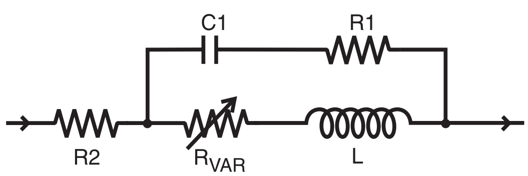
SPICE Model – 0603CT

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

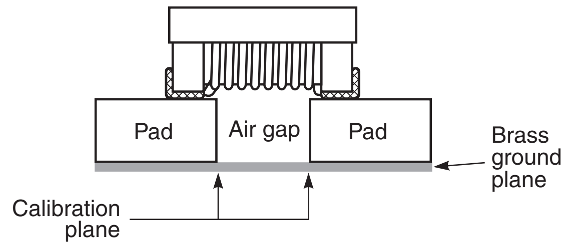


Figure 1. Test Setup

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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www.coilcraft.com
US +1-847-639-6400 sales@coilcraft.com
UK +44-1236-730595 sales@coilcraft-europe.com
Taiwan +886-2-2264 3646 sales@coilcraft.com.tw
China +86-21-6218 8074 sales@coilcraft.com.cn
Singapore + 65-6484 8412 sales@coilcraft.com.sg

SPICE Model for Coilcraft 0603CT Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
0603CT-1N0	44.72	0.036	0.0192	1.0	3.31E-06	26000
0603CT-1N2	85.72	0.084	0.0216	1.2	3.41E-06	26000
0603CT-2N0	9.58	0.027	0.0446	2.0	6.65E-06	18000
0603CT-2N2	3.12	0.037	0.0582	2.2	6.47E-06	17500
0603CT-2N3	3.08	0.037	0.0550	2.3	6.20E-06	17000
0603CT-2N5	3.98	0.048	0.0522	2.5	7.20E-06	17000
0603CT-3N0	9.60	0.031	0.0330	3.0	8.30E-06	17000
0603CT-3N3	2.10	0.031	0.0402	3.3	9.10E-06	16000
0603CT-3N6	2.90	0.035	0.0350	3.6	8.90E-06	16000
0603CT-3N9	5.79	0.040	0.0447	3.9	8.40E-06	14000
0603CT-4N3	10.59	0.061	0.0447	4.3	1.07E-05	14000
0603CT-4N7	10.29	0.096	0.0387	4.7	1.16E-05	16000
0603CT-5N1	3.65	0.040	0.0291	5.1	1.22E-05	16000
0603CT-5N6	10.82	0.046	0.0341	5.6	1.33E-05	13000
0603CT-6N8	15.02	0.064	0.0467	6.8	1.81E-05	9700
0603CT-7N2	11.02	0.038	0.0509	7.2	1.85E-05	9700
0603CT-8N2	15.82	0.060	0.0384	8.2	2.09E-05	9700
0603CT-9N5	9.42	0.074	0.0432	9.5	2.51E-05	9000
0603CT-10N	5.82	0.060	0.0414	10.0	2.45E-05	8500
0603CT-11N	4.70	0.088	0.0374	11.0	2.69E-05	8300
0603CT-12N	10.10	0.104	0.0384	12	2.85E-05	8000
0603CT-15N	12.30	0.116	0.0364	15	3.80E-05	7500
0603CT-16N	14.10	0.140	0.0424	16	4.04E-05	7300
0603CT-18N	14.10	0.160	0.0364	18	4.52E-05	7300
0603CT-20N	16.30	0.140	0.0292	20	4.80E-05	7300
0603CT-22N	16.70	0.176	0.0332	22	5.76E-05	6700
0603CT-24N	22.40	0.192	0.0316	24	6.48E-05	6500
0603CT-27N	20.60	0.216	0.0250	27	7.28E-05	6500
0603CT-30N	20.68	0.264	0.0300	30	7.88E-05	5800
0603CT-33N	31.48	0.264	0.0300	33	9.98E-05	5600
0603CT-36N	37.98	0.268	0.0270	36	9.58E-05	5600
0603CT-39N	33.48	0.320	0.0310	39	1.07E-04	5500
0603CT-43N	36.08	0.352	0.0310	43	1.28E-04	5500
0603CT-47N	36.16	0.440	0.0265	47	1.22E-04	5400
0603CT-51N	43.96	0.460	0.0247	51	1.47E-04	5400
0603CT-56N	43.96	0.560	0.0330	56	1.39E-04	5400

US +1-847-639-6400 sales@coilcraft.com
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China +86-21-6218 8074 sales@coilcraft.com.cn
Singapore + 65-6484 8412 sales@coilcraft.com.sg