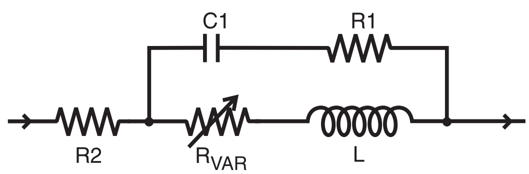
SPICE Model – xx336RAA

This lumped-element (SPICE) model data simulates the frequency-dependent behavior of Coilcraft RF surface mount inductors from 1 MHz to the upper frequency limit shown in the accompanying table.

The equivalent lumped element model schematic is shown below. The element values R1, R2, C, and L are listed for each component value. The value of the frequency-dependent variable resistor R_{VAR} relates to the skin effect and is calculated from:

$$R_{VAR} = k * \sqrt{f}$$

- k is shown for each value in the accompanying table.
- f is the frequency in Hz



The data represents de-embedded measurements, as described below. Effects due to different customer circuit board traces, board materials, ground planes or interactions with other components are not included and can have a significant effect when comparing the simulation to measurements of the inductors using typical production verification instruments and fixtures.

Each model should only be analyzed at the input and output ports. Individual elements of the model are not determined by parameter measurement. The elements are determined by the overall performance of the lumped element model compared to the measurements taken of the component.

Typically, the Self-Resonant Frequency (SRF) of the component model will be higher than the measurement of the component mounted on a circuit board. The parasitic reactive elements of a circuit board or fixture will effectively lower the circuit resonant frequency, especially for very small inductance values. Since data sheet specifications are based on typical production measurements, and the SPICE models are based on de-embedded measurements as described below, the model results may be different from the data sheet specifications.

Lumped Element Modeling Method

The measurements were made over a brass ground plane with each component centered over an air gap, as illustrated in Figure 1. The gap width for each size component is given in Table 1. The test pads were 30 mil

Table 1. Test Gap

Size	Gap Width (inch / mm)
0302	0.017 / 0.432
0402,0403	0.017 / 0.432
0603	0.026 / 0.660
0805	0.040 / 1.016
1008	0.060 / 1.524
1206	0.080 / 2.032
1812	0.120 / 3.048

(50 Ohm) wide traces of tinned gold over 25 mil thick alumina, and were not included in the gap. The TRL* calibration plane is also illustrated in Figure 1.

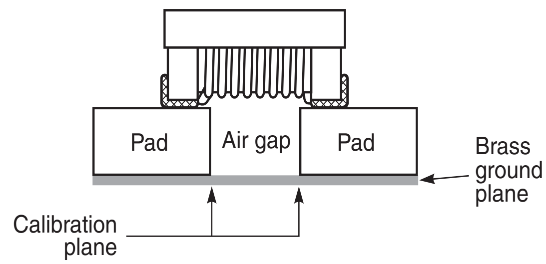


Figure 1. Test Setup

The lumped element values were determined by matching the simulation model to an average of the measurements. This method results in a model that represents as closely as possible the typical frequency-dependent behavior of the component up to a frequency just above the self-resonant frequency of the model.

The lumped element models were used to generate our 2-port S-parameters and therefore give identical results. The S-parameters are available on our web site at **http://www.coilcraft.com/models.cfm**.

Disclaimer

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1102 Silver Lake Road
Cary IL 60013
Phone 800-981-0363
Fax 847-639-1508
E-mail cp@coilcraft.com
Web www.coilcraft-cps.com

SPICE Model for Coilcraft xx336RAA Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
xx336RAA020	1	0.06	0.038	2.75	6.40E-06	17200
xx336RAA3N0	2	0.06	0.040	3.00	8.90E-06	16000
xx336RAA030	3	0.08	0.042	3.30	1.22E-05	14900
xx336RAA050	4	0.08	0.051	5.66	1.36E-05	10400
xx336RAA060	5	0.11	0.041	6.72	2.07E-05	10600
xx336RAA070	5	0.14	0.065	7.65	2.22E-05	7900
xx336RAA080	7	0.12	0.076	8.05	2.34E-05	7100
xx336RAA100	6	0.10	0.047	10.1	1.72E-05	8100
xx336RAA120	12	0.15	0.051	12.0	2.44E-05	7100
xx336RAA150	10	0.17	0.096	15.0	3.04E-05	4700
xx336RAA180	10	0.20	0.059	18.0	3.69E-05	5400
xx336RAA220	12	0.22	0.093	22.0	4.17E-05	3900
xx336RAA240	12	0.22	0.110	24.0	5.01E-05	3500
xx336RAA270	14	0.25	0.067	27.0	5.15E-05	4200
xx336RAA330	12	0.27	0.097	33.0	5.71E-05	3100
xx336RAA360	13	0.27	0.126	36.0	6.71E-05	2700
xx336RAA390	13	0.29	0.082	39.0	6.81E-05	3400
xx336RAA430	15	0.31	0.084	43.0	7.51E-05	3200
xx336RAA470	10	0.31	0.111	47.0	8.31E-05	2700

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
xx336RAA560	13	0.34	0.094	56.0	1.01E-04	2700
xx336RAA680	12	0.38	0.088	67.5	1.20E-04	2500
xx336RAA820	15	0.42	0.088	81.4	1.34E-04	2300
xx336RAA910	12	0.48	0.083	90.4	1.40E-04	2300
xx336RAA101	14	0.46	0.089	99.1	1.56E-04	2100
xx336RAA111	15	0.48	0.109	109	1.52E-04	1800
xx336RAA121	18	0.51	0.095	119	1.72E-04	1800
xx336RAA151	24	0.56	0.110	149	2.23E-04	1500
xx336RAA181	18	0.64	0.090	178	2.75E-04	1600
xx336RAA221	26	0.70	0.086	215	3.40E-04	1500
xx336RAA241	27	1.00	0.098	235	3.80E-04	1300
xx336RAA271	31	1.00	0.098	263	3.90E-04	1200
xx336RAA331	31	1.40	0.096	320	4.74E-04	1100
xx336RAA391	33	1.50	0.095	380	5.78E-04	1100
xx336RAA471	66	1.76	0.132	470	6.14E-04	800
xx336RAA561	66	1.90	0.258	560	5.54E-04	600
xx336RAA681	88	2.20	0.542	680	7.14E-04	400
xx336RAA821	125	2.35	0.255	820	9.80E-04	500

1102 Silver Lake Road
Cary IL 60013
Phone 800-981-0363
Fax 847-639-1508
E-mail cp@coilcraft.com
Web www.coilcraft-cps.com