

# SPICE Model – 0402AF

This lumped-element (SPICE) model data simulates the frequency-dependent behavior of Coilcraft RF inductors within the frequency range shown in the accompanying table for each individual inductor.

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 other production verification instruments and fixtures.

## Lumped Element Modeling Method

Measurements were made using a 50 Ohm impedance analyzer. Fixture compensation was performed to remove fixture effects. No DC bias current was applied in any of the measurements.

Measurements were also taken on a network analyzer over a brass ground plane with the component centered over an air gap with a width of 0.060 inch (1.524 mm), as illustrated in Figure 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.

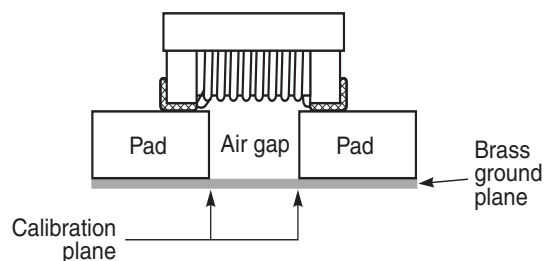
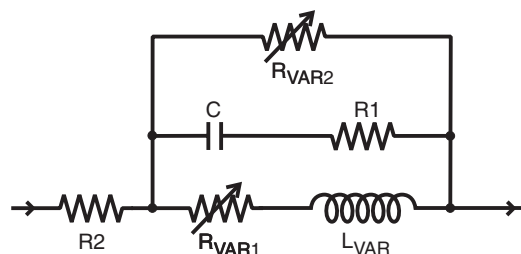


Figure 1. Test Setup

The lumped element values were determined by optimizing 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 within the model frequency range.

The equivalent lumped element model schematic is shown below. 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.



The value of the frequency-dependent variable resistor  $R_{VAR1}$  is calculated from:

$$R_{VAR1} = k1 * \sqrt{f}$$

- k1 is shown for each value in the accompanying table.
- f is the frequency in Hz
- $R_{VAR1}$  is the resistance in Ohms

The value of the frequency-dependent variable resistor  $R_{VAR2}$  is calculated from:

$$R_{VAR2} = k2 * \sqrt{f}$$

- k2 is shown for each value in the accompanying table.
- f is the frequency in Hz
- $R_{VAR2}$  is the resistance in Ohms

The value of the frequency-dependent inductance  $L_{VAR}$  is calculated from:

$$L_{VAR} = k3 - k4 * \text{LOG}(k5 * f)$$

- k3, k4, and k5 are shown in the accompanying table.
- f is the frequency in Hz
- $L_{VAR}$  is the inductance in  $\mu\text{H}$
- LOG is the natural LOG (basee)

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# SPICE Model for Coilcraft 0402AF RF Inductors

Part number	Frequency limit of model (MHz)		R1 ( $\Omega$ )	R2 ( $\Omega$ )	C (pF)	k1	k2	$L_{VAR}$ Coefficients		
	Lower	Upper						k3	k4	k5
0402AF-200	1	1000	260	0.050	2.30	2.00E-05	0.012	0.012	0.0007	3.00E-07
0402AF-220	1	1000	230	0.065	1.93	2.00E-05	0.015	0.023	0.0008	3.60E-07
0402AF-330	1	1000	450	0.060	0.830	2.00E-05	0.016	0.035	0.0014	3.60E-07
0402AF-360	1	1000	500	0.075	1.49	5.00E-05	0.023	0.038	0.0015	5.00E-07
0402AF-390	1	1000	400	0.115	1.49	4.60E-05	0.025	0.041	0.0013	4.00E-07
0402AF-510	1	1000	660	0.070	0.840	5.60E-05	0.035	0.054	0.0022	4.00E-07
0402AF-560	1	1000	500	0.095	1.02	4.80E-05	0.037	0.060	0.0018	9.00E-07
0402AF-720	1	1000	660	0.100	0.228	8.00E-06	0.030	0.078	0.0029	9.00E-07
0402AF-780	1	1000	800	0.130	0.303	3.00E-05	0.037	0.084	0.0031	9.00E-07
0402AF-101	1	1000	1200	0.160	0.276	1.80E-05	0.049	0.110	0.0040	1.50E-06
0402AF-141	1	1000	1800	0.260	0.171	4.00E-05	0.065	0.150	0.0050	9.00E-07
0402AF-181	1	1000	1800	0.280	0.106	1.20E-04	0.098	0.190	0.0059	6.00E-07
0402AF-201	1	1000	2200	0.440	0.081	8.00E-05	0.100	0.220	0.0088	1.10E-06
0402AF-221	1	1000	2600	0.530	0.073	8.00E-05	0.100	0.240	0.0087	1.10E-06
0402AF-251	1	1000	2400	0.360	0.050	1.30E-04	0.115	0.270	0.0098	9.00E-07
0402AF-271	1	1000	4000	0.550	0.066	9.00E-05	0.128	0.290	0.0098	9.00E-07
0402AF-301	1	1000	1450	0.410	0.055	7.80E-05	0.128	0.320	0.011	7.00E-07
0402AF-331	1	1000	2200	0.560	0.051	9.00E-05	0.152	0.350	0.011	7.00E-07
0402AF-361	1	1000	3200	0.575	0.041	1.15E-04	0.181	0.380	0.013	5.80E-07
0402AF-391	1	1000	2600	0.750	0.039	1.20E-04	0.210	0.410	0.013	5.20E-07
0402AF-421	1	1000	2750	0.700	0.037	1.50E-04	0.254	0.440	0.014	5.00E-07
0402AF-471	1	1000	2000	0.730	0.044	3.20E-04	0.290	0.495	0.017	5.40E-07
0402AF-561	1	1000	2000	0.920	0.051	3.00E-04	0.360	0.590	0.021	5.00E-07



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