# SPICE Model – 0603HC

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
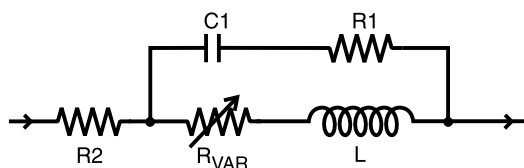
The data represents de-embedded measurements, as described below. Effects due to different customer circuit board traces, board materials, ground planes or interactions with other components are not included and can have a significant effect when comparing the simulation to measurements of the inductors using typical production verification instruments and fixtures.

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

Table 1. Test Gap

Size	Gap Width (inch/mm)
0402	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

alumina, and were not included in the gap. The TRL* calibration plane is also illustrated in Figure 1.
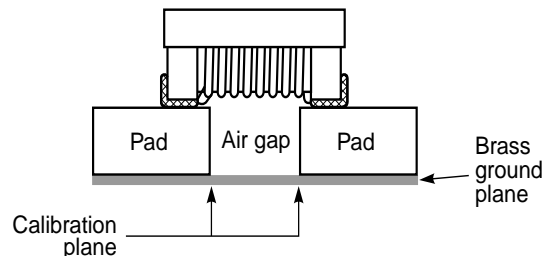

Figure 1. Test Setup

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**.

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SPICE Model for Coilcraft 0603HC Chip Inductors

Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
0603HC-1N6	5	0.030	0.042	1.3	2.91E-06	23800
0603HC-3N6	9	0.048	0.037	3.6	1.03E-05	15200
0603HC-3N9	9	0.054	0.037	3.7	9.70E-06	15000
0603HC-6N8	4	0.054	0.052	6.8	1.39E-05	9400
0603HC-7N5	4	0.059	0.078	7.5	1.51E-05	7300
0603HC-10N	10	0.071	0.045	10.0	2.05E-05	8300
0603HC-12N	10	0.075	0.079	12.0	2.48E-05	6300
0603HC-15N	11	0.080	0.062	15.0	3.12E-05	6300
0603HC-18N	15	0.099	0.085	18.0	3.32E-05	4900
0603HC-22N	15	0.099	0.062	22.0	3.84E-05	5200
0603HC-24N	15	0.105	0.095	24.0	4.50E-05	4100

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