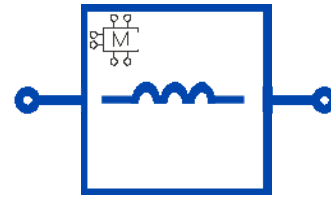


- ### Model Features
- Broadband (DC to 20GHz)
 - Equivalent circuit based
 - Substrate scalable: ($0.98 \leq H/Er \leq 16.4$)
 - Part Value Scalable (1 to 390 nH)
 - Land Pattern (Pad) scalable
 - Accurate effective series resistance
 - Developed for microstrip interconnects



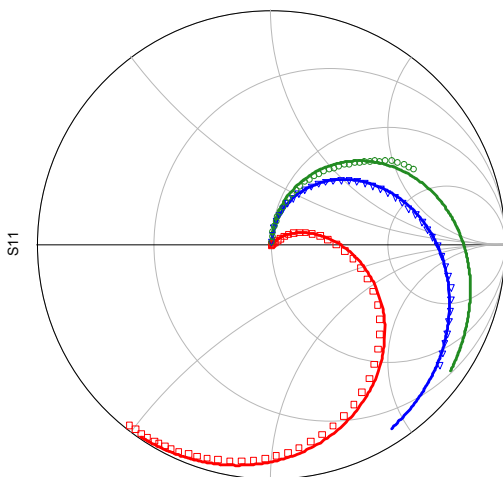
IND-CHL-0603-001
(1 to 390 nH)
0603 Body Style

Model Description

The IND-CHL-0603-001 is a substrate scalable Global Model™ for the Chilisin P/N CLH1680 Tight Tolerance series surface mount chip inductor family (additional information is available at www.chilisin.com). The models are for use with microstrip applications and account for substrate (or printed circuit board) related parasitic effects. Substrate height, dielectric constant, loss tangent, interconnect metal thickness pad length, pad width, pad gap, and component tolerance are model input parameters. Models account for up to two higher-order resonant frequency pairs beyond the fundamental parallel resonant frequency. Accurate effective series resistance (ESR) is modeled over the frequency range. A single, substrate scalable Global Model™ is available which accurately emulates all inductor values within the valid inductance range. A Sim_mode switch allows pad stack effects to be disabled.

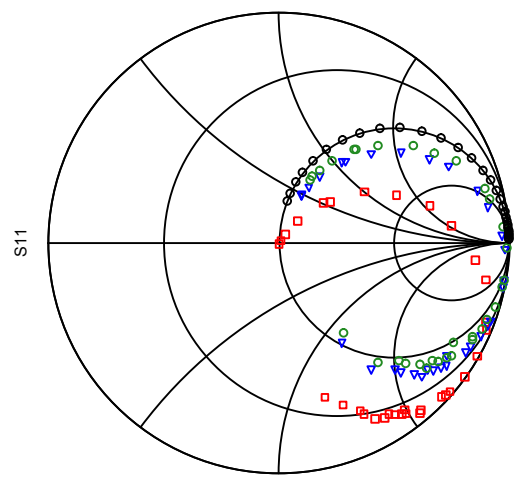
The pad dimensions used to develop datasheet plots for the model are: length = 0.76 mm, width = 0.8 mm, gap = 0.51 mm.

Frequency Sweep



Legend: □ 4mil Rogers 4350B, + 20mil Rogers 4003C, ◇ 60mil Rogers 4003C, Lines - Model, Symbols - Measured data. Measured data stops at highest valid frequency for each substrate. S11 for 1 nH inductor mounted on various substrates from 0.1 to 20 GHz.

Part Value Sweep



Legend: □ 4mil Rogers 4350B, + 20mil Rogers 4003C, ◇ 60mil Rogers 4003C, O Ideal. Model S11 at 3 GHz for capacitor values from 1 to 390 nH on various substrates compared to an ideal inductor response.

Technical Notes

- Two-port S-parameters were measured using a vector network analyzer and on-board probing with calibration referenced to the outside edges of the component pad stack.
- Inductors were measured in a series microstrip configuration. Models for alternative interconnect configurations (e.g. coplanar waveguide) are available upon request.
- Substrates used to extract the models: 4 mil Rogers 4350B, 20mil Rogers 4003C, and 60mil Rogers 4003C.
- Typical range of valid substrate types (substrate height H in mils and dielectric constant Er):
 $0.98 \leq H/Er \leq 16.4$
- Effective series resistance (ESR) was measured using a 4291A impedance analyzer and 16197 Agilent test fixture.
- Highest frequency for measurement validation: 8GHz (60 mil Rogers 4003C), 16 GHz (20 mil Rogers 4003C), and 20 GHz (4 mil Rogers 4350B)
- Multiple simulation modes (Sim_mode) are available - full mode, ideal mode and no pad stack.

Device Image

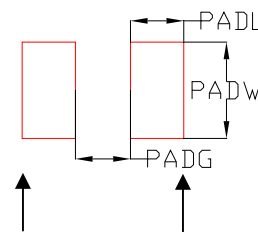


Inductor Values (nH)

1.0	1.2	1.5	1.8	2.2	2.7
3.3	3.9	4.7	5.6	6.8	8.2
10	12	15	18	22	27
33	39	47	56	62	68
82	100	120	150	180	220
270	330	390			

Highlighted inductor values are measurement-based models. Other models found via interpolation. Table shows 33 part values in the model range based on manufacturer's datasheet.

PC Board Footprint



$$27.56 (0.7) \leq \text{PADL} \leq 43.31 (1.1)$$

$$25.59 (0.65) \leq \text{PADW} \leq 43.31 (1.1)$$

$$20.08 (0.51) \leq \text{PADG} \leq 27.56 (0.7)$$

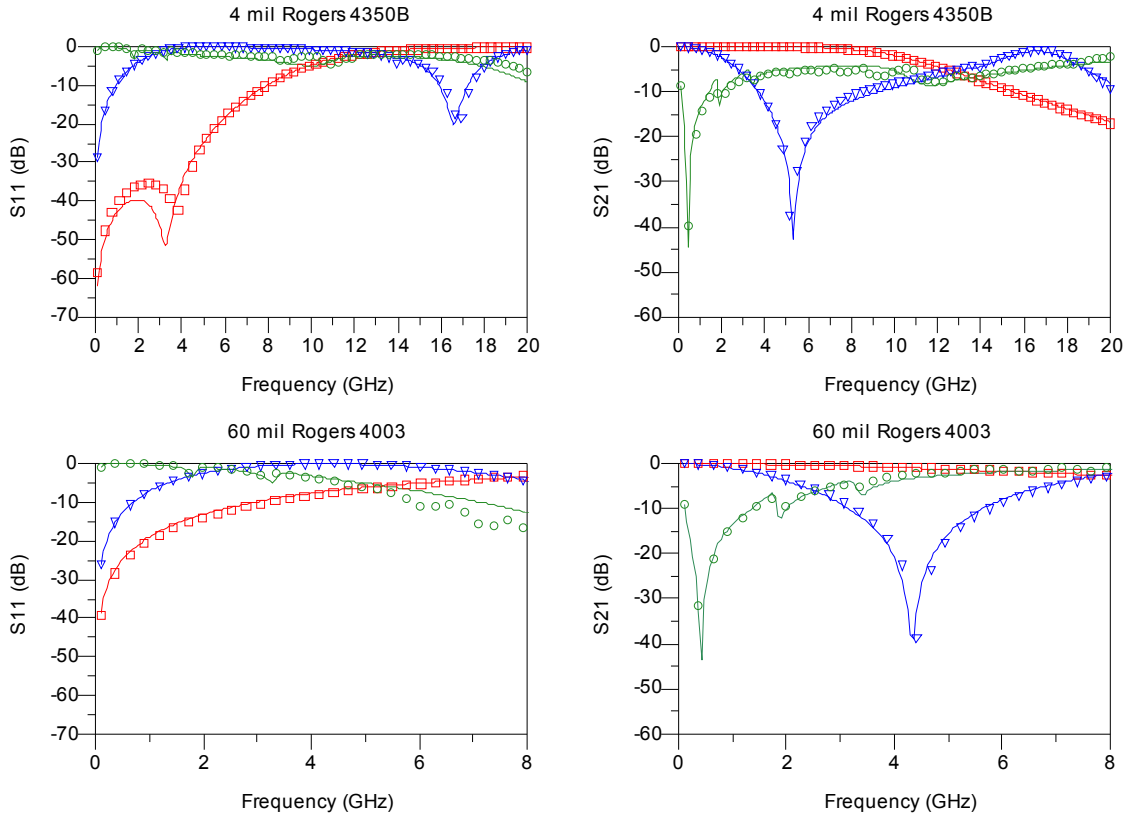
Units in mils (mm)

Reference Planes

Model Input Parameters

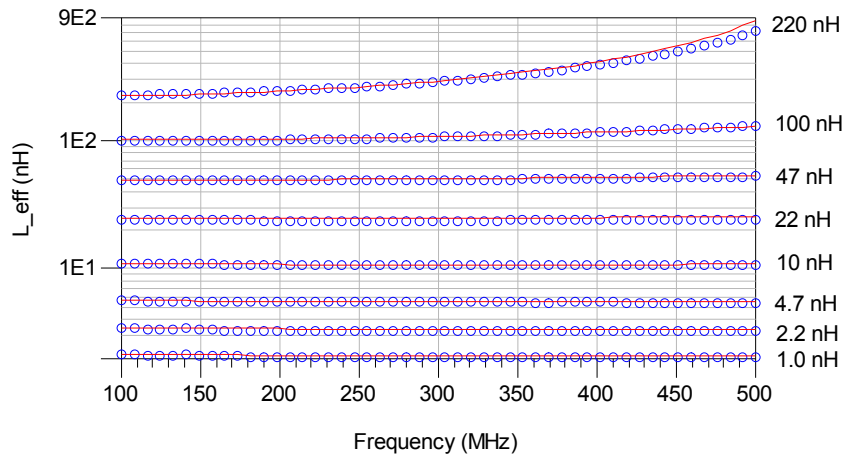
- L - Nominal component value in nH. The full parasitic model is invoked if the part value is within the valid limits of the model, otherwise an ideal element model is used.
- Subst - Microstrip substrate instance name. The model will reference the named substrate instance to obtain values for H, Er, T and TanD.
- Sim_mode - 0 for full parasitic model, 1 for ideal element, 2 for removing pad effects.
- Tolerance - Tolerance of the part value. The nominal value for this parameter should be set to 1. Use for statistical distribution.
- Pad_Width - Width of land pattern footprint
- Pad_Length - Length of land pattern footprint
- Pad_Gap - Gap between land pattern footprint

Typical Measured Series 2-Port S-Parameter Data vs. Simulated Data



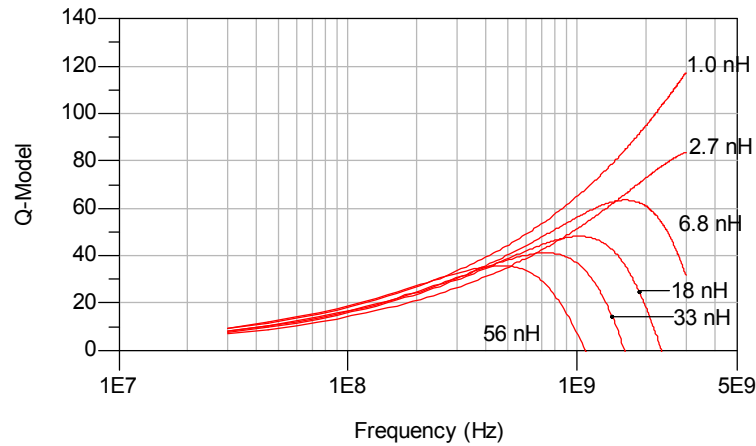
Legend: \square 1.2 nH, \triangle 6.8 nH, \diamond 390 nH, Solid lines - Model data, Symbols - Measured data

Effective Inductance



Legend: Red solid lines - Model response on 60 mil Rogers 4003C
 Blue symbols - Measurement on 60 mil Rogers 4003C
 Note: Plot is based on randomly selected part values from 1 – 390 nH.

Simulated Q-Factor



Legend: solid lines - Model response on 60 mil Rogers 4003C
Note: Plot is based on randomly selected part values from 1 – 390 nH.

Model and Datasheet Revision Notes

03/22/2013 Original model and datasheet development