



RF Capacitors

Multi-Layer High-Q, Ultra-Low Loss



Johanson High-Q Capacitors are made in North America. These lines of SMT (surface-mount), Multi-Layer High-Q, were developed for High-Q and microwave applications. RoHS compliance is standard of all unleaded parts.

Features:

- Ultra Low Loss / Low ESR
- Designed and Manufactured to Control SRFs
- EIA Case Sizes 0201 to 3838
- AEC-Q200 Available

Common Applications:

- High Frequency Communications
- All Wireless Communications
- Battery-Powered Products
- RF Power Amplifiers
- RF Generators
- Matching Networks



Product Range Summary

Series	EIA Size	Capacitance Range	Capacitance Range Additional Features
QL	0201 (QLCD Series)	0.1 to 50pF	• Made with Silver/Palladium Electrode • Mid High-Q Performance • Exhibit NP0 Temperature Characteristics • Temperature Range: -55°C to +125°C
QC	0402 (QCCF Series)	0.1pF to 33pF	• Made with Copper Electrodes • Ultra High-Q, and Low ESR (Enhanced ESR over 1.5GHz) • Performance with NP0 • Temperature Range: -55°C to +150°C
	0603 (QCCP Series)	0.1pF to 100pF	
	0805 (QCCT Series)	0.1pF to 220pF	
QS	0402 (QSCF Series)	0.1pF to 33pF	• Made with Silver/Palladium Electrodes • Ultra High-Q, and Low ESR • Performance with NP0 • Temperature Range: -55°C to +125°C
	0603 (QSCP Series)	0.1pF to 100pF	
	0805 (QSCT Series)	0.3pF to 220pF	
QE	1111 (QEDB Series)	0.2pF to 1000pF	• Made with Silver/Palladium Electrodes • Excellent high-Q, low ESR • High RF power, from HF to microwave • High Voltage High-Q • Temperature Range: -55°C to +125°C • Automotive version (AEC-Q200) available upon request for 1111
	2525 (QEEV Series)	1.0pF to 2700pF	
	3838 (QEFM Series)	1.0pF to 5100pF	

On request: Any of the High-Q Series, highest temperature can be extended to +150°C


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Mechanical Characteristics

Size	Units	Length	Width	Thickness	End Band
EIA 0201	In	.024 ± .001	.012 ± .001	.012 ± .001	.008 Max.
Metric 0603	mm	(0.60 ± 0.03)	(0.30 ± 0.03)	(0.30 ± 0.03)	(0.20 Max.)
EIA 0402	In	.040 ± .004	.020 ± .004	.020 ± .004	.010 ± .006
Metric 1005	mm	(1.02 ± 0.1)	(0.51 ± 0.1)	(0.51 ± 0.1)	(0.25 ± .15)
EIA 0603	In	.062 ± .006	.032 ± .006	.030 + .005 /- .003	.014 ± .006
Metric 1608	mm	(1.57 ± 0.15)	(0.81 ± 0.15)	(0.76 + .13 - .08)	(0.35 ± .15)
EIA 0805	In	.080 ± .008	.050 ± .008	.040 ± .006	.020 ± .010
Metric 2012	mm	(2.03 ± 0.20)	(1.27 ± 0.20)	(1.02 ± .15)	(0.50 ± .25)
EIA 1111	In	0.110	0.110	0.102 Max.	0.015
Metric 2727	mm	(2.79)	(2.79)	(2.59) Max.	(0.38)
EIA 2525	In	0.230	0.250	0.150 Max.	0.025
Metric 6363	mm	(5.84)	(6.35)	(3.81) Max.	(0.63)
EIA 3838	In	0.380	0.380	0.170 Max.	0.025
Metric 9797	mm	(9.65)	(9.65)	(4.32) Max.	(0.63)

Environmental Characteristics

	Specification	Test Parameters
Solderability	Solder coverage ≥ 90% of metalized areas No termination degradation.	Preheat chip to 120° - 150°C for 60 sec., dip terminals in rosin flux then dip in Sn62 solder @ 240° ± 5°C for 5 ± 1 sec.
Resistance to Soldering Heat	Solder coverage ≥ 90% of metalized areas No termination degradation.	Preheat device to 80° - 100°C for 60 sec. followed by 150° - 180°C for 60 sec. Dip in 260° ± 5°C solder for 10 ± 1 sec. Measure after 24 ± 2 hour cooling period.
Terminal Adhesion	Termination should not pull off. Ceramic should remain undamaged.	Linear pull force* exerted on axial leads soldered to each terminal. *0402 ≥ 2.0lbs, 0603 ≥ 4.0lbs (min.)
PCB Deflection	Termination should not pull off. Ceramic should remain undamaged.	PCB Deflection Spec
Vibration	No mechanical damage. Capacitance change: ± 2.5% or 0.25pF Q>1000 I.R. ≥ 10 G-Ohm. Breakdown voltage: 2.5 x WVDC	Cycle performed for 2 hours in each of three perpendicular directions. Frequency range 10Hz to 55 Hz to 10 Hz traversed in 1 minute. Harmonic motion amplitude: 1.5mm.
Humidity, Steady State	No mechanical damage. Capacitance change: ± 5.0% or 0.50pF max. Q>300 I.R. ≥ 1 G-Ohm. Breakdown voltage: 2.5 x WVDC	Relative humidity: 90 - 95%. Temperature: 40° ± 2°C Test time: 500 +12/-0 Hours Measure after 24 ± 2 hour cooling period
Humidity, Low Voltage	No mechanical damage. Capacitance change: ± 5.0% or 0.50pF max. Q>300 I.R. = 1 G-Ohm min. Breakdown voltage: 2.5 x WVDC	Applied voltage: 1.5 VDC, 50 mA max. Relative humidity: 85 ± 2%. Temperature: 40° ± 2°C. Test time: 240 +12 / -0 Hours Measure after 24 ± 2 hour cooling period
Thermal Cycle	No mechanical damage. Capacitance change: ± 2.5% or 0.25pF Q>2000 I.R. >10 G Ohms. Breakdown voltage: 2.5 x WVDC	5 cycles of: 30 ± 3 minutes @ -55° + 0 / -3°C, 2-3 min. @ 25°C, 30 ± 3 min. @ +125° + 3 / -0°C, 2-3 min. @ 25°C Measure after 24 ± 2 hour cooling period.
Life Test	MIL-STD-202, Method 108 No mechanical damage. Capacitance change: ± 3.0% or 0.3 pF Q>500 I.R. >1 G Ohms. Breakdown voltage: 2.5 x WVDC	Applied voltage: 200% of WVDC for capacitors rated at 500 volts DC or less. Temperature: 125° ± 3°C. Test time: 1000 + 48 - 0 hours



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Technical Notes:

S-Parameter Application Note: <https://www.johansontechnology.com/s-parameter-app-note>

Download Measured S-Parameters: <https://www.johansontechnology.com/s-parameter>

Recommended Land Pattern: <https://www.johansontechnology.com/pcb-pad-layout-recommendations>

Typical Soldering Profiles: <https://www.johansontechnology.com/typical-soldering-profile>

RoHS Compliance: <https://www.johansontechnology.com/rohs-compliance>

Dielectric

Characteristics	Test Parameters
Temperature Coefficient	0 ± 30ppm / °C, -55 to 150°C
Quality Factor / DF	Q >1,000 @ 1 MHz, Typical 10,000
Insulation Resistance	>10 GΩ @ 25°C, WVDC; 125°C IR is 10% of 25°C rating
Dielectric Strength	2.5 X WVDC Min., 25°C, 50 mA max
Test Parameters	1MHz ±50kHz, 1.0±0.2VRMS for capacitance values ≤ 1,000pF 1kHz ±50Hz, 1.0±0.2VRMS for capacitance values > 1,000pF
Available Capacitance	Size 0201: 0.2 - 100 pF Size 0402: 0.2 - 33 pF Size 0603: 0.2 - 100 pF Size 0805: 0.3 - 220 pF Size 1111: 0.2 - 1000 pF Size 2525: 0.5 - 2700 pF Size 3838: 0.5 - 5100 pF



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Voltage Ratings Chart

EIA Size Cap. Value		RF Power Applications														
		0201 (QLC)														
		NP0 (QLCD)	0402 (QSCF)	0402 (QCCF)	0603 (QSCP)	0603 (QCCP)	0805 (QSCT)	0805 (QLCT)	0805 (QCCT)	1111 (QEDB)	2525 (QEEV)	3838 (QEFM)				
Capacitance		Tolerance														
pF	Code															
0.1	0R1	A	25/50 V	50/250 V	250V	250 V	500V			1000V						
0.2	0R2		25/50 V	50/250 V	250V	250 V	500V			1000V	500V	1500V				
0.3	0R3		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V				
0.4	0R4		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V				
0.5	0R5		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V			
0.6	0R6		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
0.7	0R7		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
0.8	0R8		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
0.9	0R9		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.0	1R0		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.1	1R1		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.2	1R2		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.3	1R3		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.4	1R4		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.5	1R5		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.6	1R6		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.7	1R7		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.8	1R8		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
1.9	1R9		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
2.0	2R0		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
2.1	2R1		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
2.2	2R2		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
2.4	2R4		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
2.7	2R7		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
3.0	3R0		25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
3.3	3R3	25/50 V	50/250 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V		
3.6	3R6	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V		
3.9	3R9	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V		
4.3	4R3	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V		
4.7	4R7	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V		
5.1	5R1	A**	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
5.6	5R6		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
6.2	6R2		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
6.8	6R8		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
7.5	7R5		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
8.2	8R2	D	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
9.1	9R1		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
10	100	F	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
11	110		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
12	120		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
13	130		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
15	150		25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
16	160		G	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
18	180			25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
20	200		J	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
22	220			25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
24	240		K	25/50 V	50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
27	270	25/50 V		50/200 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
30	300	25/50 V		50 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	
33	330		25/50 V	50 V	250V	250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V	



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Voltage Ratings Chart

EIA Size Cap. Value		RF Power Applications											
		0201 (QLC)	0402 (QSCF)	0402 (QCCF)	0603 (QSCP)	0603 (QCCP)	0805 (QSCT)	0805 (QLCT)	0805 (QCCT)	1111 (QEDB)	2525 (QEEV)	3838 (QEFM)	
		NP0 (QLCD)											
Capacitance		Tolerance											
pF	Code												
36	360	25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
39	390	25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
43	430	25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
47	470	25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
51	510	25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
56	560				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
62	620				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
68	680				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
75	750				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
82	820				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
91	910				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
100	101				250 V	500V	250 V		1000V	500V	1500V	3600V	7200V
110	111						250 V		500V	300V	1500V	2500V	3600V
120	121						250 V		500V	300V	1000V	2500V	3600V
130	131						250 V		500V	300V	1000V	2500V	3600V
150	151						250 V		500V	300V	1000V	2500V	3600V
160	161						250 V		500V	300V	1000V	2500V	3600V
180	181						250 V		500V	300V	1000V	2500V	3600V
200	201						250 V		500V	300V	1000V	2500V	3600V
220	221						250 V		500V	200V	1000V	2500V	3600V
240	241							200/500V		200V	600V	2500V	3600V
270	271							200/500V		200V	600V	2500V	3600V
300	301							200/500V		200V	600V	1500V	3600V
330	331							200/500V		200V	600V	1500V	3600V
360	361							200/500V		200V	600V	1500V	3600V
390	391							200/500V		200V	500V	1500V	3600V
430	431							200/500V		200V	500V	1500V	2500V
470	471							500V		200V	500V	1500V	2500V
510	511							100V		200V	500V	1000V	2500V
560	561							100V		200V	500V	1000V	2500V
620	621							100V		200V	500V	1000V	2500V
680	681							50V		200V		1000V	2500V
750	751							50V		200V		1000V	2500V
820	821							50V		200V		1000V	2500V
910	911							50V		200V		1000V	1000V
1000	102							50V		200V		1000V	1000V
1200	122							50V				1000V	1000V
1500	152							50V				500V	1000V
1800	182							50V				500V	1000V
2200	222							50V				300V	1000V
2700	272											300V	500V
3300	332												500V
3900	392												500V
4700	472												500V
5100	512												500V
10000	103												


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HOW TO ORDER

QE	EV	252	Q	102	K	3	GU	001	E
Subfamily	Size	Voltage	DTC	Capacitance	Tol	Mark	Termination	Special Code	Pack
QS = S Series QE = E Series QL = L Series QC = C Series QG = G Series	CD = 0201 CF = 0402 CP = 0603 CT = 0805 DB = 1111 EV = 2525 FM = 3838	250 = 25V 500 = 50V 201 = 200V 251 = 250V 501 = 500V 102 = 1000V 152 = 1500V 252 = 2500V 362 = 3600V 722 = 7200V	Q = Hi-Q NP0/C0G G = NP0/C0G	1st two digits are significant; 3rd digit denotes number of zeros. 102 = 1000 pF 104 = 0.10 μ F	<10pF A = ± 0.05 pF B = ± 0.1 pF C = ± 0.25 pF D = ± 0.5 pF ≥ 10pF F = $\pm 1\%$ G = $\pm 2\%$ J = $\pm 5\%$ K = $\pm 10\%$ X = $\pm 80\%$ /-20%	1 = No mark 2 = EIA mark 3 = Cap Code & Tol Marking Available on 0805 and larger sizes AR = Axial Wire (RoHS) AN = Axial Wire (Ni/SnPb) R1 = Radial Ribbon RR = Radial Wire (Ni/Sn RoHS) RN = Radial Wire (Ni/SnPb) ZZ = Special Code	Nickel Barrier GV = Ni/Sn (RoHS) NT = Ni/SnPb GG = Ni/Au (RoHS) Non-Mag¹ GU = Cu/Sn (RoHS) NC = Cu/SnPb Mag¹ M1 = Microstrip A2 = Axial Ribbon	001 = Default catalog item 002³ = Default for AEC-Q200 0805 - 3838 K = 5" Reel Emb E = 7" Reel Emb U = 13" Reel Emb M = 5" Reel Emb Horizontally Oriented Electrodes Q¹ = 5" Reel Emb Vertically Oriented Electrodes G¹ = 7" Reel Emb Horizontally Oriented Electrodes P¹ = 7" Reel Emb Vertically Oriented Electrodes Tape Specs conform to EIA RS481	B = Bulk W = Waffle Pack 0201 - 0603 Y = 5" Reel Paper T = 7" Reel Paper R¹ = 13" Reel Paper

Example: **QCCT102Q910G1GV001K** Capacitors High-Q MLC C-Series, 0805, Hi-Q NP0/C0G, 1,000.00V, 91.00pF $\pm 2\%$, Ni/Sn (RoHS), 5" Reel Embossed Tape

¹ - Not available for all MLCC. Contact factory for info.

² - WVDC - Working Voltage DC

³ - Qualification required for automotive application. Not available for all series. Contact factory for info.

Got questions on the part numbers?

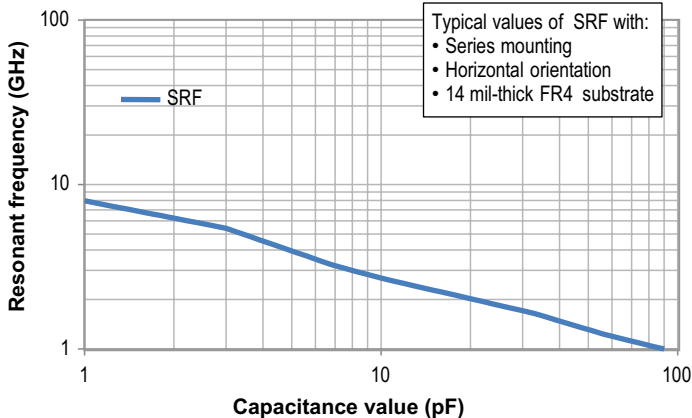
Contact the Johanson technical team at: <https://www.johansontechnology.com/ask-a-question>

RF Capacitors

Multi-Layer High-Q, Ultra-Low Loss - 0201 Size

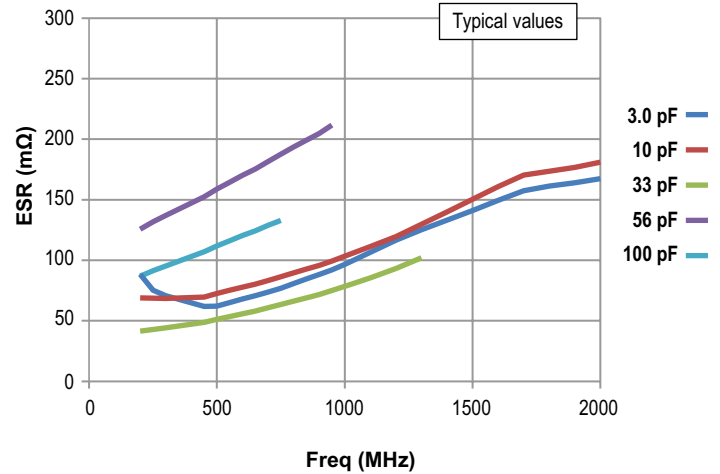
RF Characteristics

0201 - Resonant Frequency

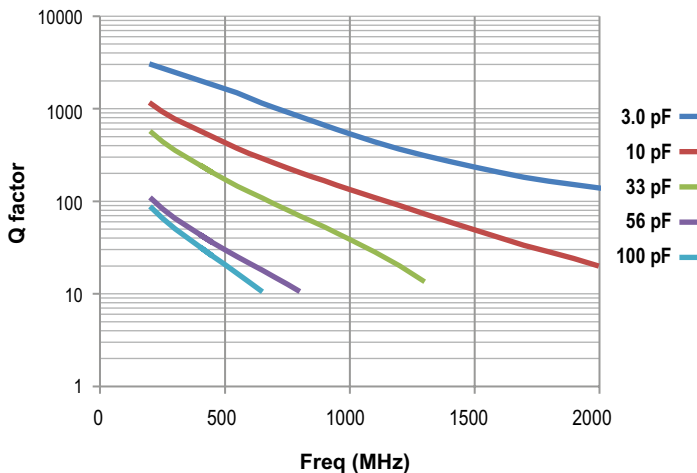


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

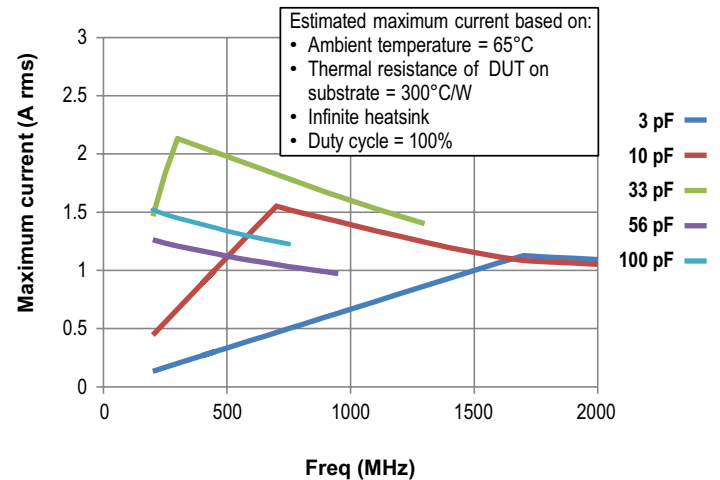
0201 - Equivalent Series Resistance (ESR)



0201 - Q factor



0201 - Max Current

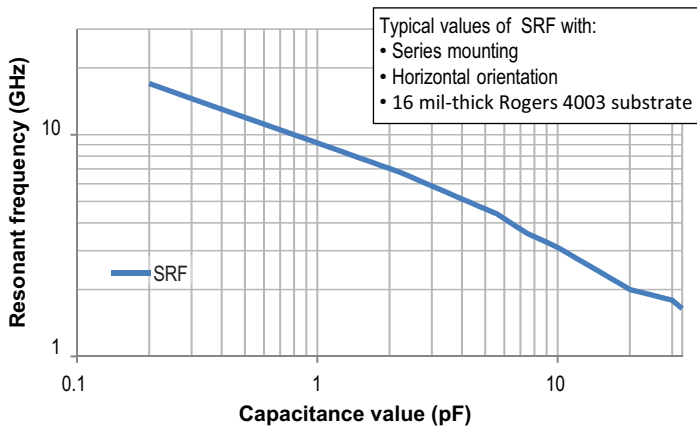


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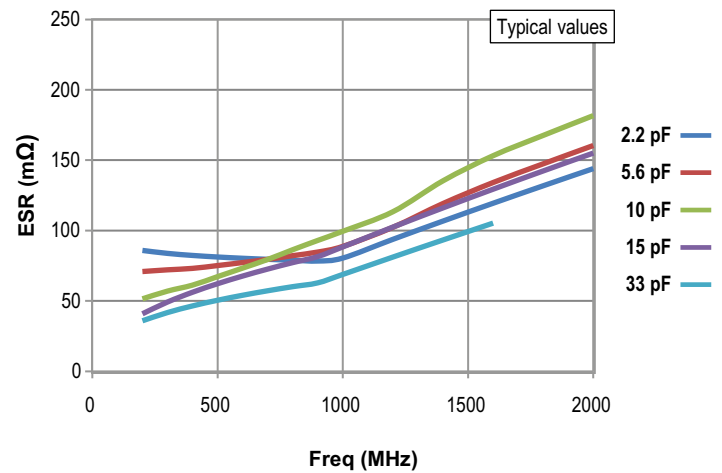
Multi-Layer High-Q, Ultra-Low Loss - 0402 Size

RF Characteristics

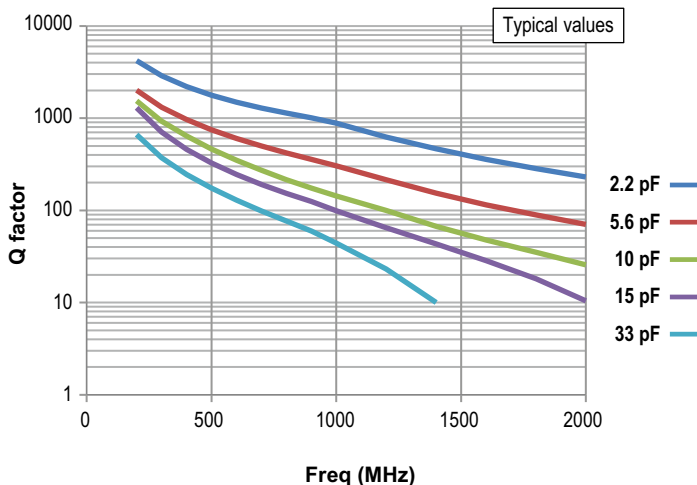
0402 - Series Resonant frequency



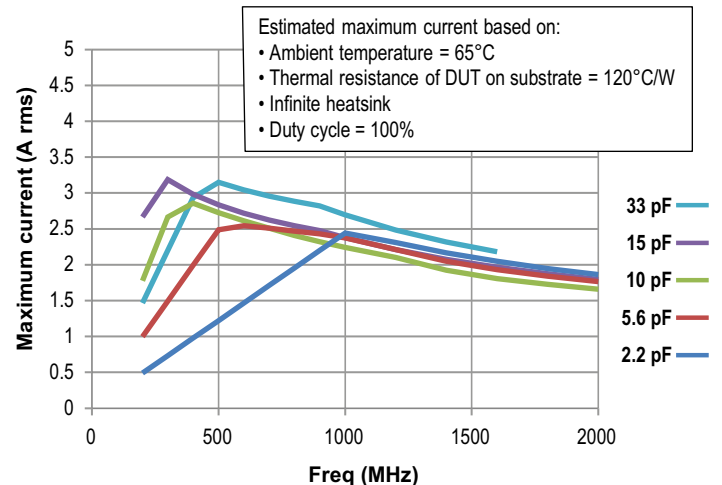
0402 - Equivalent Series Resistance (ESR)



0402 - Q factor



0402 - Max Current

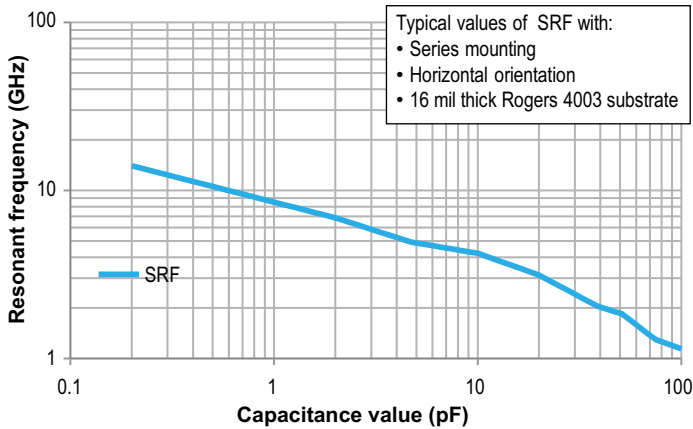


RF Capacitors

Multi-Layer High-Q, Ultra-Low Loss - 0603 Size

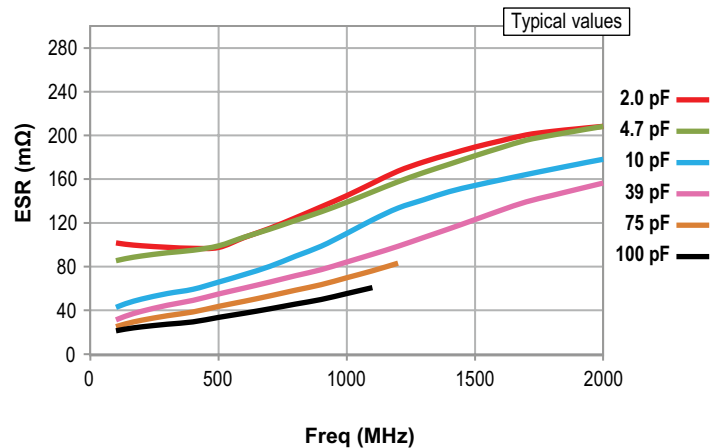
RF Characteristics

0603 - Resonant frequency

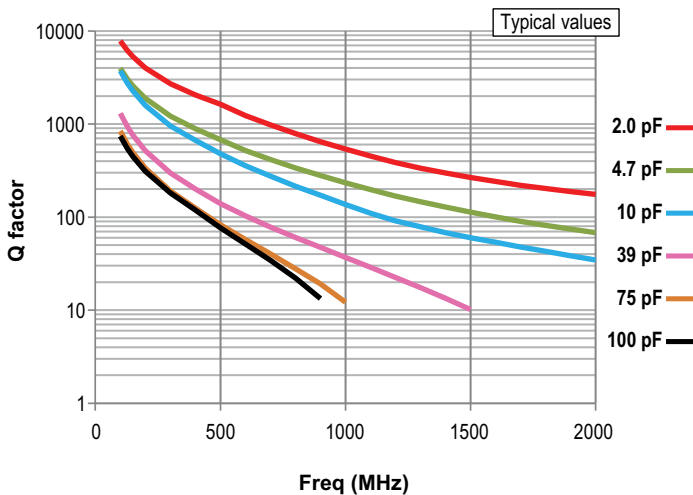


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

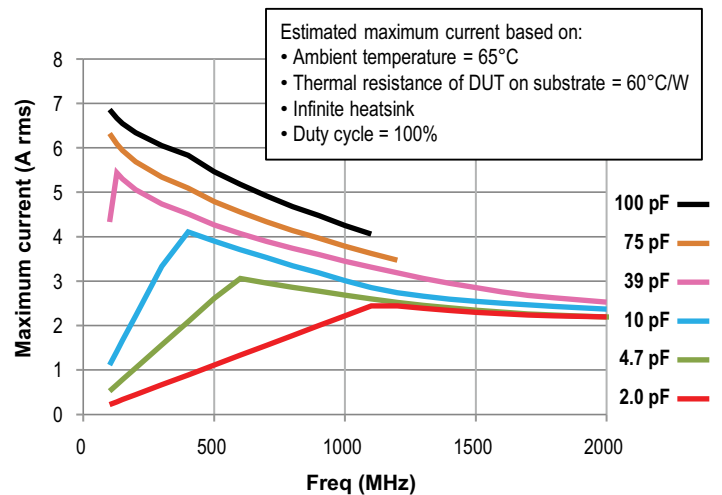
0603 - Equivalent Series Resistance (ESR)



0603 - Q factor



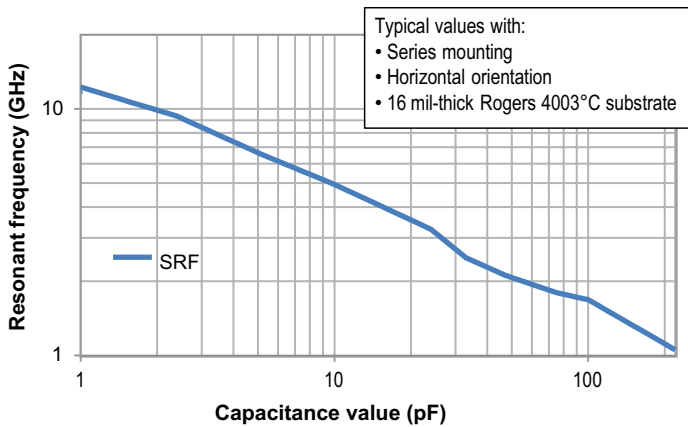
0603 - Max Current



RF Capacitors - Characteristics

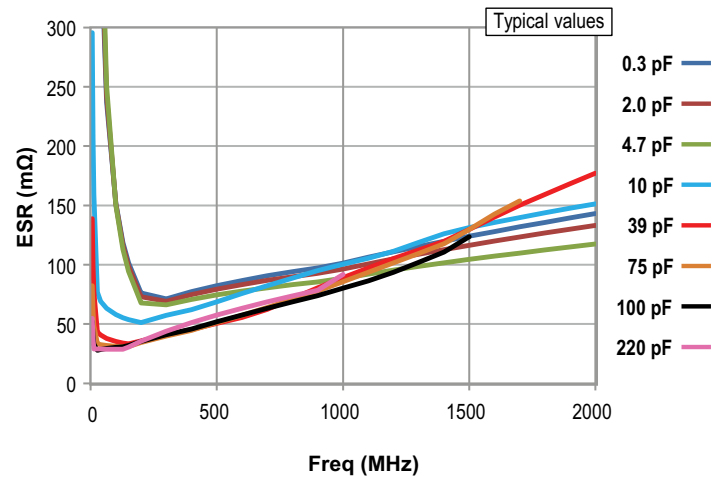
Multi-Layer High-Q, Ultra-Low Loss - 0805 Size

0805 - Resonant frequency

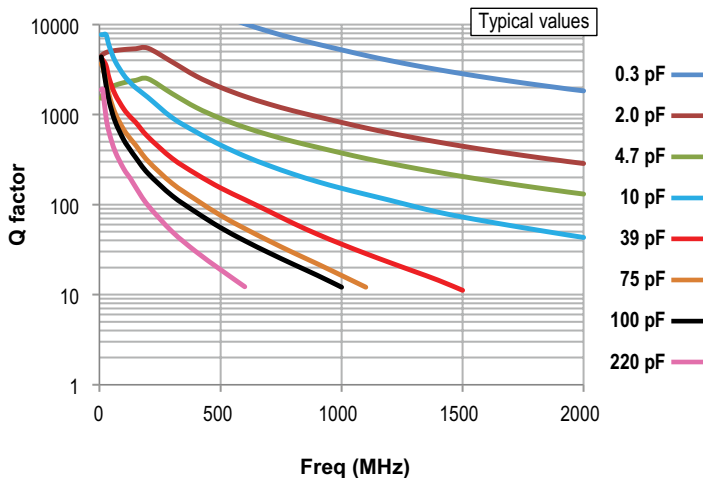


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

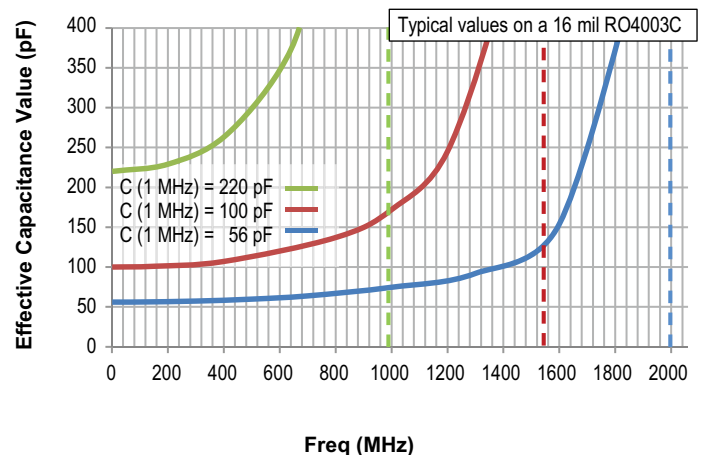
0805 - Equivalent Series Resistance (ESR)



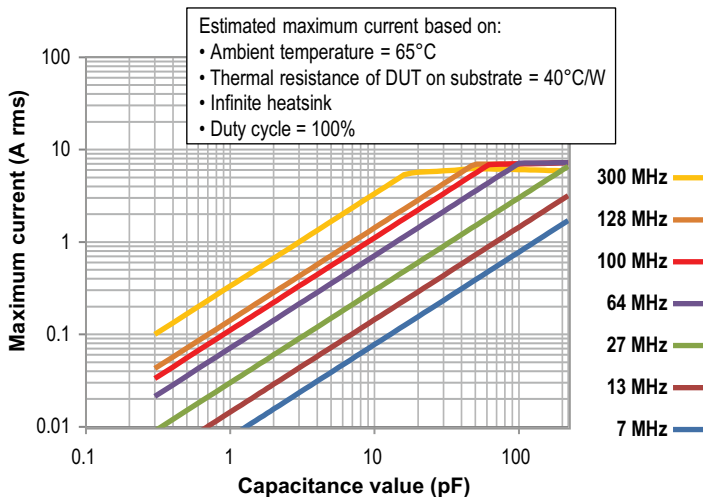
0805 - Q factor



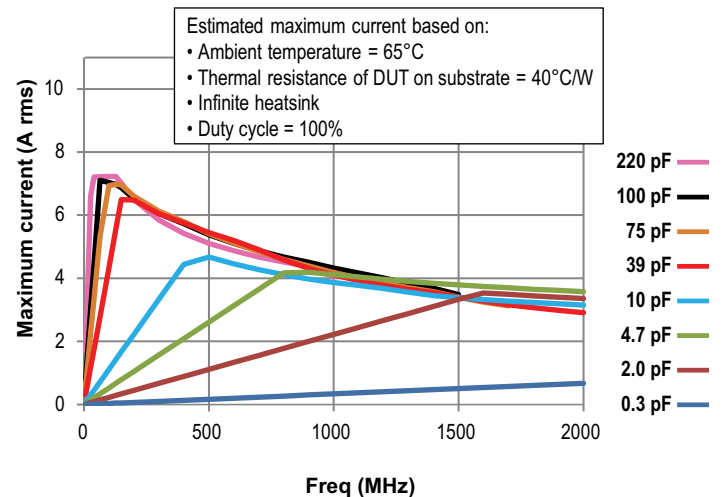
0805 - Effective capacitance value



0805 - Max Current vs. Cap. Value



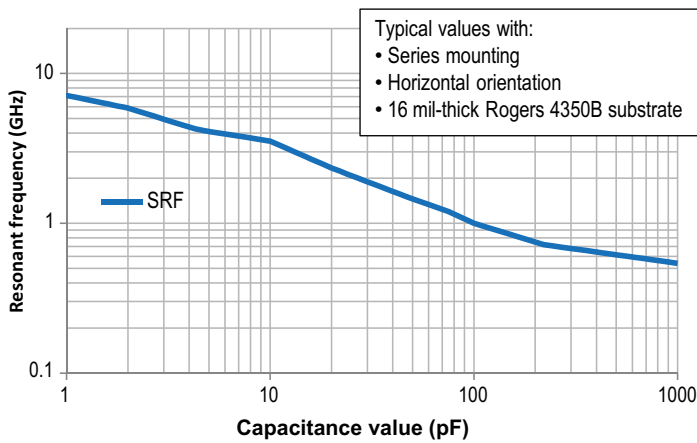
0805 - Max Current vs. Frequency



RF Capacitors - Characteristics

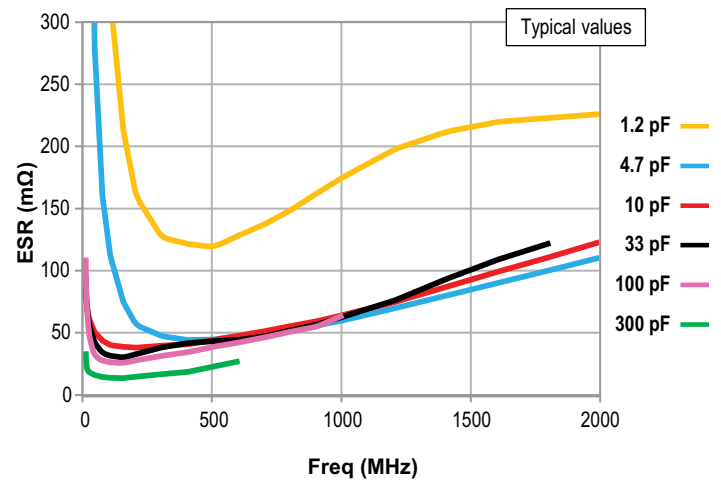
Multi-Layer High-Q, Ultra-Low Loss - 1111 Size

1111 - Resonant frequency

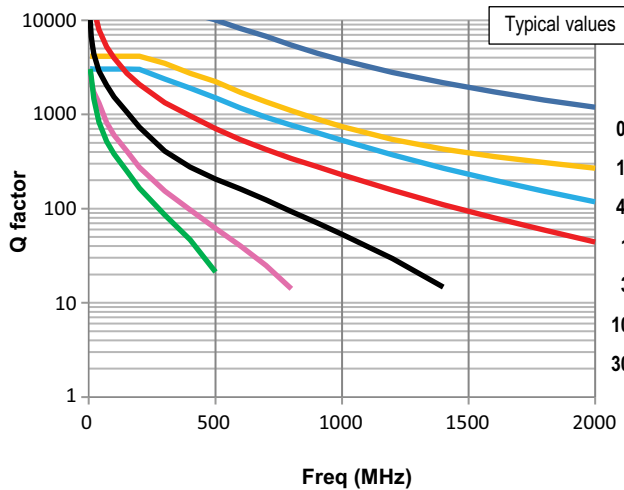


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

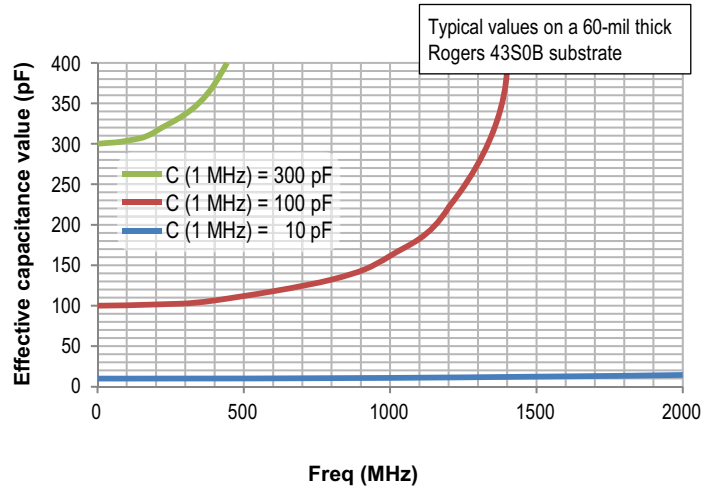
1111 - Equivalent Series Resistance (ESR)



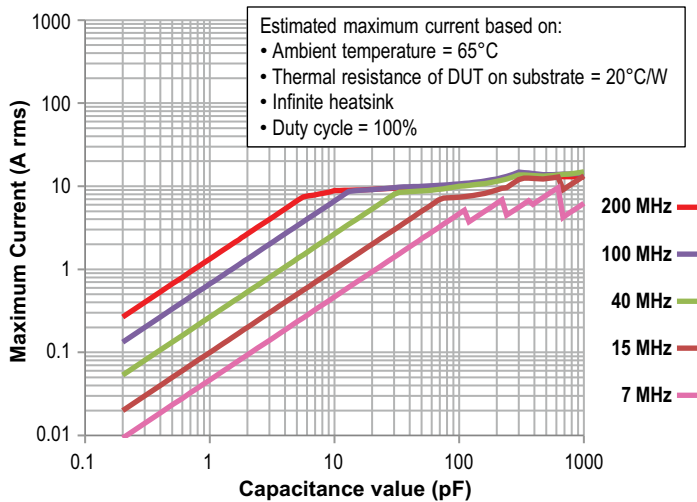
1111 - Q factor



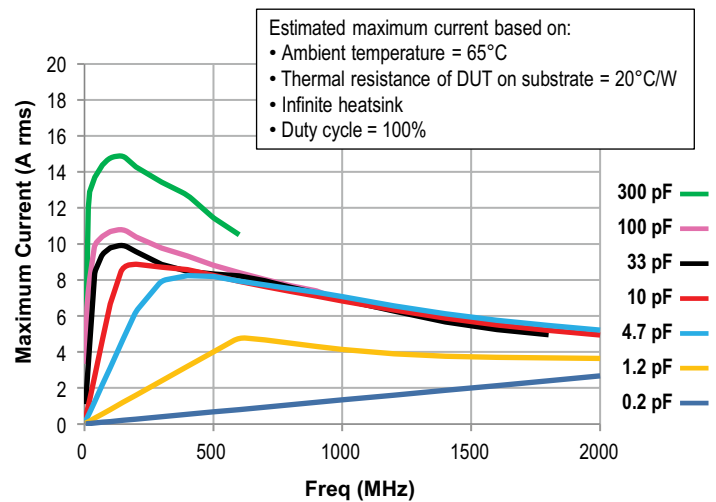
1111 - Effective capacitance value



1111 - Max Current vs. Capacitance Value



1111 - Max Current vs. Frequency

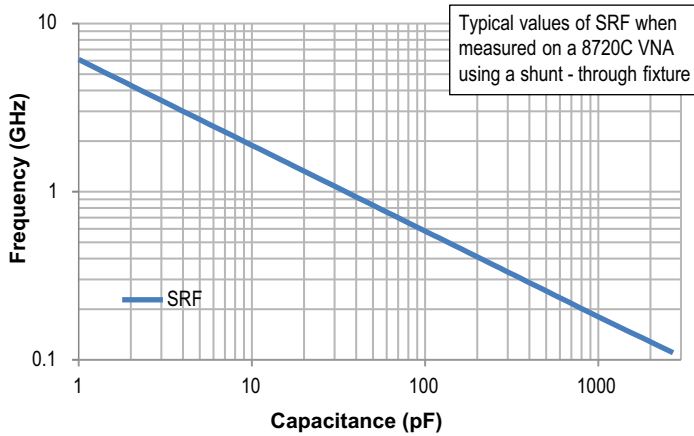


RF Capacitors

Multi-Layer High-Q, Ultra-Low Loss - 2525 Size

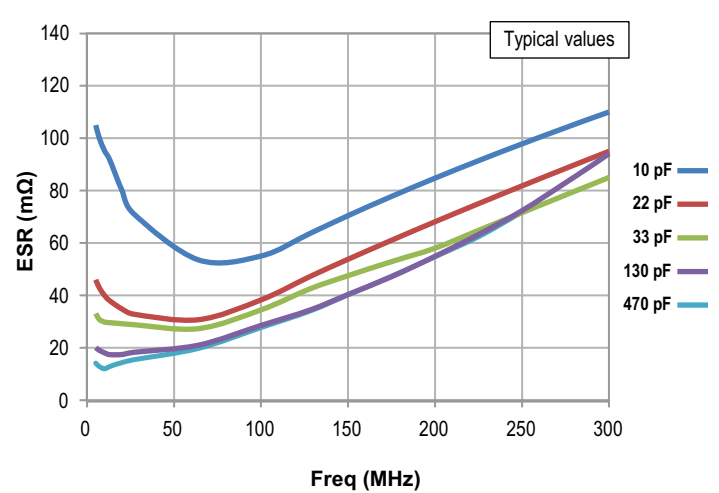
RF Characteristics

2525 - Series Resonant Frequency

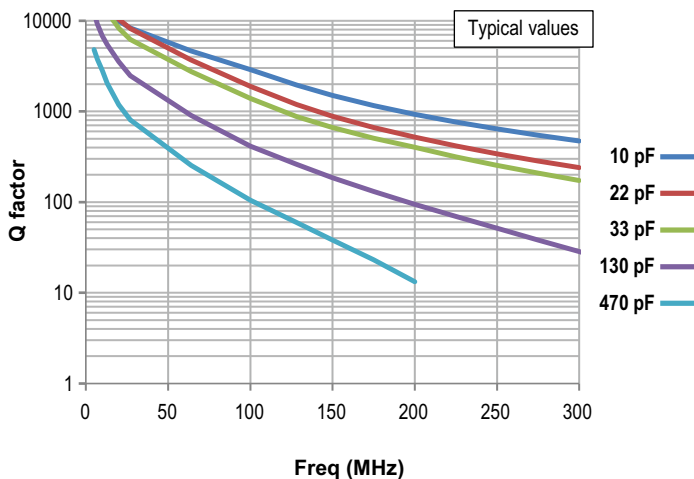


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

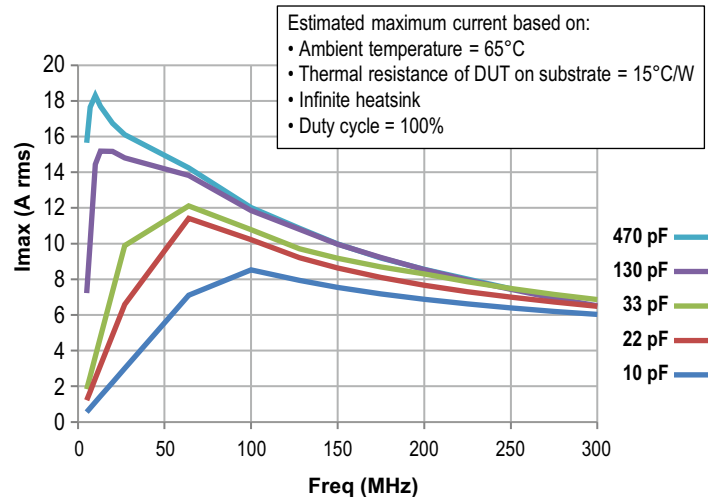
2525 - Equivalent Series Resistance (ESR)



2525 - Q factor



2525 - Max Current vs. Frequency

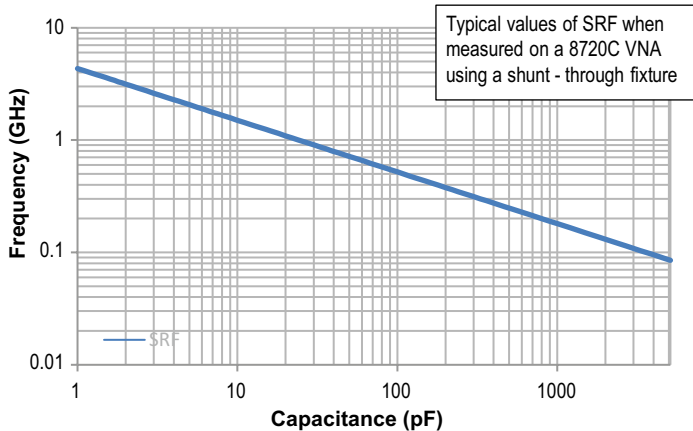


RF Capacitors

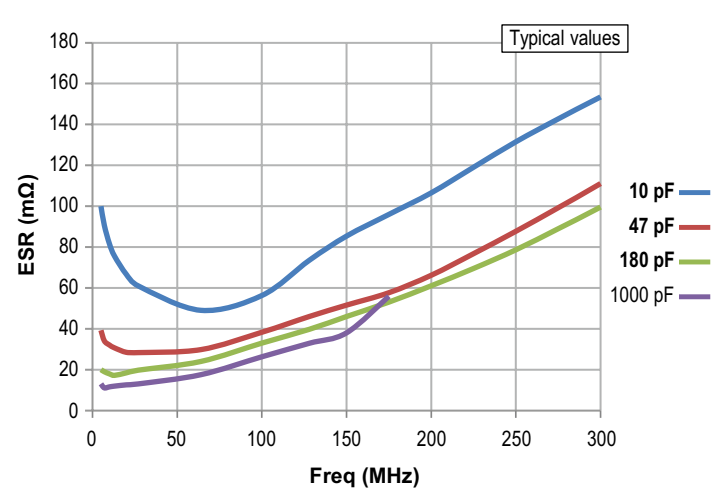
Multi-Layer High-Q, Ultra-Low Loss - 3838 Size

RF Characteristics

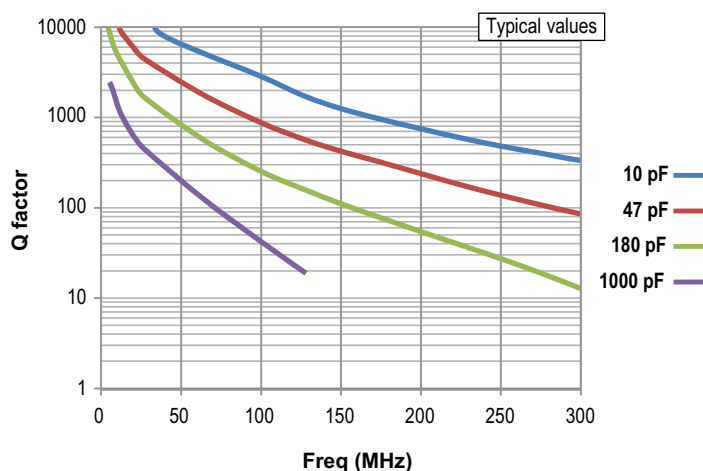
3838 - Resonant Frequency



3838 - Equivalent Series Resistance (ESR)



3838 - Q factor



3838 - Max Current vs. Frequency

