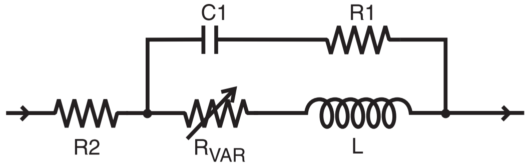
SPICE Model – 0603DC

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)
0201	0.010 / 0.254
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

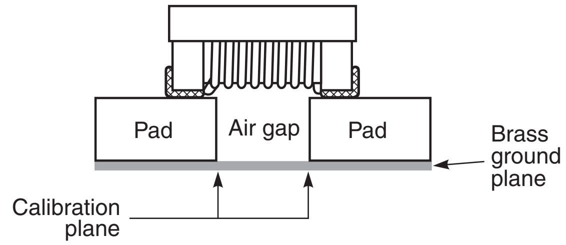


Figure 1. Test Setup

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 0603DC Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
0603DC-2N7	34.0	0.026	0.068	2.7	4.81E-06	26500
0603DC-3N3	15.0	0.032	0.074	3.3	5.23E-06	14000
0603DC-3N9	1.7	0.031	0.027	3.9	5.58E-06	16000
0603DC-4N3	12.0	0.031	0.033	4.3	6.23E-06	16000
0603DC-5N1	2.0	0.035	0.042	5.1	8.70E-06	14000
0603DC-6N2	6.0	0.037	0.033	6.2	1.00E-05	14000
0603DC-6N8	20.0	0.037	0.040	6.8	1.15E-05	14000
0603DC-7N5	4.4	0.041	0.038	7.5	1.27E-05	12000
0603DC-8N2	2.2	0.076	0.041	8.2	1.35E-05	14000
0603DC-9N1	3.0	0.016	0.041	9.1	1.65E-05	10000
0603DC-10N	2.6	0.022	0.046	10	1.95E-05	10000
0603DC-11N	4.5	0.052	0.044	11	2.00E-05	8000
0603DC-12N	3.5	0.052	0.052	12	2.00E-05	8000
0603DC-15N	10.0	0.059	0.046	15	2.54E-05	8000
0603DC-16N	67.0	0.059	0.056	16	3.20E-05	8000
0603DC-18N	33.5	0.062	0.063	18	3.40E-05	6000
0603DC-20N	63.5	0.067	0.055	20	3.75E-05	6000
0603DC-22N	23.5	0.079	0.061	22	4.15E-05	6000
0603DC-27N	37.8	0.093	0.059	27	4.57E-05	6000
0603DC-30N	45.3	0.082	0.059	30	6.01E-05	6000
0603DC-33N	55.5	0.103	0.060	33	6.28E-05	5000
0603DC-36N	45.9	0.112	0.047	36	7.00E-05	5000
0603DC-39N	66.5	0.136	0.061	39	7.70E-05	5000
0603DC-43N	24.6	0.147	0.045	43	8.10E-05	4000
0603DC-47N	34.8	0.183	0.055	47	9.50E-05	4000
0603DC-51N	45.2	0.19	0.044	51	9.90E-05	4000
0603DC-56N	36.0	0.241	0.051	56	1.07E-04	4000
0603DC-62N	42.0	0.26	0.047	62	1.21E-04	3000
0603DC-68N	51.0	0.31	0.054	68	1.38E-04	3000
0603DC-75N	58.0	0.33	0.051	75	1.54E-04	3000
0603DC-82N	72.0	0.353	0.047	82	1.56E-04	3000
0603DC-91N	64.0	0.48	0.042	91	1.86E-04	3000
0603DC-R11	42.3	0.63	0.049	110	2.41E-04	3000
0603DC-R12	54.6	0.665	0.047	120	2.68E-04	3000
0603DC-R13	38.6	0.699	0.049	130	3.20E-04	2500
0603DC-R15	42.1	0.915	0.045	150	3.65E-04	2500
0603DC-R18	46.9	1.265	0.042	180	4.14E-04	2500
0603DC-R22	36.8	1.598	0.054	220	5.55E-04	2000
0603DC-R27	40.8	1.929	0.042	270	6.51E-04	2000
0603DC-R30	31.8	2.415	0.045	300	7.23E-04	2000
0603DC-R33	57.0	2.662	0.037	330	6.03E-04	1500
0603DC-R39	38.6	3.563	0.040	390	7.11E-04	1500
0603DC-R47	71.6	4.911	0.041	470	8.11E-03	1500

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