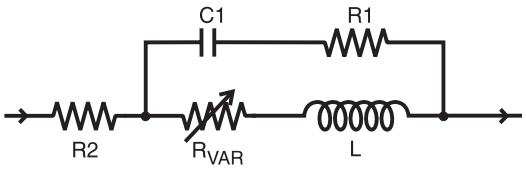
SPICE Model – xx413RAB

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

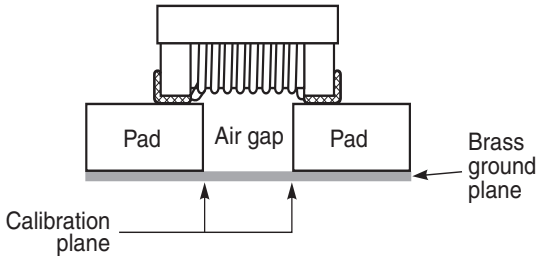


Figure 1. Test Setup

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.

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Document 158-1 Revised 11/29/12

SPICE Model for Coilcraft xx413RAB Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
xx413RAB102	150	0.62	0.21	1000	7.00E-03	1000
xx413RAB122	369	0.60	0.158	1200	7.41E-04	500
xx413RAB152	369	0.70	0.185	1500	7.61E-04	400
xx413RAB182	384	0.80	0.186	1800	8.40E-04	400
xx413RAB222	384	1.10	0.168	2200	9.40E-04	400
xx413RAB272	426	1.20	0.181	2700	1.25E-03	300
xx413RAB332	261	1.40	0.309	3300	1.45E-03	200
xx413RAB392	252	1.50	0.349	3900	1.47E-03	170
xx413RAB432	100	1.70	0.350	4300	1.20E-02	200
xx413RAB472	273	1.60	0.285	4700	1.79E-03	170
xx413RAB502	125	2.20	0.300	5000	1.80E-02	200
xx413RAB562	179	1.80	0.370	5600	2.06E-03	140
xx413RAB622	100	2.50	0.390	6200	1.00E-02	200
xx413RAB682	242	2.00	0.345	6800	2.82E-03	130
xx413RAB822	224	2.60	0.445	8200	3.47E-03	110
xx413RAB912	60	2.90	1.10	9100	2.30E-02	200
xx413RAB103	300	2.90	0.385	10000	3.89E-03	100
xx413RAB123	100	3.30	0.620	12000	2.20E-02	200
xx413RAB153	90	3.70	0.820	15000	3.40E-02	200
xx413RAB183	50	4.00	2.00	18000	3.20E-02	200
xx413RAB223	80	6.14	0.960	22000	3.70E-02	100
xx413RAB273	60	6.45	3.80	27000	3.50E-02	80
xx413RAB333	125	7.00	0.800	33000	5.50E-02	100
xx413RAB393	150	10.0	0.520	39000	6.00E-02	100
xx413RAB473	75	10.7	2.70	47000	4.50E-02	100
xx413RAB563	50	10.0	5.10	56000	5.00E-02	50
xx413RAB683	75	13.5	4.20	68000	7.00E-02	50
xx413RAB104	60	20.5	7.50	100000	6.30E-02	50

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