Evans GROUP

Eliminating Wirebonds in RF Modules: A New Class of Low-ESL Capacitors

April 2026

A Specialized and Comprehensive Capacitor Portfolio for Mission-Critical Systems

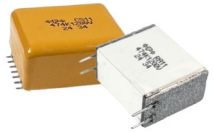
Evans

Hybrid Wet Tantalum

Evans hybrid wet tantalum capacitors are the most power dense in the industry, providing significant SWaP-savings compared to traditional capacitor technologies.

www.evans-group.com/evans
evans@evans-group.com

Locations:
E. Providence, RI
Sanford, ME
Phoenix, AZ



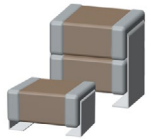
Paktron

Multilayer Polymer (MPL) Film

Paktron's multilayer polymer film capacitors offer an alternative to ceramic capacitors in specific "cannot fail" applications that demand robust mechanical & electrical solutions.

www.evans-group.com/paktron
paktron@evans-group.com

Location:
Lynchburg, VA



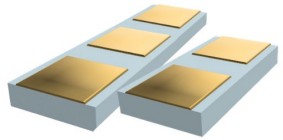
UTC

Multilayer Ceramic (MLCC)

UTC manufactures COTS and custom engineered high-reliability multi-layer ceramic chip capacitors (MLCCs) and leaded devices at their DLA 790 facility, approved to produce MIL-PRF 49470 parts, in addition to other DLA/DSCC drawings.

www.evans-group.com/utc
utc@evans-group.com

Location:
Monterey Park, CA



Eulex

RF/High Frequency Ceramic

Eulex pioneered an embedded-electrode RF capacitor architecture that delivers an order-of-magnitude increase in capacitance density with ultra-low parasitics in a hi-reliability, surface mount package.

www.evans-group.com/eulex
eulex@evans-group.com

Location:
Monterey Park, CA

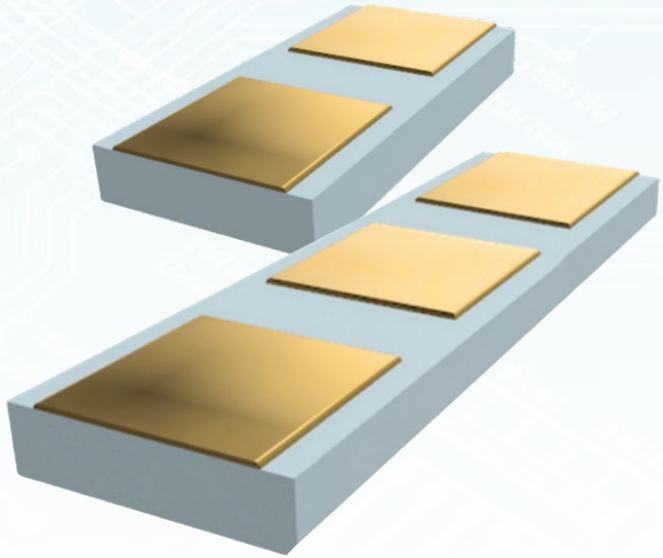
US-based Manufacturers

Quick Snapshot

	Capacitor Type	Frequency Range	Voltage Range	Capacitance Range	Core Market Segment	Core Products
Evans	Hybrid Wet Tantalum	DC-10Khz	10VDC-125VDC Up to 700V Banks	22 µF - 1F	• Mil-Aero • Oil & Gas • Space • Power Holdup • VPX Systems	• COTS Hybrid Capacitors • COTS Capacitor Banks • Custom Connectorized Banks
UTC	Multi-layer Ceramic (MLCC)	DC - 1MHz	6.3V - 10KV	0.1 pF – 220 µF	• MIL-PRF-49470 “B" and “T" level • Military and Space • MIL-PRF-31033 and MIL-PRF-28861	• SMPS • MLCC (4V-12kV) • High Temp (300°C) • Planar Arrays • Discoidal • Radial Leaded (1kV-10kV) • Military (QPL) • MegaCap (BC Series) • PULSE ENERGY CAPS
Paktron	Stacked, Multi-layer Polymer (MLP)	DC - 1MHz	50V - 1200V	0.1 µF - 42 µF	• Switch-Mode Power Supplies • Mil-Aero • Power Conversion • Automotive • Industrial • DC-LINK • VPX Systems	• Multilayer Polymer (MLP) • Advanced Polymer • Thru-Hole/SMD • RC snubber Network
Eulex	High-Frequency (RF) Ceramic	1MHz to >100GHz	6.3V - 1500V	0.02 pF - 220 nF	• Industrial High-Frequency • Microwave • Millimeter-Wave • 5G Applications	• Broadband Capacitors • Vertical Layer • Ultra-High-Q • Single Layer Binary • Substrates

Evans GROUP

EULEX



Eulex is the pioneer of an embedded-electrode RF capacitor architecture that delivers an order-of-magnitude increase in capacitance density with ultra-low parasitics.

US-based Manufacturers

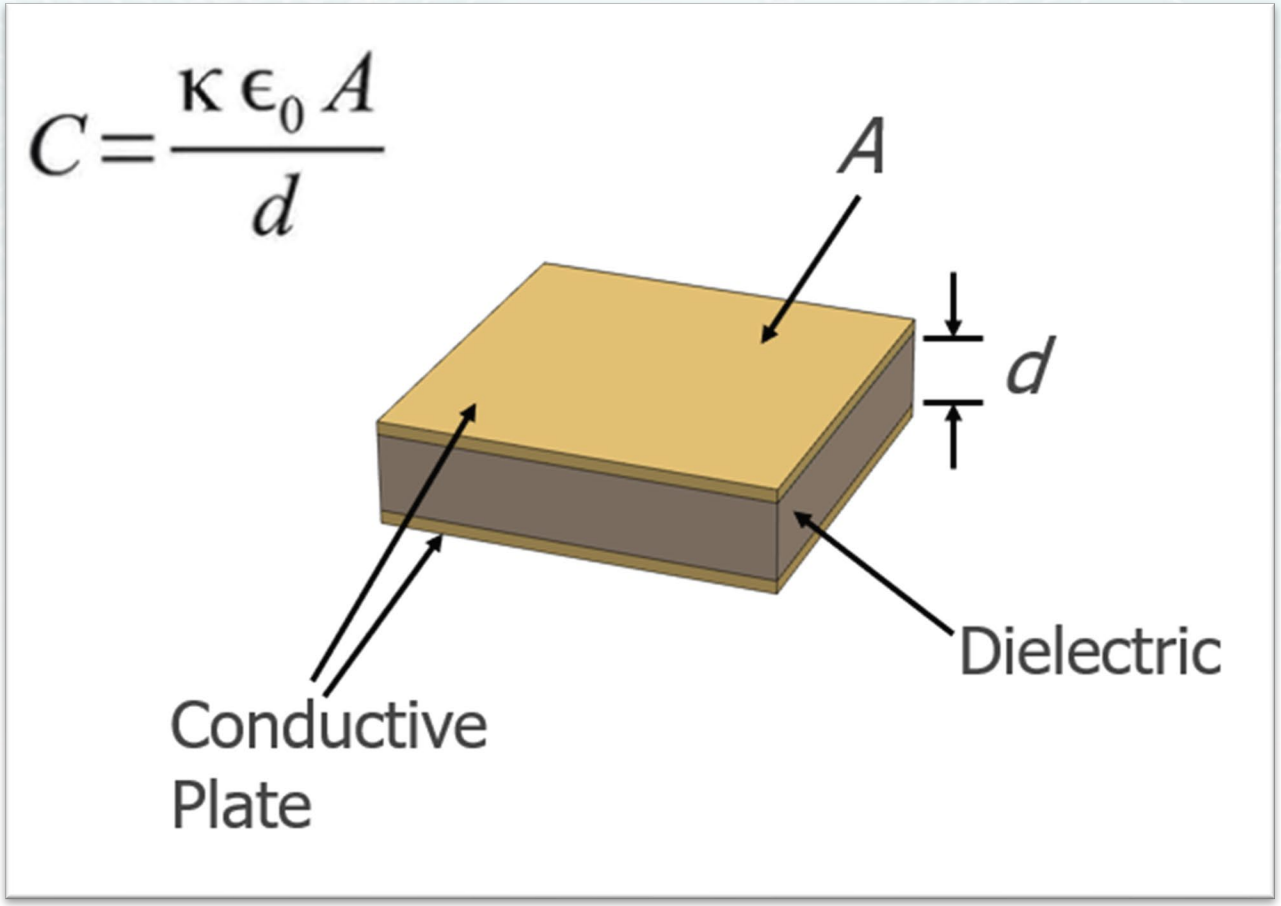
Evans Group – UTC/Eulex

- Location: 718 Monterey Pass Road, Monterey Park, CA 91754
- Founded in 1991 as UTC (Union Technology Corporation)
- 2003 certified by DSCC for Quality Management System to MIL-STD-790
- 2005 DSCC qualified UTC for 50V, 100V and 500V SMPS products to MIL-PRF-49470
- 2021 M&A by Quantic Electronics to become Quantic UTC / Eulex, later rebranding as Evans Group
- ISO 9001:2015 Certified
- ITAR Registered
- 55 employees, 1 shift
- 2 buildings, approximately 20,000 Sq ft
- 55 full time employees, Business Breakdown:
  - 70% Military, 30% Commercial

Motivation: Pushing the limits of the Discrete Single Layer Cap

Advantages of Discrete Single Layer Capacitors (SLC)

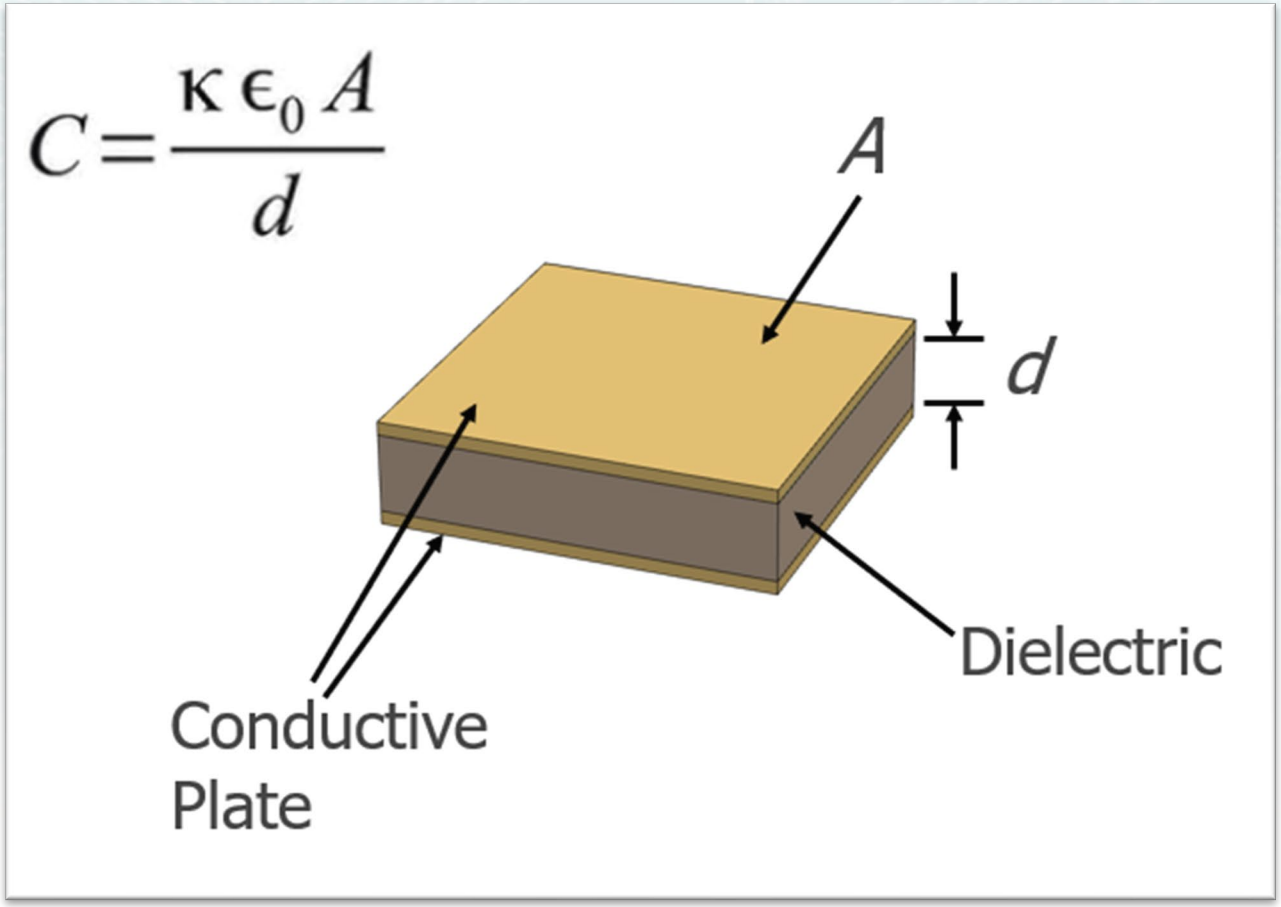
- Simplest form of a capacitor
- Closest approximation to an "Ideal Capacitor"
- Ceramic dielectric
- Monolithic, wafer-scale device
- Low Equivalent Series Resistance (ESR)
- Low dielectric loss
- High Self Resonant Frequency (SRF)



Motivation: Pushing the limits of the Discrete Single Layer Cap

Disadvantages of Discrete Single Layer Capacitors (SLC)

- Limited maximum capacitance
  - Temperature stability and dielectric loss increases as K increased
  - Size gets too large if electrode area is increased
  - Component gets too fragile/brittle is thickness decreased
- Epoxy can climb walls
  - Increased risk of electrical shorts
  - Concentrated field lines accelerates dielectric fatigue
- Requires wire bonding
  - Specialized equipment needed
  - Increases inductance and limits high frequency use
  - Loop height, physical position introduces RF variations
- Limited rated working voltage
  - Thicker parts are needed to support higher voltages but this brings greater dielectric loss
  - Arc'ing through air to bottom electrode or die-attach media (solder/epoxy) may occur with transients

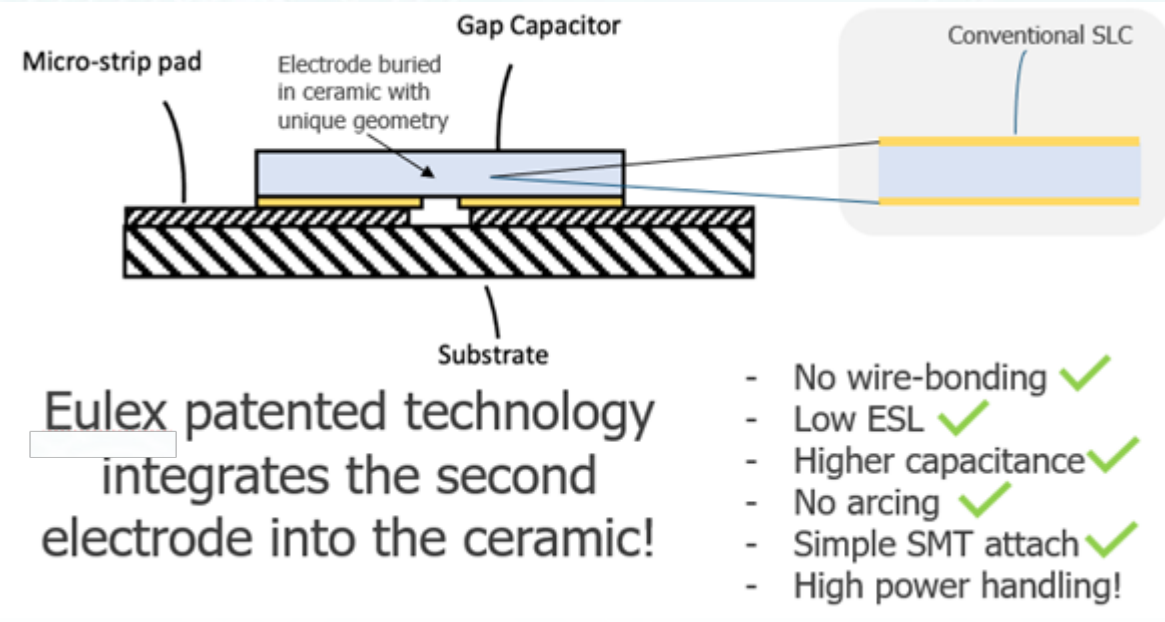


Introducing Eulex XG Series Capacitors

Evans

Exquisitely simple concept, game-changing performance

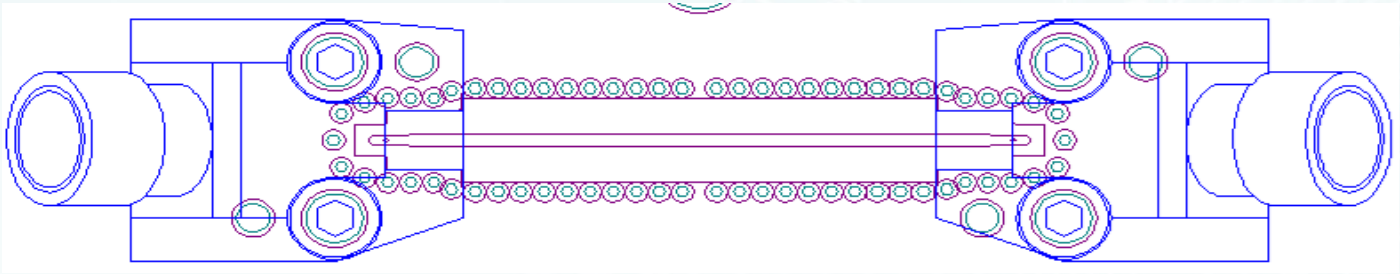
- Convenient SMT compatible form factor
- No wire-bonds needed
- Robust, resistant to fracturing/cracking
- High power handing PME design
- Low loss dielectrics
- Keeps all benefits of SLCs while eliminating the drawbacks
- Perfect for next generation high frequency RF designs
- … and MIL-aero ready!

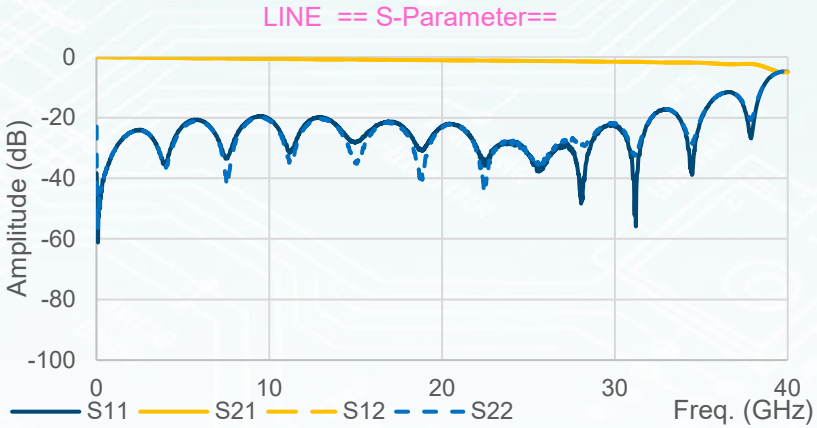


Introducing Eulex XG Series Capacitors

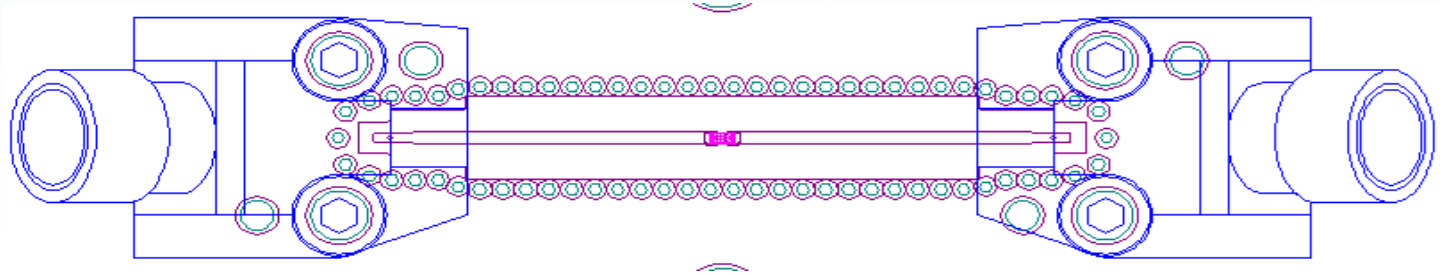
Industry Lowest ESL.. 10pH to 30pH depending on case size.

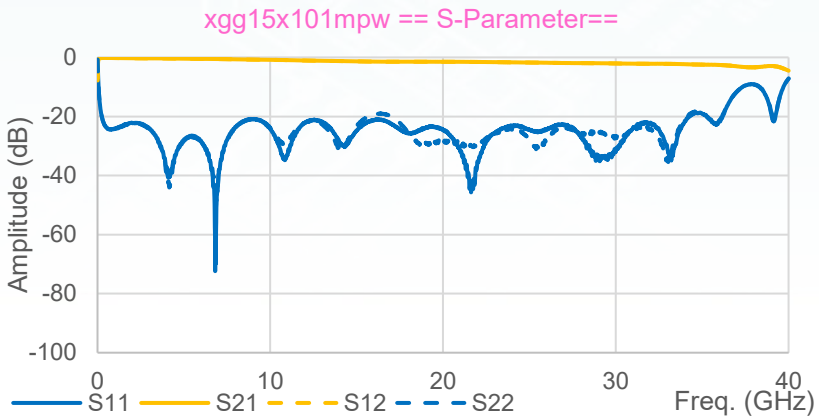
Through Line





Eulex DC Block

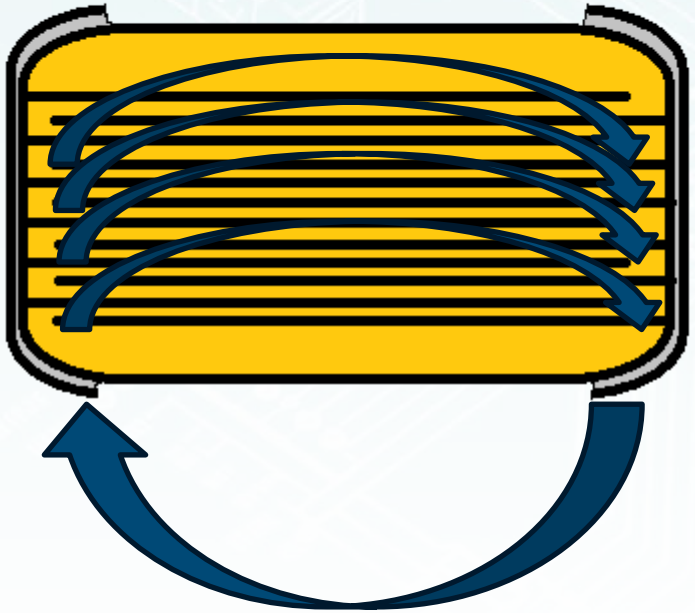


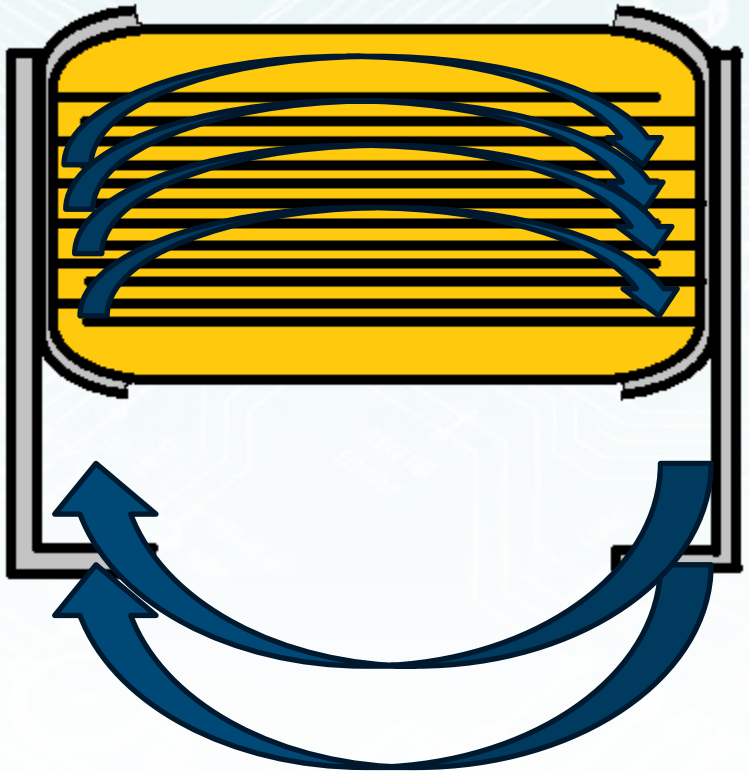


Absolute Minimum Current Loop Area

Active area effectively coplanar with substrate/microstrip

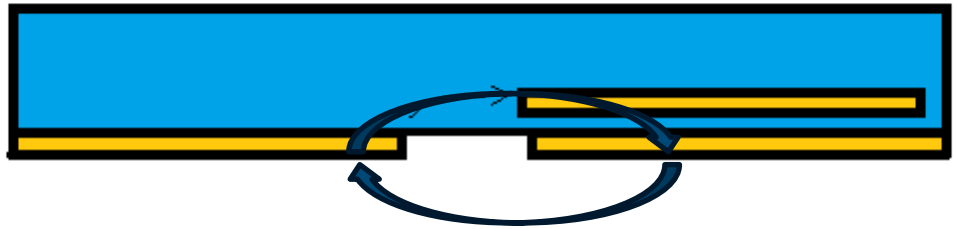
Traditional MLCCs





Leaded MLCCs

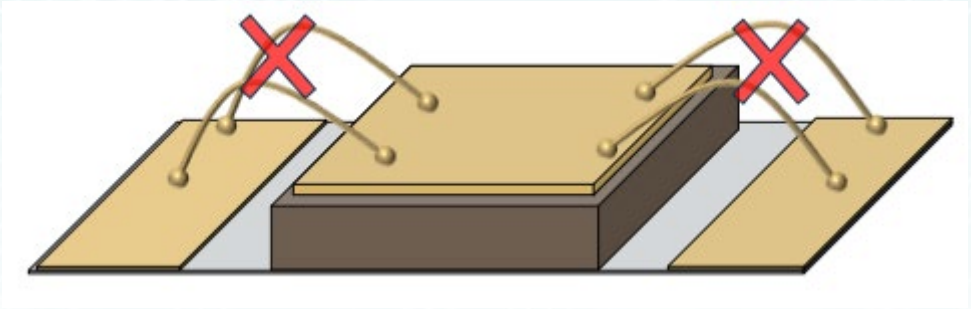
Eulex XG

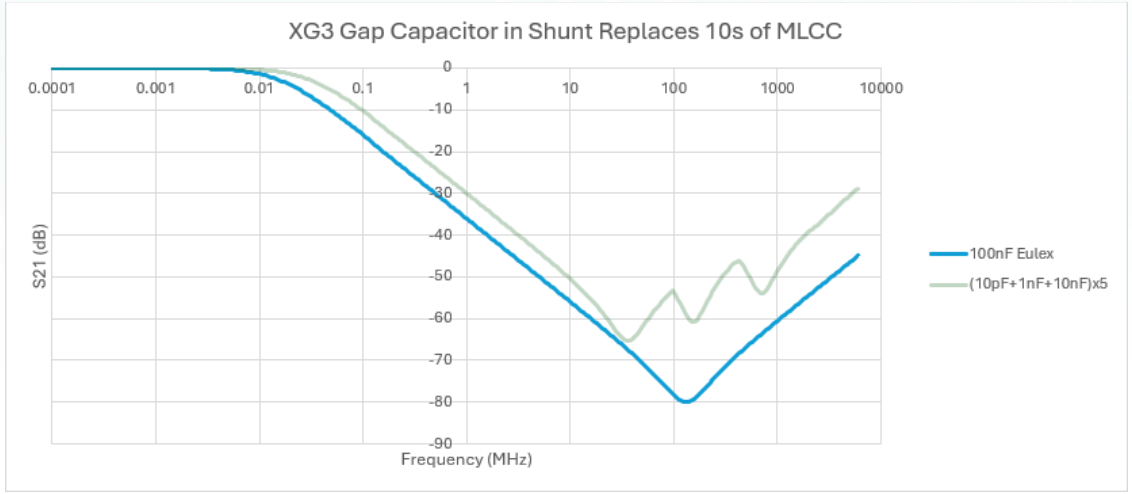


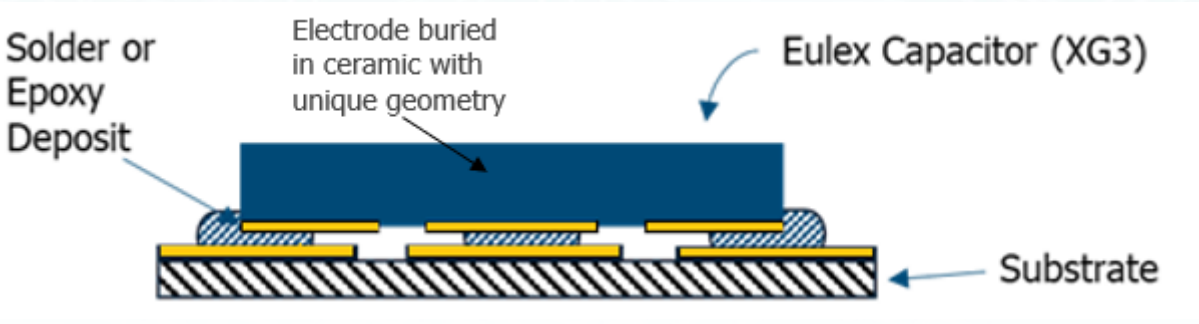
2-Pad and 3-Pad Configurations

XG3 Series 3-Terminal Broadband Filter Capacitors

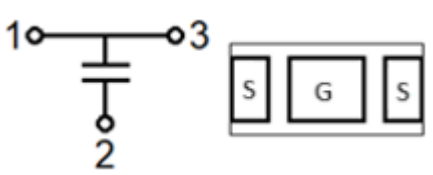
- Up to 100GHz bandwidth
- 30kHz ~ 100GHz >3dB attenuation
- Instant cleanup of DC bias lines
- Replaces 10s of MLCCs in decoupling application
- Form factors starting at 0301 size



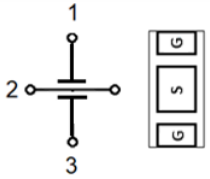




Series Configuration:



Shunt Configuration:

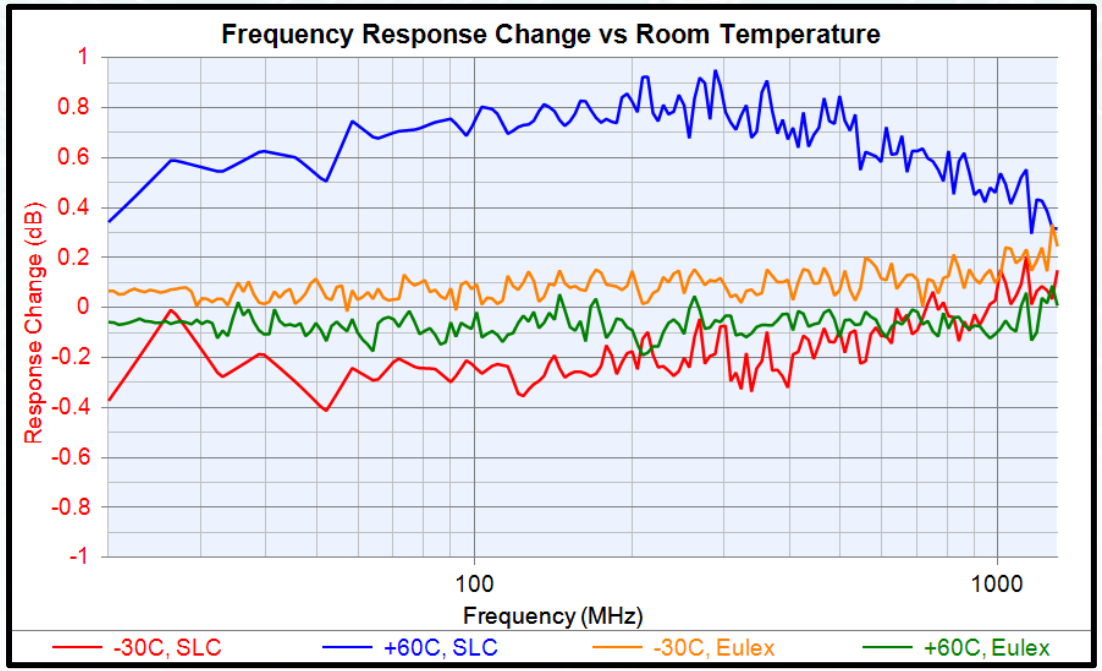


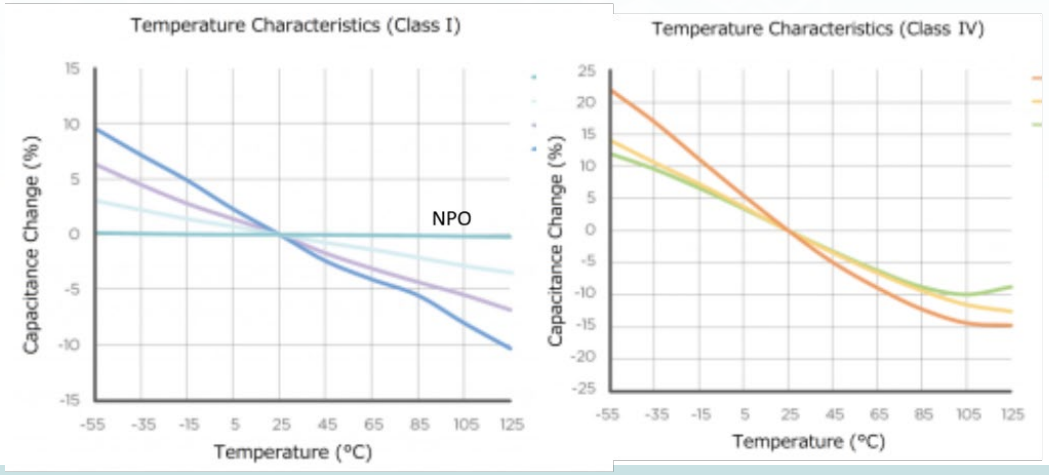
Case Study 1

Bird Technologies

- Problem:
  - SLCs suffer from limited capacitance so need to use class IV (GBBL) type dielectrics to emulate high dielectric constant materials. These X7R or X7S materials shift capacitance over temperature (and bias!) causing the amplifier response to change.
- Solution:
  - Eulex XG series capacitors can match the same capacitance with NP0 materials, minimizing response change over temperature and frequency!

“The Eulex part is our answer to a 5-year search for a better capacitor that has Class I stability, high capacitance, and great frequency response, allowing our product to better meet our specifications over time and temperature” – Martin Dummermuth, Chief Technologist

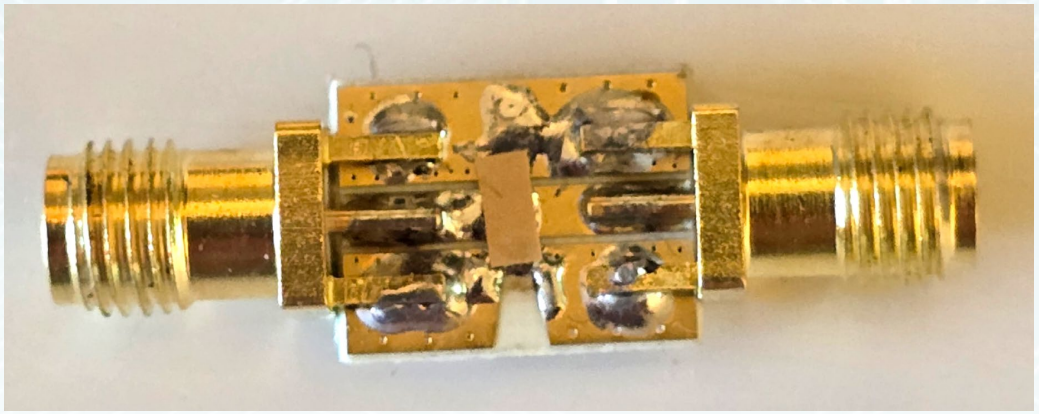


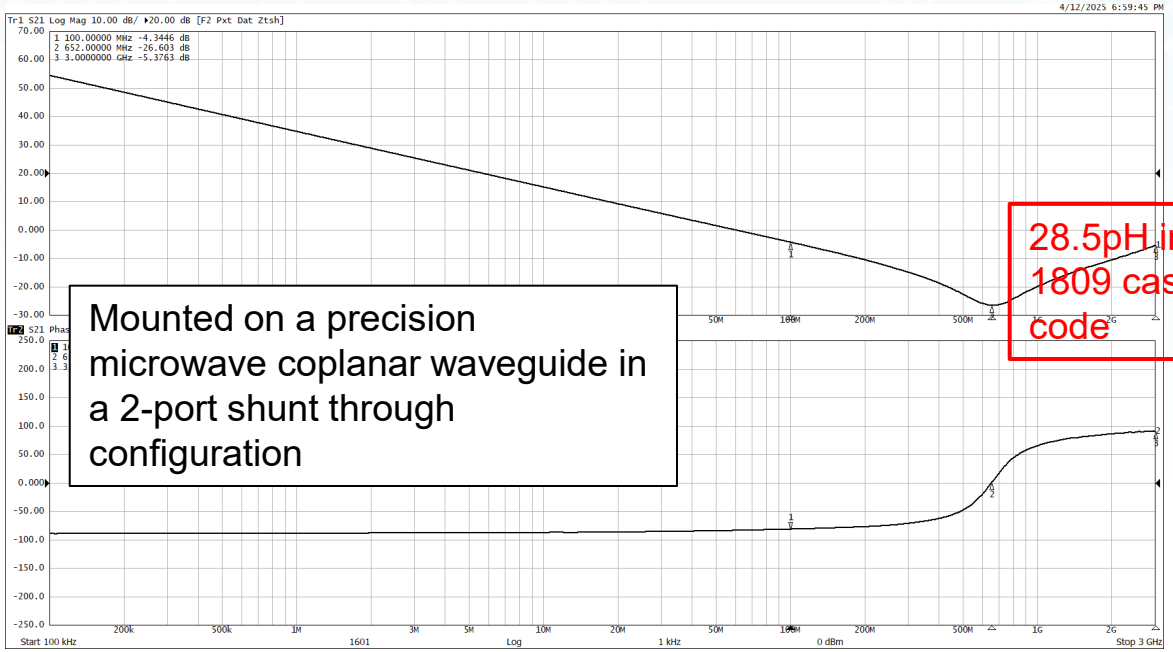


Case Study 2

Picotest

- Picotest, a specialist in low inductance measurements, was searching for new components for last millimeter decoupling in AI/datacenter power delivery networks.
- The unique geometry of Eulex XG series capacitors realizes industry lowest ESL, unlocking applications at frequencies up to 120GHz.
- Nominal capacitance ranges from 0.02pF to 100nF
- Up to 500W CW power handling in 1206 package
- High dielectric strength with breakdown voltages up to 3kV.

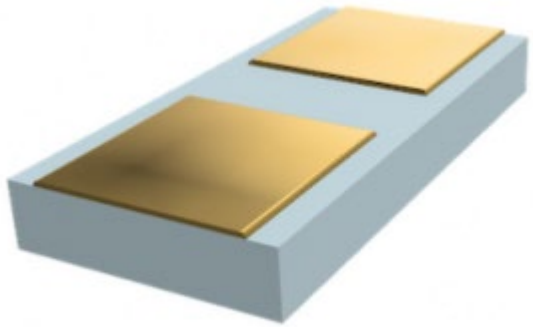




3 Technologies, One NEW Standard

SLCs
0.1pF ~ 1000pF
6.3V ~ 100V
10x10 mils and up
Application: DC block, bare die decoupling

Governing spec:
MIL-PRF-49464
(canceled)



Eulex XG Series
0.02pF ~ 100nF
6.3V ~ 1kV
20x10 mils and up
Application: **Broadband** DC block, bare and packaged die decoupling

Governing spec:
DLA Drawing 26002
(DRAFT)

MLCCs
0.1pF ~ 100uF
6.3V ~ 20kV
12x8 mils and up
Application: DC block, packaged die decoupling

Governing spec:
MIL-PRF-123, MIL-PRF-49467, others

DLA Drawing 26002

- DLA authored drawing/specification.
- Group A and Group B inspection
- Additional upscreening available (class K, etc.)
- Made in USA
- Gold or platinum electrodes
- S-parameters available upon request

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202-108	-	Method 108, Life (at Elevated Ambient Temperature)
MIL-STD-202-301	-	Method 301, Dielectric Withstanding Voltage
MIL-STD-202-302	-	Method 302, Insulation Resistance
MIL-STD-202-305	-	Method 305, Capacitance
MIL-STD-883	-	Test Methods and Procedures for Microelectronics

1. SCOPE

1.1 Scope. This drawing describes the general requirements for ceramic, single layer, 2 terminal, gap capacitors. These capacitors are intended for advanced broadband and RF applications.

1.2 Part or Identifying Number (PIN). The complete PIN is as follows:

26002	A	15	N	100	K	P	B
Drawing number	Rated voltage (see 1.2.1)	Case size (see 1.2.2)	Dielectric type (see 1.2.3)	Capacitance (see 1.2.4)	Capacitance tolerance (see 1.2.5)	Termination finish (see 1.2.6)	Group B testing option (see 1.2.7)

1.2.1 Rated voltage. The rated voltage for continuous operation at +125°C is identified by a single letter as shown in table I.

TABLE I. Rated voltage.

Symbol	Rated voltage (V_{DC})
A	6.3
C	10
E	16
L	25
G	50
B	100

1.2.2 Case size. The case size is identified by a two-digit number (see figure 1).

1.2.3 Dielectric type. The dielectric type is identified by a single letter as shown in table II.

TABLE II. Dielectric type.

Symbol	Material	Temperature coefficient	Temperature range
P	Porcelain	Neg.	-55°C to +125°C
Q	Class I (NPQ)	± 25 ppm	-55°C to +125°C
N	Class I (NPO)	± 30 ppm	-55°C to +125°C
C	Class I (NPS)	+ 0, - 5%	-55°C to +125°C
X	Class II (X7R)	± 15%	-55°C to +125°C
Y	Class III (Y5V)	+ 22%, -85%	-30°C to +85°C

1.2.4 Capacitance. The nominal capacitance value expressed in picofarads (pF) is identified by a three-digit number; the first two digits represent significant figures and the last digit specifies the number of zeros to follow. When the nominal value is less than 10 pF, the letter "R" is used to indicate the decimal point and the succeeding digit(s) of the group represent significant figure(s). For example, 1R0 indicates 1.0 pF and 0R5 indicates 0.5 pF.

1.2.5 Capacitance tolerance. The capacitance tolerance is identified by a single letter in accordance with table III.

TABLE III. Capacitance tolerance.

Symbol	Capacitance tolerance
B	± .10 pF
C	± .25 pF
D	± .50 pF
G	± 2 percent
J	± 5 percent
K	± 10 percent
M	± 20 percent
N	± 30 percent
P	+ 100, -0 percent
Z	+ 80, -20 percent

DLA WEAPONS SUPPORT (COLUMBUS) COLUMBUS, OHIO	SIZE A	CAGE CODE 037Z3	DWG NO. 26002
		REV	PAGE 2

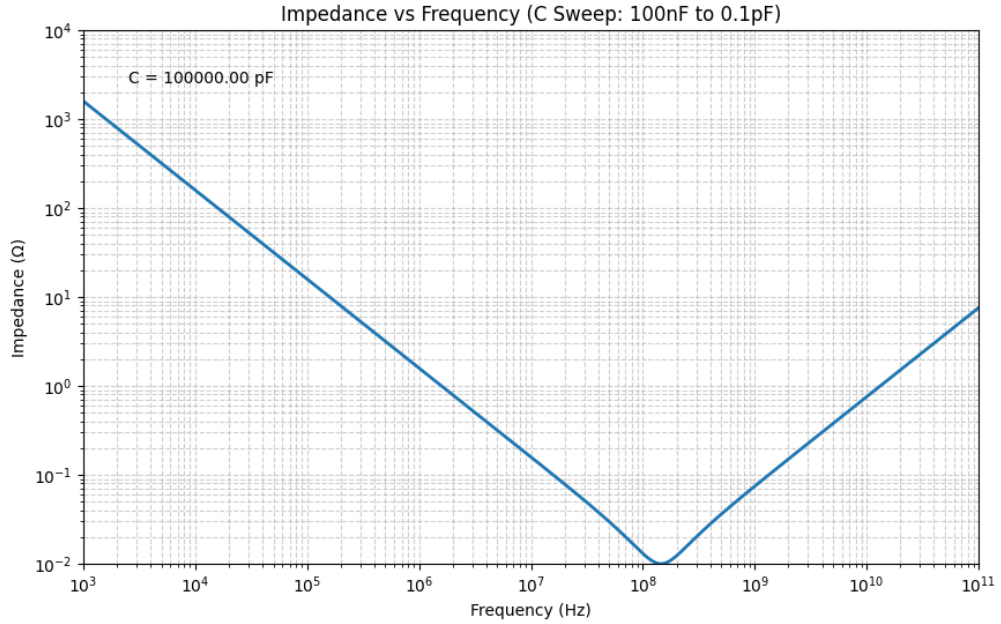
What about the Q?

The Q factor for a capacitor is given by:

$$Q = \frac{1}{\omega C R_{ESR}} = \frac{1}{\tan \delta}$$

- **What Makes a Capacitor Have High Q?**
- **Low ESR (Equivalent Series Resistance) =>** Lower ESR = lower power losses = higher Q = higher power handling.
- **Low Dissipation Factor (DF) =>** Dissipation is the ratio of ESR to capacitive reactance. A low DF means lower energy lost as heat.
- **Dielectric Material =>** High-Q capacitors use **low-loss dielectrics** such as NP0/C0G ceramics (very stable, low DF)
- **Construction and Geometry =>** Short leads, large surface areas, and optimized internal layout to reduce ESR and inductance.

- **Operating Frequency =>** Q varies with frequency—Impedance typically decreases as frequency increases for a given capacitance until **parasitics (like ESL)** begin to dominate



Design Kits

Eulex Patented Gap Capacitor kits: True SLC performance in a surface mount form factor Excellent solution for strip-line or coplanar wave-guide applications.

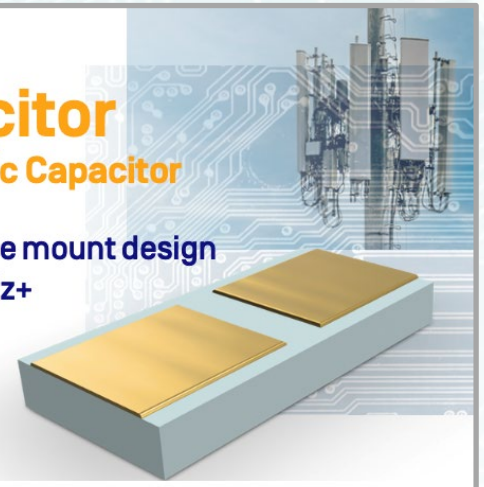
DC blocking, coupling, RF Bypass, filtering, tuning for: RF Modules, MW-filters, Pin diode RF switches, Test & Measurement, Photonics (Synchronous Optical Networking (SONET), Receive and Transmit Optical Sub-Assemblies (ROSA/TOSA), Trans-Impedance Amplifiers (TIA).

XGE10X300MGW	0201	30pF	16V	3pcs
XGE10Y201MPW	0201	200pF	16V	3pcs
XGG15P0R5BGW	0402	0.5pF	50V	3pcs
XGG15P0R7BGW	0402	0.7pF	50V	3pcs
XGG15P1R0CGW	0402	1.0pF	50V	3pcs
XGG15Q1R5CGW	0402	1.5pF	50V	3pcs
XGG15Q2R0CGW	0402	2.0pF	50V	3pcs
XGG15N100MGW	0402	10pF	50V	3pcs
XGG15C300MGW	0402	30pF	50V	3pcs
XGG15X101MGW	0402	100pF	50V	3pcs
XGG15X181MGW	0402	180pF	50V	3pcs
XGG15Y122MPW	0402	1200pF	50V	3pcs
XGG25Y322MPW	0603	3200pF	50V	3pcs

Eulex Gap Capacitor

Microwave/mm-wave Ceramic Capacitor

- True SLC performance in surface mount design
- Ultra-low loss from kHz to 67GHz+
- Highest capacitance available



Design Kit: XG-KIT-16V-50V-01

Case Size:	**0201, 0402, 0603**
Working Voltage:	**16V & 50V**
Operating Temperature:	**-55 to 85/125°C**
Dielectric	**NP0, X7R, Y5V**
Characteristics:	**0.5 to 3200pF**
Capacitance Values:	**B, C, & M**
Capacitance Tolerance:	

RoHS

Evans GROUP UTC

UTC manufactures high-reliability MLCCs in its DLA MIL-PRF-790–approved facility, COTS and custom solutions

US-based Manufacturers

Evans GROUP
UTC

Evans GROUP

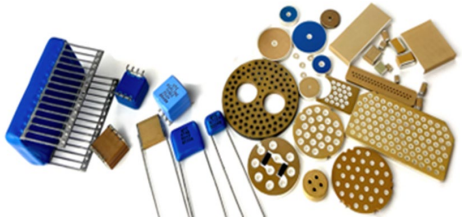
UTC manufactures high-reliability MLCCs in its DLA MIL-PRF-790–approved facility, using advanced dielectric materials, modern equipment, and rigorous screening/testing for mission-critical applications.

Features & Benefits

- Approved facility to Mil-Std 790 and approved to produce MIL-PRF 49470 parts to standard (B) level and (T) space level as well as many DLA DSCC drawings
- Product offerings include MLCCs, MegaCap (BC Series), Discoidal and Planar Arrays, Pulse Energy to 250° (Missile Detonation Caps), Military, Safety Caps, Radial Leaded and SMPS capacitors
- Screening/Testing Lab
- Recent expansion to 30,000 sq. ft. manufacturing space
- Brand new 2,500 sq. ft. clean room ISO Class 7 (10,000ppm)
- Brand new state-of-the-art equipment for buildup and routing
- Made in the USA

Typical Applications

- ✓ *Hi-rel military and defense power electronics*
- ✓ *EMI suppression and filtering*
- ✓ *Coupling/decoupling*
- ✓ *Energy storage and pulse discharge circuits*
- ✓ *Power supply filtering (input/output filtering in DC/DC converters)*
- ✓ *Aerospace avionics systems*
- ✓ *Munitions*
- ✓ *Missile guidance and control electronics*
- ✓ *Spacecraft payload and bus electronics*
- ✓ *Communications equipment (satcom, tactical radios)*



UTC Products

MLCC

- Voltage Range: 6.3V-12KV
- Cap Range: 1.2pF - 220uF
- Size: 01005 - 13060
- Dielectric: NPO, X7R, X5R
- Application: Industrial and commercial
- **MIL-PRF-32535 (“M” and “T” will be completed in 2025**)

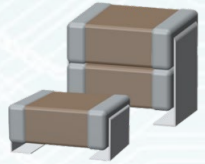
SMPS

- Voltage Range: 50V-500V
- Cap Range: .01uF – 27uF
- Size: Case Code Size 1-6
- Dielectric: NPO, X7R
- **Testing to MIL-PRF-49470 available**
- Application: Military, high end protection

Military

- B Level Voltage: 50V-500V
- Cap Range: 0.15uF - 47uF
- Size: Case Size 3, 4, 5
- Dielectric: BX, BR, BQ
- **Qualified to MIL-PRF-49470 "B"** Level (Military)
- **Qualified to MIL-PRF-49470 ("T")** Level (Space)

MegaCapType (BC Series)

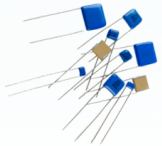


- Voltages to 1000V
- Higher capacitance on same footprint
- Dielectric: COG and X7R
- **AEC-Q200 options available**
- Applications: Industrial Smoothing and Decoupling, resonant charging systems, DC to DC conversion, DC blocking, power supplies

Pulse Energy

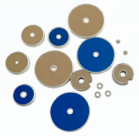
- Available in High temperature up to 250°C
- Up to 10KV range for single and multi-pulse firing applications
- Custom sizes, capacitance, and voltage ranges are available
- **Testing to MIL-PRF-49467** available
- Applications: Missiles, Downhole, detonation

Radial Leaded



- Voltage Range: 250V-10,000V
- Cap Range: .05pF - .68uF
- Size: .25 x .22 to .55 x .28
- Dielectric: NPO, X7R
- **Testing to MIL-PRF-49467** available
- Build in accordance with DSCC 87040, 87043, 87046, 87047, 87070, 87076, 87077, 87081, 89044 and 87114

Discoidal

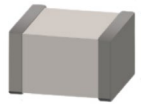


- Cap Range: .05pF – 7.2uF
- Voltage Range: 25V-3000V
- Size: 0502 - 6429
- Temperature Dielectric: NPO, X7R
- **Manufactured to meet or exceed MIL-PRF-31033 and MIL-PRF-28861**
- Application: EMI suppression filter

Planar Arrays

- Voltage Range: 50V-2000V
- Cap Range: 100pF – uF
- Size: Custom/Standard: Circular, Sub D, ARINC
- Dielectric: NPO, X7R
- **Manufactured to meet or exceed MIL-PRF- 15733 and MIL-PRF-28861**
- Can be built in accordance with MIL-STD- 1651, 1560A, 1669, 1554; C24308 Sub "D" and MIL-V-83723 micro-style arrangements
- Applications: Connectors, low-pass filter

Safety Caps



- Safety standard approval by certificate number: TUV. R-50551491 UL. E529341
- SY2 series are class X1/Y2 compliant
- SX2 series are class X2 compliant
- RoHS and HALOGEN compliant
- Applications: surge or lightning immunity in modems, facsimiles, and other equipment

Pulse Energy Capacitors (200ºC/250ºC)

Extreme Energy Delivery in Extreme Environments

***Testing to MIL-PRF-49467 Available**

Key UTC Differentiators

- Up to 250°C operation (extreme environments)
- Up to 10kV capability for pulse applications
- High energy density dielectric
- Zero aging rate → long-term reliability
- Negative TCC → predictable performance

Why It Matters

- Reliable detonation timing
- Stable output at temperature extremes
- Reduced system size & weight
- Improved safety (bleed resistor option)

Built for

- Downhole
- Missile Systems
- Detonation Applications

Evans GROUP

Thank You