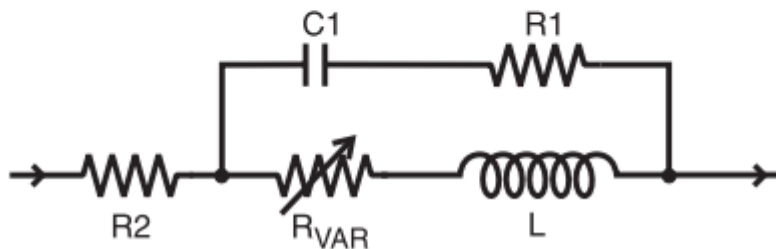


SPICE Model for Coilcraft 0402HP Chip Inductors

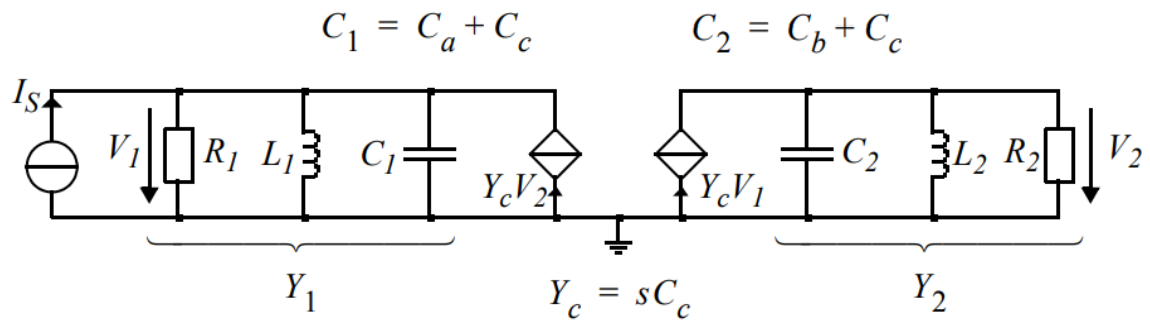
Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)	Part number	R1 (Ω)	R2 (Ω)	C (pF)	L (nH)	k	Upper limit (MHz)
0402HP-1N0	6	0.038	0.030	1.00	2.70E-06	20000	0402HP-18N	5	0.120	0.040	18.0	5.40E-05	8000
0402HP-2N0	5	0.038	0.050	2.00	5.22E-06	20000	0402HP-19N	22	0.145	0.040	19.0	4.70E-05	7000
0402HP-2N2	4	0.038	0.040	2.20	5.70E-06	20000	0402HP-20N	18	0.155	0.038	20.0	5.63E-05	7000
0402HP-2N4	13	0.042	0.044	2.40	6.20E-06	20000	0402HP-22N	22	0.160	0.035	22.0	6.28E-05	7000
0402HP-2N7	11	0.056	0.044	2.70	6.46E-06	20000	0402HP-23N	18	0.160	0.036	23.0	6.42E-05	7000
0402HP-3N3	15	0.045	0.032	3.30	7.80E-06	20000	0402HP-24N	30	0.170	0.039	24.0	6.80E-05	7000
0402HP-3N6	10	0.045	0.022	3.60	8.10E-06	20000	0402HP-26N	20	0.290	0.035	26.0	7.20E-05	7000
0402HP-3N9	12	0.045	0.042	3.90	9.70E-06	14000	0402HP-27N	30	0.275	0.026	27.0	6.70E-05	7000
0402HP-4N3	10	0.040	0.048	4.30	1.12E-05	12000	0402HP-30N	22	0.275	0.035	30.0	7.20E-05	7000
0402HP-4N7	13	0.060	0.052	4.70	1.29E-05	12000	0402HP-33N	30	0.330	0.034	33.0	7.78E-05	7000
0402HP-5N1	15	0.100	0.044	5.10	1.45E-05	12000	0402HP-36N	32	0.360	0.028	36.0	9.40E-05	7000
0402HP-5N6	1	0.048	0.032	5.60	1.27E-05	12000	0402HP-37N	26	0.480	0.032	37.0	9.70E-05	7000
0402HP-6N2	15	0.050	0.047	6.20	1.43E-05	12000	0402HP-39N	38	0.380	0.033	39.0	8.60E-05	6000
0402HP-6N8	15	0.055	0.049	6.80	1.65E-05	12000	0402HP-40N	30	0.380	0.032	40.0	1.00E-04	6000
0402HP-7N5	12	0.080	0.051	7.50	2.04E-05	10000	0402HP-43N	44	0.520	0.035	43.0	1.10E-04	6000
0402HP-8N2	17	0.054	0.036	8.20	2.04E-05	10000	0402HP-47N	48	0.580	0.029	47.0	1.35E-04	6000
0402HP-8N7	11	0.058	0.048	8.70	2.13E-05	10000	0402HP-51N	40	0.700	0.034	51.0	1.41E-04	6000
0402HP-9N0	18	0.070	0.039	9.00	2.21E-05	10000	0402HPH-56N	30	1.00	0.041	56.0	1.36E-04	5000
0402HP-9N5	10	0.075	0.048	9.50	2.43E-05	10000	0402HPH-68N	25	1.20	0.035	68.0	1.72E-04	5000
0402HP-10N	4	0.085	0.051	10.0	2.57E-05	10000	0402HPH-82N	40	1.25	0.035	82.0	2.28E-04	4000
0402HP-11N	10	0.065	0.042	11.0	2.67E-05	10000	0402HPH-R10	20	1.20	0.039	100	2.71E-04	4000
0402HP-12N	10	0.070	0.043	12.0	2.84E-05	10000	0402HPH-R12	20	1.20	0.038	120	3.26E-04	3000
0402HP-13N	4	0.140	0.047	13.0	3.40E-05	9000	0402HPH-R15	40	2.00	0.041	150	3.72E-04	3000
0402HP-15N	15	0.078	0.038	15.0	4.00E-05	9000	0402HPH-R18	40	2.10	0.041	180	4.20E-04	3000
0402HP-16N	18	0.130	0.044	16.0	4.50E-05	8000	0402HPH-R22	20	3.10	0.037	220	5.10E-04	3000

$$R_{VAR} = k * \sqrt{f}$$

- k is shown for each value in the accompanying table.
- f is the frequency in Hz



Coupling of two resonant LC circuits



We may write the following system of equations

$$\begin{pmatrix} Y_1 & -Y_c \\ -Y_c & Y_2 \end{pmatrix} \cdot \begin{pmatrix} V_1 \\ V_2 \end{pmatrix} = \begin{pmatrix} I_s \\ 0 \end{pmatrix}$$

Solving for $V_2(I_s)$ to get the transimpedance transfer function one gets

$$V_2 = \frac{\begin{vmatrix} Y_1 & I_s \\ -Y_c & 0 \end{vmatrix}}{\begin{vmatrix} Y_1 & -Y_c \\ -Y_c & Y_2 \end{vmatrix}} = I_s \cdot \frac{Y_c}{Y_1 \cdot Y_2 - Y_c^2}$$

$$\frac{V_2}{I_s} = \frac{Y_c}{Y_1 \cdot Y_2 - Y_c^2}$$

V_1 if needed would be given by

$$V_1 = \frac{\begin{vmatrix} I_s & -Y_c \\ 0 & Y_2 \end{vmatrix}}{\begin{vmatrix} Y_1 & -Y_c \\ -Y_c & Y_2 \end{vmatrix}} = I_s \cdot \frac{Y_2}{Y_1 \cdot Y_2 - Y_c^2}$$

From which we could compute (useless in our case since this is the 2nd equation

$$\frac{V_2}{V_1} = \frac{Y_c}{Y_2}$$

You may try to find the third order solution for 3 coupled network using the same principle

LT spice configuration

The menu bar looks as below



Pen allow you to add wires

GND defines the global (node 0) node

'A' allows you to name node and make ports for hierarchical editing

R C and L components, go on top of the symbol and right click to edit properties

AND: Sources are found under the components icon (AND gate)

Most right icon is to add SPICE DIRECTIVES needed for defining the simulations

`.ac dec 1000 200e6 2e9` specifies a log sim with 1000 pts/decade, start and stop freq of 200MHz and 2GHz

`AC=1 0` specifies the magnitude and phase of the current 1A (so that V is a direct image of Z), phase of 0 rad

Parameter para is to be defined as {para} in between the bracket when specifying the component value; then a `.PARAM para = value` is to be given as a directive

You may sweep a parameter with the `.step param para list val1 val2 ...` or a lin sweep with min max and step

Then RUN the simulation and select what you want to be plotted.

Save the plot configuration to get it automatically.

