

# XG Series Eulex Gap Capacitors

Groundbreaking technology delivering the highest-Q, lowest loss, ceramic capacitor in a surface mount, high-reliability package for advanced broadband and RF designs

- 5G and next generation telecoms
- Test & Measurement
- AI & Machine learning new high speed architecture
- Automotive, mmwave / vision sensing, C-V2X
- Military & aerospace radar / sat coms
- Photonics



Quantic Eulex pioneers high-frequency advanced capacitor technologies for wireless, radar, satellite, and computing applications. Committed to performance, reliability, and versatility, Eulex continues to set new standards in RF and microwave engineering.

**Quantic™ Eulex**

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# XG Series Eulex Gap Capacitors

## Groundbreaking Technology for Advanced Broadband and RF Applications

Introducing the XG Series Eulex Gap Capacitor: a revolutionary design engineered to redefine performance in extreme high-frequency applications. Overcoming the limitations of conventional capacitor solutions, the XG Series Eulex Gap Capacitor sets a new standard, delivering unmatched results. Available in two configurations – the 2-Terminal [XG2] and 3-Terminal [XG3] – this innovation redefines high-frequency capacitor capabilities.

### High-Performance Features

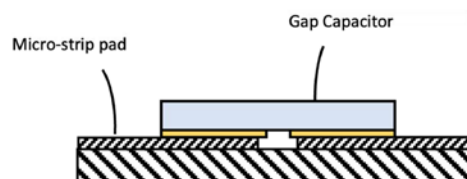
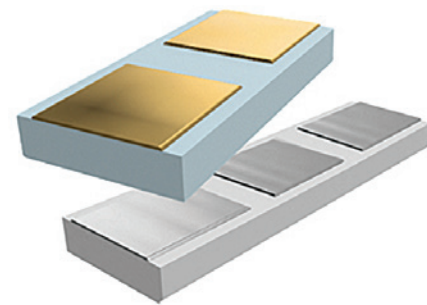
- 10x Increase in Capacitance
- Class 1 Dielectric Stability
- Higher Q
- Low Loss
- Ultra-Low ESR & ESL
- Ultra-High SRF
- Broadband Performance
- High Voltage and Power Handling
- Low Profile Suitable for SMD or Embedding
- Available in 2 and 3-terminal configurations
- *Filtering*
- *Decoupling*
- *Signal Coupling and DC Blocking*
- *Impedance Matching*
- *Designed for high continuous wave [CW] RF power handling - up to 500 Watts (validated up to 50 Watts CW)*

### Novel Construction

**Proprietary Internal Geometry:** Externally, the XG Series Eulex Gap Capacitor features a single-sided gapped pair of electrodes. However, what is not visible is the unique internal electrode geometry embedded within the dielectric material. This patented design enhances capacitance, achieves low ESR/ESL, and minimizes parasitic resonances.

**Single-Layer Construction:** Unlike MLCCs with their stacked layers, the XG Series Eulex Gap Capacitor maintains true a single-layer construction, minimizing resistive losses and enhancing high-frequency performance.

**Streamlined Design:** By eliminating wire bonds, vias, and traditional terminations – primary sources of parasitic inductance – the XG Series Eulex Gap Capacitor achieves enhanced reliability and minimizes mechanical vulnerabilities.



For general filtering, XG2 [2-Terminal] offers simplicity, durability, and performance for RF, microwave, and tuning.

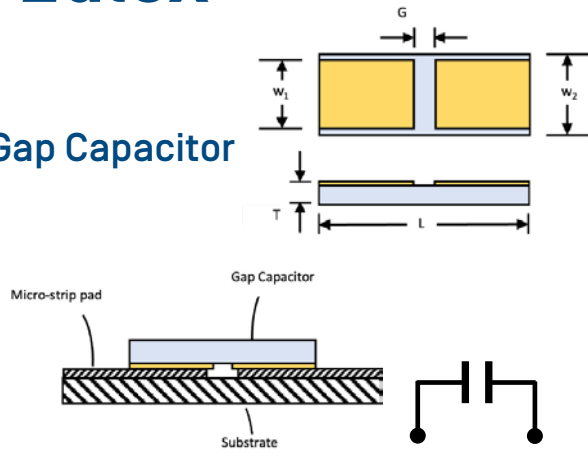
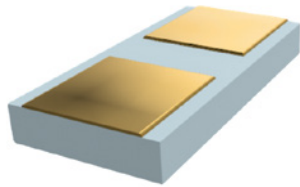


3-pad terminal Gap capacitor mounted face-down on GCPW (coplanar waveguide w/GND)

XG3 [3-Terminal] offers superior high-frequency capabilities and frequency.

## XG SERIES

### XG2 - 2 Terminal Gap Capacitor



Our groundbreaking XG2, a 2-terminal gap capacitor, offers low insertion loss and ultra-high self-resonant frequencies. Manufactured from ultra-stable materials with high Q and extremely high self-resonance, the XG2's innovative design allows for useful capacitance values far exceeding those offered by other manufacturers. Parts can be mounted across the micro-strip eliminating inductance from bond wires and further extending high frequency performance. Applications include DC blocking, RF bypass, impedance matching, filtering, tuning and coupling.

### Standard Dimensions

SIZE	XG10	XG15	XG20	XG25	XG30	XG35	XG40	XG50
Pad Width [W1] inch [mm]	0.007 ±0.002 [0.178 ±0.051]	0.017 ±0.003 [0.432 ±0.076]	0.020 ±0.003 [0.508 ±0.076]	0.025 ±0.003 [0.635 ±0.076]	0.030 ±0.003 [0.762 ±0.076]	0.035 ±0.003 [0.889 ±0.076]	0.040 ±0.003 [1.016 ±0.076]	0.048 ±0.003 [1.219 ±0.076]
Chip Width [W2] inch [mm]	0.012 Max [0.305 Max]	0.020 ±0.002 [0.508 ±0.051]	0.025 Max [0.635 Max]	0.030 Max [0.762 Max]	0.035 Max [0.889 Max]	0.045 Max [1.143 Max]	0.050 Max [1.27 Max]	0.065 Max [1.615 Max]
Length [L] inch [mm]	0.020 ±0.004 [0.508 ±0.102]	0.040 ±0.004 [1.016 ±0.102]	0.050 Max [1.270 Max]	0.080 Max [2.032 Max]	0.080 Max [2.032 Max]	0.080 Max [2.032 Max]	0.080 Max [2.032 Max]	0.080 Max [2.032 Max]
Thickness [T] inch [mm]	0.009 Max [0.229 Max]	0.009 Max [0.229 Max]	0.010 Max [0.254 Max]	0.010 Max [0.254 Max]	0.010 Max [0.254 Max]	0.010 Max [0.254 Max]	0.014 Max [0.356 Max]	0.014 Max [0.356 Max]
Gap [G] inch [mm]	0.003 Nom [0.076] Nom	0.005 Nom [0.127] Nom	0.005 Nom [0.127] Nom	0.005 Nom [0.127] Nom	0.005 Nom [0.127] Nom	0.005 Nom [0.127] Nom	0.010 Nom [0.254] Nom	0.010 Nom [0.254] Nom

Custom dimensions also available



### Selection Guide

Capacitance [pF]	Size	XG10		XG15		XG20		XG25		XG30		XG35		XG40		XG50	
Rated Voltage	Dielectric	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
6.3 Volt	P	0.35	0.4	0.95	1.1	1.8	2	2.8	3.3	4	4.7	5.7	6.5	7.5	8.7	11	13
	Q	0.8	0.9	3.2	3.6	5.8	6.6	9.1	10	13	15	18	22	24	28	40	44
	N	2.6	2.8	14	16	25	29	40	47	60	68	82	91	110	120	170	190
	C	12	12.5	48	56	88	100	140	160	200	240	280	330	370	430	590	680
	X	75	80	410	470	760	870	1200	1400	1700	2000	2400	2800	3200	3600	5000	5800
	Y	350	370	1700	2000	3200	3600	5000	5700	7400	8400	10000	12000	13000	15000	21000	24000
16 Volt	P	0.20	0.25	0.65	0.75	1.2	1.4	1.9	2.2	2.7	4.4	3.7	4.4	4.8	5.6	7.5	8.7
	Q	0.50	0.6	2.2	2.5	3.9	4.6	6.2	7.2	9	10	12	14	16	18	25	3
	N	1.6	1.8	9.4	11	17	20	27	31	39	45	51	60	68	80	108	125
	C	6.8	7.3	33	39	60	70	94	110	140	160	180	210	240	280	370	430
	X	47	52	290	330	510	600	810	930	1100	1300	1600	1800	2100	2400	3200	3800
	Y	210	230	1200	1400	2100	2500	3400	3900	4900	5600	6500	7600	8600	10000	13000	15000
25 Volt	P	0.18	0.23	0.55	0.65	1	1.8	1.6	1.8	2.3	2.6	3.1	3.5	4	4.6	6.3	7.1
	Q	0.4	0.5	1.9	2.1	3.3	3.7	5.2	5.8	7.5	8.5	10	11	13	15	20	24
	N	1.3	1.5	8	9	14	16	23	25	33	36	43	50	58	65	90	100
	C	5.6	6.1	27	33	50	57	80	90	110	130	150	180	200	220	320	360
	X	39	44	240	270	430	490	680	750	970	1100	1300	1500	1800	2000	2700	3000
	Y	180	200	1000	1200	1800	2000	2800	3200	4000	4600	5500	6200	7200	8200	11000	13000
50 Volt	P	0.16	0.21	0.5	0.55	0.9	1	1.4	1.5	2	2.2	2.7	3	3.5	3.9	5.4	6
	Q	0.35	0.45	1.6	1.8	2.9	3.2	4.5	5	6.5	7.2	8.8	10	12	13	18	20
	N	1.2	1.4	7	7.8	12	14	20	22	27	33	38	43	49	56	80	86
	C	5	5.5	25	27	43	49	68	75	100	110	130	150	170	190	270	300
	X	36	41	210	230	370	420	580	650	840	930	1200	1300	1500	1700	2400	2600
	Y	160	180	870	970	1600	1800	2500	2700	3500	3900	4800	5200	6200	6800	9800	11000
100 Volt	P	0.15	0.2	0.4	0.45	0.75	0.82	1.2	1.3	1.6	1.8	2.3	2.5	2.9	3.3	4.6	5.1
	Q	0.3	0.4	1.3	1.5	2.4	2.7	3.7	4.3	5.4	6.2	7.2	8.2	9.6	11	15	18
	N	1	1.2	5.8	6.6	11	12	16	18	23	27	33	36	39	47	65	72
	C	4.7	5.2	20	23	37	40	57	640	82	91	110	130	150	160	230	270
	X	33	38	180	200	330	360	490	560	700	780	960	1100	1200	1400	2000	2200
	Y	150	170	750	820	1300	1500	2000	2300	3000	3300	4000	4500	5200	5800	8200	9100

## Part Numbering

XG	L	40	X	302	K	G	W
Gap Capacitor	Voltage Code	Case Size	Dielectric Type	Capacitance Value	Capacitance Tolerance	Metallization Type	Packaging

Dielectric Type	P Porcelain	Q NPQ (Class I)	N NPO (Class I)	C NCS (Class I)	X X7R (Class II)	Y Y5V (Class III)
Operating Temperature Range	-55°C to 125°C	-55°C to 125°C	-55°C to 125°C	-55°C to 125°C	-55°C to 125°C	-30°C to +85°C
Temperature Coefficient [ /°C]	Neg.	±25ppm	±30ppm	+0-5%	±15%	+22% -82%
Max Dissipation Factor	0.01%	0.10%	0.15%	0.05%	2.50%	4.00%
Min Insulation Resistance @ 25°C	100GΩ	100GΩ	100GΩ	100GΩ	100GΩ	10GΩ
Min Insulation Resistance @ 125°C	100GΩ	10GΩ	10GΩ	10GΩ	10GΩ	1GΩ

Capacitance Code	
R05	0.05pF
0R2	0.20pF
1R0	1.0pF
2R7	2.7pF
270	27pF
271	270pF
102	1000pF

Below 10pF, R denotes a decimal point.  
For 10pF and above, first 2 digits are significant values and 3<sup>rd</sup> digit indicates the number of zeros.

Capacitance Tolerance		
B	±0.10pF	(P,Q) <9.1pF
C	±0.25pF	(P,Q) <9.1pF
D	±0.50pF	(P,Q) <9.1pF
G	±2%	(P,Q) 10pF
J	±5%	(P,Q,N) >10pF
K	±10%	[All Dielectrics]
M	±20%	[All Dielectrics]
Z	+80/-20%	[All Dielectrics]

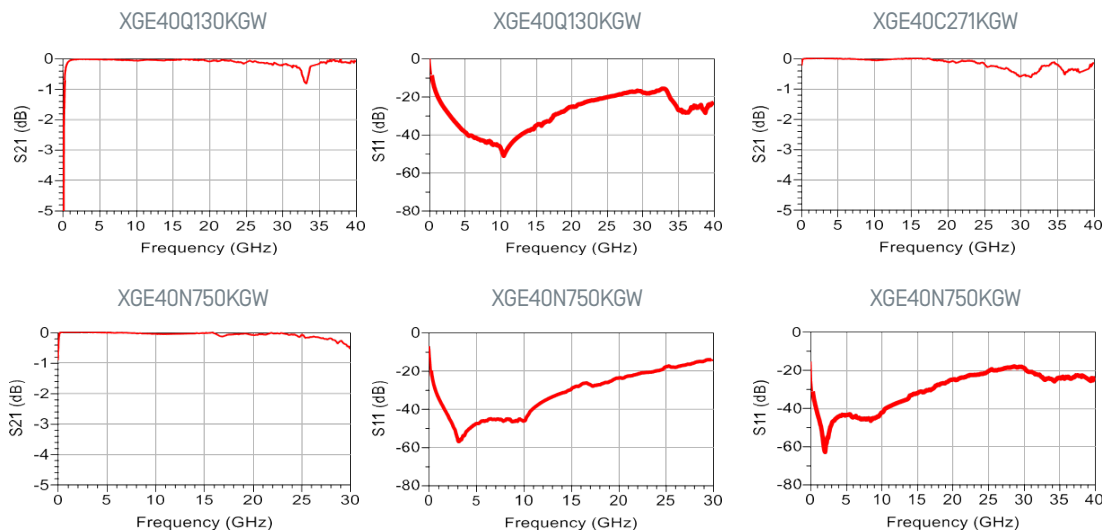
Voltage Code	
A	6.3VDC
E	16VDC
L	25VDC
G	50VDC
B	100VDC

Metallization	
P	Pt 100µin min
G	Au 100µin min

Electrical & Mechanical Characteristics	
Voltage Rating:	6.3, 16, 25, 50, 100 WVDC
Insulation Resistance:	See Chart [Dielectric code]
Dielectric Withstanding Voltage:	250% of WVDC
Dissipation Factor:	See Chart [Dielectric code]
Capacitance Test:	Values > 1000pF (1.0±0.2 VRMS @ 1KHz, 25°C) Values ≤ 1000pF (1.0±0.2 VRMS @ 1MHz, 25°C)
Shear Strength:	Size dependent
Metallization Thickness:	100µin min [99.9% Au]

Packaging	
W	ESD Waffle Pack

## Frequency Characteristics



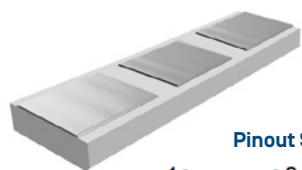
\*Parts tested on .020" thick Rogers board fixture with .008" gap.



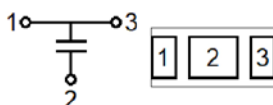
## XG SERIES

### XG3 - 3 Terminal Gap Capacitor

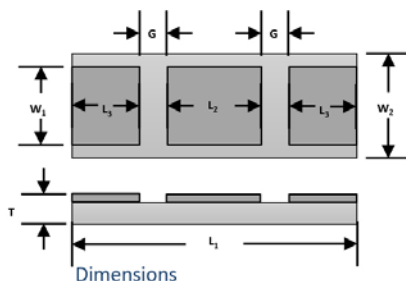
Our groundbreaking XG3, a 3-terminal gap capacitor, is engineered for superior high-frequency and ultra-stable performance. By leveraging a unique ultra-thin, single-layer design, it minimizes equivalent series inductance (ESL) while eliminating the need for wire bonding, unlike traditional single-layer capacitors (SLCs). This innovative design combines the high-frequency performance of SLCs with the exceptionally low mounting inductance of 3-terminal configurations, resulting in superior effectiveness for power supply bypassing, filtering, and noise suppression. The surface-mountable package ensures ease of integration into your circuit designs.



Pinout Schematic

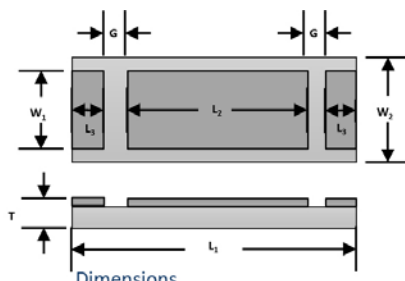


1507



Dimensions

1809  
1707  
0602  
0502  
0301



Dimensions

#### Case Size & Dimensions

Case Size	Length [L] Inch [mm]	Chip Width [W <sub>2</sub> ] Inch [mm]	Thickness [T] Inch [mm]	Center Pad [L <sub>2</sub> ] Inch [mm]	Side Pad [L <sub>3</sub> ] Inch [mm]	Pad Width [W <sub>1</sub> ] Inch [mm]	Gap [G] Inch [mm]
1809	0.180 ±0.005 [4.572 ±0.127]	0.090 ±0.005 [2.286 ±0.127]	0.020 Max [0.508 Max]	0.120 ±0.004 [3.048 ±0.102]	0.020 ±0.003 [0.508 ±0.076]	0.060 ±0.003 [1.524 ±0.076]	0.008 Min [0.203 Min]
1707	0.170 ±0.005 [4.318 ±0.127]	0.070 ±0.005 [1.778 ±0.127]	0.018 Max [0.457 Max]	0.110 ±0.004 [2.794 ±0.102]	0.020 ±0.003 [0.508 ±0.076]	0.060 ±0.003 [1.524 ±0.076]	0.008 Min [0.203 Min]
1507	0.150 ±0.005 [3.810 ±0.127]	0.070 ±0.005 [1.778 ±0.127]	0.016 Max [0.406 Max]	0.060 ±0.002 [1.524 ±0.051]	0.036 ±0.003 [0.914 ±0.076]	0.060 ±0.003 [1.524 ±0.076]	0.008 Min [0.203 Min]
0602	0.060 ±0.004 [1.524 ±0.102]	0.020 ±0.002 [0.508 ±0.051]	0.012 Max [0.305 Max]	0.040 ±0.002 [1.016 ±0.051]	0.005 ±0.002 [0.127 ±0.051]	0.018 ±0.002 [0.457 ±0.051]	0.003 Min [0.076 Min]
0502	0.050 ±0.004 [1.270 ±0.102]	0.020 ±0.002 [0.508 ±0.051]	0.012 Max [0.305 Max]	0.030 ±0.002 [0.762 ±0.051]	0.005 ±0.002 [0.127 ±0.051]	0.018 ±0.002 [0.457 ±0.051]	0.003 Min [0.076 Min]
0301	0.030 ±0.003 [0.762 ±0.076]	0.010 ±0.002 [0.254 ±0.051]	0.010 Max [0.254 Max]	0.018 ±0.002 [0.457 ±0.051]	0.005 ±0.002 [0.127 ±0.051]	0.008 ±0.002 [0.203 ±0.051]	0.003 Min [0.076 Min]

#### Eulex Part Numbering System

XG	3	A	0301	N	100	K	P	W
Eulex Gap	Number of Pads	Voltage Code	Case Size	Dielectric Type	Capacitance	Capacitance Tolerance	Metallization Type	Packaging

#### Dielectrics and Voltage Rating

Dielectric Type		Dielectric Characteristics	
		Temp Coeff	Temp Range
P	Porcelain	Neg.	-55 to 125°C
Q	Class I/NPQ	±25ppm	-55 to 125°C
N	Class I/NPO	±30ppm	-55 to 125°C
C	Class I/NPS	+0-5%	-55 to 125°C
X	Class II/X7R	±15%	-55 to 125°C
Y	Class III/Y5V	+22%-82%	-30 to 85°C

#### Capacitance Rating

6.3V	1809 Cap [pF]	1707 Cap [pF]	1507 Cap [pF]	0602 Cap [pF]	0502 Cap [pF]	0301 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

#### Termination Material

Metallization	
P	Pt 100µin min
G	Au 100µin min

#### Packaging

Packaging	
G	Gel-Pak
T	Tape and Reel
W	ESD Waffle Pack

16V	1809 Cap [pF]	1707 Cap [pF]	1507 Cap [pF]	0602 Cap [pF]	0502 Cap [pF]	0301 Cap [pF]
P	56	39	22	4.5	3.3	0.8
Q	130	90	50	10	7.5	1.8
N	400	300	150	33	25	6.0
C	1900	1300	700	140	100	26
X	1300	9000	5000	990	740	170
Y	60000	41000	22000	4500	3300	800

## Capacitance Rating

25V	1809	1707	1507	0602	0502	0301
	Cap [pF]	Cap [pF]	Cap [pF]	Cap [pF]	Cap [pF]	Cap [pF]
P	47	33	18	3.9	2.7	0.7
Q	110	75	44	8.2	6.5	1.5
N	370	250	140	27	20	5.0
C	1600	1100	600	120	90	22
X	11000	7400	4200	820	625	150
Y	51000	35000	19000	3800	2700	680

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

50V	1809	1707	1507	0602	0502	0301
	Cap [pF]	Cap [pF]	Cap [pF]	Cap [pF]	Cap [pF]	Cap [pF]
P	44	30	17	3.5	2.5	0.6
Q	100	70	39	8.0	6.0	1.4
N	330	220	130	26	19	4.7
C	1500	1000	560	110	82	20
X	10000	7000	3900	750	580	140
Y	47000	32000	17000	3500	2500	600

Dielectric	Cap Limit	Capacitance Tolerance
[P,Q]	<9.1pF	B ± 0.10pF
		C ± 0.25pF
		D ± 0.50pF
[P,Q]	>10pF	G ± 2%
[P,Q,N]	>10pF	J ± 5%
All		K ± 10%
All		M ± 20%
All		Z ± 80-20%

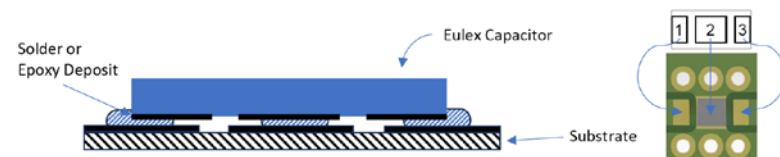
## Test Conditions

No.	Item	Test Condition	Requirements
1	Visual & Dimensions	Suitable optical or mechanical measurement system	<ul style="list-style-type: none"> <li>No major defects</li> <li>Conforms to individual specification sheet</li> </ul>
2	Capacitance	<ul style="list-style-type: none"> <li>Measured at 1.0±0.2Vrms, 1.0MHz±10%</li> <li>Measured at room temperature</li> </ul>	<ul style="list-style-type: none"> <li>Shall not exceed specified capacitance plus allowed tolerance.</li> </ul>
3	Dielectric Strength	<ul style="list-style-type: none"> <li>250% of rated voltage.</li> <li>Duration: 1 to 5 sec.</li> <li>Charge &amp; discharge current &lt;50mA.</li> </ul>	<ul style="list-style-type: none"> <li>No evidence of damage or arc-over during test.</li> </ul>
4	Insulation Resistance	<ul style="list-style-type: none"> <li>Time rated voltage applied for 120 secs Max</li> <li>Test at room temperature</li> </ul>	<ul style="list-style-type: none"> <li>&gt;10Gohm for Y5V.</li> </ul>
5	Temperature Coefficient	<ul style="list-style-type: none"> <li>No electrical load</li> <li>Allow temperature to equilibrate prior to measure</li> </ul>	<ul style="list-style-type: none"> <li>Capacitance change within bounds listed on page 6 across rated temperature range [varies with dielectric material].</li> </ul>
6	Termination Strength	MIL-STD-883, device mounted to Au metalized alumina substrate with Au-Sn20. Apply force parallel to substrate until failure.	<ul style="list-style-type: none"> <li>Die bond strength 2N min. (size dependent)</li> </ul>
7	High Temperature Load	<ul style="list-style-type: none"> <li>Test temp.: 125±3°C</li> <li>Applied voltage: Rated Volt</li> <li>Test time: 1000+24/-0 hrs.</li> <li>Cap. / DF / I.R. Measurement to be made after de-aging at 150°C for 1hr then 24±2hr age at RT"</li> </ul>	<ul style="list-style-type: none"> <li>No major damage</li> <li>Cap change: within ±7.5% or ±0.75pF whichever is larger</li> <li>I.R. ≥1GΩ"</li> </ul>

## Mounting Methods

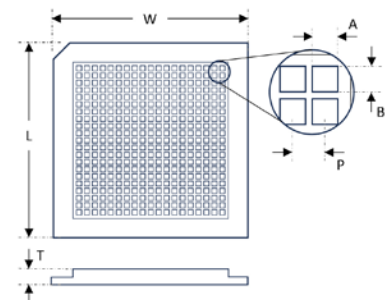
### Solder Attach

Parts are mounted terminations down.  
Solder compositions suitable for Au attachment are acceptable  
Au-Sn20 or In-Pb30 solder is recommended  
Do not exceed 320°C  
Heating cycle to remain below 5°C/sec and cooling below 4°C/sec



### Epoxy Bonding

Parts are suitable for conductive epoxy bonding. Epoxy should be deposited towards edge of part, taking care not to short gap between terminals.



Dimensions [mm]					
A	B	P	W	L	T
Samples Provided in Gel-Pak AD-22T-00X8					



## Performance Data

	Maximum Capacitance / [pF]															
	100 Volt				50 Volt				16 Volt				6.3 Volt			
	P	NPO	X7R	Max	P	NPO	X7R	Max	P	NPO	X7R	Max	P	NPO	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
<b>Eulex</b>	<b>3.3</b>	<b>47</b>	<b>1400</b>	<b>5800</b>	<b>3.9</b>	<b>56</b>	<b>1700</b>	<b>6800</b>	<b>5.6</b>	<b>80</b>	<b>2400</b>	<b>10000</b>	<b>8.7</b>	<b>120</b>	<b>3600</b>	<b>15000</b>

Competitor Comparison (Based on 0804 size device)

\* Uses GBBL dielectric

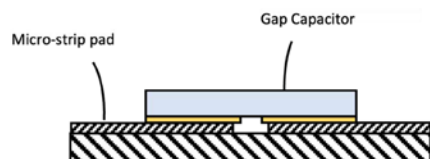
The unique technology and advanced manufacturing techniques utilized by Eulex enables ultra-high capacitance values to be achieved in various dielectric material classes -- up to 10x greater than existing technologies using equivalent case sizes.

## Common Part Sizes

Eulex Part Number	Case Size	Capacitance	Voltage	TCC	Termination
XGE10X300MGW	0201	30pF	16VDC	±15%	Au
XGE10Y201MPW	0201	200pF	16VDC	+22/-82%	Pt
XGG15P0R5BGW	0402	0.5pF	50VDC	-30ppm	Au
XGG15P0R7BGW	0402	0.7pF	50VDC	-30ppm	Au
XGG15P1R0BGW	0402	1.0pF	50VDC	-30ppm	Au
XGG15Q1R5CGW	0402	1.5pF	50VDC	±25ppm	Au
XGG15Q2R0CGW	0402	2.0pF	50VDC	±25ppm	Au
XGG15N100KGW	0402	10pF	50VDC	±30ppm	Au
XGG15X820KGW	0402	82pF	50VDC	±15%	Au
XGG15X101KGW	0402	100pF	50VDC	±15%	Au
XGG15X181MGW	0402	180pF	50VDC	±15%	Au
XGG15Y102MPW	0402	1000pF	50VDC	+22%/-82%	Pt
XGG25Y302MPW	0603	3000pF	50VDC	+22%/-82%	Pt

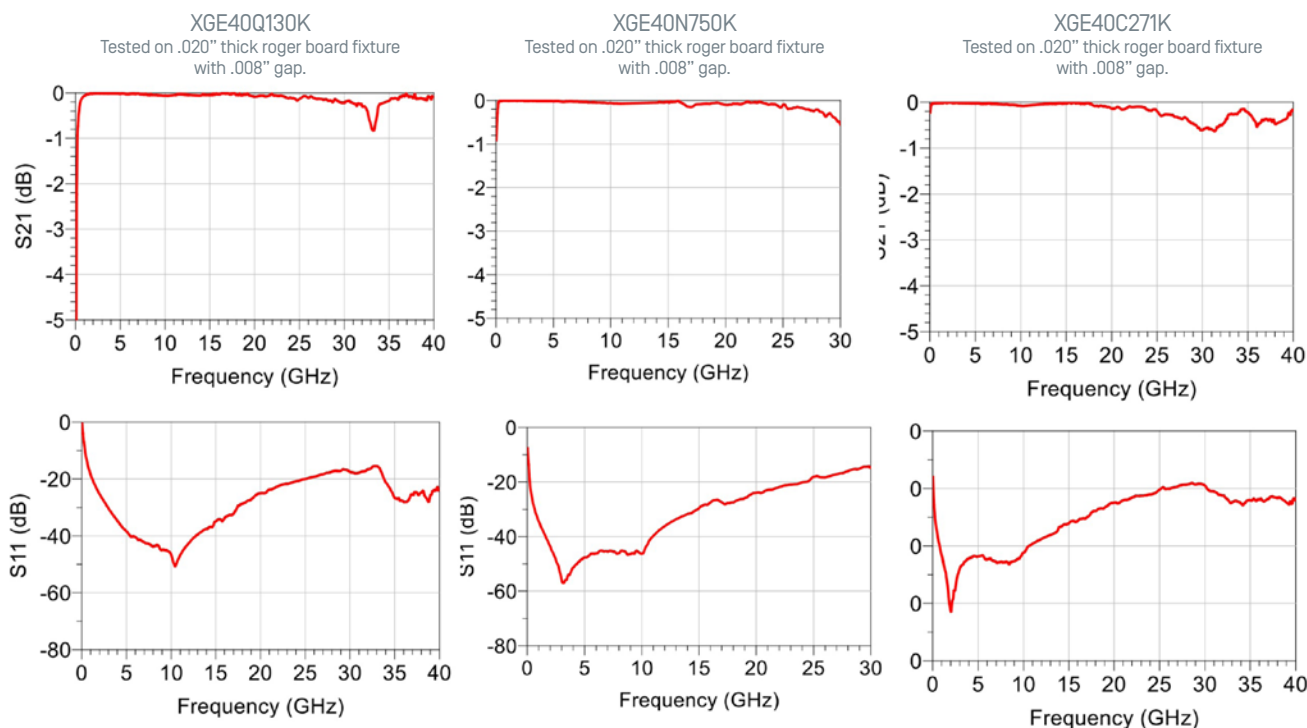
\* Other sizes, values and termination materials are available

## Mounting Methods

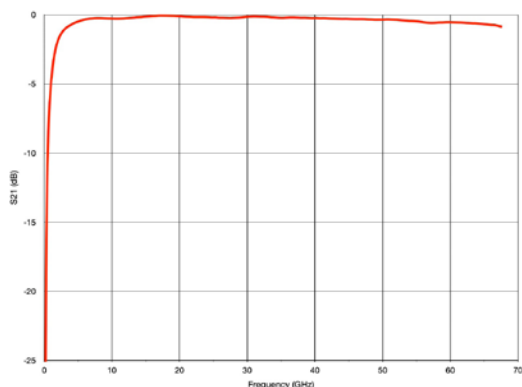


- Eulex Gap Capacitors are suitable for surface mounting either using solder or conductive epoxy.
- Low temperature indium-based solders or Au/Sn eutectics work best with our Au terminations.
- High conductivity Ag bearing epoxies are an extremely effective attachment method. Care should be taking in both methods not to bridge the gap between terminations and not to thermally shock the ceramic body.
- Most standard cleaning chemistries can be used with Eulex Gap Capacitors.





Test data to 67GHz supplied by: **Quantic X-Microwave**



## High Reliability Screening Capabilities

### XGB15N120MG

W90-13 Life Test [20pcs]				
100G0hrs	Avg Cap (pF)	DF%	IR	Date
Initial	13.73	20 pass	20 pass	11/27/2023
24hrs	13.80	20 pass	20 pass	11/28/2023
100hrs	13.76	20 pass	20 pass	12/1/2023
500hrs	13.78	20 pass	20 pass	12/18/2023
1000hrs	13.77	20 pass	20 pass	1/8/2024
2000hrs	13.65	20 pass	20 pass	2/19/2024
3000hrs	13.62	20 pass	20 pass	3/31/2024
4000hrs	13.70	20 pass	20 pass	5/12/2024
5000hrs	13.77	20 pass	20 pass	6/23/2024
6000hrs	13.77	20 pass	20 pass	8/4/2024
Rated Voltage: 100 VDC		IR 025°C: 100 GΩ, 100 VDC		
Capacitance: 12pF +/- 20%		IR @125°C: NA		
Dissipation Factor: 0.15% Max		Voltage Conditioning: 200 VDC		
DWV: 250 VDC				

All dielectric materials used by Eulex are qualified through rigorous life testing of representative final components at 2x working Voltage DC bias conditions at 125C for 2000 hours minimum.

Example data for XGB15N120MG is shown to the left, showing minimal change in capacitance after even 6000 hours of testing, with zero failures.

Additional qualification testing includes 85%RH/85C damp heat testing for 240 hours.

Tested parameters include capacitance, dissipation factor (DF), insulation resistance (IR) and dielectric withstanding voltage (DWV). While DWV is tested at 250% of rated voltage as per many MIL-PRF standards, Eulex dielectric breakdown voltage is typically over 10x rated voltage.

## Additional Screening Capabilities

- MIL-PRF-123
- MIL-PRF-32535
- MIL-PRF-38534 Class H and Class K

## Customer Testing - PMI

Customer: Planar Monolithics Industries (PMI), Ballenger Creek, Maryland.

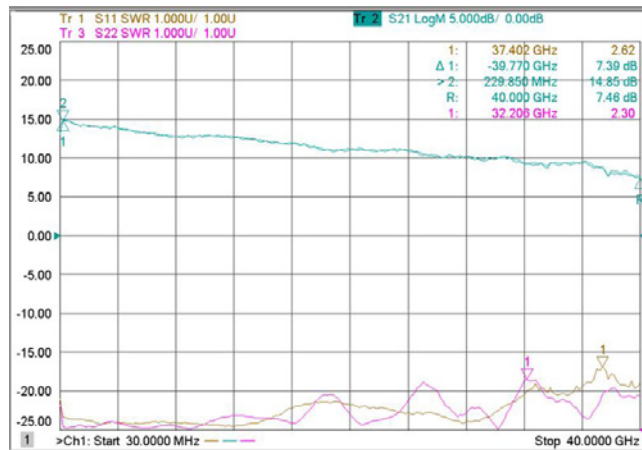
PMI is a leading supplier of custom, high-reliability radio frequency microwave components and subsystems covering DC to 70 GHz, delivering industry-standard performance for mission-critical applications in the military, communications, commercial and consumer industries.

Test #1: Broadband Low Noise Amplifier Performance Testing (PMI)

PMI tested the XG3 Eulex Gap Capacitor in a Low Noise Amplifier (LNA). By replacing one (1) singlelayer capacitor (SLC) with one (1) XG3 Eulex Gap Capacitor in PMI's PE2-12-30M40G-5R5-18-12-292FF LNA, the test yielded the following significant performance improvements.

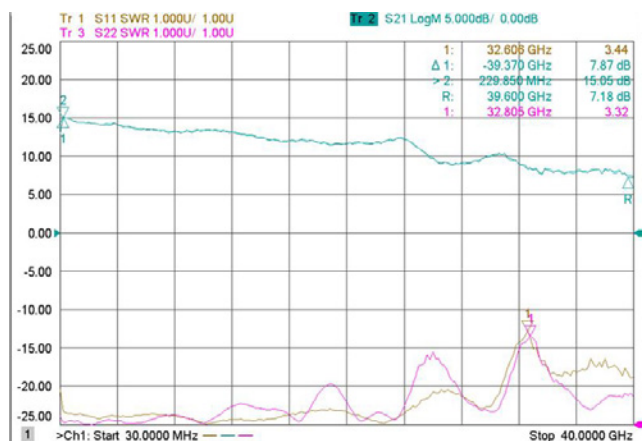
- Reduced Voltage Standing Wave Ratio (VSWR) from 3.3:1 to 2.3:1, indicating a better impedance match and reduced signal reflection.
- Improved gain ripple from +/-2dB to +/-0.5dB, demonstrating a more consistent gain performance across the frequency band.

### Using Eulex Gap Capacitor



*"Our independent evaluation of the Eulex Gap Capacitors (Single Layer, High-Q) has revealed outstanding performance across a range of critical parameters. The combination of lower cost, higher Q, better RF metrics (VSWR, SRF, Loss, etc.) increased power/voltage handling and the elimination of wirebonds represents a significant advancement in capacitor technology. These capacitors offer a compelling solution for high performance RF designs." - Sebastian Palacio, VP/GM, PMI*

### Using Conventional SLC

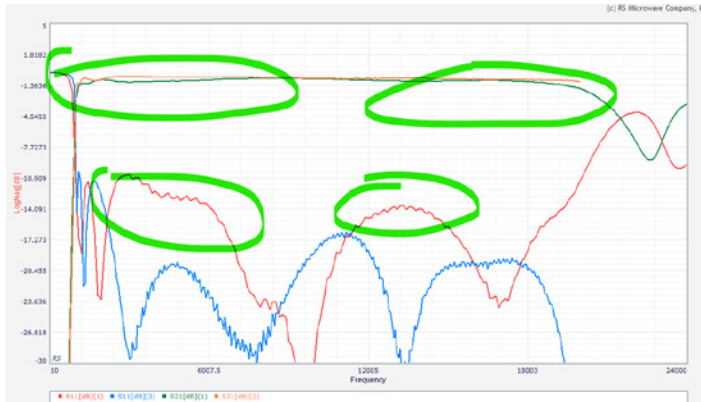


SLC Results: S-Parameters show the wire-bonded and tuned circuit has +/-2dB ripple.

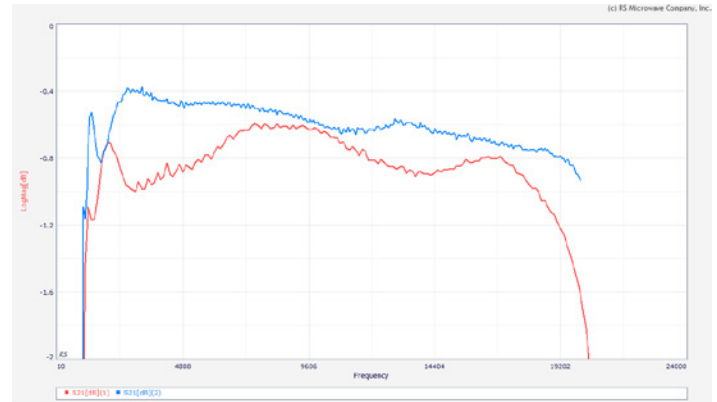
## Test #2: High Pass Filter

PMI tested the XG3 Eulex Gap Capacitor in a High Pass Filter. By replacing one [1] single layer capacitor (SLC) with one [1] XG3 Eulex Gap Capacitor in PMI's HP-118-CD-SFF, the XG3 Eulex Gap Capacitor replacement demonstrated the following superior characteristics:

- Improved return loss from 11dB (typical) to 20dB (typical).
- Improved insertion loss (approximately 0.4 dB improvement up to 18GHz and 1dB at 20GHz).
- Lower coupling loss at the cutoff frequency (fc); that is, the cutoff angle closest to 90 degrees.
- Maintained performance up to 20 GHz, enabling a broader frequency range without self-resonance.
- Increased power handling capability from 1W to 50W. Note: While this improvement included an inductor upgrade, the XG3 Eulex Gap Capacitor was a key enabler for achieving this higher power handling.



Orange and Blue - XG3 Eulex Gap Capacitor  
Green and Red - Single Layer Capacitor



Blue - XG3 Eulex Gap Capacitor  
Red - Single Layer Capacitor

## Key Outcomes from PMI Testing

PMI's testing highlighted several key advantages of the XG3 Eulex Gap Capacitor:

- Higher Q (Quality Factor): Demonstrates lower losses and greater rejection before the cut-off frequency and improved efficiency.
- Lower Parasitic Effects: Reduces unwanted inductance and resistance, leading to better high-frequency performance.
- Consistent Performance: Maintains similar performance characteristics across different capacitance values within the same footprint.
- High-Frequency Capability: Sustains performance at frequencies up to 70GHz and beyond.
- Simplified Design: Reduces the need for complex tuning or wire bonds, simplifying the manufacturing process. Easy to assemble, reducing labor costs.
- Enhanced Power and Voltage Handling: Provides improved performance compared to traditional SLC capacitors.

## Conclusion

PMI's testing effectively showcased the Eulex Gap Capacitor's ability to outperform traditional single-layer capacitors in critical RF applications. The results demonstrate the potential of Eulex Gap Capacitors to enhance the performance and reliability of high-frequency electronic systems.

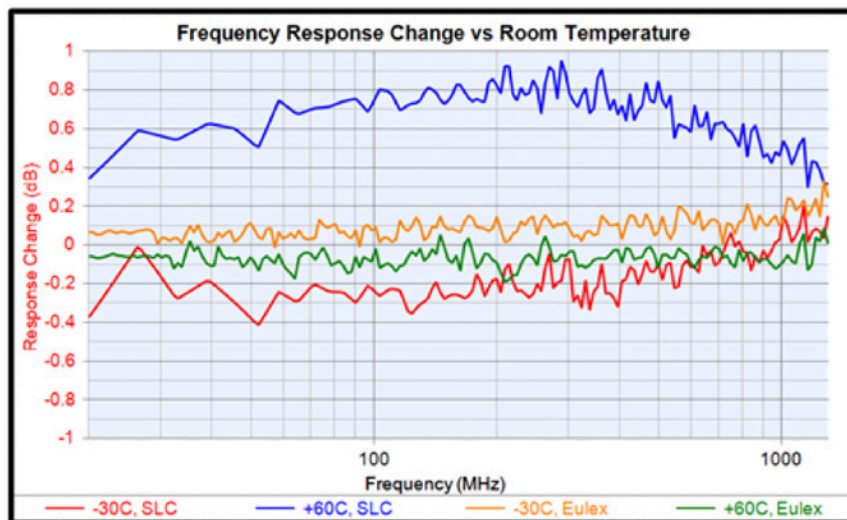
## Customer Testing - Bird Technologies

**Customer:** Bird Technologies, Solon, OH

Bird Technologies is a company specializing in RF and microwave wireless communication solutions.

**Test:** Coplanar Wave Guide Application

Bird conducted testing on the XG3 Eulex Gap Capacitor within a Grounded Coplanar Waveguide (GCPW) design. The GCPW, a common transmission line structure in high-frequency circuits provided, a controlled environment to evaluate the capacitor's performance as a shunt component. The testing focused on characterizing the insertion loss and stability of the capacitor over a wide frequency range and under varying temperature conditions.



*"The XG Series is our answer to a 5-year search for a better capacitor that has Class 1 stability, high capacitance and great frequency response, allowing us to better meet our specifications over time and temperature." - Martin Dummermuth, Chief Technologist Bird Technologies*

## Key Outcomes from Bird Technologies' Testing

- Eulex XG3 exhibited exceptional performance, especially at lower frequencies, where traditional capacitors often struggle due to increased impedance.
- The Eulex XG3 also showed remarkably stable performance over a wide temperature range, outperforming a standard single-layer capacitor in the same GCPW configuration.

## Conclusion

Bird's data underscores the suitability of the Eulex XG3 Gap Capacitor for applications requiring stable performance, low loss, and high reliability, particularly in high-frequency circuits and demanding environments due to being able to realize high capacitance values even with class 1 stable materials.

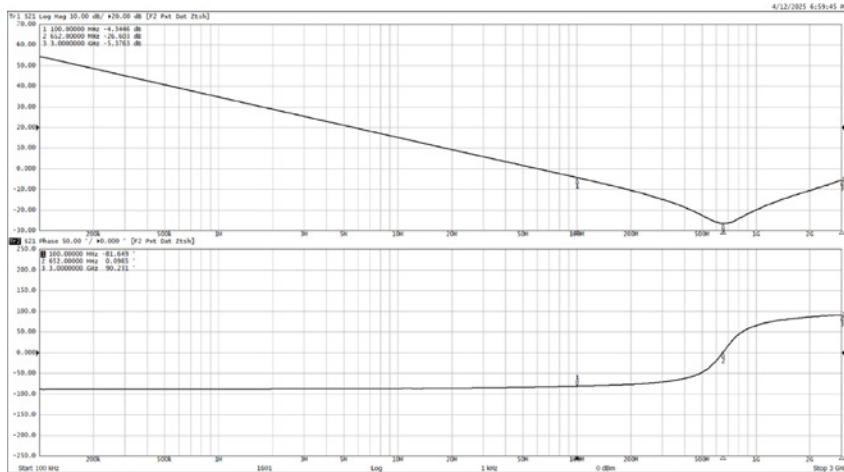
## Customer Testing - Picotest

**Customer:** Picotest, Phoenix, AZ

A company specializing in high fidelity testing and measurement tools, primarily for power-related applications.

**Test:** Low Frequency High Power Application

Picotest utilized its specialized Bode 500 measurement tool to independently verify the inductance of the XG3 Eulex Gap Capacitor. The testing protocol focused on quantifying the capacitor's Equivalent Series Inductance (ESL) with the aim of accurately measuring inductance values at the pico-Henry level.



*"The XG Series Capacitors exhibit remarkably low ESL, making them well-suited for coupling in microwave applications." - Steve Sandler, Managing Dir., Picotest*

3.3nF

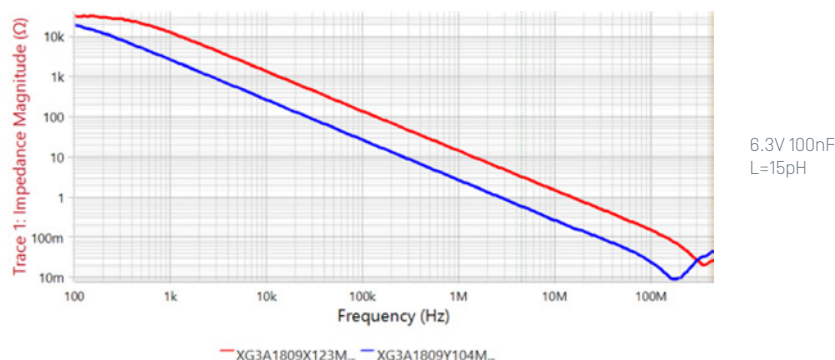
## Key Outcomes from Picotest Testing

- Successful measurement of pico-Henry level inductance, demonstrating the capacitor's ultra-low inductance characteristics and validating accurate measurement at these levels.
- The significance of these results lies in demonstrating superior performance of the XG3 Eulex Gap Capacitor compared to traditional Multilayer Ceramic Capacitors (MLCCs). While typical MLCCs exhibit inductance values on the order of 200 pico-Henries, the XG3 Eulex Gap Capacitor exhibited significantly lower inductance, as low as 15 pico-Henries.
- The data indicates that approximately 20 MLCCs would be required to match the performance of a single XG3 Eulex Gap Capacitor

## Conclusion

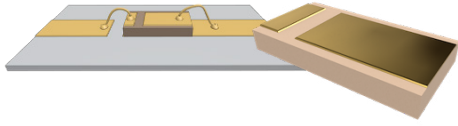
This validation confirms the XG3 Eulex Gap Capacitor's suitability for applications in RF circuits, DC blocking, power integrity solutions, and high-reliability markets where minimizing inductance is paramount. The results provided independent confirmation of the XG3 Eulex Gap Capacitor's low inductance, underscoring its benefits for demanding high-frequency applications.

Impedance



6.3V 100nF  
L=15pH

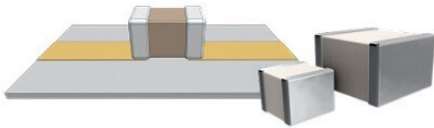
## Additional Eulex Products



### Binary Capacitors

Suitable for 5G, telecom, industrial, military and space applications requiring high self resonance frequencies to 100GHz

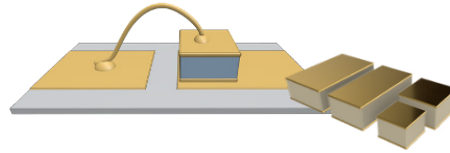
- › 20X capacitance design
- › Wire-bondable
- › Additional Capacitor on Device
- › Configurable Design



### Ultra-High Q

High frequency performance MLCC (high Q / low ESR design). Economical solution for demanding RF applications.

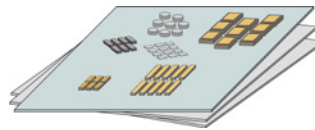
- › Size 01005 thru 1111
- › > 0.1pF to 1000pF
- › > 6.3 volt to 1500 volt
- › > NPO dielectric ( $\pm 30$ ppm / °C)



### Vertical Layer

High capacitance, wire-bondable MLCC. Class II dielectric for RF Bypass and DC Blocking across a wide frequency range.

- › Miniature Form Factor (1515-5080)
- › Wire-bondable, Au Terminations
- › Class II (-55°C to 125°C)
- › High Frequency Response



### Substrates

Eulex has the capability to manufacture custom substrates from a range of ceramic materials with thin or thick film metallization and inclusion of thick film resistors.

- › High Purity Al<sub>2</sub>O<sub>3</sub>
- › High Q dielectrics >100GHz
- › AlN with Exceptional Thermal Conductivity
- › Custom Size & Shape
- › Metallization Options

## Order Eulex Design Kits





# Capacitors Portfolio for Mission Critical Applications



Our portfolio offers a diverse range of capacitor technologies, including multilayer polymer film capacitors, multilayer ceramic capacitors and assemblies, high-frequency RF & Microwave ceramic capacitors, as well as the most power-dense hybrid wet tantalum capacitors in the industry. These capacitors are designed to deliver critical performance in defense, aerospace, energy, and communications applications, where reliability, space efficiency, weight reduction, and power optimization are critical requirements.

## 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.

- › Voltage range from 10 to 125V
- › Cap values ranges from 22uF-1F
- › Rugged hermetically sealed design withstands high shock & vibration
- › Ultra-low ESR “enable” high-current applications
- › Space Grade [Qualified to NASA-INST-002]

[www.quanticevans.com](http://www.quanticevans.com)

## Eulex

### High Frequency RF & Microwave Ceramic

Eulex's Patented technology allows ceramic capacitors to be manufactured with higher capacitance using fewer dielectrics improving temperature and frequency performance in a high reliability package.

- › Up to 10x capacitance
- › The XG Series Gap Capacitors are available in 2 and 3-terminal configurations
- › Frequencies exceeding 100GHz
- › Ultra-high Q dielectrics
- › Product offering includes gap, binary, vertical layer, ultra-high Q
- › Voltage range from 6.3V-1500V

[www.quanticeulex.com](http://www.quanticeulex.com)

## Paktron

### Stacked, Multi-layer Polymer [MLP] Film

Paktron's Multilayer Polymer capacitors offer a ceramic capacitor alternative in specific “cannot fail” applications that demand robust mechanical & electrical solutions.

- › Highest ripple current rating per C\*V in the industry
- › Offers better electrical stability over temperature compared to XB
- › Self healing - does not fail short
- › Mechanically flexible does not crack
- › Voltage ratings from 50VDC-1200VDC
- › Cap values from 0.1uF-20uF

[www.quanticpaktron.com](http://www.quanticpaktron.com)

## UTC

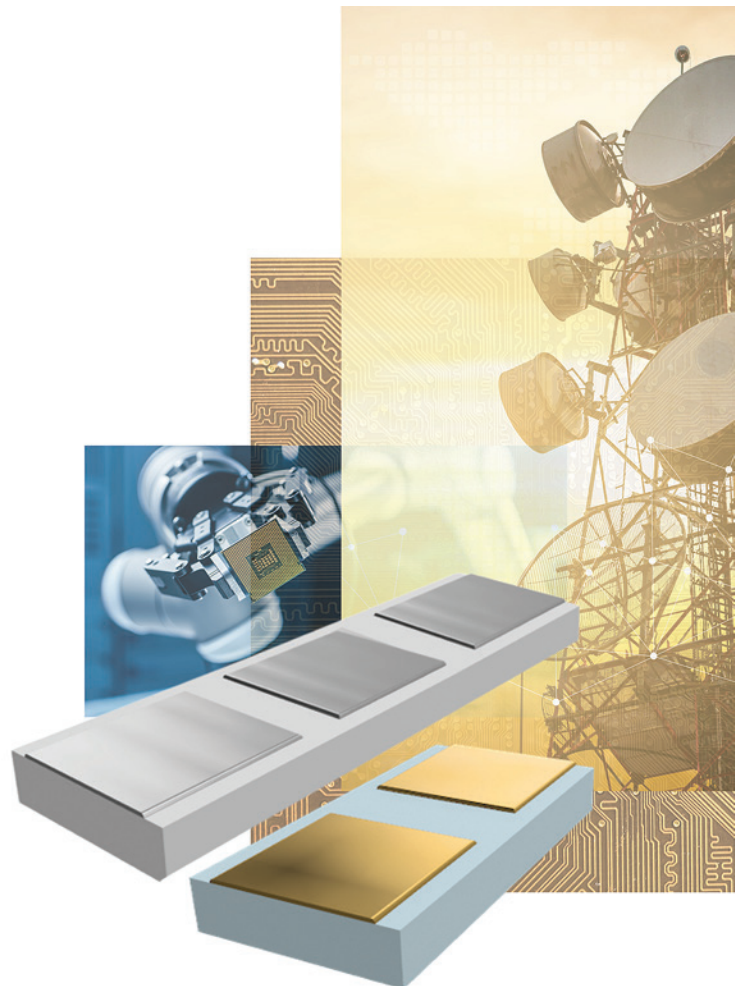
### Multi-layer Ceramic [MLCC]

UTC manufactures standard and engineered high-reliability multi-layer ceramic chip capacitors [MLCCs] and leaded devices, approved to produce MIL-PRF 49470 parts to standard (B) level and (T) space levels, in addition to a wide variety of DLA drawings.

- › Equipped to perform a variety of MIL-PRF testing
- › Low ESR & ESL – excellent for frequency decoupling
- › Multiple dielectrics available including NP0, X7R, X5R, Y5V - PME and BME formulations.
- › Low-cost manufacturing options available
- › Product offerings include MLCCs, planar arrays, discoidals, pulse energy, megacap type (BC), safety caps and SMPS.

[www.quanticutc.com](http://www.quanticutc.com)





## **XG Series Eulex Gap Capacitor**

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