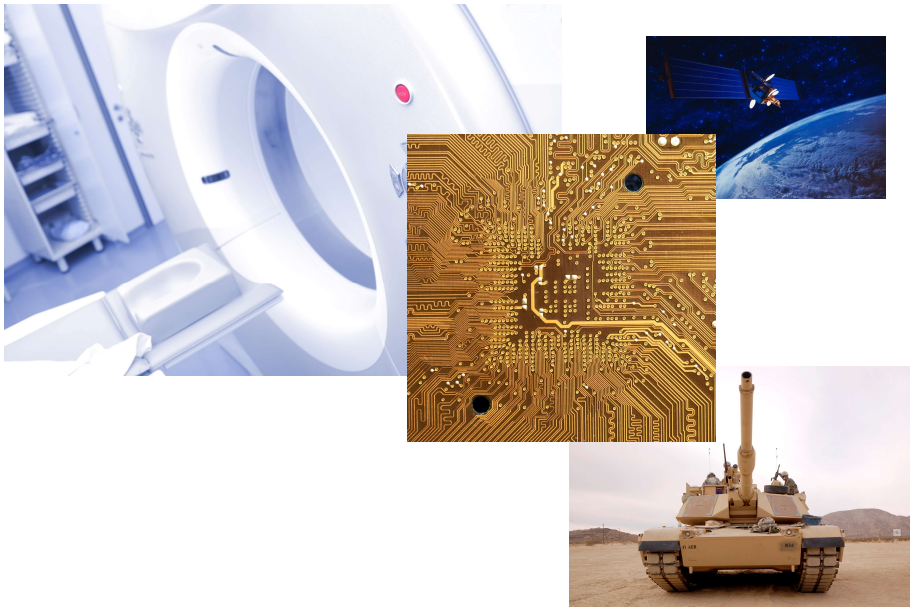
Quantic Eulex®

Revolutionizing High-Frequency Applications: 3-Terminal XG3 Gap Capacitor



Colin McClennan, VP/GM
Quantic Electronics | Capacitors

Alex Moalemi, Founder
Quantic Eulex

Speakers

- Capacitor manufacturing leader with 20+ years of experience in engineering and processes.
- As Vice President and General Manager at Quantic Electronics, he drives strategic initiatives and oversees operations, fostering innovation and organizational growth of the Capacitor Division.
- Board Member since 2007, Southeastern New England Defense Industry Alliance (SENEDIA)

Colin McClennan
VP/GM, Quantic Electronics | Capacitors

- Electrical engineer with over 25 years of experience in the passive components industry.
- Electrical component innovator, having been awarded 3 patents, with additional patents pending.
- Developed passive components for companies such as Presidio, Novacap, Powergenix,and Wright Capacitors, prior to joining Quantic Eulex.

Alex Moalemi
Founder

About Quantic™ Eulex

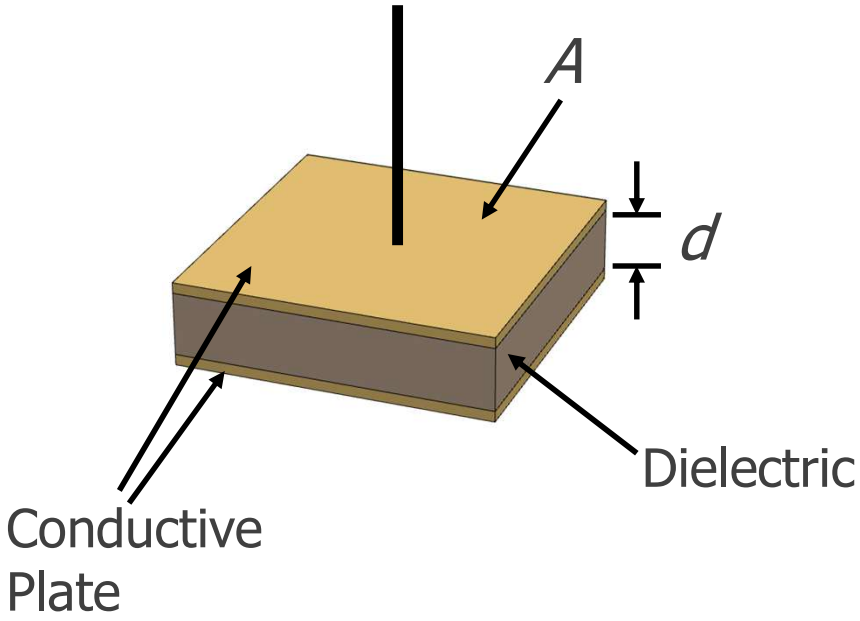
- Quantic™ Eulex, formerly known as Eulex Components, was founded in 2019 by Alex Moalemi.
- Quantic™ Eulex is located in Monterey Park, California.
- The primary objective in forming Quantic™ Eulex was to work on a single layer capacitor (SLC) replacement technology, and that was achieved in 2021 when the company's US Patent was granted.
- Quantic™ Eulex develops innovative ceramic components for the most demanding high-frequency microwave, millimeter-wave, and 5G applications. Their solutions deliver design advantages through small-footprint, low-profile packaging, and a wide voltage range, fully tested up to 70Ghz with a roadmap planned from 6.5 to 100 GHz. The reliability of Quantic™ Eulex capacitors is well-established, at temperatures ranging from -55° to 125°C.

Meeting Performance Needs in High Frequency Applications

The industry's demand for the Eulex 3-Terminal capacitor stems from the need to overcome the limitations of conventional single-layer wire-bondable ceramic capacitors, enabling effective performance in high-frequency applications, including 5G, microwave, and millimeter-wave systems.

Advantages of the Single Layer Capacity (SLC)

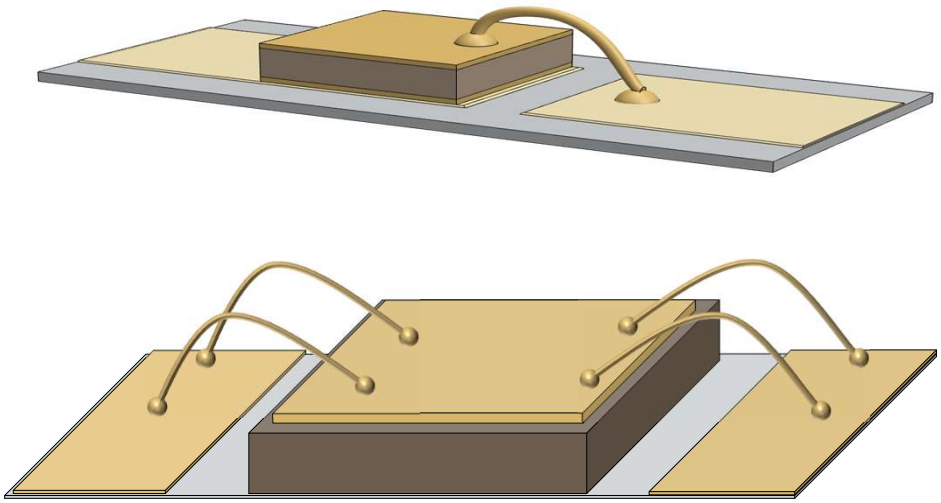
- Capacitor in Simplest Form
- Closest to an “Ideal Capacitor”
- Ceramic Dielectric
- Monolithic Device
- Low Resistivity Electrodes
- Low Equivalent Series Resistivity (ESR)
- Low Dissipative Loss
- High Self Resonant Frequency



Limitations of the SLC in Demanding, High Frequency Applications

$$C = \frac{\varepsilon A}{d}$$

- Capacitance Limitations
- Highly dependent on dielectric constant
- Many dielectrics
- Performance trade-offs as material ε increases
- Wire-Bond
- Expensive equipment
- Manufacturing difficulties
- Reliability
- Performance of circuit (especially at higher frequencies)



SLC Typical Wire-Bond Attachment

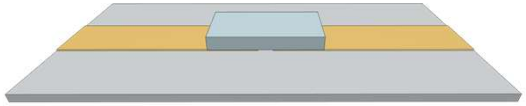
1st Generation: Eulex 2-Terminal Gap Capacitor

Quantic Eulex

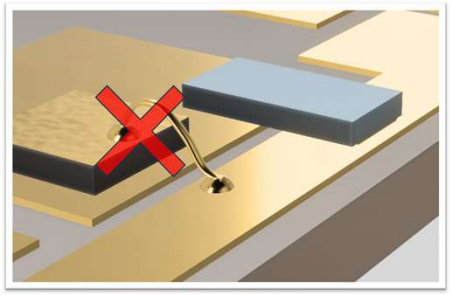
Patented Technology Mitigates Many Limitations of the SLC and Provides 10x Capacitance

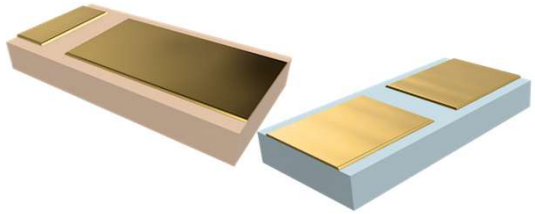
Advantages

- Up to 20x capacitance
- Fewer Dielectrics
- True Single Layer (no vias)
- High Reliability
- No Wire-Bond
- Simpler Part Selection
- Ultra-High Q Dielectrics
- Range of Voltages



Gap capacitor mounted face-down on strip-line





Gap Capacitor Configurations

	Maximum Capacitance / pF															
	100 Volt				50 Volt				16 Volt				6.3 Volt			
	P	NP0	X7R	Max	P	NP0	X7R	Max	P	NP0	X7R	Max	P	NP0	X7R	Max
Company A	X	1.0	82	120	X	X	X	X	X	X	X	X	X	X	X	X
Company B	X	X	X	X	X	X	X	*1400	X	X	X	X	X	X	X	X
Company C	X	X	X	X	0.2	1.5	68	*250	X	X	X	X	X	X	X	X
Company D	0.2	2	68	*820	0.3	2.7	68	*1200	X	X	X	X	X	X	X	X
Eulex	3.3	47	1400	5800	3.9	56	1700	6800	5.6	80	2400	10000	8.7	120	3600	15000

Competitor Comparison (Based on 0804 size device)

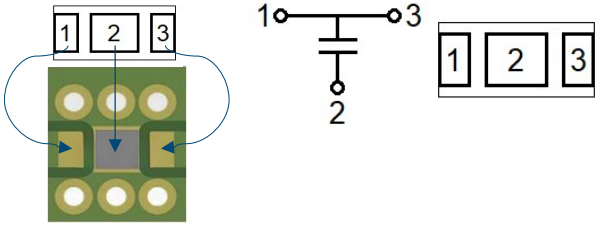
* Uses GBBL dielectric

Filters & Decoupling Capacitors 3-Terminal (XG3) Capacitor

Quantic Eulex

Features:

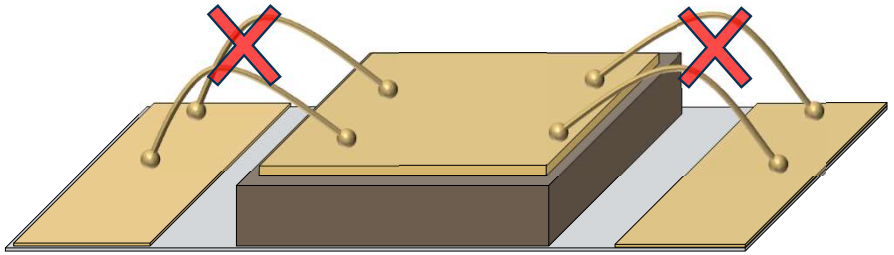
- Single-layer Design: Balanced shunt capacitors for effective EMI filtering and noise attenuation.
- Filtering: Offers exceptional rejection for both single-ended and differential configurations (tested to 70 GHz)
- Low Inductance: Achieved the lowest ESL and maintained temperature stability of less than 0.2 dB, enhancing high-frequency performance and attaining extremely low mounting inductance of the 3-terminal gap capacitor, all within a surface-mountable package..
- Component Reduction: Substitutes SLC/X2Y components with a single EMI filter (XG3).
- Applications: Ideal for amplifier decoupling, high-speed data filtering, and much more.....



3-pad terminal Gap capacitor mounted face-down on GCPW (coplanar waveguide w/GND)

Applications:

- Amplifier Filter and Decoupling
- • High-Speed Data Filtering
- • EMC I/O Filtering
- • FPGA / ASIC/µ-P Decoupling
- • DDR Memory Decoupling



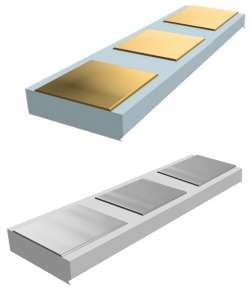
2nd Generation: Eulex 3-Terminal XG3 Capacitor

Quantic Eulex

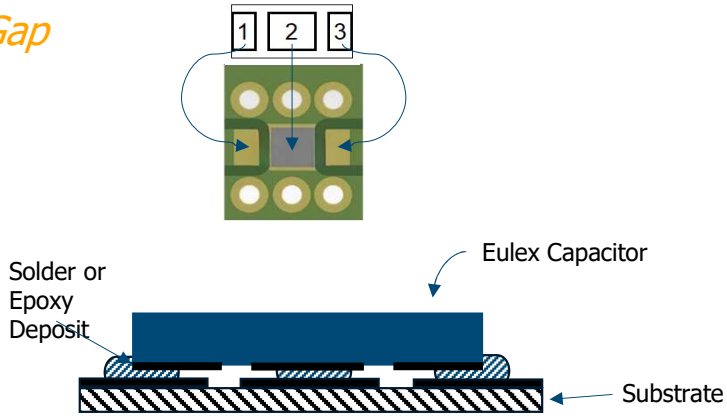
Building upon the success of the 2-Terminal design, the 3-Terminal Eulex Gap Capacitor represents a further refinement of the technology, pushing the boundaries of performance even further.

Advantages

- Negligible Mounting Inductance
- Highest Capacitance
- Fewer Dielectrics
- True-Single Layer (no vias)
- High Reliability
- No Wire-Bond
- Simpler Part Selection
- Ultra-High Q Dielectrics
- Range of Voltages



3-pad Terminal Gap Capacitor Configurations



3-pad terminal Gap capacitor mounted face-down on GCPW (coplanar waveguide w/GND)

6.3V	1809	1707	1507	0602	0502	0301
	Cap (pF)	Cap (pF)	Cap (pF)	Cap (pF)	Cap (pF)	Cap (pF)
P	100	68	39	7.5	5.6	1.2
Q	220	150	82	15	12	3.0
N	700	500	270	56	40	10
C	3200	2200	1200	240	180	40
X	22000	15000	8200	1600	1200	290
Y	100000	68000	37000	7500	5600	1300

Available In 6.3V to 100V

100V	1809	1707	1507	0602	0502	0301
	Cap (pF)	Cap (pF)	Cap (pF)	Cap (pF)	Cap (pF)	Cap (pF)
P	40	27	15	3.0	2.2	0.6
Q	95	65	35	7.0	5.0	1.2
N	300	200	120	22	17	4.0
C	1300	900	500	100	75	18
X	9000	6400	3500	700	530	120
Y	43000	29000	15000	3000	2200	560

Performance Data

Data Courtesy of Bird Technologies® and Quantic PMI PLANAR MONOLITHICS

Quantic Eulex®

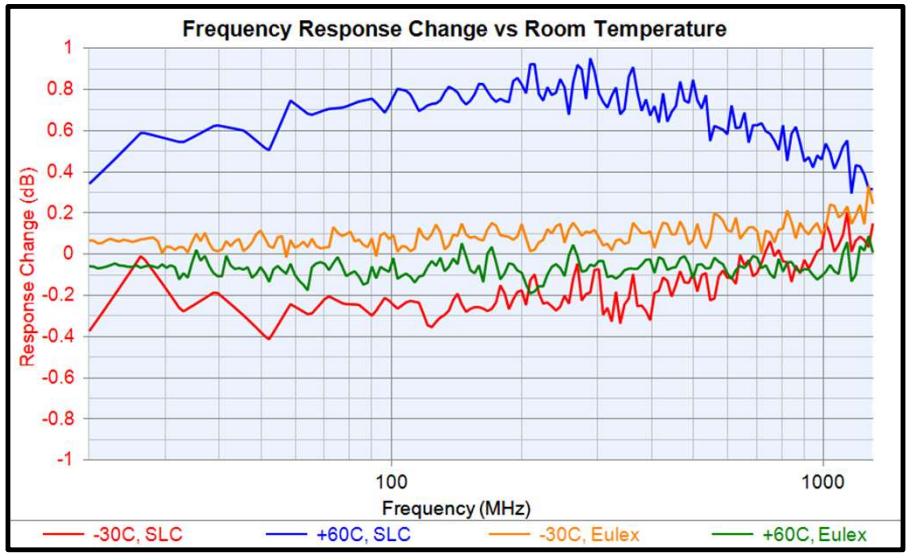
Our circuit was in need of a capacitor with 2 major requirements:

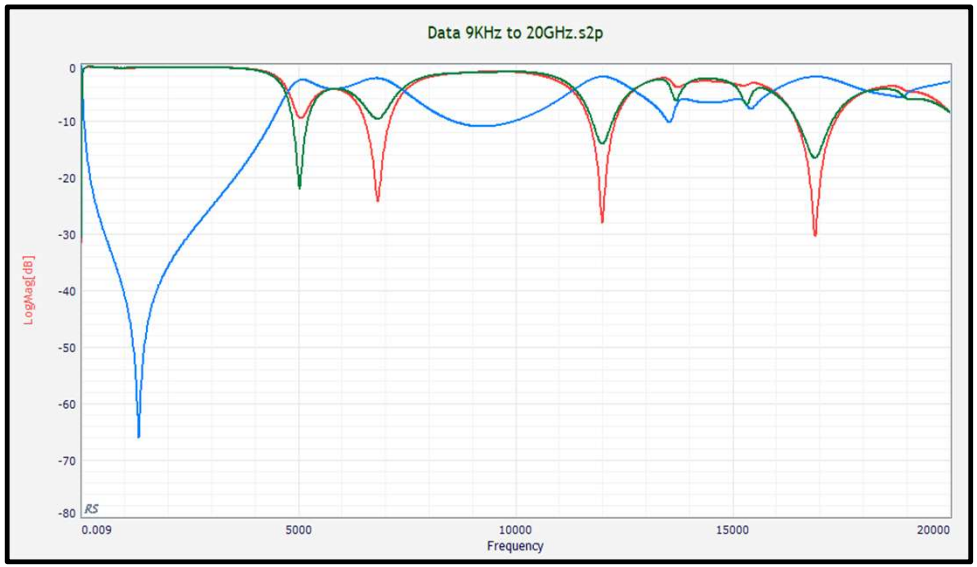
Exceptional high-frequency response that was typically only available with a single-layer capacitor (SCL)Relatively high capacitance value (270pF) with NPO-type stability

XG3A150N271KPW

Resonant Frequency is 1.6GHz, and the ESL of 28pH

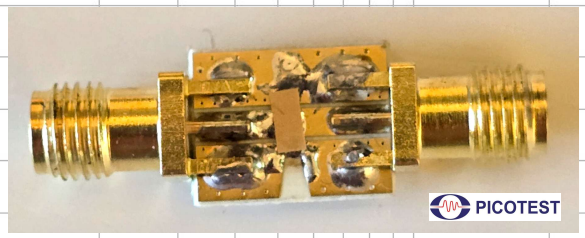
Grounded coplanar waveguide (SLC vs 3-pad Terminal)





"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

Mounted for 2-Port Shunt Through Measurement on PicoTest BODE 500

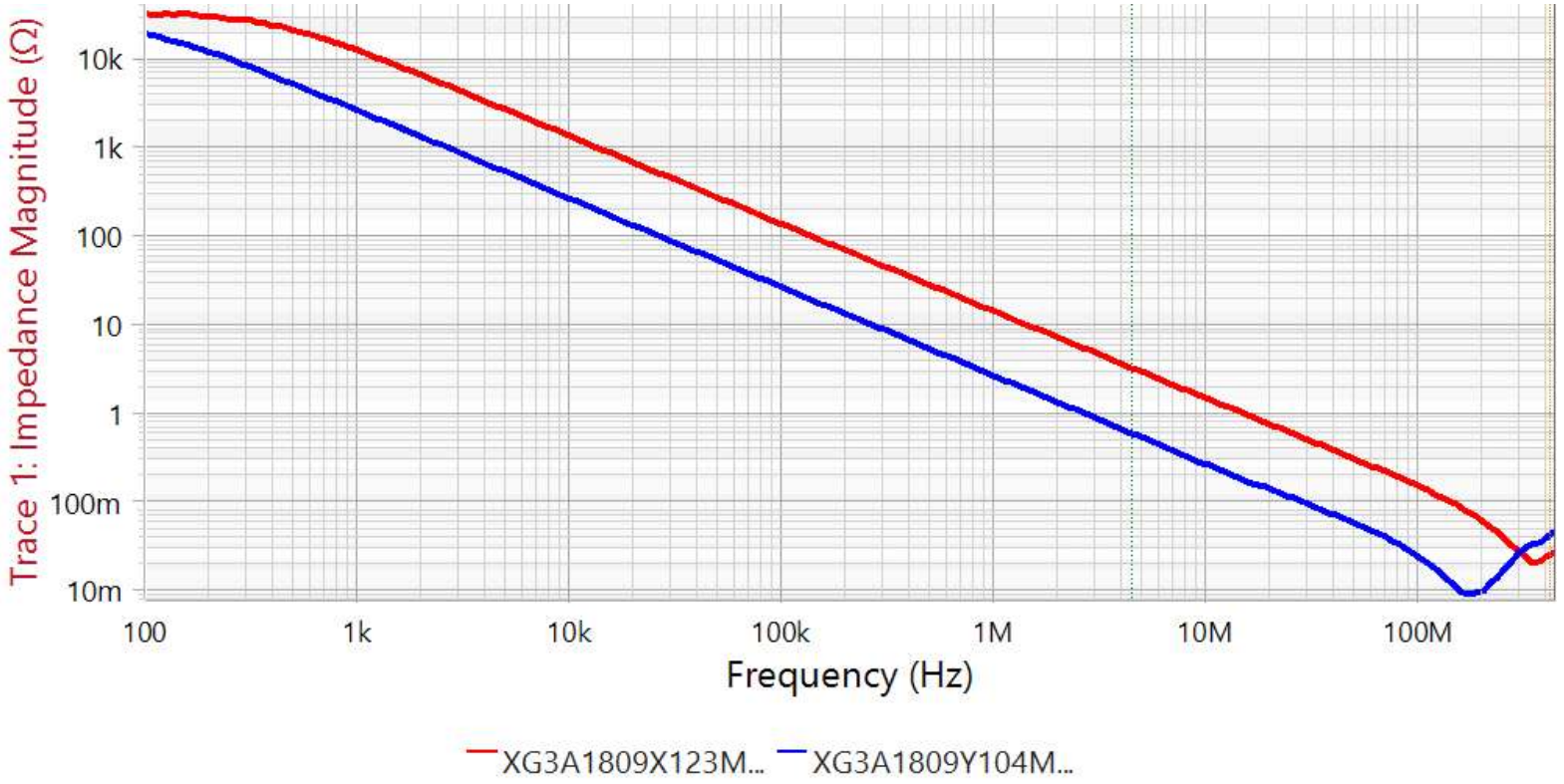


XG3E1507X332MP
W

28.5p
H

Mounted on a precision microwave coplanar waveguide in a 2-port shunt through configuration

Impedance Vs Frequency



6.3V 12nF
L= 28.5pH

6.3V 100nF
L= 15pH

Summary

The novel structure of our Eulex capacitor offers ultra- high SRF, ultra-low inductance, the highest capacitance density in a true single layer device all wrapped up in a high reliability surface mount package. The compact form factor allows these parts to be very close to the IC and are also suitable for embedded designs.

Quantic Eulex®

Thank You!

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