Radial and Axial Leaded Multilayer Ceramic Capacitors

S-Series with C³ Technology, Radial and Axial, Ceramic Cased, 50 - 200 VDC (Commercial Grade)

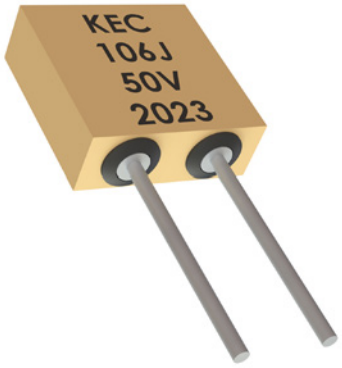
Overview

KEMET's S Series radial ceramic cased capacitors are designed with C0G and X7R dielectrics which feature a 125°C maximum operating temperature and patented C³ technology which eliminates potential problems associated with conventional epoxy cased/potted capacitors.

These devices are ideal for power supplies, DC/DC conversion and well suited for timing, resonant, bypass, and decoupling applications. These capacitors are widely used in industries related to semiconductors, telecommunications, test/diagnostic equipment and power/grid.

Benefits

- Operating temperature range of −55°C to +125°C
- High shock and vibration capability
- Capacitance range from 120 pF – 5.6 µF in X7R
- Capacitance range from 10 pF – 0.15 µF in C0G
- DC voltage ratings of 50 V, 100 V and 200 V
- High thermal stability
- Encapsulation meets flammability standard UL 94 V–0



Applications

- Switch mode power supplies
- DC/DC Converters
- Lighting ballast
- Measuring equipment
- Inverters
- Telecom equipment
- High voltage coupling

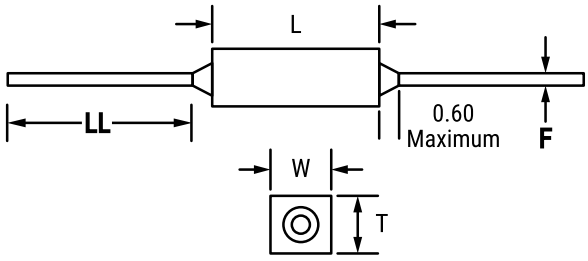
Ordering Information

S	C	R	06	B	103	K	G	S	
Series	Dielectric	Lead Configuration	Style/ Size	Voltage Rating	Cap. Code	Capacitance Tolerance[1]	Lead Wire Barrier Layer[2]	Test Level	Packaging
S = Standard Axial and Radial Capacitors	C = C0G R = X7R	A = Axial R = Radial	Axial: 16 25 39 50 69 Radial: 05 06 07 08 09	B = 50 V D = 100 V F = 200 V	Two significant digits and number of zeros	J = ±5% K = ±10% M = ±20%	G = Gold coated W = Solder coated	S = KEMET standard screening A = MIL-PRF-20, Group A Test (C0G) A = MIL-PRF-39014 (X7R) X = Special	Blank = Waffle Tray

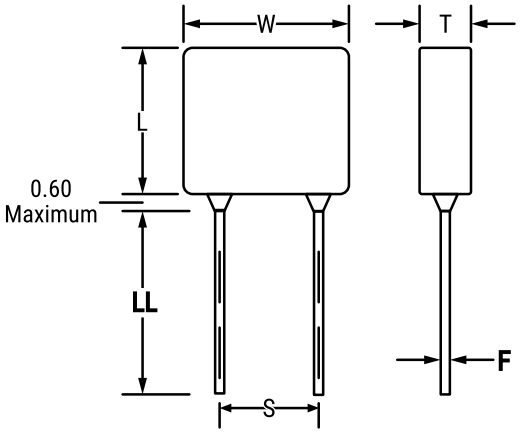
[1] *Additional capacitance tolerance offerings may be available. Contact KEMET for details.*
[2] *Please refer to the Construction section in the datasheet.*

Dimensions – Inches (Millimeters)

Axial



Radial



Series	Lead Configuration	Style/ Size	Length (L)	Width (W)	Thickness (T)	Lead Spacing ±0.030 (S)	Lead Diameter (F)	Lead Length Minimum (LL)
S	Axial	16	0.170 (4.32)	0.080 (2.03)	0.080 (2.03)		0.020 ±0.002 (0.508 ±0.051)	1.25 (31.75)
		25	0.270 (6.86)	0.100 (2.54)	0.100 (2.54)			
		39	0.400 (10.16)	0.150 (3.81)	0.150 (3.81)		0.025 ±0.002 (0.635 ±0.051)	
		50	0.520 (13.21)	0.265 (6.73)	0.160 (4.06)			
		69	0.720 (18.29)	0.370 (9.40)	0.160 (4.06)			
	Radial	05	0.200 (5.08)	0.200 (5.08)	0.100 (2.54)	0.200 ±0.030 (5.08 ±0.76)	0.020 ±0.002 (0.508 ±0.051)	
		06	0.300 (7.62)	0.300 (7.62)	0.100 (2.54)	0.200 ±0.030 (5.08 ±0.76)		
		07	0.300 (7.62)	0.300 (7.62)	0.150 (3.81)	0.200 ±0.030 (5.08 ±0.76)		
		08	0.500 (12.70)	0.500 (12.70)	0.100 (2.54)	0.400 ±0.030 (10.16 ±0.76)	0.025 ±0.002 (0.635 ±0.051)	
		09	0.500 (12.70)	0.500 (12.70)	0.150 (3.81)	0.400 ±0.030 (10.16 ±0.76)		

Table 1A – S Series C0G Waterfall

Type		AXIAL (SCA)																RADIAL (SCR)														
Style		16			25			39			50			69			05			06			07			08			09		
		Voltage																														
Capacitance	Capacitance Code	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
10 pF	100																X	X	X													
12 pF	120																X	X	X													
15 pF	150																X	X	X													
18 pF	180																X	X	X													
22 pF	220																X	X	X													
27 pF	270	X	X	X													X	X	X													
33 pF	330	X	X	X													X	X	X													
39 pF	390	X	X	X													X	X	X													
47 pF	470	X	X	X													X	X	X													
56 pF	560	X	X	X	X	X	X										X	X	X													
68 pF	680	X	X	X	X	X	X										X	X	X													
82 pF	820	X	X	X	X	X	X										X	X	X													
100 pF	101	X	X	X	X	X	X										X	X	X													
120 pF	121	X	X	X	X	X	X										X	X	X													
150 pF	151	X	X	X	X	X	X										X	X	X													
180 pF	181	X	X	X	X	X	X										X	X	X													
220 pF	221	X	X	X	X	X	X	X	X	X							X	X	X													
270 pF	271	X	X	X	X	X	X	X	X	X							X	X	X													
330 pF	331	X	X	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X							
390 pF	391	X	X	X	X	X	X	X	X	X							X	X	X	X	X	X	X	X	X							
470 pF	471	X	X		X	X	X	X	X	X							X	X	X	X	X	X	X	X	X							
560 pF	561	X	X		X	X	X	X	X	X							X	X	X	X	X	X	X	X	X							
680 pF	681	X	X		X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
820 pF	821				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,000 pF	102				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,200 pF	122				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,500 pF	152				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1,800 pF	182				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2,200 pF	222				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2,700 pF	272				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3,300 pF	332				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3,900 pF	392				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4,700 pF	472				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5,600 pF	562							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6,800 pF	682							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
8,200 pF	822							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
10,000 pF	103							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
12,000 pF	123							X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X
15,000 pF	153							X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X
18,000 pF	183							X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X
22,000 pF	223							X	X		X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X
27,000 pF	273							X	X		X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
33,000 pF	333										X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
39,000 pF	393										X	X	X	X	X	X							X	X		X	X	X	X	X	X	X
47,000 pF	473										X	X	X	X	X	X							X	X		X	X	X	X	X	X	X
56,000 pF	563										X	X		X	X	X										X	X	X	X	X	X	X
68,000 pF	683										X	X		X	X	X										X	X	X	X	X	X	X
82,000 pF	823													X	X	X										X	X		X	X	X	X
0.1 uF	104													X	X	X										X	X		X	X	X	X
0.12 uF	124													X	X														X	X		
0.15 uF	154													X	X														X	X		
Capacitance	Capacitance Code	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
Style		16			25			39			50			69			05			06			07			08			09		
Type		Axial (SCA)															Radial (SCR)															

Table 1B – S Series X7R Waterfall

Type		AXIAL (SRA)																RADIAL (SRR)														
Style		16			25			39			50			69			05			06			07			08			09		
		Voltage																														
Capacitance	Capacitance Code	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
120 pF	121																X	X	X												
150 pF	151																X	X	X												
180 pF	181																X	X	X												
220 pF	221																X	X	X												
270 pF	271																X	X	X												
330 pF	331																X	X	X												
390 pF	391																X	X	X												
470 pF	471																X	X	X												
560 pF	561																X	X	X												
680 pF	681	X	X	X													X	X	X												
820 pF	821	X	X	X													X	X	X												
1,000 pF	102	X	X	X													X	X	X												
1,200 pF	122	X	X	X													X	X	X												
1,500 pF	152	X	X	X													X	X	X												
1,800 pF	182	X	X	X													X	X	X												
2,200 pF	222	X	X	X													X	X	X												
2,700 pF	272	X	X	X													X	X	X												
3,300 pF	332	X	X	X													X	X	X												
3,900 pF	392	X	X	X	X	X	X										X	X	X												
4,700 pF	472	X	X	X	X	X	X										X	X	X												
5,600 pF	562	X	X	X	X	X	X										X	X	X												
6,800 pF	682	X	X	X	X	X	X										X	X	X												
8,200 pF	822	X	X	X	X	X	X										X	X	X												
10,000 pF	103	X	X	X	X	X	X										X	X	X	X	X	X	X	X	X						
12,000 pF	123	X	X		X	X	X										X	X	X	X	X	X	X	X	X						
15,000 pF	153	X	X		X	X	X	X	X	X							X	X	X	X	X	X	X	X	X						
18,000 pF	183				X	X	X	X	X	X							X	X	X	X	X	X	X	X	X						
22,000 pF	223				X	X	X	X	X	X							X	X	X	X	X	X	X	X	X						
27,000 pF	273				X	X	X	X	X	X							X	X	X	X	X	X	X	X	X						
33,000 pF	333				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
39,000 pF	393				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
47,000 pF	473				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
56,000 pF	563				X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
68,000 pF	683				X	X		X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
82,000 pF	823				X	X		X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
0.1 uF	104				X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
0.12 uF	124				X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
0.15 uF	154							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
0.18 uF	184							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
0.22 uF	224							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
0.27 uF	274							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
0.33 uF	334							X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
0.39 uF	394							X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X
0.47 uF	474							X	X	X	X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
0.56 uF	564							X	X	X	X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
0.68 uF	684							X	X		X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
0.82 uF	824							X	X		X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
1 uF	105										X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	X
1.2 uF	125										X	X	X	X	X	X							X	X		X	X	X	X	X	X
1.5 uF	155										X	X	X	X	X	X							X	X		X	X	X	X	X	X
1.8 uF	185										X	X		X	X	X							X	X		X	X		X	X	X
2.2 uF	225										X	X		X	X	X										X	X		X	X	X
2.7 uF	275													X	X	X										X	X		X	X	
3.3 uF	335													X	X														X	X	
3.9 uF	395													X	X														X	X	
4.7 uF	475													X	X														X	X	
5.6 uF	565													X	X																
Capacitance	Capacitance Code	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
Style		16			25			39			50			69			05			06			07			08			09		
Type		Axial (SCA)															Radial (SCR)														

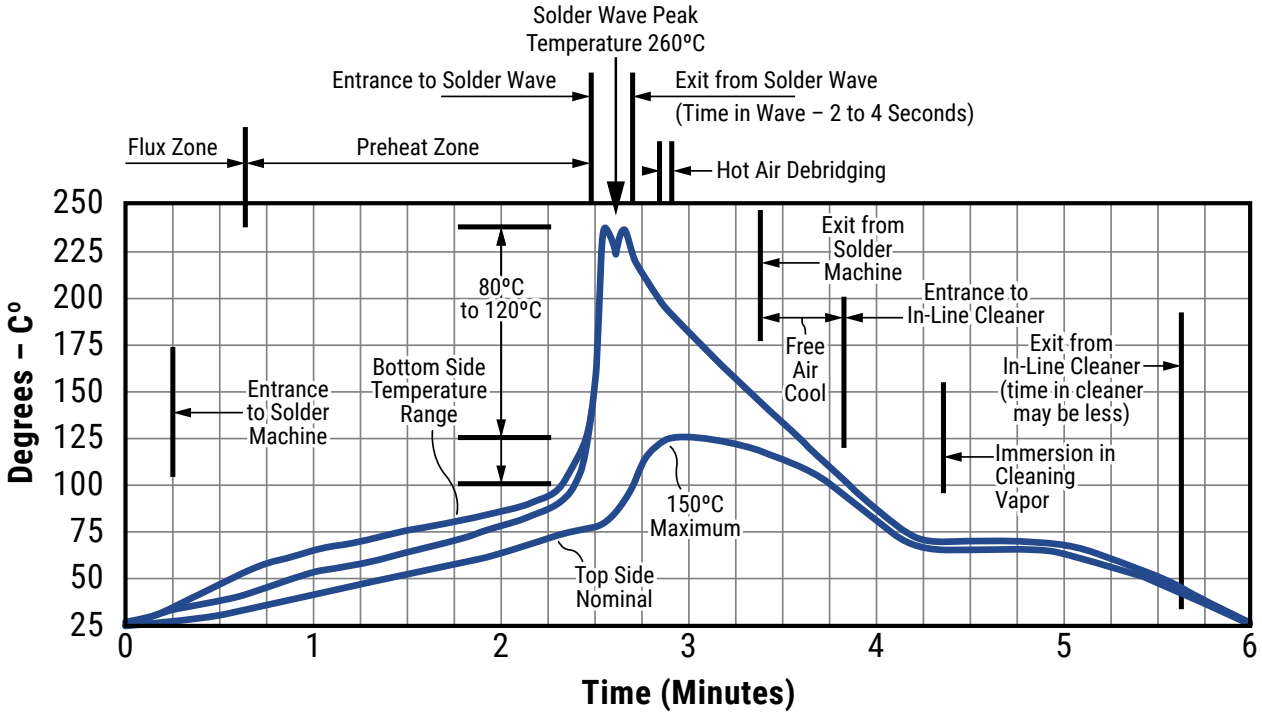
Soldering Process

Recommended Soldering Technique:

- Solder Wave
- Hand Soldering (Manual)

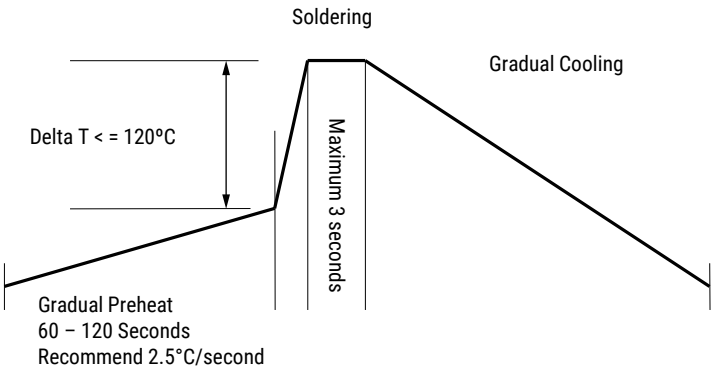
Recommended Soldering Profile:

- Optimum Wave Solder Profile



- Hand Soldering (Manual)

Manual Solder Profile with Pre-heating



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 Condition	Limits
Visual & Mechanical	KEMET Internal	No defects that may affect performance (10X)	Dimensions according KEMET Spec Sheet
Capacitance (Cap)	MIL-STD-202 Method 305	C ≤ 100 pF: 1 MHz ± 100 kHz and 1.0 ±0.2 V_{RMS} C > 100 pF: 1 kHz ±100 Hz and 1.0 ±0.2 V_{RMS}	Dimensions according KEMET Spec Sheet
Dissipation Factor (DF)	KEMET Internal	C ≤ 100 pF: 1 MHz ± 100 kHz and 1.0 ±0.2 V_{RMS} C > 100 pF: 1 kHz ±100 Hz and 1.0 ±0.2 V_{RMS}	X7R: 2.5% C0G: 0.15%
Insulation Resistance (IR)	MIL-STD-202 Method 302	Apply rated voltage for 120 seconds at 25°C	Within Specification To obtain IR limit, divide MΩ-µF value by the capacitance and compare to GΩ limit. Select the lower of the two limits. 100 GΩ or 1,000 Megohm-microfarad, whichever is less.
Temperature Coefficient of Capacitance (TCC)	KEMET Internal	C0G: 0 ppm/°C ±30 ppm/°C X7R: ±15%	Within Specification
Dielectric Withstanding Voltage (DWV)	KEMET Internal	250% of rated voltage (5±1 seconds and charge/discharge not exceeding 50 mA)	Withstand test voltage without insulation breakdown or damage.
Aging Rate (Maximum % Capacitance Loss/ Decade Hour)	KEMET Internal	Capacitance measurements (including tolerance) are indexed to a referee time of 48 or 1,000 hours. Please refer to a part number specific datasheet for referee time details.	Please refer to a part number specification sheet for specific Aging rate
Terminal Strength	MIL-STD-202 Method 211	Applied force: 5 pounds (2.3 kg)	No evidence of mechanical damage
Solderability	MIL-STD-202 Method 208	Condition: 4 hours ±15 minutes at 155°C dry bake apply all methods Test 245 ± 5°C (SnPb & Pb-Free)	Visual Inspection. 95% coverage on termination. No leaching
Temperature Cycling	JESD22 Method JA–104	1,000 cycles (–55°C to +125°C) 2 - 3 cycles per hour Soak Time: 1 or 5 minutes	Measurement at 24 hours ±4 hours after test conclusion. Cap: Initial Limit DF: Initial Limit IR: Initial Limit
Moisture Resistance	MIL-STD-202 Method 106	Number of cycles required 10, 24 hours per cycle. Steps 7a and 7b not required	Visual examination: No mechanical damage. Marking shall remain legible Measurement at 24 hours +/- 4 hours after test conclusion. Within Post Environmental Limits Cap (C0G): ±0.3% or ±0.25 pF shift Cap(X7R): ±20% IR: 10% of Initial Limit DF Limits Maximum (C0G): 0.25 % DF Limits Maximum (X7R): 3 %

Table 2 – Performance & Reliability: Test Methods and Conditions cont.

Thermal Shock	MIL-STD-202 Method 107	Number of cycles required 5, (–55°C to 125°C) Dwell time 15 minutes.	Cap: Initial Limit DF: Initial Limit IR: Initial Limit
High Temperature Life	MIL-STD-202 Method 108	1,000 hours at +125°C, +4°C, -0°C. with rated voltage, ±5 percent.	Measurement at 24 hours +/- 4 hours after test conclusion. Within Post Environmental Limits Cap (C0G): ±0.3% or ±0.25 pF shift Cap(X7R): ±20% IR: 10% of Initial Limit DF Limits Maximum (C0G): 0.25 % DF Limits Maximum (X7R): 3 %
Storage Life		1,000 hours at 125°C, Unpowered	
Vibration	MIL-STD-202 Method 204	5 g's for 20 minutes, 12 cycles each of 3 orientations. Test from 10 – 2,000 Hz	Cap: Initial Limit DF: Initial Limit IR: Initial Limit
Mechanical Shock	MIL-STD-202 Method 213	100 g's 6 ms Half-sine, Velocity Change 12.3 feet/second (Condition C)	Cap: Initial Limit DF: Initial Limit IR: Initial Limit
Resistance to Solvents	MIL-STD-202 Method 215	Add Aqueous wash chemical OKEMCLEAN (A 6% concentrated Oakite cleaner) or equivalent. Do not use banned solvents	Capacitors shall be visually examined for evidence of mechanical damage and marking.

Packaging Quantities

Style	Waffle Pack Quantity	Style	Waffle Pack Quantity
SCR05	56	SCA16	25
SCR06	28	SCA25	25
SCR07	28	SCA39	25
SCR08	20	SCA50	25
SCR09	20	SCA69	25
SRR05	56	SRA16	25
SRR06	28	SRA25	25
SRR07	28	SRA39	25
SRR08	20	SRA50	25
SRR09	20	SRA69	25

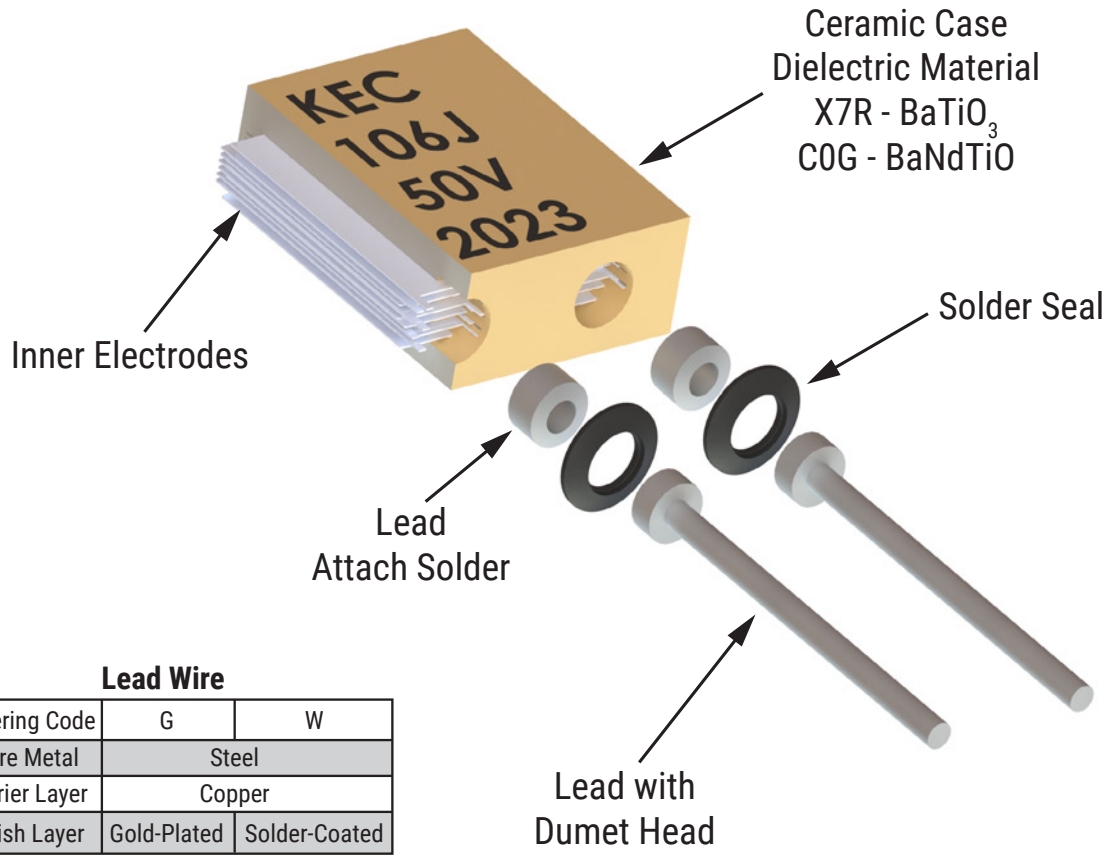
Storage & Handling

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

Radial

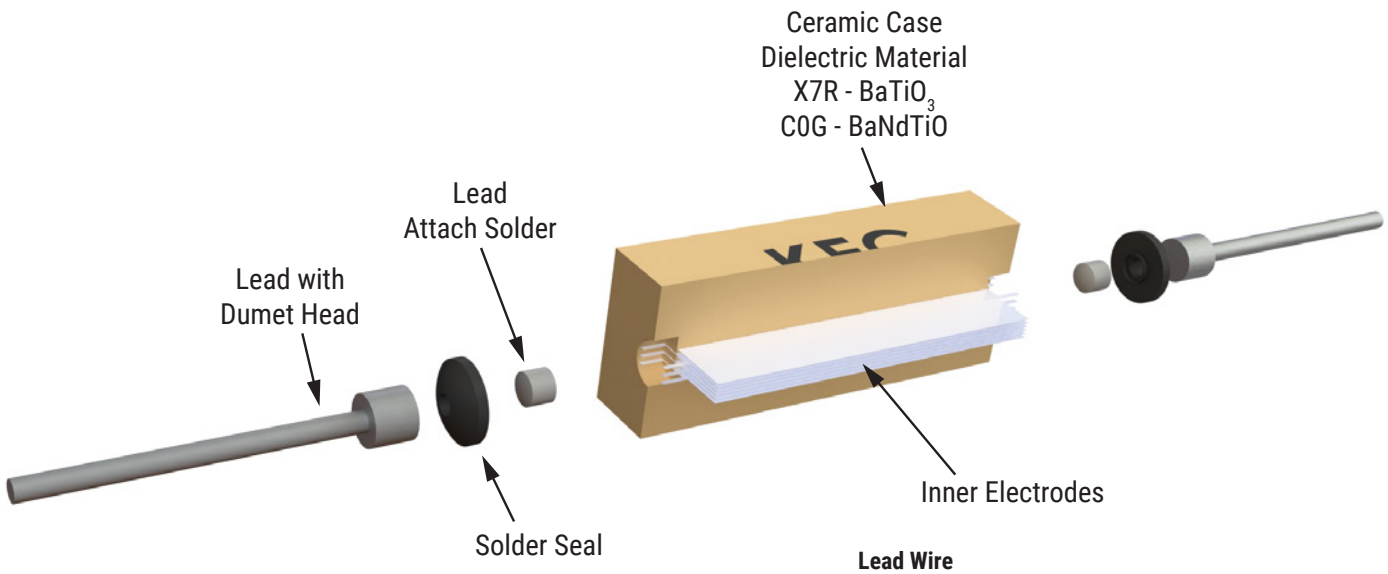


Lead Wire

Ordering Code	G	W
Core Metal	Steel	
Barrier Layer	Copper	
Finish Layer	Gold-Plated	Solder-Coated

Construction cont.

Axial

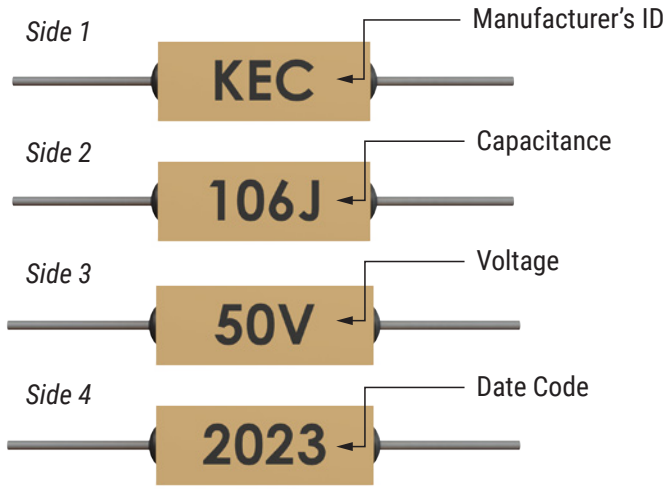


Lead Wire

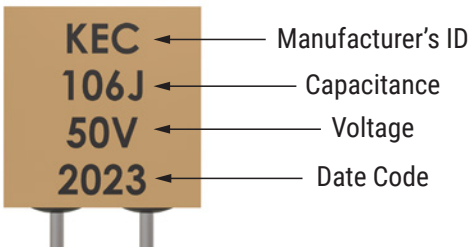
Ordering Code	G	W
Core Metal	Steel	
Barrier Layer	Copper	
Finish Layer	Gold-Plated	Solder-Coated

Marking

Axial



Radial



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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 indicated or that other measures may not be required.