RF Capacitors

Multi-Layer High-Q, Ultra-Low Loss Capacitors

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	CASE SIZE	CAPACITANCE RANGE	ADDITIONAL FEATURES
QL	0201	≥50pF	• Made with Silver/Palladium Electrode • Mid High-Q Performance • Exhibit NP0 Temperature Characteristics • Temperature Range: -55°C to +125°C
QC	0402	0.1 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	0.1pF to 100pF	
	0805	0.1pF to 220pF	
QS	0402	0.1 - 33pF	• Made with Silver/Palladium Electrodes • Ultra High-Q, and Low ESR • Performance with NP0 • Temperature Range: -55° C to +125 ° C
	0603	0.1 - 100pF	
	0805	0.3 - 220pF	
QE	1111	0.2 - 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	1.0 - 2700pF	
	3838	1.0 - 5100pF	

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

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Mechanical & Environmental Characteristics

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 mm ± 0.1 mm)	(0.51 mm ± 0.1 mm)	(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)

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 or 0.5mm is below normal industry standards of 1.0mm and AEC-Q 200 spec of 2.0mm
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 WDVC for capacitors rated at 500 volts DC or less. Temperature: 125° ± 3°C. Test time: 1000 + 48 - 0 hours

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Dielectric & Technical Notes

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

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

RF Capacitors - Multi-Layer High-Q, Ultra-Low Loss Capacitors

Voltage Ratings Chart

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	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	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	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	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	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	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	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

Tolerance: A, B, C, D (0.1 pF – 4.7 pF); A**, B, C, D (5.1 pF – 9.1 pF); F, G, J, K (10 pF – 33 pF)

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Voltage Rating Chart Continued

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														
36	360		25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
39	390		25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
43	430		25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
47	470		25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
51	510		25/50 V			250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
56	560					250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
62	620					250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
68	680					250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
75	750					250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
82	820	F				250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
91	910					250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
100	101	G				250 V	500V	250 V		1000V	500V	1500V	3600V	3600V	7200V
110	111							250 V		500V	300V	1500V	2500V	3600V	7200V
120	121							250 V		500V	300V	1000V	2500V	3600V	7200V
130	131	J						250 V		500V	300V	1000V	2500V	3600V	7200V
150	151							250 V		500V	300V	1000V	2500V	3600V	7200V
160	161	K						250 V		500V	300V	1000V	2500V	3600V	7200V
180	181							250 V		500V	300V	1000V	2500V	3600V	7200V
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	F							50V		200V		1000V	2500V	
820	821								50V		200V		1000V	2500V	
910	911	G							50V		200V		1000V	1000V	
1000	102								50V		200V		1000V	1000V	
1200	122								50V				1000V	1000V	
1500	152	J							50V				500V	1000V	
1800	182								50V				500V	1000V	
2200	222	K							50V				300V	1000V	
2700	272												300V	500V	
3300	332													500V	
3900	392													500V	
4700	472													500V	
5100	512													500V	
10000	103														

RF Capacitors - Multi-Layer High-Q, Ultra-Low Loss Capacitors

How To Order

HOW TO ORDER

QE	EV	252	Q	102
Subfamiy	**Size**	**Voltage**	**DTC**	**Capacitance**
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	1st two digits are significant; 3rd digit denotes number of zeros. **102** = 1000 pF **104** = 0.10 µF

K	3	GU	001	E
Tol	**Mark**	**Termination**	**Special Code**	**Pack**
<10pF **A** = ±0.05pF **B** = ±0.1pF **C** = ±0.25pF **D** = ±0.5pF **≥10pF** **F** = ±1% **G** = ±2% **J** = ±5% **K** = ±10%	**1** = No mark **2** = EIA mark **3** = Cap Code & Tol **Marking** available on 0805 and larger sizes	**Nickel Barrier** **GV** = Ni/Sn (RoHS) **NT** = Ni/SnPb **GG** = Ni/Au (RoHS) **Non-Mag**[1] **GU** = Cu/Sn (RoHS) **NC** = Cu/SnPb **Mag**[1] **M1** = Microstrip **A2** = Axial Ribbon **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	**001** = Default catalog item **002**[3] = Default for AEC-Q200	**B** = Bulk **W** = Waffle Pack **0201 - 0603** **Y** = 5" Reel Paper **T** = 7" Reel Paper **R**[1] = 13" Reel Paper **0805 - 3838** **K** = 5" Reel Emb **E** = 7" Reel Emb **U** = 13" Reel Emb **M** = 5" Reel Emb Horizontally Oriented Electrodes **Q**[1] = 5" Reel Emb Vertically Oriented Electrodes **G**[1] = 7" Reel Emb Horizontally Oriented Electrodes **P**[1] = 7" Reel Emb Vertically Oriented Electrodes **Tape Specs** conform to EIA RS481

Example: **QEEV252Q102K3GU001E** Capacitors High-Q MLC E-Series, 2525, Hi-Q NP0/C0G, 2500V, 47pF±10%, Cu/Sn (RoHS), 7" Reel Embossed Tape

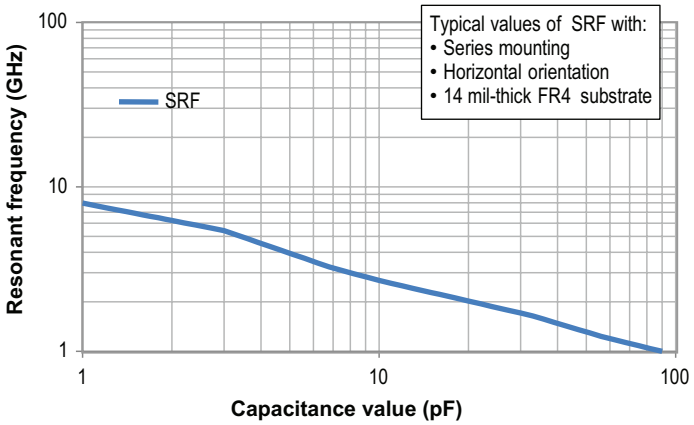
[1] - Not available for all MLCC. Contact factory for info.
[2] - WVDC - Working Voltadge DC
[3] - Qualification required for automotive application. Not available for all series. Contact factory for info.

Got questions on the part numbers?
Contact the Johanson technical team at:
https://www.johansontechnology.com ask-a-question

RESOURCE ▶ https://www.johansontechnology.com/high-q-multi-layer-capacitors

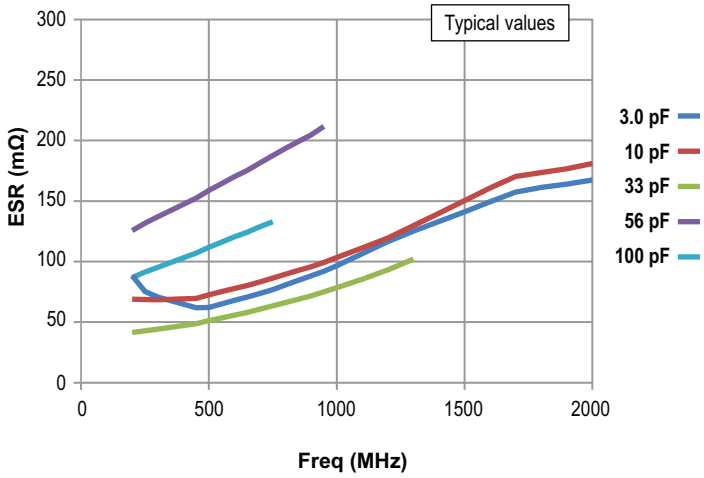
RF Characteristics - 0201 Size

0201 - Resonant Frequency

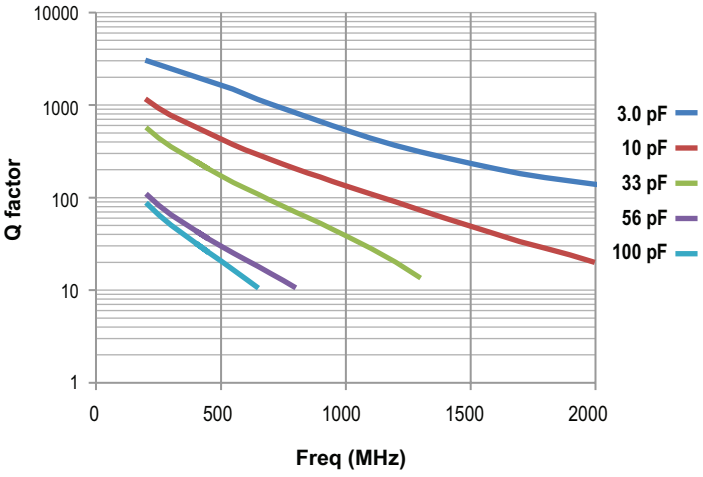


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

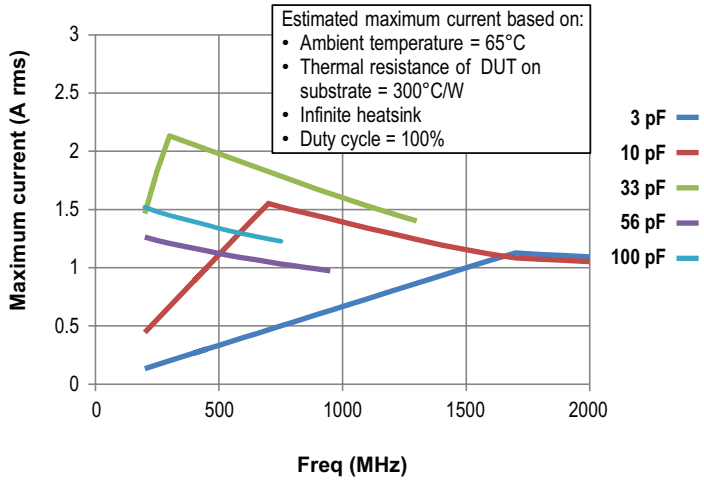
0201 - Equivalent Series Resistance (ESR)



0201 - Q factor

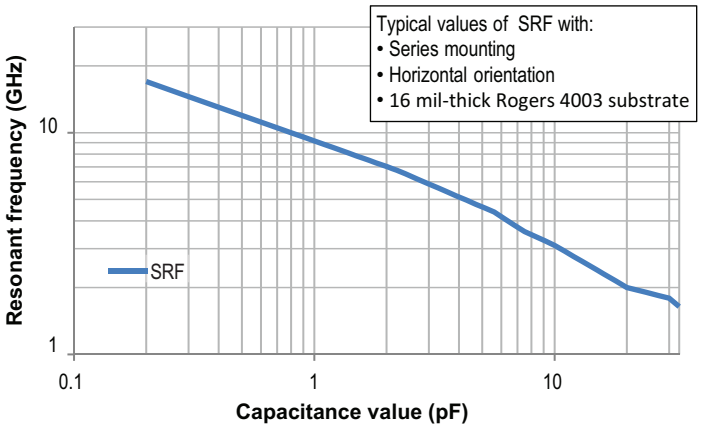


0201 - Max Current



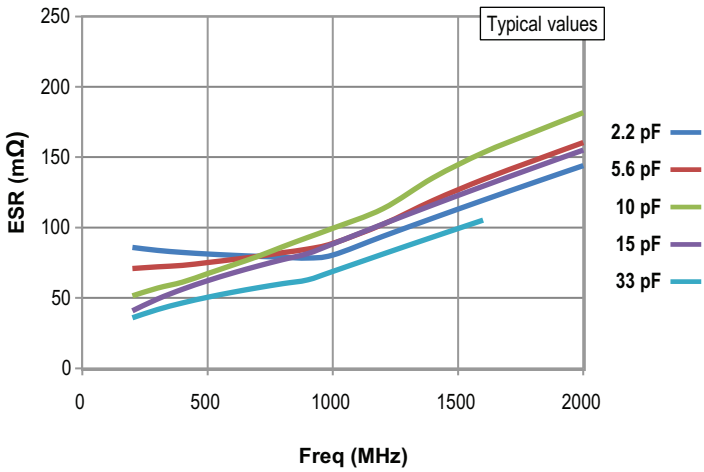
RF Characteristics - 0402 Size

0402 - Series Resonant frequency

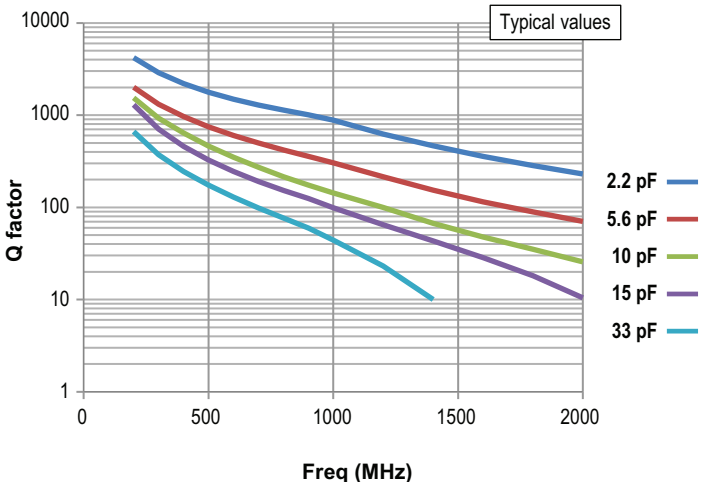


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

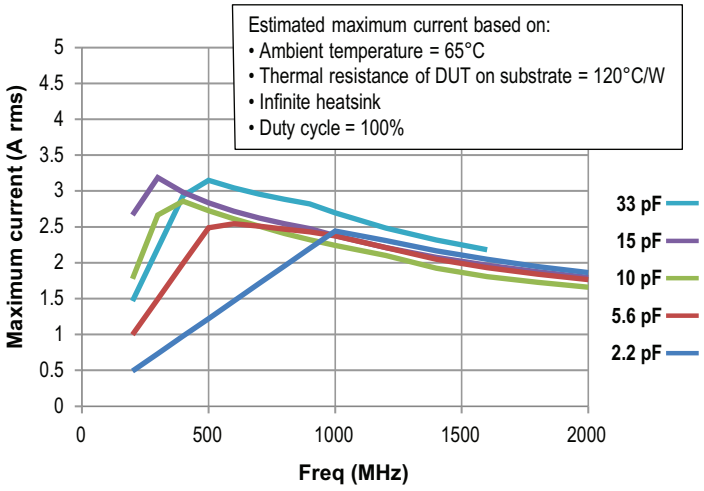
0402 - Equivalent Series Resistance (ESR)



0402 - Q factor

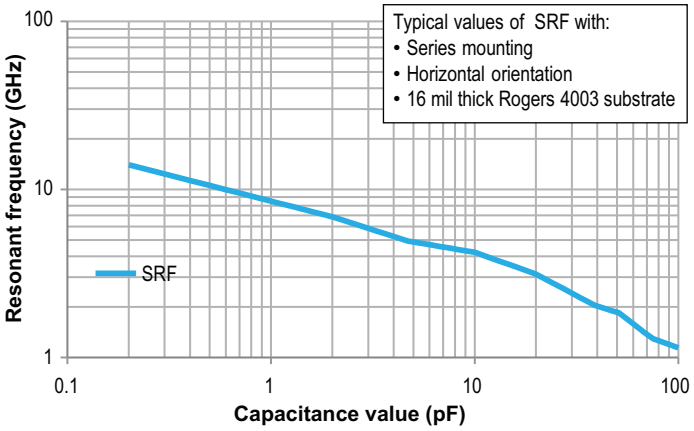


0402 - Max Current



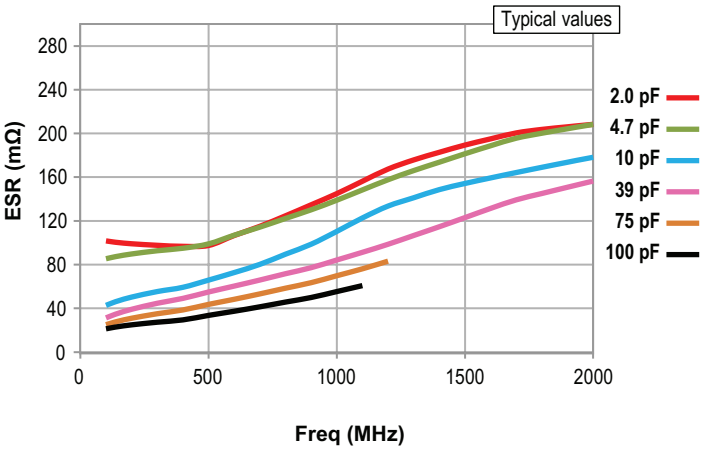
RF Characteristics - 0603 Size

0603 - Resonant frequency

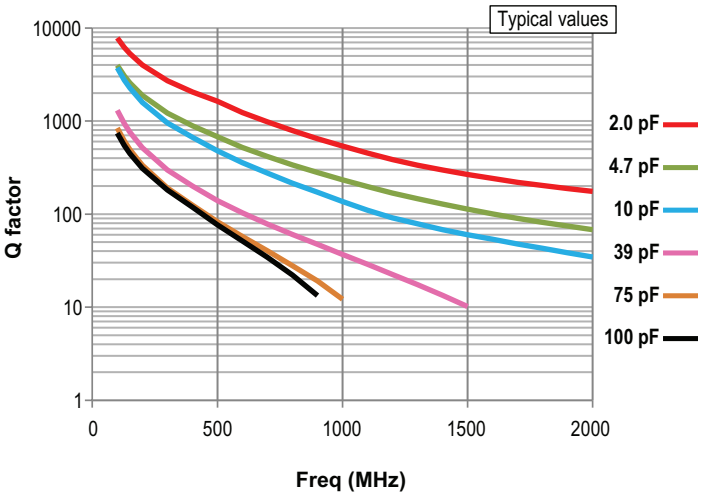


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

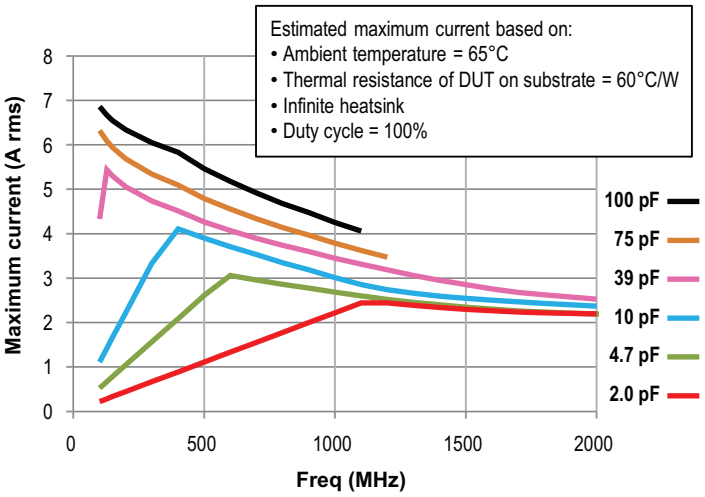
0603 - Equivalent Series Resistance (ESR)



0603 - Q factor

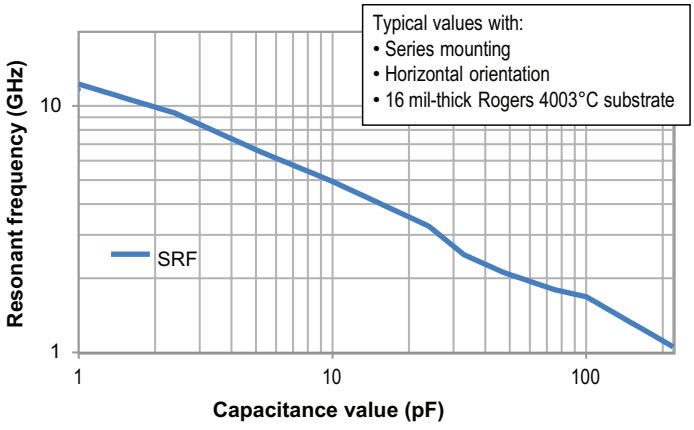


0603 - Max Current



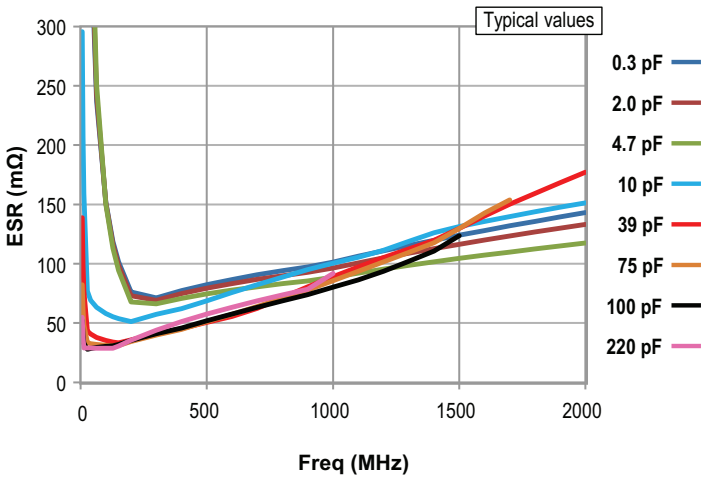
RF Characteristics - 0805 Size

0805 - Resonant frequency

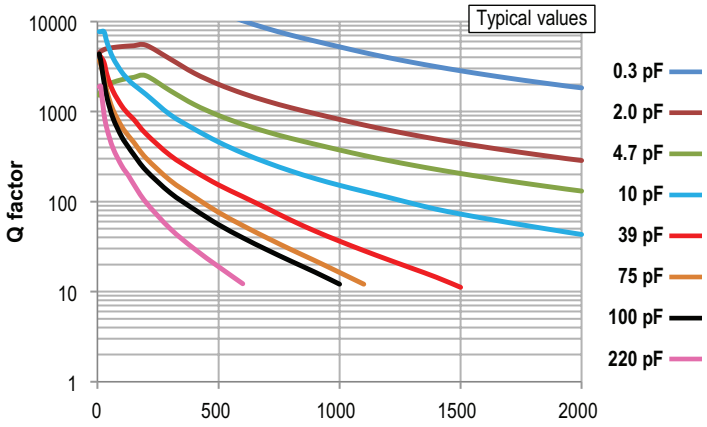


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

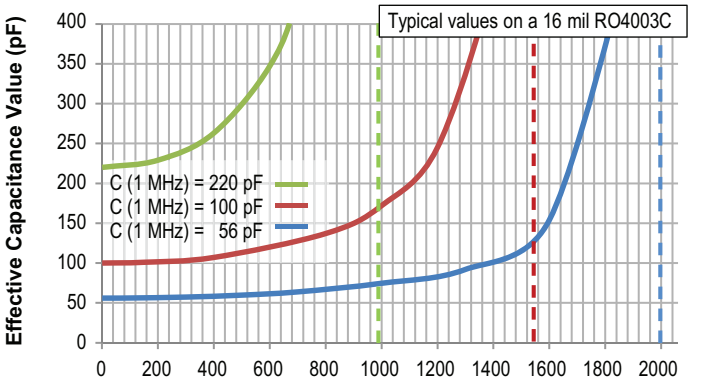
0805 - Equivalent Series Resistance (ESR)



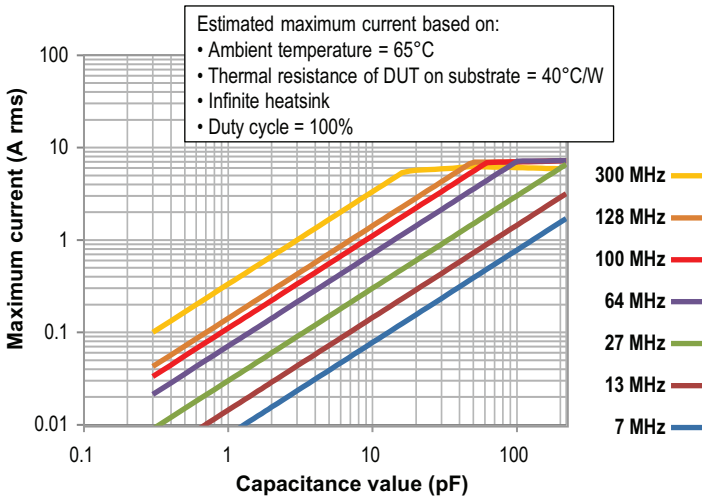
0805 - Q factor



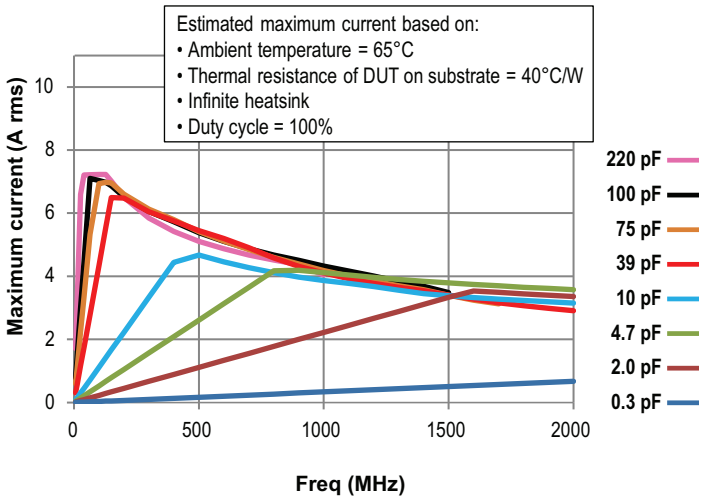
0805 - Effective capacitance value



0805 - Max Current vs. Cap. Value

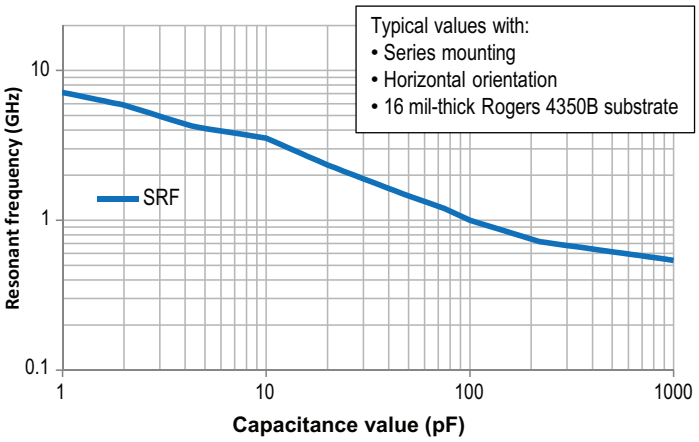


0805 - Max Current vs. Frequency



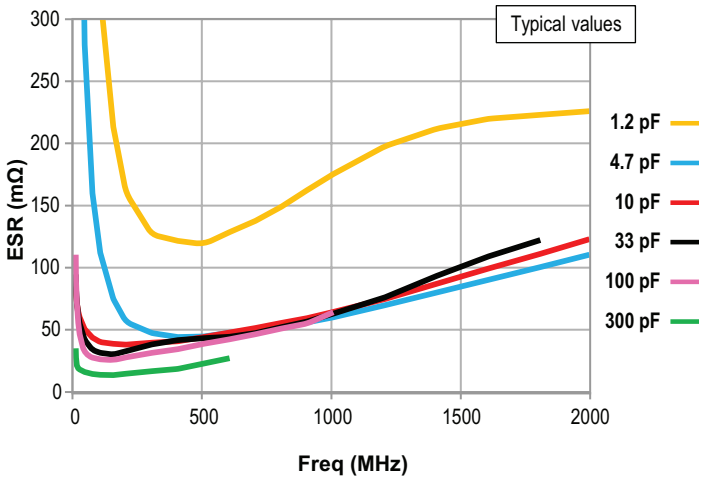
RF Characteristics - 1111 Size

1111 - Resonant frequency

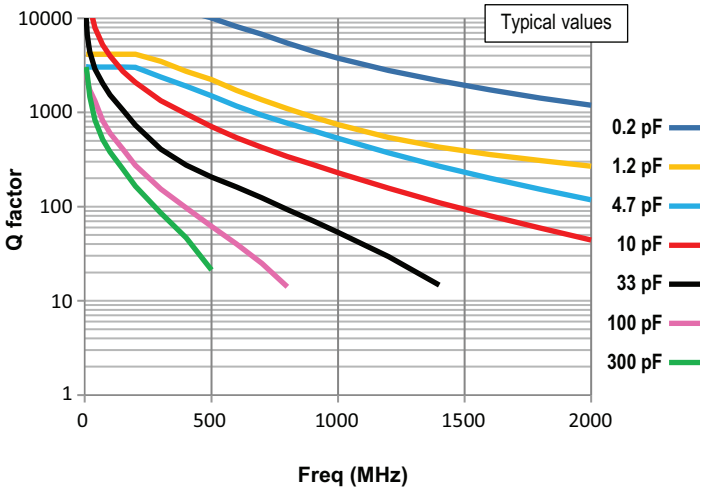


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

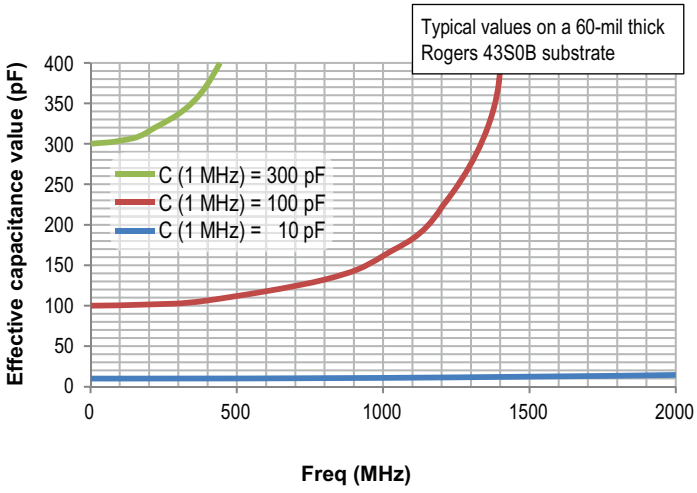
1111 - Equivalent Series Resistance (ESR)



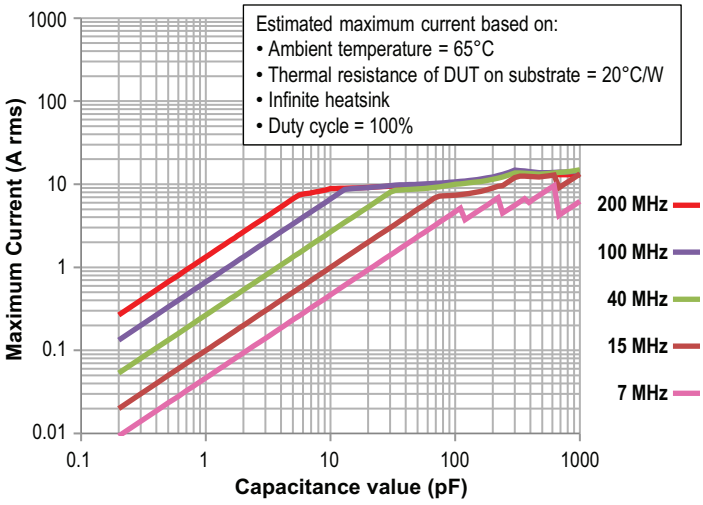
1111 - Q factor



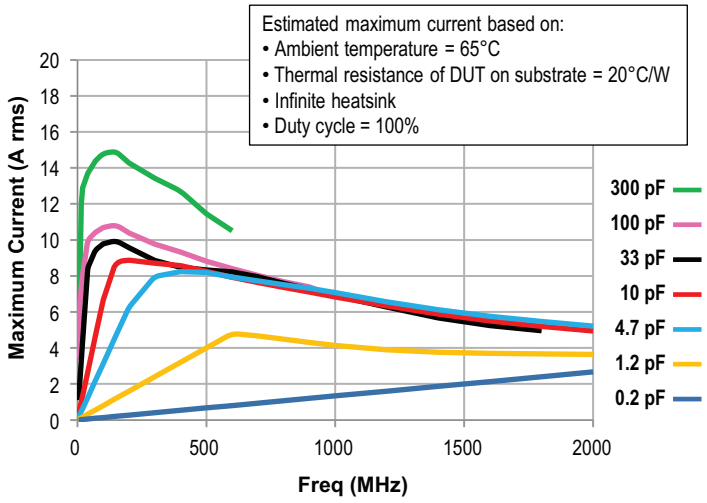
1111 - Effective capacitance value



1111 - Max Current vs. Capacitance Value

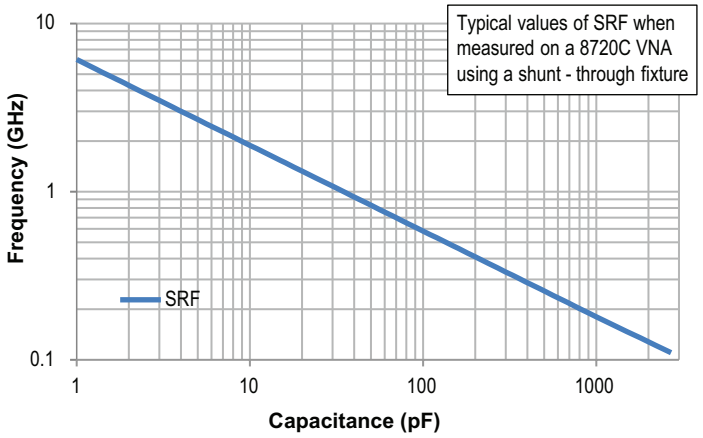


1111 - Max Current vs. Frequency



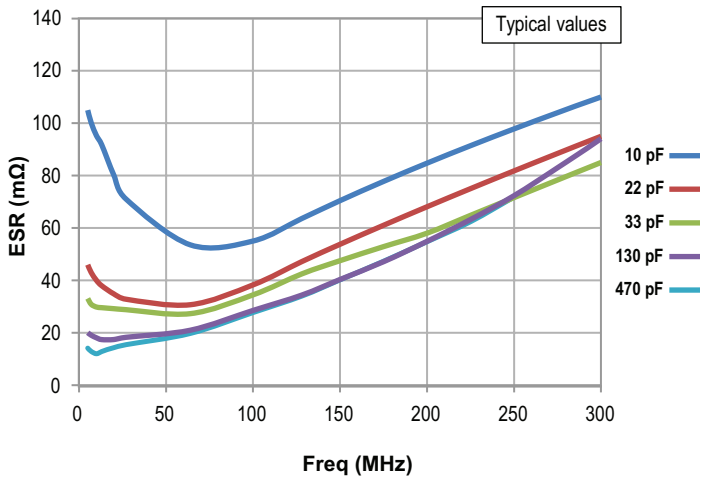
RF Characteristics - 2525 Size

2525 - Series Resonant Frequency

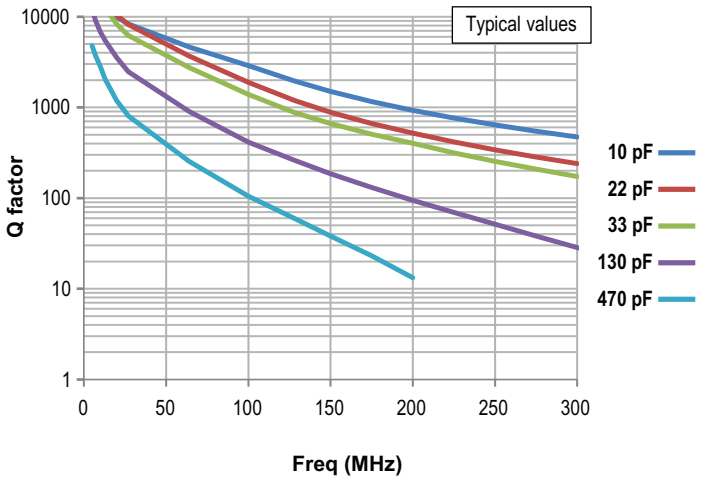


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

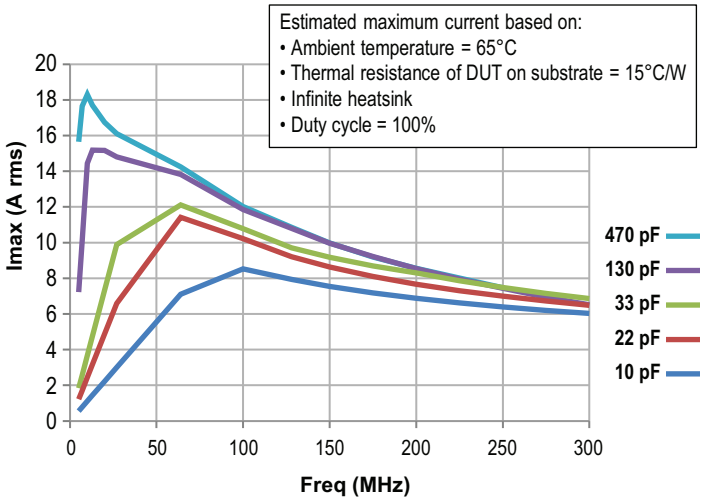
2525 - Equivalent Series Resistance (ESR)



2525 - Q factor

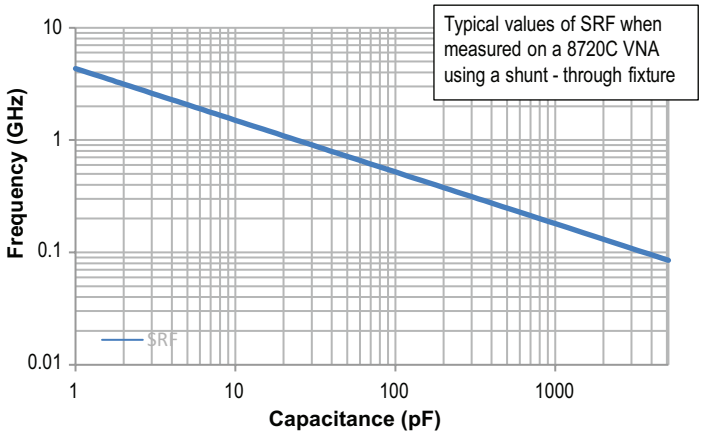


2525 - Max Current vs. Frequency



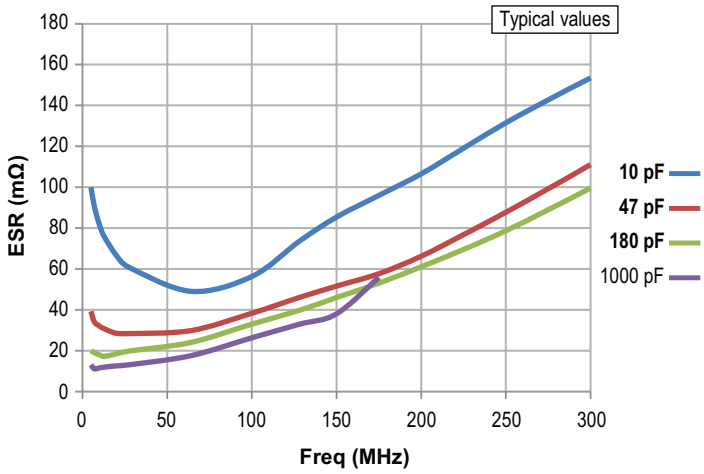
RF Characteristics -3838 Size

3838 - Resonant Frequency

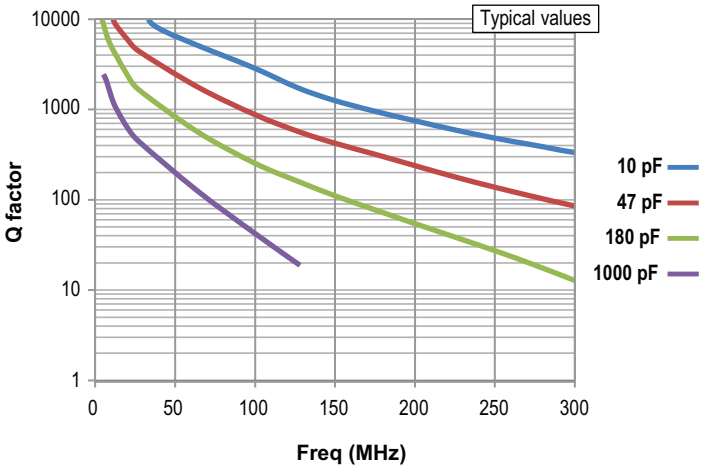


The Series Resonant Frequency is highly dependent on the substrate, pad dimensions, and measurement method. The above chart is for reference only.

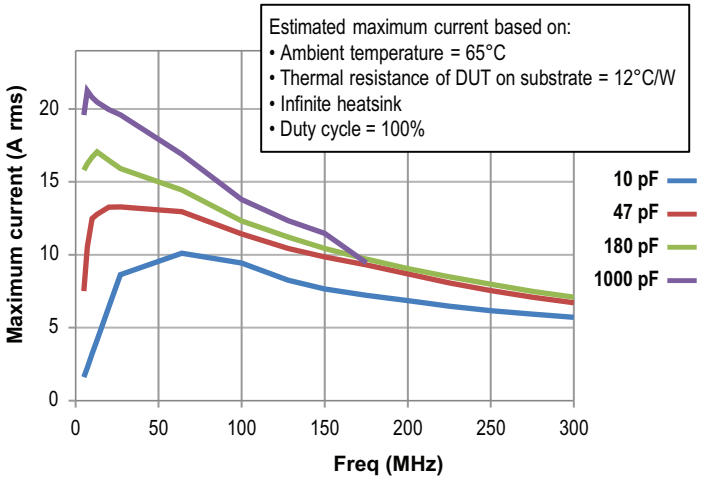
3838 - Equivalent Series Resistance (ESR)



3838 - Q factor



3838 - Max Current vs. Frequency



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