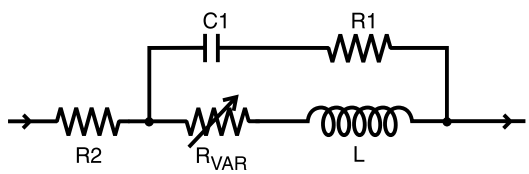
SPICE Model – 1206CS

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

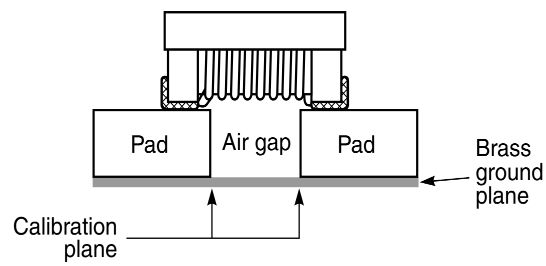


Figure 1. Test Setup

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

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SPICE Model for Coilcraft 1206CS Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
1206CS-030	12	0.1	0.051	3.4	4.35E-06	12800
1206CS-060	11	0.1	0.035	6.8	1.37E-05	10900
1206CS-100	11	0.1	0.043	11.5	1.95E-05	7900
1206CS-120	11	0.1	0.086	15	2.58E-05	4900
1206CS-150	8	0.1	0.050	18	3.02E-05	5900
1206CS-180	12	0.1	0.078	21	3.22E-05	4400
1206CS-220	14	0.1	0.101	24	3.97E-05	3600
1206CS-270	14	0.1	0.082	29	4.67E-05	3600
1206CS-330	10	0.1	0.131	35	4.95E-05	2600
1206CS-390	12	0.1	0.086	39	6.21E-05	3100
1206CS-470	14	0.1	0.115	47	7.31E-05	2400
1206CS-560	13	0.1	0.107	56	9.00E-05	2300
1206CS-680	10	0.2	0.127	68	1.03E-04	1900
1206CS-820	12	0.2	0.089	83	1.30E-04	2100
1206CS-101	10	0.2	0.091	100	1.57E-04	1900
1206CS-121	18	0.2	0.052	118	1.73E-04	2150

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
1206CS-151	20	0.3	0.089	140	1.91E-04	1600
1206CS-181	15	0.4	0.067	183	2.67E-04	1600
1206CS-221	25	0.5	0.082	223	3.15E-04	1300
1206CS-271	25	0.5	0.074	280	3.95E-04	1300
1206CS-331	33	0.6	0.071	329	4.01E-04	1200
1206CS-391	35	0.7	0.058	390	4.85E-04	1100
1206CS-471	35	1.3	0.075	470	6.02E-04	1000
1206CS-561	25	1.3	0.067	557	6.70E-04	900
1206CS-621	28	1.5	0.071	615	6.71E-04	800
1206CS-681	28	1.5	0.059	670	7.51E-04	850
1206CS-751	5	2.2	0.062	720	8.40E-04	760
1206CS-821	5	1.8	0.060	775	9.70E-04	760
1206CS-911	5	2.8	0.063	810	1.01E-03	730
1206CS-102	125	2.8	0.059	835	9.90E-04	730
1206CS-122	100	3.2	0.060	1060	1.33E-03	650

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