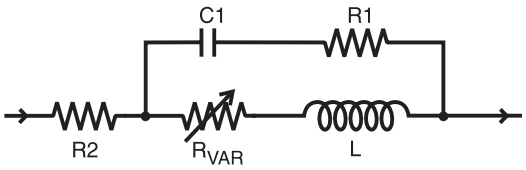
SPICE Model – xx312RAG

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 (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.

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

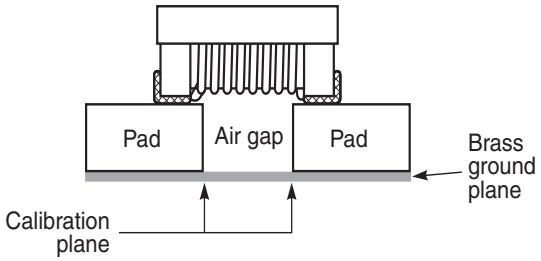


Figure 1. Test Setup

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

Coilcraft makes every attempt to provide accurate measurement data and software, representative of our components, in a usable format. Coilcraft, however, disclaims all warrants relating to the use of its data and software, whether expressed or implied, including without limitation any implied warranties of merchantability or fitness for a particular purpose. Coilcraft cannot and will not be liable for any special, incidental, consequential, indirect or similar damages occurring with the use of the data and/or software.

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 xx312RAG Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
xx312RAG1N8	25	0.033	0.014	1.80	6.50E-06	25000
xx312RAG2N2	25	0.180	0.014	2.20	1.14E-05	25000
xx312RAG3N3	5	0.024	0.047	3.30	7.62E-06	20000
xx312RAG3N6	2	0.031	0.041	3.60	7.60E-06	20000
xx312RAG3N9	10	0.039	0.060	3.90	8.40E-06	14000
xx312RAG4N3	18	0.080	0.054	4.30	1.02E-05	14000
xx312RAG4N7	13	0.100	0.051	4.70	1.39E-05	14000
xx312RAG5N1	8	0.036	0.041	5.10	8.70E-06	14000
xx312RAG5N6	11	0.036	0.038	5.60	9.30E-06	14000
xx312RAG6N0	12	0.036	0.061	6.00	9.10E-06	10000
xx312RAG6N8	10	0.042	0.061	6.80	1.13E-05	10000
xx312RAG7N2	11	0.052	0.067	7.20	1.12E-05	10000
xx312RAG7N5	14	0.080	0.074	7.50	1.40E-05	10000
xx312RAG8N2	22	0.054	0.034	8.20	1.30E-05	10000
xx312RAG8N7	15	0.054	0.037	8.70	1.35E-05	10000
xx312RAG9N1	9	0.037	0.053	9.10	1.70E-05	10000
xx312RAG9N5	17	0.053	0.048	9.50	1.44E-05	10000
xx312RAG10N	12	0.048	0.074	10.0	1.56E-05	10000
xx312RAG11N	10	0.042	0.061	11.0	2.24E-05	10000
xx312RAG12N	9	0.088	0.064	12.0	2.83E-05	9000
xx312RAG15N	13	0.078	0.066	15.0	2.50E-05	9000
xx312RAG16N	3	0.085	0.068	16.0	3.10E-05	9000
xx312RAG18N	10	0.066	0.064	18.0	3.66E-05	8000
xx312RAG22N	2	0.140	0.058	22.0	4.90E-05	8000
xx312RAG23N	16	0.150	0.068	23.0	4.90E-05	8000
xx312RAG24N	21	0.074	0.061	24.0	4.60E-05	8000
xx312RAG27N	11	0.150	0.063	27.0	5.63E-05	8000

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
xx312RAG30N	14	0.130	0.052	30.0	6.10E-05	6000
xx312RAG33N	14	0.170	0.053	33.0	6.97E-05	6000
xx312RAG36N	18	0.200	0.063	36.0	7.90E-05	6000
xx312RAG39N	22	0.190	0.049	39.0	7.88E-05	6000
xx312RAG43N	21	0.170	0.047	43.0	8.32E-05	6000
xx312RAG47N	20	0.240	0.047	47.0	9.40E-05	6000
xx312RAG51N	35	0.280	0.040	51.0	1.10E-04	6000
xx312RAG56N	47	0.300	0.038	56.0	1.20E-04	6000
xx312RAG68N	44	0.330	0.043	68.0	1.32E-04	4000
xx312RAG72N	25	0.420	0.045	72.0	1.45E-04	4000
xx312RAG75N	40	0.520	0.047	75.0	1.40E-04	4000
xx312RAG82N	40	0.460	0.056	82.0	1.50E-04	4000
xx312RAG91N	42	0.580	0.058	91.0	1.60E-04	4000
xx312RAGR10	60	0.540	0.034	100	1.80E-04	4000
xx312RAGR11	55	0.580	0.041	110	2.00E-04	3000
xx312RAGR12	40	0.720	0.038	120	2.40E-04	3000
xx312RAGR15	50	0.820	0.046	150	2.20E-04	3000
xx312RAGR18	120	1.50	0.031	180	2.80E-04	3000
xx312RAGR20	160	2.00	0.029	200	3.00E-04	2500
xx312RAGR21	190	2.00	0.034	210	3.00E-04	2500
xx312RAGR22	160	2.00	0.037	220	3.30E-04	2000
xx312RAGR25	120	3.00	0.044	250	3.50E-04	2000
xx312RAGR27	120	2.25	0.041	270	3.90E-04	2000
xx312RAGR30	120	2.80	0.040	300	4.20E-04	2000
xx312RAGR33	200	3.60	0.036	330	4.70E-04	2000
xx312RAGR36	160	4.00	0.032	360	4.90E-04	2000
xx312RAGR39	140	4.00	0.037	390	5.30E-04	2000

Specifications subject to change without notice. Document 158-24 Revised 01/30/08

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