



Capacitors

CapStrate® (Bulk Capacitance Embedded in Substrate)

Our new line of CapStrate® products integrate large amounts of bulk capacitance into a ceramic substrate allowing elimination of large discrete capacitive components saving critical space and simplifying your assembly process.

Our extensive experience in design and manufacture of large format, custom geometries allows us to develop unique and innovative solutions which successfully solve a wide variety of our customer's design challenges.

We'll work proactively with you to fully understand your requirements and recommend the best solution compatible with your application needs.

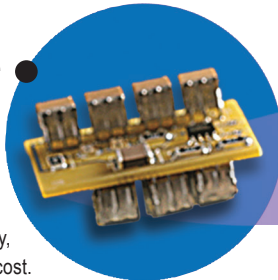
Applications & Features:

- Rated Working Voltages from 50V to 500V, (specials from 1kV to 7.5kV)
- Temperature ranges: -55°C to 125°C (specials to 200°C and 250°C)
- Compact Designs Utilizing Military Grade Ceramics
- Custom Sizes, Values, and Voltages Available
- Integrated Capacitance Substrates

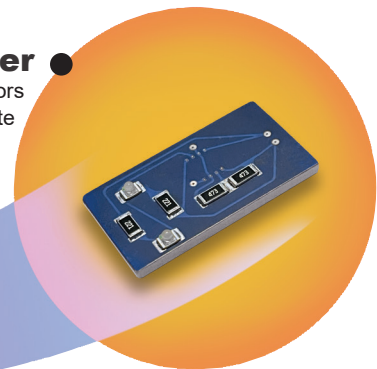
Power Electronic Solutions:

CapStrate® Capacitors embedded into Substrate result into critical space saving, simplifying assembly, fewer solder joints, and lower assembly cost.

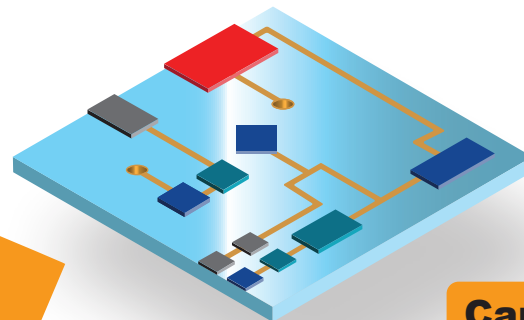
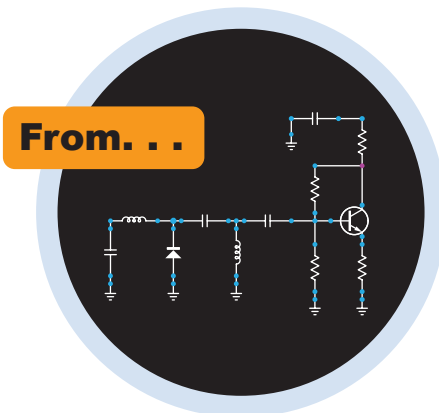
Before
Stacked Capacitors



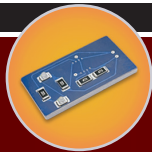
After
CapStrate® Capacitors embedded into substrate



Choosing the correct CapStrate® influences the mechanical and electrical function of a design. Johanson Dielectrics offers ceramic substrates for use in application specific environments. It is recommended to choose the right substrate that meets the required electrical requirements and is suitable for the environment the product will operate in.



CapStrate®


Capacitors - CapStrate®

Selection, Sizes, & Shapes

CapStrate® Sizes:

CapStrate® designs are traditionally available in rectangular or circular formats. Our standard size dimensions are listed below for rectangular and circular designs. Unique form factors will be considered.

Additional Features:

- High reliability conductor traces
- Plated and through-hole vias
- Assembly services
- Solder pads

Table 1: Available CapStrate® & Electrical Properties

CapStrate® Material	X7R	NP0	X8R
Dissipation Factor	<2.5%	<0.15%	<2.5%
Dielectric Strength (V/mil)	200	300	200
Temperature Coefficient	± 15%	0 ± 30 ppm/°C	± 15%
Temperature Range	-55 °C to +125 °C	-55 °C to +125 °C	-55 °C to +150 °C

Table 2: Rectangular Dimensions (CapStrate®)

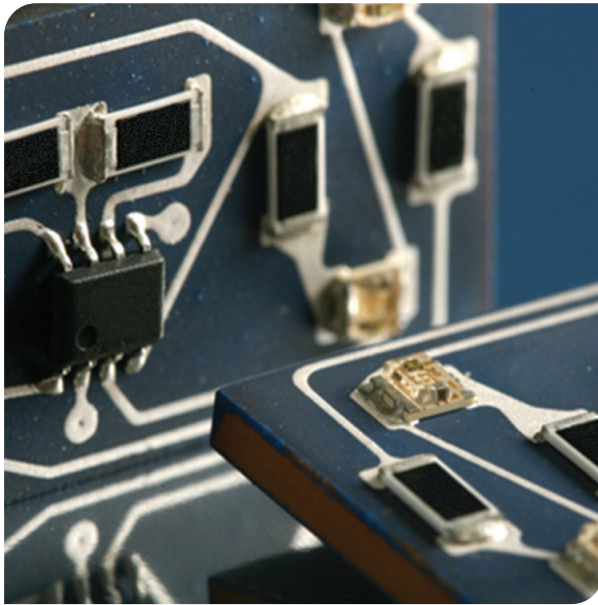
Dimension	Minimum	Maximum	Tolerance
Thickness	0.050" (1.27mm)	0.215" (5.461mm)	+/- 0.005 (0.127mm)
Length	0.20" (5.08mm)	2.00"/1.00" (50.8/25.4mm)	+/- 0.005 (0.127mm)
Width	0.20" (5.08mm)	1.00"/2.00" (25.4/50.8mm)	+/- 0.005 (0.127mm)
Temperature Range	-55 °C to +125 °C	-55 °C to +125 °C	-55 °C to +150 °C

Table 3: Circular Dimensions (CapStrate®)

Dimension	Minimum	Maximum	Tolerance
Thickness	0.050" (1.27mm)	0.215" (5.46mm)	+/- 0.005 (0.127mm)
Diameter	0.20" (5.08mm)	2.00" (50.8mm)	+/- 0.005 (0.127mm)



Capacitors - CapStrate®
Integrating Bulk Capacitance



Close up of space saving surface traces and components on a rectangular CapStrate®

The advantages of **CapStrate®** Dielectrics can be fully realized by replacing discrete capacitors with bulk capacitance from the ceramic substrates. The amount of capacitance that can be utilized varies depending on the design dimensions.

Tables 4 and 5 reference the maximum amount of capacitance that can be designed for dimensional, substrate and voltage constraints.

Typical voltage ratings vary from 100 to 1000V, however, engineers are invited to discuss special voltage requirements not listed below.

Table 4: Rectangular Bulk Capacitance (CapStrate®)

NP0	Length	Width	Thickness	100V	250V	500V	1000V
Maximum Size	2.00" (50.8mm)	1.00" (25.4mm)	0.150" (3.81mm)	5000nF	2500nF	1400nF	940nF
Minimum Size	0.20" (5.08mm)	0.20" (5.08mm)	0.050" (1.27mm)	30nF	9nF	5nF	2.8nF

X7R	Length	Width	Thickness	100V	250V	500V	1000V
Maximum Size	2.00" (50.8mm)	1.00" (25.4mm)	0.150" (3.81mm)	120000nF	60000nF	25000nF	8000nF
Minimum Size	0.20" (5.08mm)	0.20" (5.08mm)	0.050" (1.27mm)	800nF	200nF	70nF	20nF

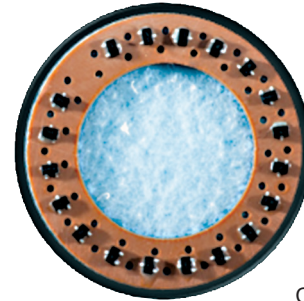
X8R	Length	Width	Thickness	100V	250V	500V	1000V
Maximum Size	2.00" (50.8mm)	1.00" (25.4mm)	0.150" (3.81mm)	84000nF	42000nF	17500nF	5600nF
Minimum Size	0.20" (5.08mm)	0.20" (5.08mm)	0.050" (1.27mm)	560nF	140nF	49nF	14nF



Capacitors - CapStrate®

Integrating Bulk Capacitance Density

- Custom Geometry
- Increased Bulk Capacitance
- High Voltage Capabilities
- Reduction in Size



Circular CapStrate®

Table 5: Circular Bulk Capacitance (CapStrate®)

NP0	Diameter	Thickness	100V	250V	500V	1000V	1000V
Maximum Size	2.00" (50.8mm)	0.150" (3.81mm)	7600nF	3800nF	2600nF	1400nF	940nF
Minimum Size	0.20" (5.08mm)	0.050" (1.27mm)	25nF	6nF	3nF	1.7nF	2.8nF

X7R	Diameter	Thickness	100V	250V	500V	1000V	1000V
Maximum Size	2.00" (50.8mm)	0.150" (3.81mm)	180000nF	95000nF	40000nF	12000nF	8000nF
Minimum Size	0.20" (5.08mm)	0.050" (1.27mm)	550nF	140nF	45nF	15nF	20nF

X8R	Diameter	Thickness	100V	250V	500V	1000V	1000V
Maximum Size	2.00" (50.8mm)	0.150" (3.81mm)	126000nF	66500nF	28000nF	8400nF	5600nF
Minimum Size	0.20" (5.08mm)	0.050" (1.27mm)	385nF	98nF	31.5nF	10.5nF	14nF

Additional sizes and form factors not listed are possible. Contact Johanson to assess the feasibility of your design. Reference table 6 for the maximum capacitance density that can be used for a given substrate. **Capacitance density is presented in nF/(mils)³. This is the maximum amount of capacitance available in each volume.**

Table 6: Max Capacitance Density

Rectangular	X7R	NP0	X8R	Circular	X7R	NP0	X8R
100V	4.00E-04	1.67E-05	2.80E-04	100V	3.82E-04	1.61E-02	1.13E-02
250V	2.00E-04	8.33E-06	1.40E-04	250V	2.02E-04	8.10E-03	5.67E-03
500V	8.33E-05	4.67E-06	5.83E-05	500V	8.49E-05	5.51E-03	3.86E-03
1000V	2.67E-05	3.13E-06	1.87E-05	1000V	2.54E-05	2.97E-03	2.08E-03



Capacitors - CapStrate®
Metallization/Solder Pad

Johanson Dielectrics offers a variety of metallization schemes that are high reliability conductors. These metals can be utilized as conductors, solder pads, or methods of thermal transfer. Designers should select the available metal based on the metallization properties that best suit their design. Careful selection of particular metallizations is dependent on requirements for solderability, temperature resistance, and electrical performance.

Table 7: Metallization Schemes Available

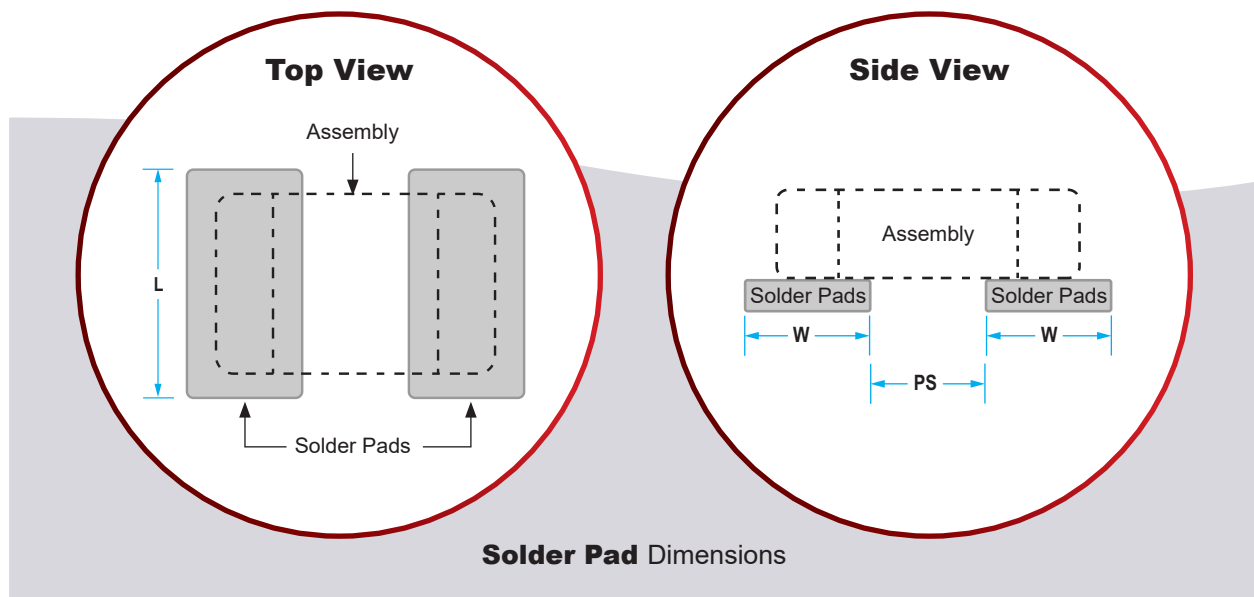
Dielectric	Ag / Pt	Ni / Au	Ag / Ni / Au
X7R	X	X	-
X8R	X	X	-
NP0	X	-	X

Table 8: Metallization Properties

Material Property	Ag / Pt	Ni / Au	Ag / Ni / Au
Recommended Thickness	14µm	7-12µ"	Contact Factory
Max Solder Temp	218°C	260°C	230°C

Table 9: Solder Pad Dimensions

Metallization	Length (Minimum)	Width (Minimum)	Pad Spacing (Minimum)
Ag/Pt	0.015" (0.381mm)	0.010" (0.254mm)	0.007" (0.178mm)
Ni/Au	0.015" (0.381mm)	0.010" (0.254mm)	0.007" (0.178mm)
Ag/Ni/Au	0.015" (0.381mm)	0.010" (0.254mm)	0.007" (0.178mm)



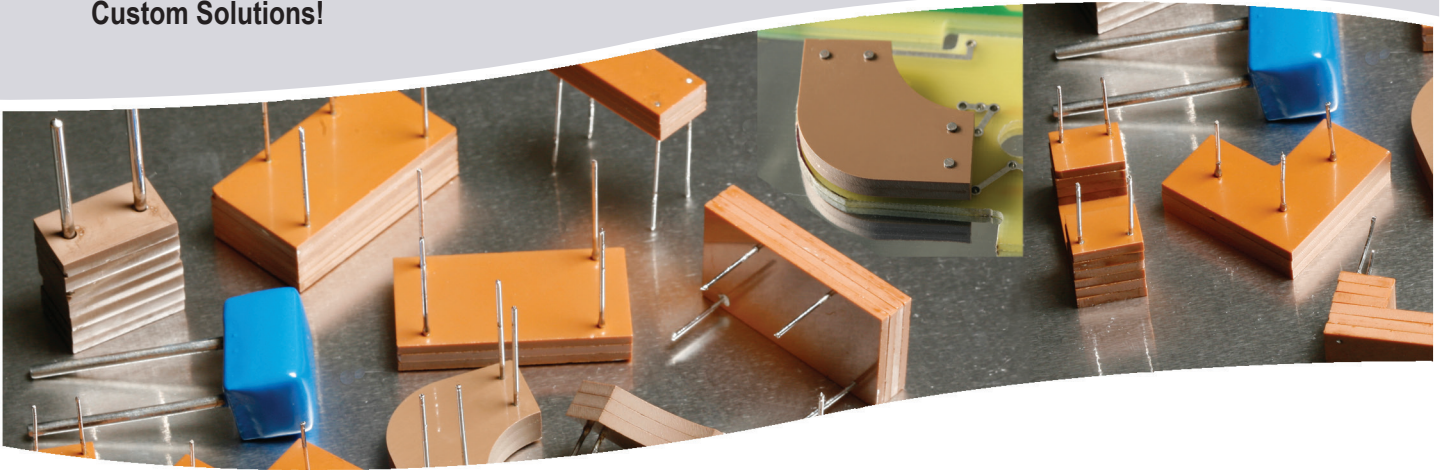
Contact technical team: <https://www.johansondielectrics.com/ask-a-question>



Capacitors

Custom Shape Bulk Capacitance (Custom Solutions)

Custom Solutions!



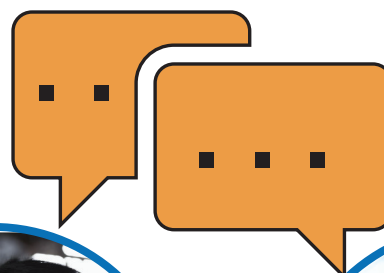
Another custom approach is our variable pitch design. No longer are you limited to a vendor's standard catalog

offering or only square or rectangular custom designs. We let you become your own capacitor designer by not only telling us the desired capacitance and voltage, but also the size, shape, and location of leads!

This process helps insure that the resulting capacitor satisfies every aspect of your design requirements.

Features

- Custom shapes to fit specific requirements
- Multiple capacitors in a single assembly
- Multiple pin, lead-frame, and flying wire options
- Bare ceramic, epoxy coated, potted solutions
- NP0/COG and X7R solutions from -55°C to + 125°C



Send us your
unique design
requirements

Contact Johanson today!

<https://www.johansondielectrics.com/ask-a-question>



Don't miss the opportunity to work with our outstanding design engineers. Visit our website for more information. We look forward to assisting you with your unique design requirements. See "RESOURCE" below.