Switch Mode Power Supply Multi-Layer Capacitors

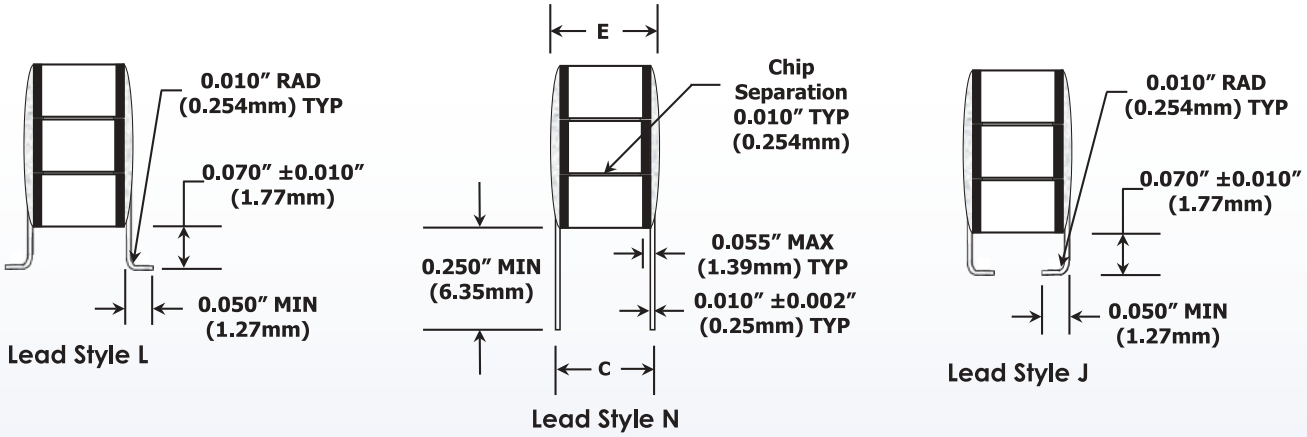
High Rel. Space Level NPO(BP) & X7R (BQ, BR & BX) – 50 Vdc to 500 Vdc

CalRamic Technologies LLC manufactures a series of highly reliable, military / commercial grade, leaded SMPS ceramic capacitors in accordance with MIL-PRF-49470 and 87106 equivalents that feature large capacitance values and are designed for use in a variety of applications including input and output filters for switch mode power supplies, DC to DC converters, decoupling, snubbers, energy storage and high capacitance discharge circuits.

Available with ultra-stable Class I, NPO and stable Class II, X7R (BQ, BR & BX) dielectric materials, these designs exhibit inherently low Equivalent Series Resistance (ESR) and Equivalent Series Inductance (ESL) characteristics, making them the preferred choice versus higher loss Aluminum and Tantalum electrolytic capacitors at operational frequencies up to 1MHz.

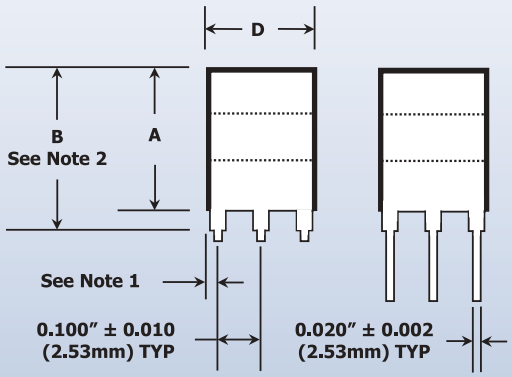
B

Lead Configurations



Mechanical Dimensions

Case Code	A Max	B Max	C ± 0.025 (0.63mm)	D Min / Max	E Max	Number of Leads Per Side
3	Ref. Table 1	0.715" (18.16mm)	0.450" (11.43mm)	0.950" - 1.075" (24.13mm - 27.3mm)	0.500" (12.7mm)	10
4	Ref. Table 1	0.545" (13.14mm)	0.400" (10.16mm)	0.350" - 0.425" (8.89mm - 10.79mm)	0.440" (11.17mm)	4
5	Ref. Table 1	0.545" (13.14mm)	0.250" (6.35mm)	0.224" - 0.275" (5.68mm - 6.98mm)	0.300" (7.62mm)	3



Notes

1. Case Code 3 & 4 @ 0.025" – 0.100" (0.63 – 2.54mm) Case Code 5 @ 0.012" – 0.100" (0.30 – 0.100mm).
2. Dimension B MAX = Dimension A + 0.065" (1.65mm).
   - Reference Electrical Characteristics
   - Table 1 for actual "A" height dimension.
   - Tin – Lead plating utilized for all lead configurations.
   - Vertical stack available upon request – Contact Factory.

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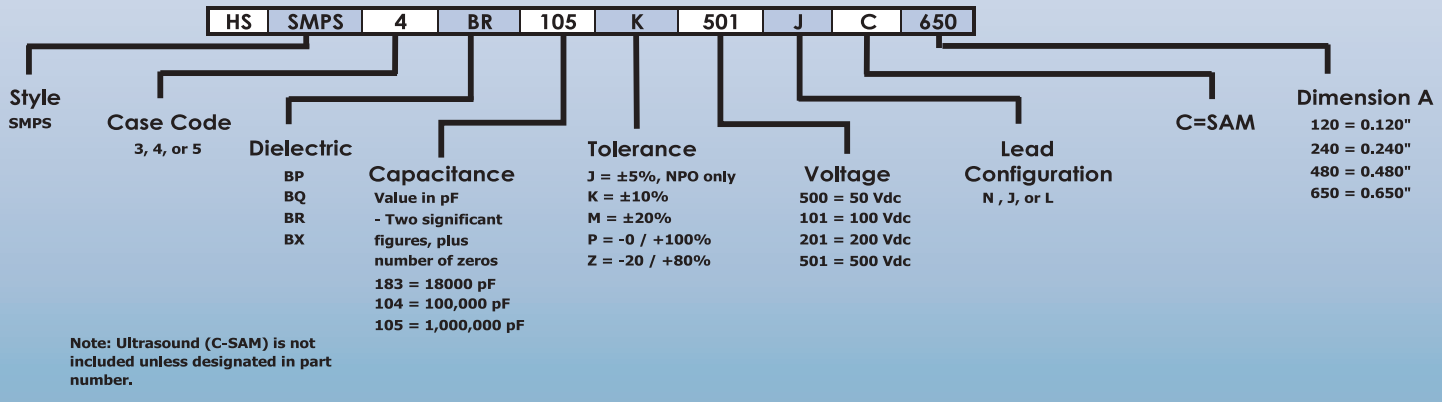
Performance Characteristics

Specification	Dielectric Type (EIA Designation)			
	NPO (BP)	X7R [BQ]	X7R [BR]	X7R [BX]
Material Classification	Type I, Ultra Stable	Type II, Stable		
Coefficient of Thermal Expansion	9 x 10^{-6} / °C	11 x 10^{-6} / °C		
Density	67 g / in^3			
Operating Temperature Range	-55 to +125°C			
Aging Rate	0	-2% Max per decade hour		
Temperature Coefficient	0 ±30 PPM / °C	±15%		
Voltage - Temperature Coefficient	0 PPM / °C ±30 PPM / °C	+15 / -50%	+15 / -40%	+15 / -25%
Capacitance Range	0.010 to 2.2 µF	0.150 to 5.6 µF	0.470 to 12 µF	0.680 to 47 µF
Voltage Range	50 VDC to 500 VDC			
Insulation Resistance @ +25°C	100,000 MΩ or 1000 MΩ - µF, W/E is less			
Insulation Resistance @ +125°C	10,000 MΩ or 100 MΩ - µF, W/E is less			
Dissipation Factor	0.15% Max @ 1 kHz & 1 VRMS Max	2.5% Max @ 1 kHz & 1 VRMS Max		
DWV	2.5 X WVDC@ 50, 100 & 200 VDC / 1.5 X WVDC @ 500 VDC			

Notes

1. Group A screening available to MIL-PRF-49470. [Voltage conditioning performed at 2.0 x WVDC for product rated at > 500 VDC & 1.2 x WVDC for product rated at ≤ 500 VDC].
2. Voltage – Temperature Coefficient limits define the allowable capacitance change as a percentage of the +25°C measured value, across the temperature range of -55 to +125°C, while under bias.
3. Special testing including Ultrasound (C-SAM). Contact factory for more information.
4. Custom voltages, package sizes and capacitance values are available. Contact factory for more information.
5. X7R dielectrics are not intended for AC line filtering applications.
6. Large ceramic capacitors, even leaded devices are susceptible to damage when exposed to thermal and / or mechanical shock. Refer to Technical Bulletin AN112 for handling and installation recommendations.
7. Calramic Technologies recommends the use of a lower profile capacitor design for those applications where high vibration or mechanical shock may be a concern.
8. The use of a Tin – Lead alloy with a minimum of 3% lead content per mass, has proven to be an effective means of inhibiting reliability concerns related to tin whisker growth.

Part Number / Ordering Information



Note: Ultrasound (C-SAM) is not included unless designated in part number.

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High Rel. Space Level NPO(BP) & X7R (BQ, BR & BX) – 50 Vdc to 500 Vdc

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Electrical / Mechanical Characteristics

NPO (BP) Dielectric

Capacitance (µF)	50V (BP)		100V (BP)		200V (BP)		500V (BP)	
	Case Code (in)	Max "A" Dim (in)	Case Code (in)	Max "A" Dim (in)	Case Code (in)	Max "A" Dim (in)	Case Code (in)	Max "A" Dim (in)
0.010							5	0.120
0.012							5	0.240
0.015							5	0.240
0.018							5	0.240
0.022					5	0.120	5	0.360
0.027					5	0.240	5	0.360
0.033					5	0.240	4 / 5	0.240 / 0.480
0.039					5	0.240	4 / 5	0.240 / 0.480
0.047			5	0.240	5	0.360	4 / 5	0.240 / 0.650
0.056	5	0.120	5	0.240	5	0.360	4	0.360
0.068	5	0.240	5	0.240	4 / 5	0.120 / 0.480	4	0.360
0.082	5	0.240	5	0.240	4 / 5	0.240 / 0.480	4	0.480
0.10	5	0.240	5	0.360	4 / 5	0.240 / 0.650	4	0.480
0.12	5	0.360	5	0.360	4	0.360	3 / 4	0.240 / 0.650
0.15	5	0.360	4 / 5	0.240 / 0.480	4	0.360	3	0.240
0.18	4 / 5	0.240 / 0.480	4 / 5	0.240 / 0.650	4	0.480	3	0.240
0.22	4 / 5	0.240 / 0.480	4 / 5	0.240 / 0.650	4	0.480	3	0.360
0.27	4 / 5	0.240 / 0.650	4	0.360	3 / 4	0.240 / 0.650	3	0.360
0.33	4	0.360	4	0.480	3	0.240	3	0.480
0.39	4	0.480	4	0.480	3	0.240	3	0.650
0.47	4	0.480	3 / 4	0.240 / 0.650	3	0.360		
0.56	3 / 4	0.240 / 0.650	3 / 4	0.240 / 0.650	3	0.360		
0.68	3	0.240	3	0.240	3	0.480		
0.82	3	0.240	3	0.120	3	0.360		
1.0	3	0.360	3	0.360	3	0.650		
1.2	3	0.360	3	0.480				
1.5	3	0.480	3	0.480				
1.8	3	0.480	3	0.650				
2.2	3	0.650						
2.7								
3.3								
3.9								
4.7								

X7R Dielectric (BQ, BR, BX)

Capacitance (µF)	50V (BX)		100V (BX)		200V (BR)		500V (BQ)	
	Case Code (in)	Max "A" Dim (in)	Case Code (in)	Max "A" Dim (in)	Case Code (in)	Max "A" Dim (in)	Case Code (in)	Max "A" Dim (in)
0.10								
0.12								
0.15							5	0.120
0.18							5	0.240
0.22							5	0.240
0.27							5	0.240
0.33							5	0.360
0.39							5	0.360
0.47					5	0.240	5	0.360
0.56					5	0.240	4 / 5	0.240 / 0.480
0.68			5	0.120	5	0.360	4 / 5	0.240 / 0.650
0.82			5	0.240	5	0.360	4	0.360
1.0	5	0.120	5	0.240	4 / 5	0.120 / 0.480	4	0.360
1.2	5	0.120	5	0.240	4 / 5	0.240 / 0.480	4	0.360
1.5	5	0.240	5	0.360	4 / 5	0.240 / 0.650	4	0.480
1.8	5	0.240	5	0.360	4	0.360	3 / 4	0.240 / 0.650
2.2	5	0.240	5	0.480	4	0.360	3	0.240
2.7	5	0.360	5	0.480	4	0.480	3	0.360
3.3	5	0.360	4 / 5	0.240 / 0.650	4	0.480	3	0.360
3.9	5	0.480	4	0.360	3 / 4	0.240 / 0.650	3	0.360
4.7	4 / 5	0.240 / 0.480	4	0.360	3	0.240	3	0.480
5.6	4 / 5	0.240 / 0.650	4	0.480	3	0.240	3	0.650
6.8	4	0.360	4	0.480	3	0.360		
8.2	4	0.360	4	0.650	3	0.360		
10.0	4	0.480	3	0.240	3	0.480		
12.0	4	0.480	3	0.240	3	0.650		
15.0	3 / 4	0.240 / 0.650	3	0.360				
18.0	3	0.240	3	0.360				
22.0	3	0.360	3	0.480				
27.0	3	0.360	3	0.650				
33.0	3	0.360						
39.0	3	0.480						
47.0	3	0.650						

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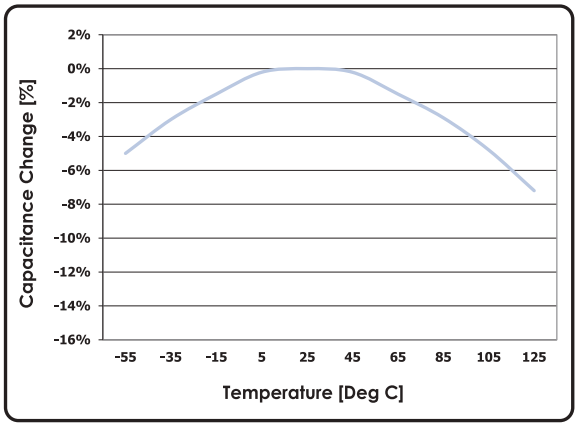
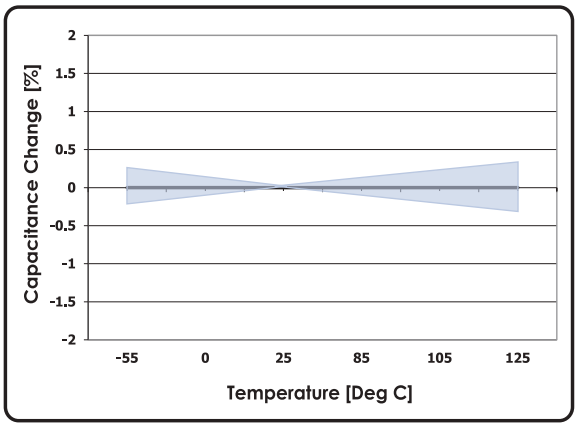
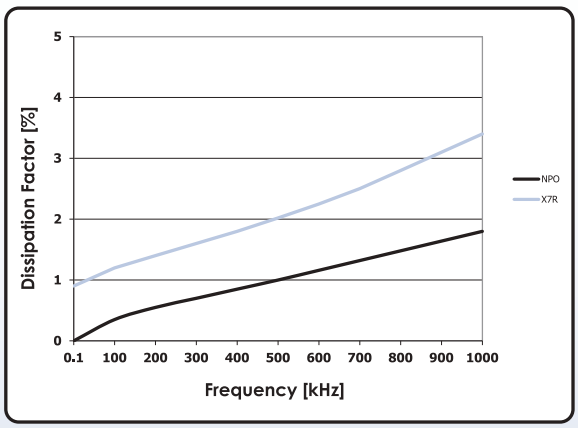
Performance Charts (Typical)



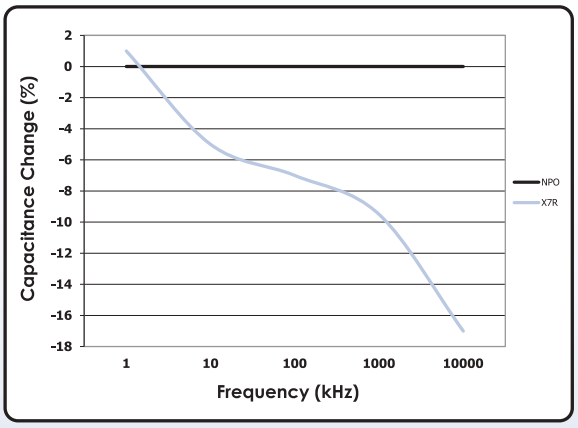
X7R Temperature Coefficient



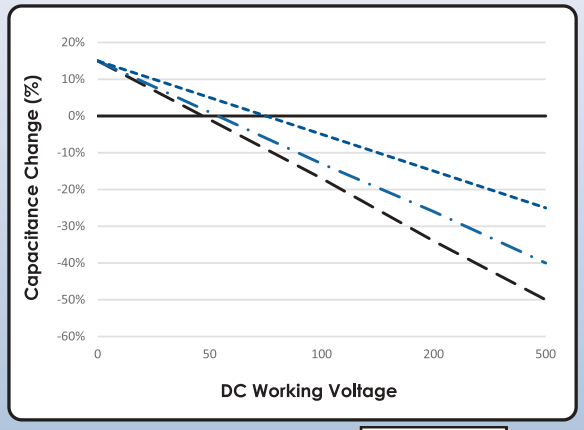
NPO Temperature Coefficient



DF Vs Frequency



Capacitance Vs Frequency



Voltage Coefficient

Notes

Partnering with our clients for combined success.

ISO 9001:2015 CERTIFIED QUALITY MANAGEMENT SYSTEM

MADE IN USA

CalRamic Technologies LLC manufactures High Voltage Ceramic Capacitors. All of our products are manufactured in the United States. Applications of our products are Space Level, Military Aircraft and Ground Based Systems, Commercial Aerospace, SMPS, Medical Imaging, High Temperature (Geophysical and Geothermal), Pulse Discharge and High Repetition Rate, and a variety of commercial and industrial applications.

Our products range from Radial Leaded Multilayer and Disc to Surface Mount Chip capacitors in a variety of dielectrics to suit your application. We can produce large or small production quantities. Our lean manufacturing process and discipline offer the shortest lead times in the industry with out-of-stock same day delivery.

We also offer our “Fast Track” delivery for those special delivery needs. Custom designs and variations are welcome.

MADE IN USA

BASIC APPLICATIONS

It is the basic ability of a capacitor to store energy for controlled release that makes it an extremely valuable tool for use in a wide range of applications in the electronics industry. Typical applications would include:

Energy / Pulse Discharge

The energy stored in the capacitor can be discharged for use in an ignition, firing or triggering circuit or as a power source.

Direct Current Blockage

A fully charged capacitor acts as a high impedance device and can block the passage of DC current while still allowing AC current to pass to a specified portion of the circuit.

Coupling of Circuit Components

With the ability to pass AC signals, a capacitor is able to couple one section of an AC circuit to another circuit.

Decoupling of Circuit Components

Capacitors are often used in integrated circuits (IC's) to minimize noise in the logic signal by providing an additional current source.

Filter Capacitors

The reactance of a capacitor is inversely proportional to the frequency thereby offering decreased resistance to current flow at higher frequency levels. This ability to decrease or increase the impedance of the circuit allows the capacitor to discriminate and filter out undesired frequencies.

By-Pass Capacitor

The ability to block DC current and allow the passage of AC current permits the capacitor to be placed in parallel with other components to by-pass the AC at a certain frequency without allowing the DC component of the signal to pass.

Snubber Capacitors

Capacitors can be used to protect sensitive components in a circuit by limiting the energy associated with high voltage transients generated by the opening of relays or silicon controlled rectifiers (SCR) used to drive high inductance loads.

Switch Mode Power Supply

For applications including input and output filters for switch mode power supplies, DC to DC converters, decoupling, snubbers, energy storage and high capacitance discharge circuits.
See pages 27 & 49 for more information.

CalRamic Technologies LLC is an ISO9001-2015 Certified facility. Our commitment to Quality is our primary objective and we pride ourselves on our satisfaction to our client base. Our Goal is to provide the upmost Quality from the initial contact in introducing our company, to quoting the same day if possible, followed by offering short deliveries coupled with “on time deliveries” of our products. And of course, what we consider the most important element, the reliability of the components in the application once delivered. In addition, we remain dynamic and open to our customer’s inputs so we may continue to improve in all aspects related to our chosen field. We continue to grow at a substantial rate and believe that is in direct response to maintaining the Quality Objectives stated above.

42 °C
NEW ELEMENTS 10/9

MORE ABOUT US

CalRamic Technologies LLC is a U.S.-based High Voltage Ceramic Capacitor manufacturer with over 20 years' experience. Our team focuses on producing exceptional quality capacitors by using superior quality materials with a highly trained team.

CalRamic produces a variety of components in a multitude of configurations ranging from 500VDC to 80KVDC. Our Lean Manufacturing principles provide shorter lead times, rapid prototype turnaround deliveries, multiple design derivations for your custom application, and a variety of dielectric types depending on your specific application.

Our quality control system conforms to and exceeds ISO 9001-2015 requirements. We manufacture capacitors suitable for a wide range of applications like: Geothermal, Commercial/Industrial, Medical, Commercial Aerospace, Ground Based Military, Military Aerospace and even Hi-Reliability Space Satellite Systems. Our manufacturing design guidelines, material choices, and precision controls result in performance-based High Voltage Capacitors for your specific application.

The CalRamic Technologies Leadership has created a culture that encourages personal growth and success for each team member, while building a We Succeed as a Team environment. In addition, we look for opportunities to support our local community through non-profit involvement and CalRamic Team events throughout the year.

We are committed to the best approaches and practices that limit environmental impact, and an extensive safety and awareness training program that limits hazardous exposures to our Team Members.

CalRamic Technologies LLC is fully committed to our clients' success. On our website we offer a full ceramic capacitor educational library with Application Notes and Product Training Modules that help our clients understand the technical nature of High Voltage Ceramic Capacitors.

We are fully committed to your application's success.

Jeff Day

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