	152	152	152	152	
1600pF		162	162	162	162	162	162	
1800pF		182	182	182	182	182	182	
2000pF		202	202	202	202	202	202	
2200pF		222	222	222	222	222	222	
2400pF		242	242	242	242	242		
2700pF		272	272	272	272	272		
3000pF		302	302	302	302	302		
3300pF		332	332	332	332	332		
3600pF		362	362	362	362	362		
3900pF		392	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				
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	273					
0.033µF		333						
0.039µF		393						
Rated Voltage (VDC)		500	630	1000	1500	2000	2500	3000
Voltage Code		C	B	D	F	G	Z	H

These products are protected under one or more of the following United States Patents and their non-US counterparts: US Pat. No. 7172985; U.S. Pat. No. 7670981.

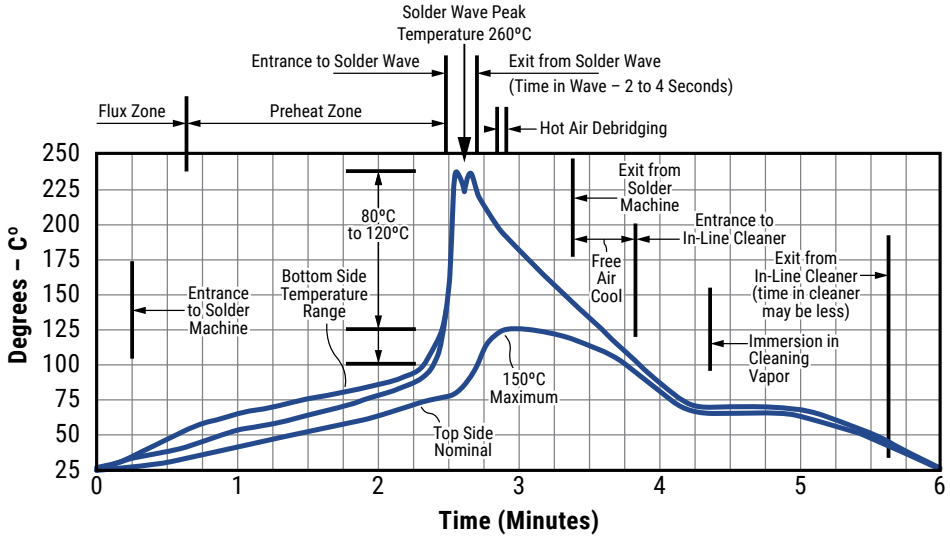
Soldering Process

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 C. 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)

Manual Solder Profile with Pre-heating

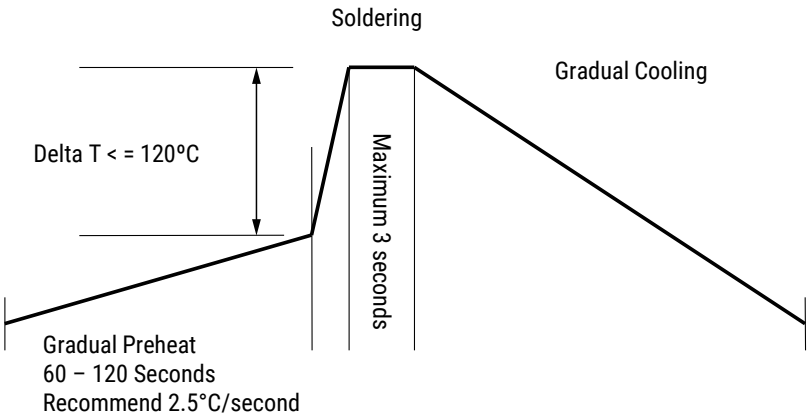


Table 2 – Performance & Reliability: Test Methods and Conditions

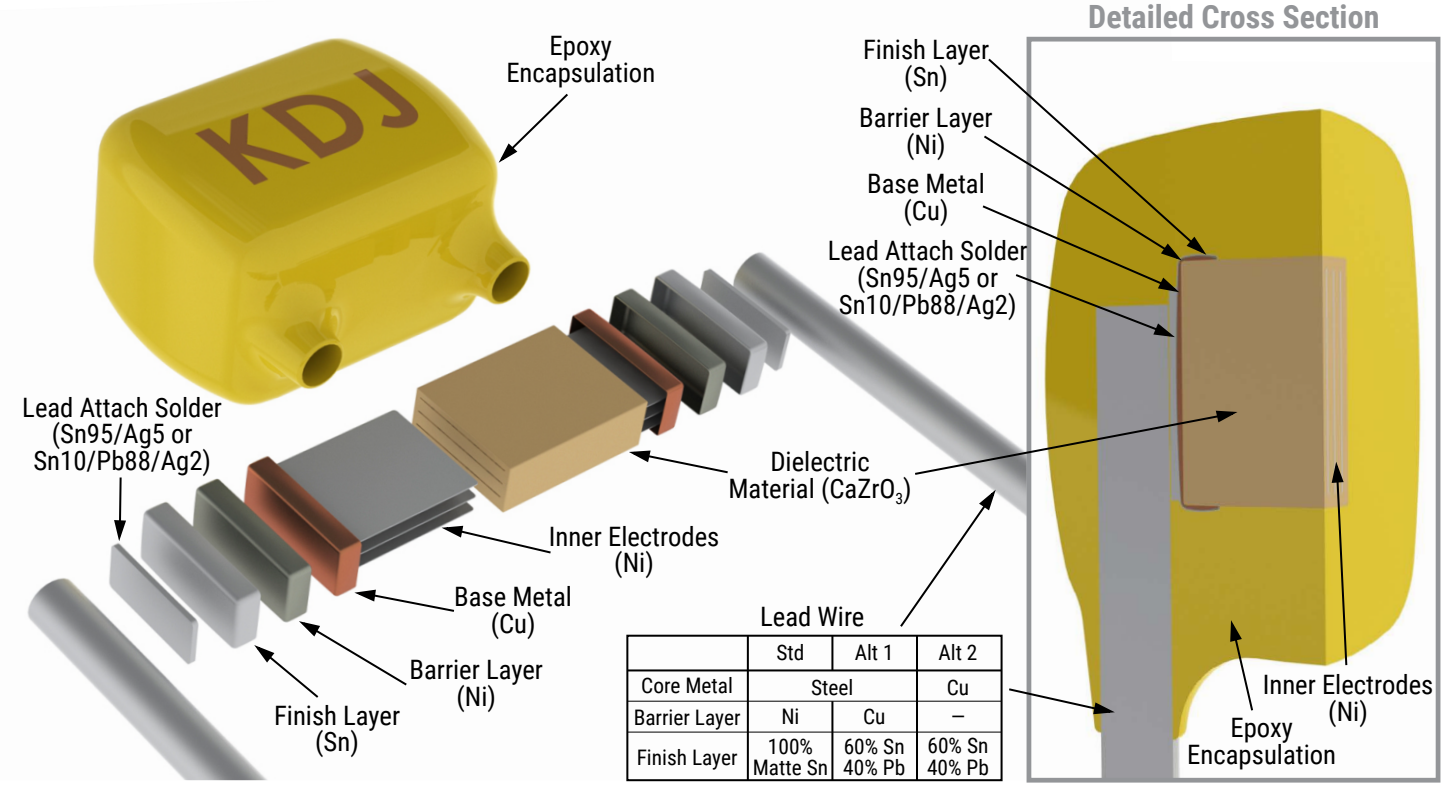
Stress	Reference	Test or Inspection Method
Solderability	J–STD–002	Magnification 50X. Conditions: a) Method A, at 235°C, Category 3
Temperature Cycling	JESD22 Method JA-104	1,000 cycles (–55°C to +125°C), measurement at 24 hours ±4 hours after test conclusion.
Biased Humidity	MIL–STD–202 Method 103	Load humidity, 1,000 hours 85°C/85%RH and 200Vdc maximum. Add 100 K ohm resistor. Measurement at 24 hours ±4 hours after test conclusion.
		Low volt humidity, 1,000 hours 85C°/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 and 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 with 1.2 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 – 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 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.

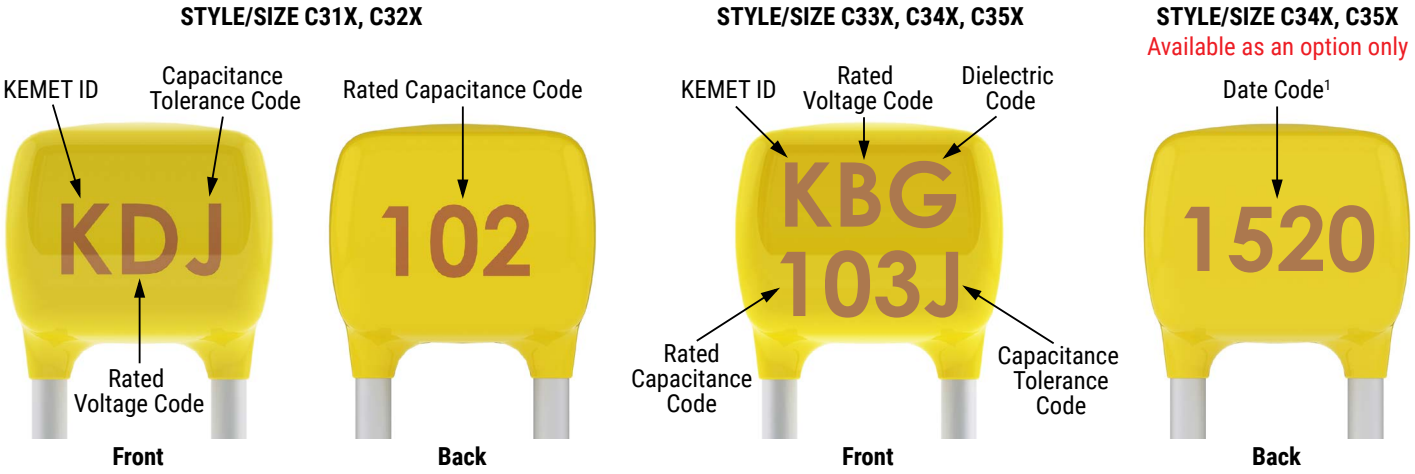
KEMET recommends storing the un-mounted capacitors in their original packaging, in a location away from direct sunlight, and where the temperature and relative humidity do not exceed 40 degrees centigrade and 70% respectively. For optimum solderability, capacitor stock should be used promptly, preferably 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



[1] To properly request the inclusion of the date code in the marking information provided on the component, ordering code C-SPEC 9207 must be added to the end of the ordering code.

Date Code	
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)
315	500/Bag	2500	2500
316			
317			
318			
320			
321		N/A	N/A
322		2500	2500
323			
324			
325			
326			
327			
328			
330	250/Bag	1500	1500
331		N/A	N/A
333		1500	
335			
336			
340	100/Bag	1000	1000
346			
350	50/Bag	N/A	500
356			

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.

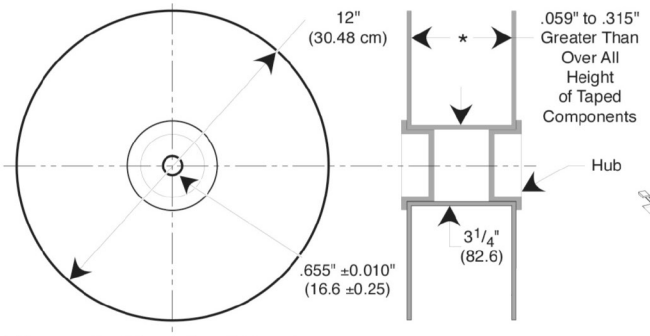
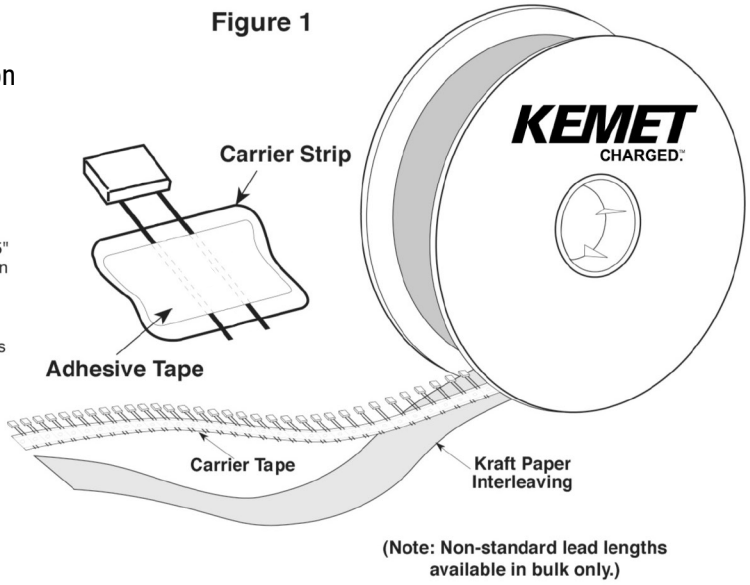


Figure 3: Standard Reel

Figure 1



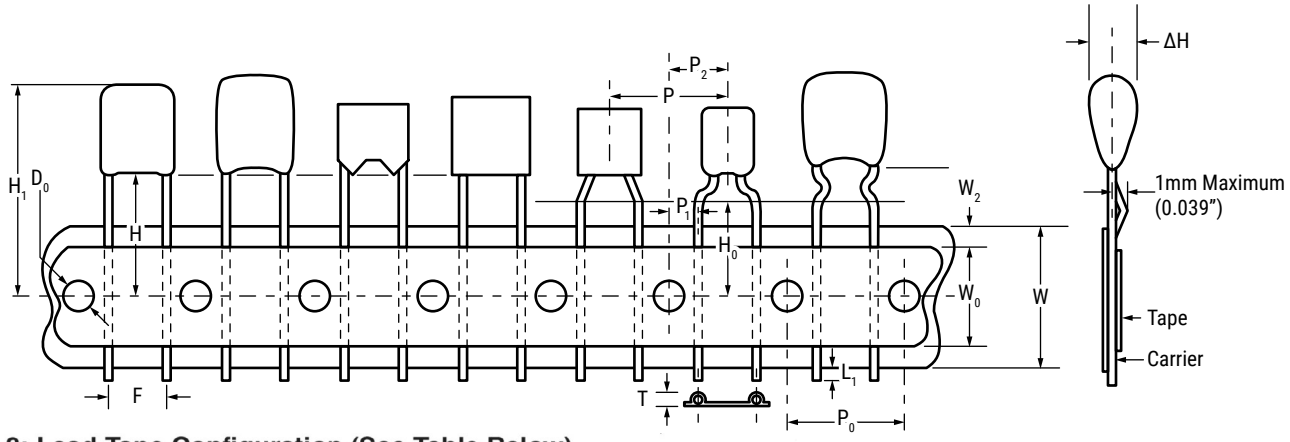


Figure 2: Lead Tape Configuration (See Table Below)

Ceramic Radial Tape and Reel Dimensions

Metric will govern

Constant Dimensions — Millimeters (Inches)								
D_0 ±0.2 (0.008)	P_0 ±0.3 (0.012)	ΔH ±0.2 (0.008)	L_1 Maximum	t ±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)

Ceramic Radial Tape and Reel Dimensions cont.

Metric will govern

Variable Dimensions — Millimeters (Inches)							
F ±0.78 (0.030)[1]	P_1 ±0.30 (0.012)[1]	P ±0.3 (0.012)	P_2 ±1.3 (0.51)	H		H_0	
				Straight Lead Configuration		Formed Lead Configuration[2]	
				Packaging C-Spec[3]			
				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				

[1] Measured at the egress from the carrier tape, on the component side.

[2] 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.

[3] 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_0	Sprocket Hole Diameter
P_0	Sprocket Hole Pitch
P	Component Pitch
F	Lead Spacing
P_1	Sprocket Hole Center to Lead Center
P_2	Sprocket Hole Center To Component Center
H	Height to Seating Plane (Straight Leads Only)
H_0	Height to Seating Plane (Formed Leads Only)
H_1	Component Height Above Tape Center
ΔH	Component Alignment
L_1	Lead Protrusion
t	Composite Tape Thickness
W	Carrier Tape Width
W_0	Hold-Down Tape Width
W_2	Hold-Down Tape Location

KEMET Electronics Corporation Sales Offices

For a complete list of our global sales offices, please visit 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.