

Ultra-High Q

# XQ

Series



### Features

- Ultra-high Q
- Low ESR/ESL
- Ultra-stable dielectric characteristic ( $\pm 30\text{ppm}/^\circ\text{C}$ )
- Capacitance (0.1 pF to 1000pF)
- Available in narrow tolerances
- Size 01005 to 1111
- Voltage up to 1500V
- Operating temperature to  $150^\circ\text{C}$  (X8G)

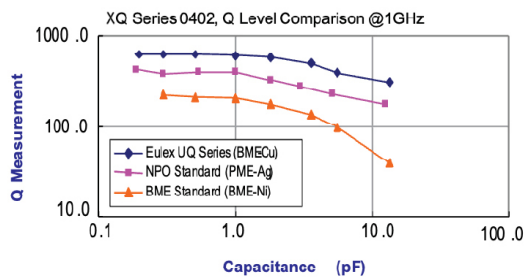
### Applications

- Power station
- Base station
- UHF/microwave
- Timing circuits
- Mixers

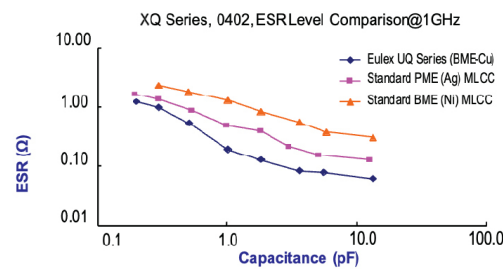
## Product Overview

Eulex ultra-high Q and ultra-low ESR XQ-series capacitors feature ultra-high Q, ultra-high self-resonance frequencies and ultra-low ESR. Manufactured with temperature and voltage stable NP0 & X8G dielectrics ( $\pm 30\text{ppm}/^\circ\text{C}$ ), Pb-free terminations and copper electrodes.

### Ultra-High Q



### Ultra-Low ESR



## Part Numbering System

XQ	G	02	N	0R5	B	N	T
Series	Voltage Code	Case Code	Dielectric Type	* Capacitance	Tolerance	Termination	** Packaging
Ultra-High Q	A = 6.3VDC	01 = 01005	N = NP0	R05 = 0.05pF	A = $\pm 0.05\text{pF}$	N = Cu/Ni/Sn	T = 7" reel
	C = 10VDC	02 = 0201	G = X8G	0R2 = 0.20pF	B = $\pm 0.10\text{pF}$		R = 13" reel
	E = 16VDC	04 = 0402		1R0 = 1.0pF	C = $\pm 0.25\text{pF}$		
	L = 25VDC	05 = 0505		2R7 = 2.7pF	D = $\pm 0.5\text{pF}$		
	G = 50VDC	06 = 0603		270 = 27pF	F = $\pm 1\%$		
	B = 100VDC	08 = 0805		271 = 270pF	G = $\pm 2\%$		
	R = 200VDC	11 = 1111		102 = 1000pF	J = $\pm 5\%$		
	H = 250VDC						
	S = 500VDC						
	F = 1500VDC						

\* Below 10pF, R denotes a decimal point.

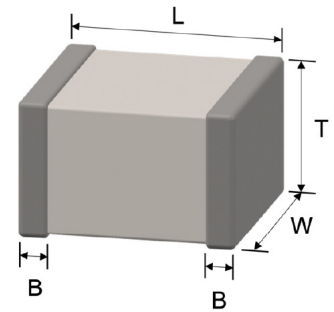
For 10pF and above, first 2 digits are significant values and 3rd digit indicates the number of zeros.

\*\* 0505 and 1111 Case sizes shipped in plastic carrier tape. All other case sizes are shipped in paper carrier.



## Case Size & Dimensions

Case Size EIA (metric)	Length (L) inch (mm)	Width (W) Inch (mm)	Thickness (T) inch (mm)	End-Band (B) inch (mm)
01 01005 (0402)	.016±.001 (0.40±0.02)	.008±.001 (0.20±0.02)	.008±.001 (0.20±0.02)	.004±.001 (0.10±0.03)
02 0201 (0603)	.024±.001 (0.60±0.03)	0.012±.001 (0.30±0.03)	0.012±.001 (0.30±0.03)	.006±.002 (0.15±0.05)
04 0402 (1005)	.039±.002 (1.00±0.05)	.020±.002 (0.50±0.05)	.020±.002 (0.50±0.05)	.010+.002/-.004 (0.25+0.05/-0.10)
05 0505 (1414)	.055+.015/-0.010 (1.40+0.38/-0.25)	.055±.015 (1.40±0.38)	.045±.006 (1.15±0.15)	.010+.010/-0.005 (0.25+0.25/-0.13)
06 0603 (1608)	.063±.004 (1.60±0.10)	.031±.004 (0.80±0.10)	.031±.003 (0.80±0.07)	.016±.005 (0.40±0.15)
06 +0603 (1608)	.063+.006/-0.004 (1.60+0.15/-0.10)	.031+.006/-0.004 (0.80+0.15/-0.10)	.020±.004 (0.50±0.10)	.016±.005 (0.40±0.15)
08 0805 (2012)	.079±.008 (2.00±0.20)	.049±.008 (1.25±0.20)	.033±.004 (0.85±0.10)	.020±.008 (0.50±0.20)
08 +0805 (2012)	.079±.006 (2.00±0.15)	.049±.004 (1.25±0.10)	.024±.004 (0.60±0.10)	.020±.008 (0.50±0.20)
11 1111 (2828)	.110+.020/-0.010 (2.79+0.51/-0.25)	.110±.015 (2.79±0.38)	≤.070 (≤1.78)	.015±.010 (0.38±0.25)



+ Thin profile for capacitance values ≤0.2pF

## Dielectric Properties & Electrical Summary

Dielectric	NP0 (Class I)	X8G (Class I)
Size	01005, 0201, 0402, 0505, 0603, 0805, 1111	0402, 0603, 0805
Capacitance 1	0.1pF to 1000pF	0.2pF to 82pF
Capacitance Tolerance	Cap≤5pF: A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)	
Rated Voltages (WVDC)	6.3V, 10V, 25V, 50V, 100V, 200V, 250V, 500V, 1500V	200V, 250V, 500V
Insulation Resistance	≥10GΩ @ 25°C or RxC≥100Ω-F whichever is smaller	
Operating Temperature	-55 to +125°C	-55 to +150°C
Capacitance Change (TC)	±30ppm/°C	
Dissipation Factor (DF)	0.10% Max	0.15% Max

<sup>1</sup> Measured at 1.0±0.2Vrms, 1.0MHz±10% for capacitance values ≤1000pF and 1.0kHz±10% for capacitance>1000pF

## Available Capacitance Values

### X8G Dielectric (0603 - 0805)

Case Size Voltage	0402		0603		0805		Tolerance Code
	200	250	250	500	250	500	
0.1pF (0R2)	●						
0.2pF (0R2)	●		○	○			A, B
0.3pF (0R3)	●		●	●	●	●	A, B
0.4pF (0R4)	●	●	●	●	●	●	A, B
0.5pF (0R5)	●	●	●	●	●	●	A, B, C
0.6pF (0R6)	●	●	●	●	●	●	A, B, C
0.7pF (0R7)	●	●	●	●	●	●	A, B, C
0.8pF (0R8)	●	●	●	●	●	●	A, B, C
0.9pF (0R9)	●	●	●	●	●	●	A, B, C
1.0pF (1R0)	●	●	●	●	●	●	A, B, C
1.1pF (1R1)	●	●	●	●	●	●	A, B, C
1.2pF (1R2)	●	●	●	●	●	●	A, B, C
1.3pF (1R3)	●	●	●	●	●	●	A, B, C
1.4pF (1R4)	●	●	●	●	●	●	A, B, C
1.5pF (1R5)	●	●	●	●	●	●	A, B, C
1.6pF (1R6)	●	●	●	●	●	●	A, B, C
1.7pF (1R7)	●	●	●	●	●	●	A, B, C
1.8pF (1R8)	●	●	●	●	●	●	A, B, C
1.9pF (1R9)	●	●	●	●	●	●	A, B, C
2.0pF (2R0)	●	●	●	●	●	●	A, B, C
2.1pF (2R1)	●	●	●	●	●	●	A, B, C
2.2pF (2R2)	●	●	●	●	●	●	A, B, C
2.3pF (2R3)	●	●	●	●	●	●	A, B, C
2.4pF (2R4)	●	●	●	●	●	●	A, B, C
2.5pF (2R5)	●	●	●	●	●	●	A, B, C
2.6pF (2R6)	●	●	●	●	●	●	A, B, C
2.7pF (2R7)	●	●	●	●	●	●	A, B, C
2.8pF (2R8)	●	●	●	●	●	●	A, B, C
2.9pF (2R9)	●	●	●	●	●	●	A, B, C
3.0pF (3R0)	●	●	●	●	●	●	A, B, C
3.1pF (3R1)	●	●	●	●	●	●	A, B, C
3.2pF (3R2)	●	●	●	●	●	●	A, B, C
3.3pF (3R3)	●	●	●	●	●	●	A, B, C
3.4pF (3R4)	●	●	●	●	●	●	A, B, C
3.5pF (3R5)	●	●	●	●	●	●	A, B, C
3.6pF (3R6)	●	●	●	●	●	●	A, B, C
3.7pF (3R7)	●	●	●	●	●	●	A, B, C
3.8pF (3R8)	●	●	●	●	●	●	A, B, C
3.9pF (3R9)	●	●	●	●	●	●	A, B, C
4.0pF (4R0)	●	●	●	●	●	●	A, B, C
4.1pF (4R1)	●	●	●	●	●	●	A, B, C
4.2pF (4R2)	●	●	●	●	●	●	A, B, C
4.3pF (4R3)	●	●	●	●	●	●	A, B, C
4.4pF (4R4)	●	●	●	●	●	●	A, B, C
4.5pF (4R5)	●	●	●	●	●	●	A, B, C
4.6pF (4R6)	●	●	●	●	●	●	A, B, C
4.7pF (4R7)	●	●	●	●	●	●	A, B, C
4.8pF (4R8)	●	●	●	●	●	●	A, B, C
4.9pF (4R9)	●	●	●	●	●	●	A, B, C
5.0pF (5R0)	●	●	●	●	●	●	B, C, D
5.1pF (5R1)	●	●	●	●	●	●	B, C, D
5.2pF (5R2)	●	●	●	●	●	●	B, C, D
5.3pF (5R3)	●	●	●	●	●	●	B, C, D
5.4pF (5R4)	●	●	●	●	●	●	B, C, D
5.5pF (5R5)	●	●	●	●	●	●	B, C, D
5.6pF (5R6)	●	●	●	●	●	●	B, C, D
5.7pF (5R7)	●	●	●	●	●	●	B, C, D
5.8pF (5R8)	●	●	●	●	●	●	B, C, D
5.9pF (5R9)	●	●	●	●	●	●	B, C, D
6.0pF (6R0)	●	●	●	●	●	●	B, C, D

### CONTINUED - X8G Dielectric (0603 - 0805)

Case Size Voltage	0402		0603		0805		Tolerance Code
	200	250	250	500	250	500	
6.1pF (6R1)	●	●	●	●	●	●	B, C, D
6.2pF (6R2)	●	●	●	●	●	●	B, C, D
6.3pF (6R3)	●	●	●	●	●	●	B, C, D
6.4pF (6R4)	●	●	●	●	●	●	B, C, D
6.5pF (6R5)	●	●	●	●	●	●	B, C, D
6.6pF (6R6)	●	●	●	●	●	●	B, C, D
6.7pF (6R7)	●	●	●	●	●	●	B, C, D
6.8pF (6R8)	●	●	●	●	●	●	B, C, D
6.9pF (6R9)	●	●	●	●	●	●	B, C, D
6.9pF (6R9)	●	●	●	●	●	●	B, C, D
7.0pF (7R0)	●	●	●	●	●	●	B, C, D
7.1pF (7R1)	●	●	●	●	●	●	B, C, D
7.2pF (7R2)	●	●	●	●	●	●	B, C, D
7.3pF (7R3)	●	●	●	●	●	●	B, C, D
7.4pF (7R4)	●	●	●	●	●	●	B, C, D
7.5pF (7R5)	●	●	●	●	●	●	B, C, D
7.6pF (7R6)	●	●	●	●	●	●	B, C, D
7.7pF (7R7)	●	●	●	●	●	●	B, C, D
7.8pF (7R8)	●	●	●	●	●	●	B, C, D
7.9pF (7R9)	●	●	●	●	●	●	B, C, D
8.0pF (8R0)	●	●	●	●	●	●	B, C, D
8.1pF (8R1)	●	●	●	●	●	●	B, C, D
8.2pF (8R2)	●	●	●	●	●	●	B, C, D
8.3pF (8R3)	●	●	●	●	●	●	B, C, D
8.4pF (8R4)	●	●	●	●	●	●	B, C, D
8.5pF (8R5)	●	●	●	●	●	●	B, C, D
8.6pF (8R6)	●	●	●	●	●	●	B, C, D
8.7pF (8R7)	●	●	●	●	●	●	B, C, D
8.8pF (8R8)	●	●	●	●	●	●	B, C, D
8.9pF (8R9)	●	●	●	●	●	●	B, C, D
9.0pF (9R0)	●	●	●	●	●	●	B, C, D
9.1pF (9R1)	●	●	●	●	●	●	B, C, D
9.2pF (9R2)	●	●	●	●	●	●	B, C, D
9.3pF (9R3)	●	●	●	●	●	●	B, C, D
9.4pF (9R4)	●	●	●	●	●	●	B, C, D
9.5pF (9R5)	●	●	●	●	●	●	B, C, D
9.6pF (9R6)	●	●	●	●	●	●	B, C, D
9.7pF (9R7)	●	●	●	●	●	●	B, C, D
9.8pF (9R8)	●	●	●	●	●	●	B, C, D
9.9pF (9R9)	●	●	●	●	●	●	B, C, D
10pF (100)	●	●	●	●	●	●	F, G, J
11pF (110)	●	●	●	●	●	●	F, G, J
12pF (120)	●	●	●	●	●	●	F, G, J
13pF (130)	●	●	●	●	●	●	F, G, J
15pF (150)	●	●	●	●	●	●	F, G, J
16pF (160)	●	●	●	●	●	●	F, G, J
18pF (180)	●	●	●	●	●	●	F, G, J
20pF (200)	●	●	●	●	●	●	F, G, J
22pF (220)	●	●	●	●	●	●	F, G, J
24pF (240)	●	●	●	●	●	●	F, G, J
27pF (270)	●	●	●	●	●	●	F, G, J
30pF (300)	●	●	●	●	●	●	F, G, J
33pF (330)	●	●	●	●	●	●	F, G, J
36pF (360)	●	●	●	●	●	●	F, G, J
39pF (390)	●	●	●	●	●	●	F, G, J
43pF (430)	●	●	●	●	●	●	F, G, J
47pF (470)	●	●	●	●	●	●	F, G, J
56pF (560)	●	●	●	●	●	●	F, G, J
68pF (680)	●	●	●	●	●	●	F, G, J
82pF (820)	●	●	●	●	●	●	F, G, J

### NP0 Dielectric (01005)

Case Size Voltage	01005		Tolerance Code
	16	25	
0.2pF (0R2)	●	●	A, B
0.3pF (0R3)	●	●	A, B
0.4pF (0R4)	●	●	A, B
0.5pF (0R5)	●	●	A, B, C
0.6pF (0R6)	●	●	A, B, C
0.7pF (0R7)	●	●	A, B, C
0.75pF (R75)	●	●	A, B, C
0.8pF (0R8)	●	●	A, B, C
0.9pF (0R9)	●	●	A, B, C
1.0pF (1R0)	●	●	A, B, C
1.2pF (1R2)	●	●	A, B, C
1.5pF (1R5)	●	●	A, B, C
1.8pF (1R8)	●	●	A, B, C
2.0pF (2R0)	●	●	A, B, C
2.2pF (2R2)	●	●	A, B, C
2.7pF (2R7)	●	●	A, B, C
3.0pF (3R0)	●	●	A, B, C
3.3pF (3R3)	●	●	A, B, C
3.9pF (3R9)	●	●	A, B, C
4.0pF (4R0)	●	●	A, B, C
4.7pF (4R7)	●	●	A, B, C
5.0pF (5R0)	●	●	A, B, C
5.6pF (5R6)	●	●	B, C, D
6.0pF (6R0)	●	●	B, C, D
6.8pF (6R8)	●	●	B, C, D
7.0pF (7R0)	●	●	B, C, D
8.0pF (8R0)	●	●	B, C, D
8.2pF (8R2)	●	●	B, C, D
9.0pF (9R0)	●	●	B, C, D
10pF (100)	●	●	C, D, G
12pF (120)	●	●	J
15pF (150)	●	●	J
20pF (200)	●	●	J
22pF (220)	●	●	J

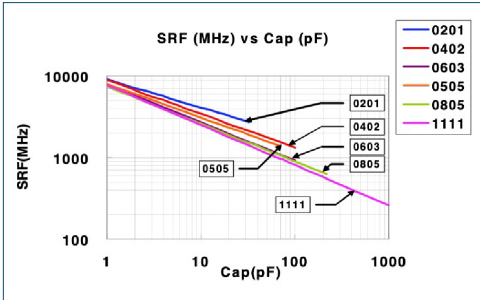
● Capacitance available  
○ Capacitance available (thin profile)



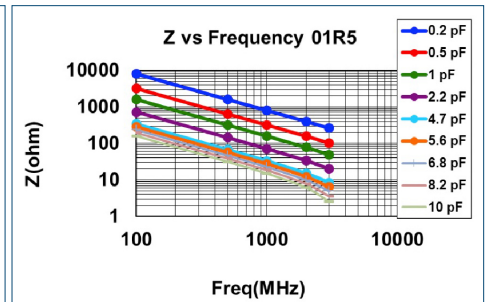
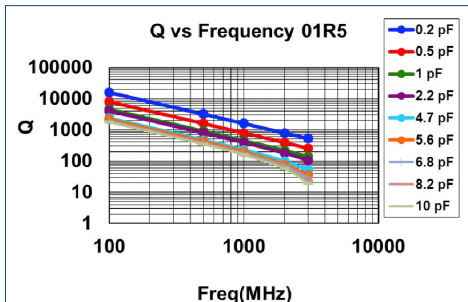
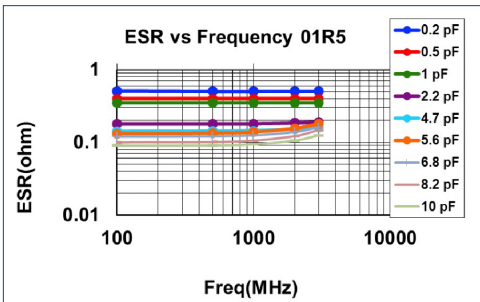


## Frequency Characteristics

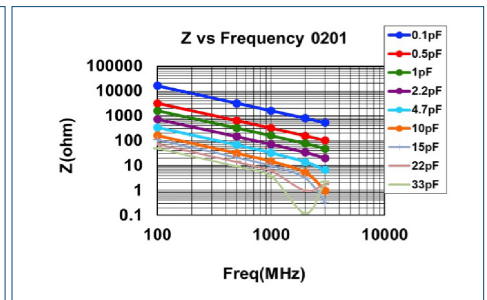
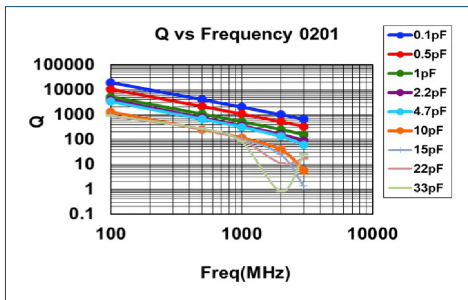
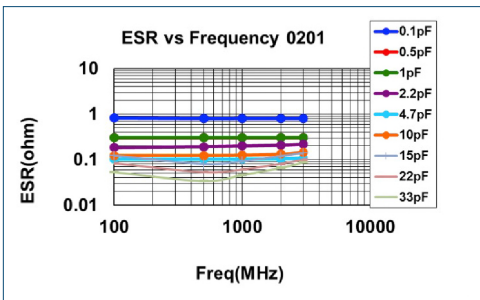
### SRF vs Cap (0201 thru 111)



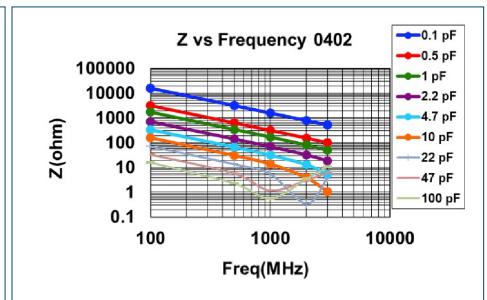
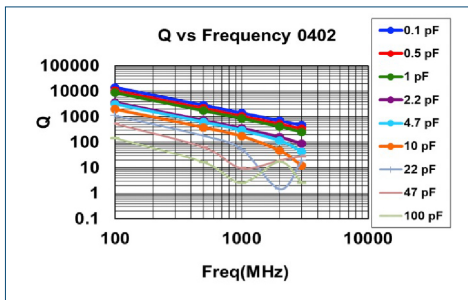
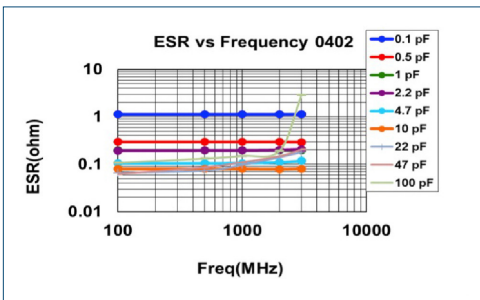
### 01005 Frequency Characteristics



### 0201 Frequency Characteristics

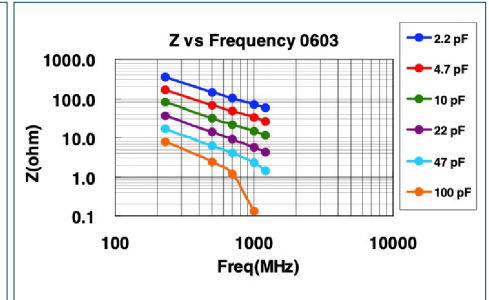
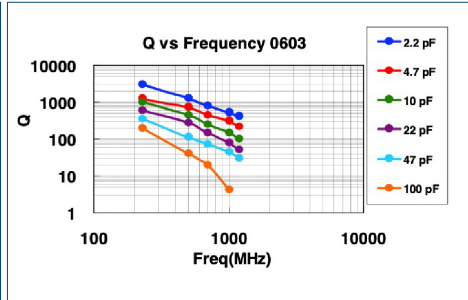
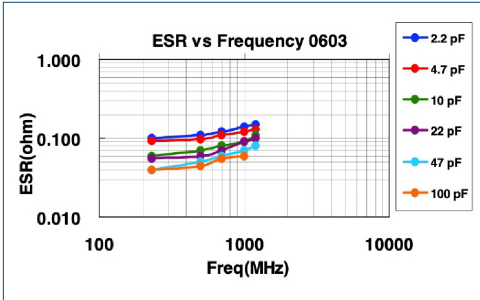


### 0402 Frequency Characteristics

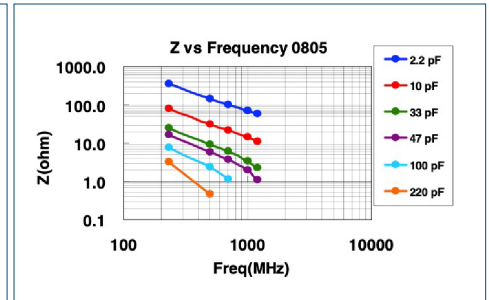
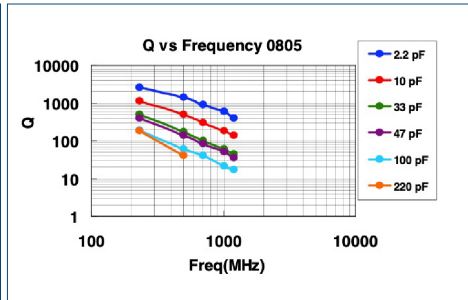
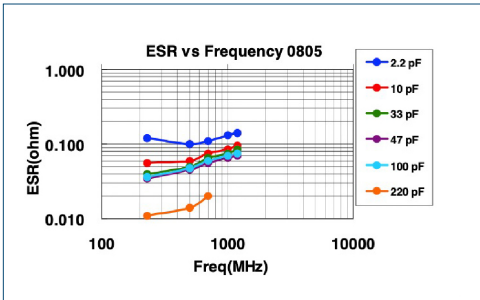


## Frequency Characteristics

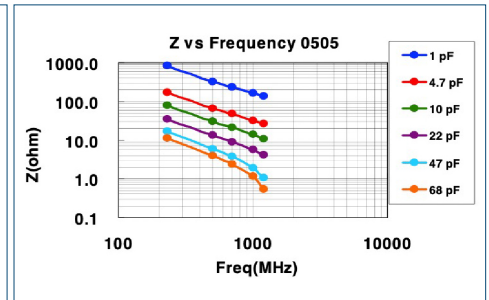
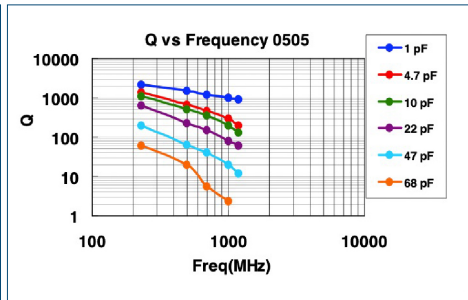
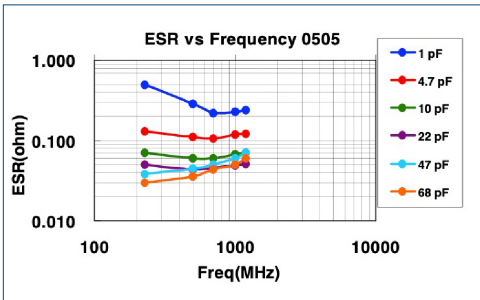
### 0603 Frequency Characteristics



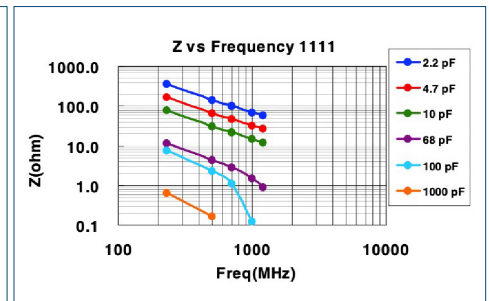
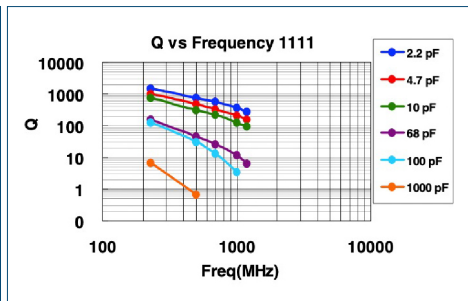
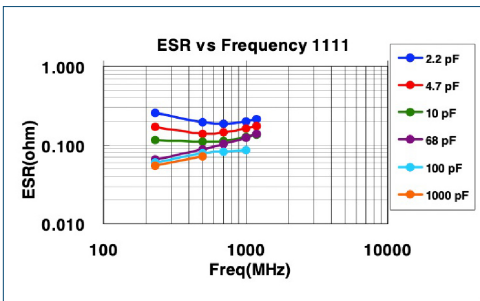
### 0805 Frequency Characteristics



### 0505 Frequency Characteristics



### 1111 Frequency Characteristics



## 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>For capacitance <math>\leq 1000\text{pF}</math>: <math>1.0 \pm 0.2\text{Vrms}</math>, <math>1.0\text{MHz} \pm 10\%</math></li> <li>For capacitance values <math>&gt;1000\text{pF}</math>: <math>1.0 \pm 0.2\text{Vrms}</math>, <math>1.0\text{kHz} \pm 10\%</math></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>Applied voltage:  <math>\leq 100\text{V}</math> : 250% of rated voltage.                      (RF02: 300% rated voltage.)  <math>200\text{V} \sim 300\text{V}</math> : 200% rated voltage. <math>500\text{V} \sim 999\text{V}</math> : 150% rated voltage. <math>1000\text{V} \sim 3000\text{V}</math> : 120% rated voltage</li> <li>Duration: 1 to 5 sec.</li> <li>Charge &amp; discharge current <math>&lt;50\text{mA}</math>.</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  <math>\leq 100\text{V}</math> → max. 120 sec.  <math>\geq 200\text{V}</math> → max 60 sec. (Max 500V)</li> <li>Test at room temperature</li> </ul>	<ul style="list-style-type: none"> <li><math>\geq 10\text{G}\Omega</math> or <math>\text{RxC} \geq 100\Omega\text{-F}</math> whichever is smaller</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 <math>\pm 30\text{ppm}/^\circ\text{C}</math>;                      → NP0: <math>-55 \sim 125^\circ\text{C}</math> at <math>25^\circ\text{C}</math>                      → X8G: <math>-55 \sim 150^\circ\text{C}</math> at <math>25^\circ\text{C}</math></li> </ul>
6	Termination Adhesion Strength	<ul style="list-style-type: none"> <li>Applied Force                      01005: 1N; 0201: 2N; 0402 to 0603: 5N;  <math>&gt;0603</math>: 10N</li> <li>Test time: <math>10 \pm 1</math> sec.</li> </ul>	<ul style="list-style-type: none"> <li>No major damage or removal of termination</li> </ul>
7	Vibration Resistance	<ul style="list-style-type: none"> <li>Vibration frequency: <math>10 \sim 55</math> Hz/min.</li> <li>Total amplitude: 1.5mm</li> <li>Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</li> <li>Cap./DF(Q) Measurement to be made after de-aging at <math>150^\circ\text{C}</math> for 1hr then set for <math>24 \pm 2</math> hrs at room temp</li> </ul>	<ul style="list-style-type: none"> <li>No major damage</li> <li>Capacitance change, Q and DF to meet initial specification</li> </ul>
8	Solderability	<ul style="list-style-type: none"> <li>Solder temperature: <math>235 \pm 5^\circ\text{C}</math></li> <li>Dipping time: <math>2 \pm 0.5</math> sec.</li> </ul>	<ul style="list-style-type: none"> <li>95% min. coverage of all metalized area.</li> </ul>
9	Bend Test	<ul style="list-style-type: none"> <li>Force applied to middle of substrate at a rate of approx. <math>1\text{mm/s}</math> until 1mm deflection achieved, pressure maintained for <math>5 \pm 1</math> sec.</li> </ul>	<ul style="list-style-type: none"> <li>No major damage</li> <li>Capacitance change before and after test within <math>\pm 5.0\%</math> or <math>\pm 0.5\text{pF}</math> (whichever is larger).</li> </ul>
10	Resistance to Soldering Heat	<ul style="list-style-type: none"> <li>Solder temperature: <math>260 \pm 5^\circ\text{C}</math></li> <li>Dipping time: <math>10 \pm 1</math> sec</li> <li>Preheating: <math>120 \sim 150^\circ\text{C}</math> for 1 min before immersion</li> <li>Cap. / DF(Q) / I.R. Measurement to be made after de-aging at <math>150^\circ\text{C}</math> for 1hr then 24hr age at RT</li> </ul>	<ul style="list-style-type: none"> <li>No major damage</li> <li>Capacitance change: within <math>\pm 2.5\%</math> or <math>\pm 0.25\text{pF}</math> whichever is larger.                      Q/D.F., I.R. and dielectric strength meet initial spec</li> <li>25% max. leaching on each edge.</li> </ul>

## Test Conditions

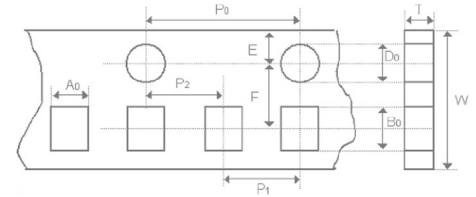
No.	Item	Test Condition	Requirements																																		
11	Temperature Cycle	<ul style="list-style-type: none"> <li>Conduct 5-cycles:               <ol style="list-style-type: none"> <li>Min operating temp: +0/-3°C for 30±3mins</li> <li>Room temp for 2-3mins</li> <li>Max operating temp: +0/-3°C for 30±3mins</li> <li>Room Temp for 2-3 mins</li> </ol> </li> <li>Cap. / DF(Q) / 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 defects</li> <li>Cap change: within ±2.5% or ±0.25pF whichever is larger.</li> <li>Q/D.F., I.R. and dielectric strength: To meet initial requirements.</li> </ul>																																		
12	Humidity (Steady State)	<ul style="list-style-type: none"> <li>Test temp.: 40±2°C</li> <li>Humidity: 90~95% RH</li> <li>Test time: 500+24/-0hrs.</li> <li>Cap. / DF(Q) / 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 ±5.0% or ±0.5pF whichever is larger.</li> <li>Q/D.F. value: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥275+2.5C Cap&lt;10pF; Q≥200+10C</li> <li>I.R. ≥1GΩ</li> </ul>																																		
13	Humidity (Under Load)	<ul style="list-style-type: none"> <li>Test temp.: 40±2°C</li> <li>Humidity: 90~95%RH</li> <li>Test time: 500+24/-0 hrs.</li> <li>Applied voltage: rated voltage (MAX. 500V)</li> <li>Cap. / DF(Q) / 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>Q/D.F. value: Cap≥30pF, Q≥200; Cap&lt;30pF, Q≥100+10/3C</li> <li>I.R.: ≥500MΩ.</li> </ul>																																		
14	High Temperature Load	<ul style="list-style-type: none"> <li>Test temp.: NP0: 125±3°C X8G: 150±3°C</li> <li>Applied voltage:               <ol style="list-style-type: none"> <li>(1) 10V≤Ur&lt;500V: 200% rated voltage.</li> <li>(2) ≤6.3V or 500V: 150% rated voltage.</li> <li>(3) Ur≥630V: 120% rated voltage.</li> </ol> </li> <li>Test time: 1000+24/-0 hrs.</li> <li>Cap. / DF(Q) / 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 ±3.0% or ±0.3pF whichever is larger.</li> <li>Q/D.F. value: Cap≥30pF, Q≥350; 10pF≤Cap&lt;30pF, Q≥275+2.5C Cap&lt;10pF; Q≥200+10C</li> <li>I.R. ≥1GΩ</li> </ul>																																		
15	ESR	<ul style="list-style-type: none"> <li>The ESR should be measured at room temperature and tested at 1.0±0.1 GHz.</li> <li>The ESR should be measured at room temperature and tested at 500±50 MHz.</li> </ul>	<table border="1"> <tbody> <tr> <td rowspan="4">01005</td> <td>0.2pF≤Cap≤1pF:&lt; 700mΩ/pF</td> <td rowspan="4">0201</td> <td>0.1pF≤Cap≤1pF:&lt; 350mΩ/pF</td> </tr> <tr> <td>1pF&lt;Cap≤2pF:&lt; 600mΩ</td> <td>1pF&lt;Cap≤5pF:&lt; 300mΩ</td> </tr> <tr> <td>2pF&lt;Cap≤5pF:&lt; 500mΩ</td> <td>5pF&lt;Cap≤22pF:&lt; 250mΩ</td> </tr> <tr> <td>5pF&lt;Cap≤10pF:&lt; 300mΩ</td> <td></td> </tr> <tr> <td rowspan="3">0402</td> <td>10pF&lt;Cap≤22pF:&lt; 350mΩ</td> <td rowspan="3">0603</td> <td>0.1pF≤Cap≤1pF:&lt; 1500mΩ</td> </tr> <tr> <td>0.1pF≤Cap≤1pF:&lt; 350mΩ/pF</td> <td>1pF&lt;Cap≤10pF:&lt; 250mΩ</td> </tr> <tr> <td>1pF&lt;Cap≤5pF:&lt; 300mΩ</td> <td>10pF&lt;Cap≤220pF:&lt; 200mΩ</td> </tr> <tr> <td rowspan="3">0505</td> <td>5pF&lt;Cap≤100pF:&lt; 250mΩ</td> <td rowspan="3">0805</td> <td>0.3pF≤Cap≤1pF:&lt; 1500mΩ</td> </tr> <tr> <td>0.4pF≤Cap&lt;1.0pF:&lt; 1500mΩ</td> <td>1pF&lt;Cap≤10pF:&lt; 250mΩ</td> </tr> <tr> <td>1.0pF≤Cap&lt;10pF:&lt; 250mΩ</td> <td>Cap&gt;10pF:&lt; 200mΩ</td> </tr> <tr> <td colspan="2"></td> <td colspan="2">0201, 22pF≤Cap≤33pF:&lt; 300mΩ</td> </tr> <tr> <td colspan="2"></td> <td colspan="2">1111, 100pF&lt;Cap≤1000pF:&lt; 150mΩ</td> </tr> </tbody> </table>	01005	0.2pF≤Cap≤1pF:< 700mΩ/pF	0201	0.1pF≤Cap≤1pF:< 350mΩ/pF	1pF<Cap≤2pF:< 600mΩ	1pF<Cap≤5pF:< 300mΩ	2pF<Cap≤5pF:< 500mΩ	5pF<Cap≤22pF:< 250mΩ	5pF<Cap≤10pF:< 300mΩ		0402	10pF<Cap≤22pF:< 350mΩ	0603	0.1pF≤Cap≤1pF:< 1500mΩ	0.1pF≤Cap≤1pF:< 350mΩ/pF	1pF<Cap≤10pF:< 250mΩ	1pF<Cap≤5pF:< 300mΩ	10pF<Cap≤220pF:< 200mΩ	0505	5pF<Cap≤100pF:< 250mΩ	0805	0.3pF≤Cap≤1pF:< 1500mΩ	0.4pF≤Cap<1.0pF:< 1500mΩ	1pF<Cap≤10pF:< 250mΩ	1.0pF≤Cap<10pF:< 250mΩ	Cap>10pF:< 200mΩ			0201, 22pF≤Cap≤33pF:< 300mΩ				1111, 100pF<Cap≤1000pF:< 150mΩ	
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"Room Temperature" or "RT" equivalent to 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

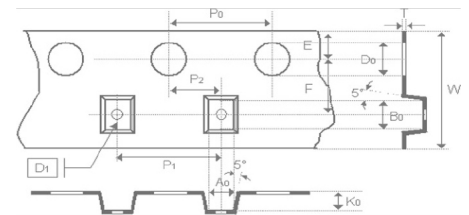
## Packaging Dimensions & Part Count

Size	Carrier Tape Dimensions (mm)						
	01005	0201	0402	505	603	805	1111
A0	0.25 ±0.05	0.40 ±0.10	0.70 ±0.20	<1.90	1.05 ±0.30	1.50 ±0.20	<3.05
B0	0.45 ±0.05	0.70 ±0.10	1.20 ±0.20	<1.90	1.80 ±0.30	2.30 ±0.20	<3.80
T	≤ 0.50	≤ 0.55	≤ 0.80	0.23 ±0.10	≤ 1.20	≤ 1.20	0.23 ±0.10
K0	N/A	N/A	N/A	<1.50	N/A	N/A	< 2.50
W	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30
P0	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
10xP0	40.00 ±0.1	40.00 ±0.1	40.00 ±0.1	40.00 ±0.1	40.00 ±0.1	40.00 ±0.1	40.00 ±0.1
P1	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
P2	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05
D0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D1	N/A	N/A	N/A	1.00 ±0.10	N/A	N/A	1.00 ±0.10
E	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10
F	"3.30 ±0.05"	"3.30 ±0.05"	"3.30 ±0.05"	"3.30 ±0.05"	"3.30 ±0.05"	"3.30 ±0.05"	"3.30 ±0.05"

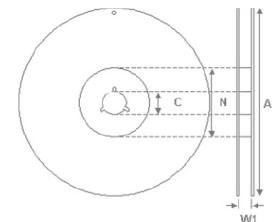
**Paper Tape Dimensions**



**Plastic Tape Dimensions**



**Reel Dimensions**



Size	Thickness (mm)	Type	7" Reel	13" Reel
01005	0.20±0.02	Paper	20,000	-
0201	0.30±0.03		15,000	70,000
0402	0.50±0.05		10,000	50,000
0603	0.80±0.07		4,000	15,000
	0.50±0.10		4,000	-
0805	0.60±0.10		4,000	15,000
	0.85±0.10	4,000	15,000	
0505	1.15±0.15	Plastic	3,000	-
1111	≤ 1.78		2,000	-

Reel Size	01001, 0201, 0402, 0505, 0603, 0805, 1111	
	7" Reel	13" Reel
C	13.0±0.5	13.0±0.5
W <sub>1</sub>	10.0±1.5	10.0±1.5
A	178.0±2.0	330.0±2.0
N	60.0+1.0/-0.0	50.0 min

## Storage & Handling Conditions

- Parts should be stored in their original packing where possible. Temperature should be between 5°C and 40°C. Relative humidity maintained between 20% to 70%
- Do not store in the presence of salts, hydrogen sulfide, sulfur dioxide, chloride gas, ammonia or other acid and alkali.
- It is recommended that the product be used within one year of receipt. Check solderability in case shelf-life extension is needed.

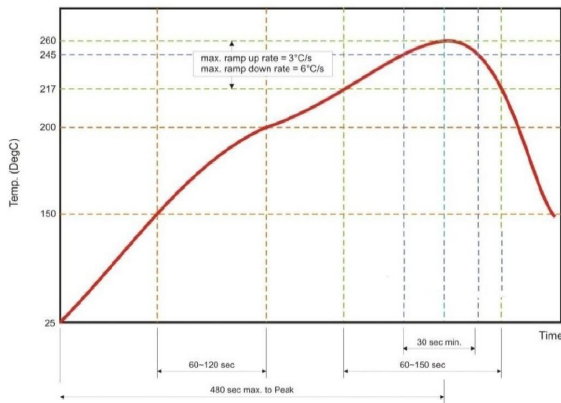
## Soldering Conditions

Termination material is suitable for Pb-free soldering and high-Pb containing solder. Reflow and Wave solder profiles for SAC305 alloy are suggest below. The use of N<sub>2</sub> may be required to aide in solderability especially for higher temperature solder compositions. Case sizes ≤ 0402, 0505 and, 1111 should only be attached using reflow soldering.

Vapour phase soldering can expose parts to similar stresses to those experienced during wave reflow and similar pre-heat and cool down conditions should be considered.

Hand soldering and re-work using a soldering iron can expose the capacitors to very high temperature deltas increasing the risk to cracking of the ceramic body. If use of soldering iron can not be avoided, a fine tip iron not exceeding 30 watts should be used. Parts should be pre-heated carefully and the soldering iron tip must NOT touch the capacitor.

**Recommended reflow profile for SAC305 (Sn/Ag/Cu alloy) solder pastes.**



**Recommended wave profile for SAC305 (Sn/Ag/Cu alloy) solder pastes.**

