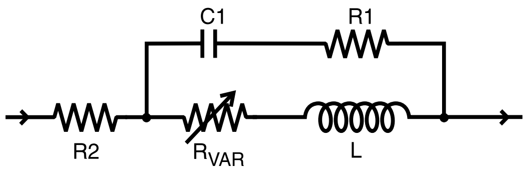
SPICE Model – 0603HP

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

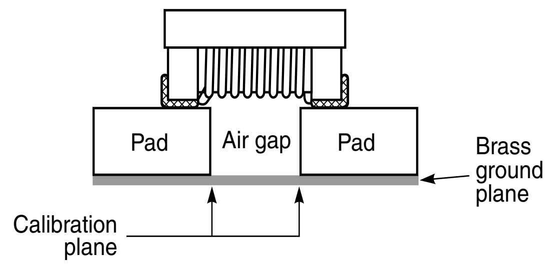


Figure 1. Test Setup

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 0603HP Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
0603HP-1N8	25	0.033	0.014	1.80	6.50E-06	25000
0603HP-2N2	25	0.180	0.014	2.20	1.14E-05	25000
0603HP-3N3	5	0.024	0.047	3.30	7.62E-06	20000
0603HP-3N6	2	0.031	0.041	3.60	7.60E-06	20000
0603HP-3N9	10	0.039	0.060	3.90	8.40E-06	14000
0603HP-4N3	18	0.080	0.054	4.30	1.02E-05	14000
0603HP-4N7	13	0.100	0.051	4.70	1.39E-05	14000
0603HP-5N1	8	0.036	0.041	5.10	8.70E-06	14000
0603HP-5N6	11	0.036	0.038	5.60	9.30E-06	14000
0603HP-6N0	12	0.036	0.061	6.00	9.10E-06	10000
0603HP-6N8	10	0.042	0.061	6.80	1.13E-05	10000
0603HP-7N2	11	0.052	0.067	7.20	1.12E-05	10000
0603HP-7N5	14	0.080	0.074	7.50	1.40E-05	10000
0603HP-8N2	22	0.054	0.034	8.20	1.30E-05	10000
0603HP-8N7	15	0.054	0.037	8.70	1.35E-05	10000
0603HP-9N1	9	0.037	0.053	9.10	1.70E-05	10000
0603HP-9N5	17	0.053	0.048	9.50	1.44E-05	10000
0603HP-10N	12	0.048	0.074	10.0	1.56E-05	10000
0603HP-11N	10	0.042	0.061	11.0	2.24E-05	10000
0603HP-12N	9	0.088	0.064	12.0	2.83E-05	9000
0603HP-15N	13	0.078	0.066	15.0	2.50E-05	9000
0603HP-16N	3	0.085	0.068	16.0	3.10E-05	9000
0603HP-18N	10	0.066	0.064	18.0	3.66E-05	8000
0603HP-22N	2	0.140	0.058	22.0	4.90E-05	8000
0603HP-23N	16	0.150	0.068	23.0	4.90E-05	8000
0603HP-24N	21	0.074	0.061	24.0	4.60E-05	8000
0603HP-27N	11	0.150	0.063	27.0	5.63E-05	8000
0603HP-30N	14	0.130	0.052	30.0	6.10E-05	6000
0603HP-33N	14	0.170	0.053	33.0	6.97E-05	6000
0603HP-36N	18	0.200	0.063	36.0	7.90E-05	6000
0603HP-39N	22	0.190	0.049	39.0	7.88E-05	6000
0603HP-43N	21	0.170	0.047	43.0	8.32E-05	6000
0603HP-47N	20	0.240	0.047	47.0	9.40E-05	6000
0603HP-51N	35	0.280	0.040	51.0	1.10E-04	6000
0603HP-56N	47	0.300	0.038	56.0	1.20E-04	6000
0603HP-68N	44	0.330	0.043	68.0	1.32E-04	4000
0603HP-72N	25	0.420	0.045	72.0	1.45E-04	4000
0603HP-75N	40	0.520	0.047	75.0	1.40E-04	4000
0603HP-82N	40	0.460	0.056	82.0	1.50E-04	4000
0603HP-91N	42	0.580	0.058	91.0	1.60E-04	4000
0603HP-R10	60	0.540	0.034	100	1.80E-04	4000
0603HP-R11	55	0.580	0.041	110	2.00E-04	3000
0603HP-R12	40	0.720	0.038	120	2.40E-04	3000
0603HP-R15	50	0.820	0.046	150	2.20E-04	3000
0603HP-R18	120	1.50	0.031	180	2.80E-04	3000
0603HP-R20	160	2.00	0.029	200	3.00E-04	2500
0603HP-R21	190	2.00	0.034	210	3.00E-04	2500
0603HP-R22	160	2.00	0.037	220	3.30E-04	2000
0603HP-R25	120	3.00	0.044	250	3.50E-04	2000
0603HP-R27	120	2.25	0.041	270	3.90E-04	2000
0603HP-R30	120	2.80	0.040	300	4.20E-04	2000
0603HP-R33	200	3.60	0.036	330	4.70E-04	2000
0603HP-R36	160	4.00	0.032	360	4.90E-04	2000
0603HP-R39	140	4.00	0.037	390	5.30E-04	2000

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