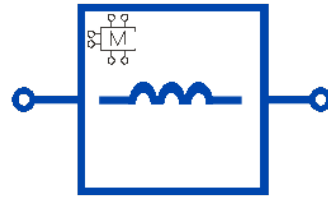


surface mount chip inductor model

- Model Features***
- Broadband validation: DC – 10GHz
 - Equivalent circuit based
 - Substrate scalable: ($1 \leq H/Er \leq 16.2\text{mil}$)
 - Part value scalable: (47 to 27000nH)
 - Land Pattern (Pad) scalable
 - Validation: Equivalent series resistance
 - Developed for microstrip interconnects
- * See Technical Notes for more details



IND-CHL-0805-002
(47 to 27000nH)
0805 Body Style

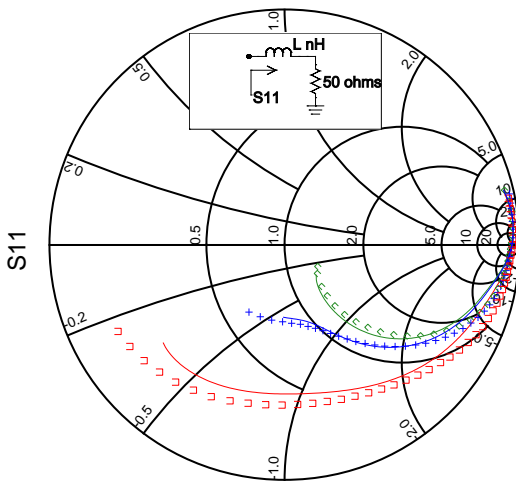
Model Description

The IND-CHL-0805-002 is a substrate scalable Microwave Global Model™ for the Chilisin P/N CL2012 series surface mount inductors (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, component tolerance, pad width, pad length, and pad gap are model input parameters. Models account for up to two higher-order resonant frequency pairs beyond the fundamental series resonant frequency. The model is validated with measured equivalent series resistance (ESR). A single, substrate scalable and pad scalable Microwave Global Model™ is available that accurately emulate all inductor values within the valid inductance range. A Sim_mode switch allows pad stack effects to be disabled.

Model simulation may vary slightly based on simulator used.

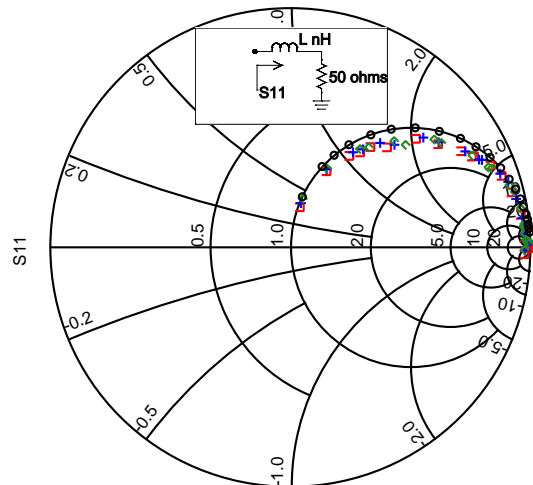
The pad dimensions used to develop datasheet plots for the model are: length = 32.3 (0.82), width = 49.2 (1.25), gap = 30 (0.762). Units in mil (mm).

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 a 1200 nH inductor mounted on various substrates from 0.045 to 10 GHz.

Part Value Sweep

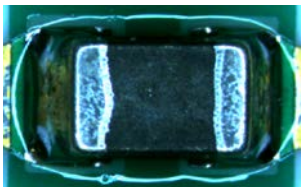


Legend: □ 4mil Rogers 4350B, + 20mil Rogers 4003C, ◇ 60mil Rogers 4003C, O Ideal Model S11 at 75 MHz for inductor values from 47 to 27000 nH on various Rogers substrates compared to an ideal inductor response.

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 2-port series configuration using a 50-ohm microstrip test fixture. Models for alternative interconnect configurations (e.g. coplanar waveguide) are available upon request.
- Nominal part value range (47 to 27000nH)
 - Tolerance on low value: 20%
 - Tolerance on high value: 10%
 - Actual part value range (37.6 to 29700nH).
- Pad scalable models are validated with S-parameter measurements within the recommended pad range.
- Substrates used to extract the models: 4 mil Rogers 4350B, 20mil Rogers 4003C, and 60mil Rogers 4003C.
- Validated substrate range of substrate height and dielectric constant ratios based on substrates used to develop the model:
 - $1 \leq H/Er \leq 16.2(\text{mil})$
 - $0.03 \leq H/Er \leq 0.41(\text{mm})$
- Equivalent series resistance (ESR) was measured using a 4291A impedance analyzer and 16197 Agilent test fixture.
- Highest frequency for measurement validation: 6GHz (60 mil Rogers 4003C), 10 GHz (20 mil Rogers 4003C), and 10 GHz (4 mil Rogers 4350B)
- Multiple simulation modes (Sim_mode) are available - full mode, ideal mode and no pad stack.

Device Image

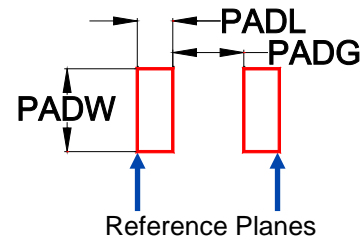


Inductor Values (nH)

47	68	82	100	120	150
180	220	270	330	390	470
560	680	820	1000	1200	1500
1800	2200	2700	3300	3900	4700
5600	6800	8200	10000	12000	15000
18000	22000	27000			

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



$$32.3 (0.82) \leq \text{PADL} \leq 55.1 (1.40)$$

$$43.7 (1.11) \leq \text{PADW} \leq 61.0 (1.55)$$

$$19.7 (0.50) \leq \text{PADG} \leq 29.9 (0.76)$$

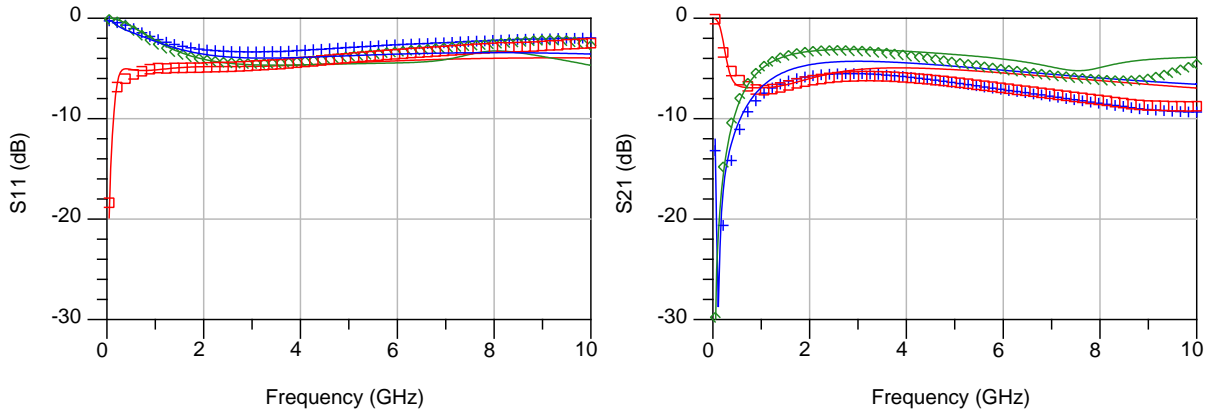
Units in mil (mm)

Model Input Parameters

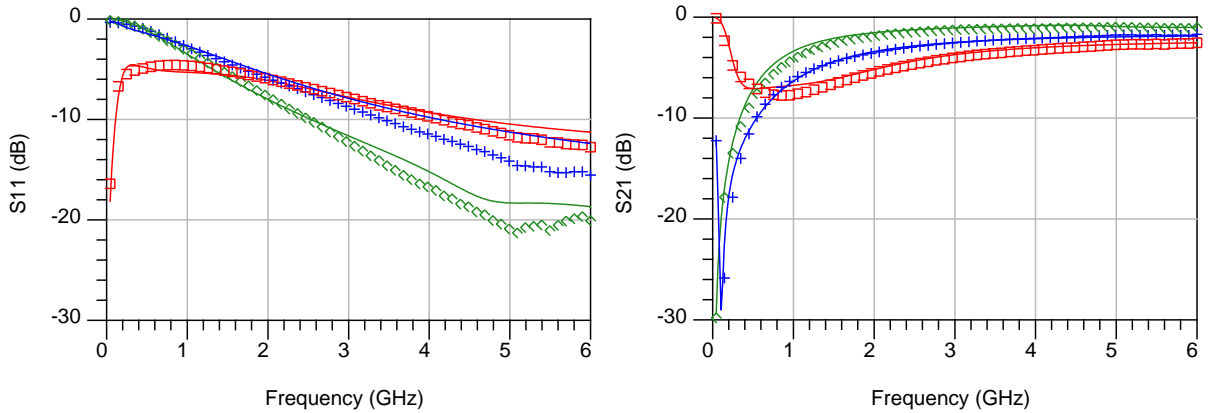
- L - Nominal component value in nH. The full parasitic model is invoked if the part value is within the valid limits of the model, otherwise an ideal element model is used.
- Subst - Microstrip substrate instance name. The model will reference the named substrate instance to obtain values for H, Er, T and TanD.
- Sim_mode - 0 for full parasitic model, 1 for ideal element, 2 for removing pad effects.
- Pad_mode - 0 for default to Sim_mode, 1 for pads always in layout, 2 for pads never in layout
- 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 - Pad - to - pad spacing (inside pad edge - to - inside pad edge)
- L_Discrete - Discrete input parameter based on manufacturer available part values can be used for tuning and optimization. Overrides L input parameter.

Model vs. Measured Series 2-port S-parameter Data

4mil Rogers 4350B (H/Er = 1 mil):

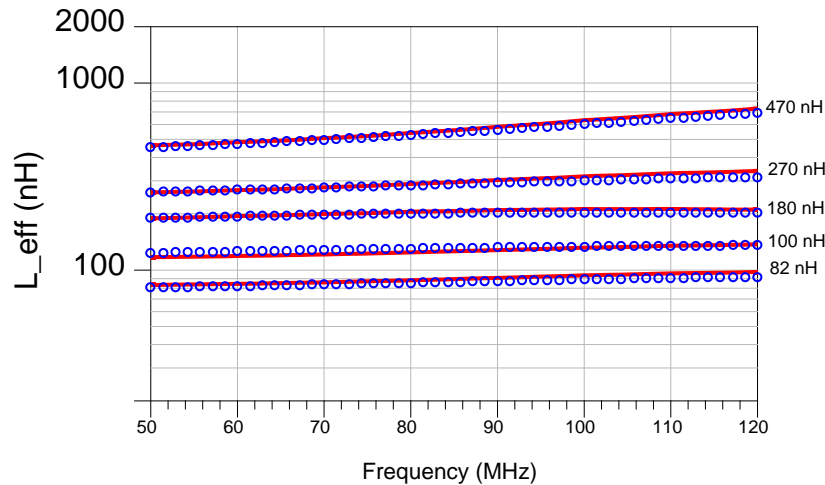


60 mil Rogers 4003C (H/Er = 16.2 mil):



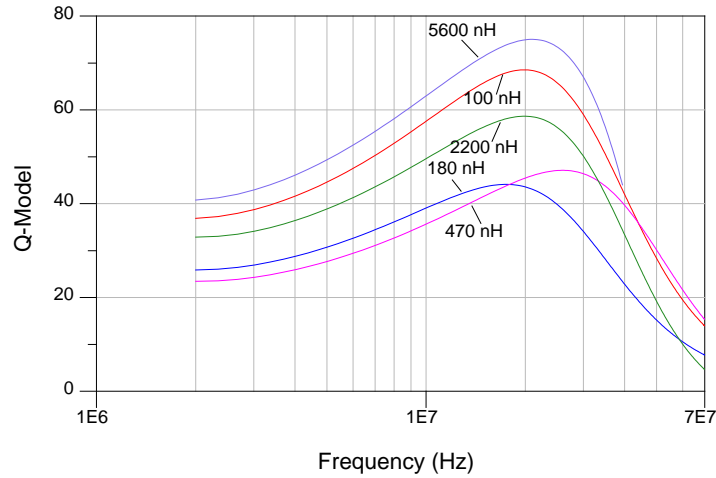
Legend: □ 47nH, + 120nH, ◇ 27000nH, Solid lines - Model data, Symbols - Measured data

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 selected part values from 47 – 27000nH.

Simulated Q-Factor

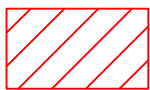
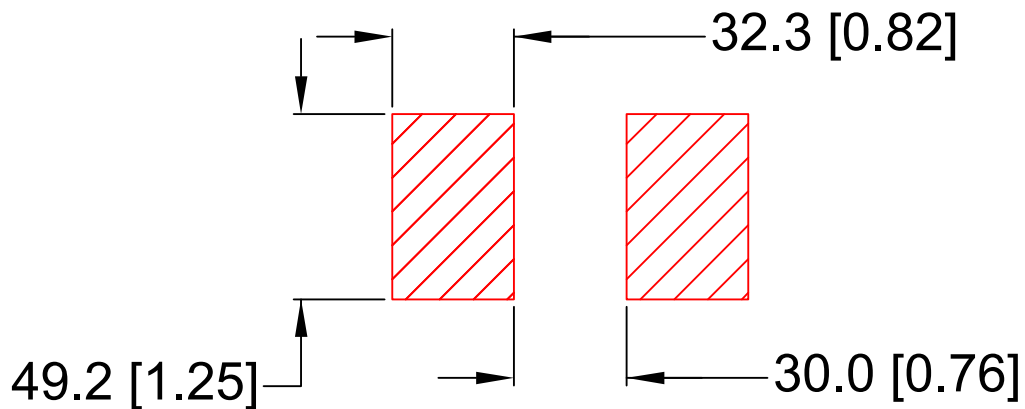


Legend: solid lines - Model response on 60 mil Rogers 4003C
Note: Plot is based on selected part values from 47 – 27000nH.

Model and Datasheet Revision Notes

5/12/2016 Original model and datasheet development

Nominal Footprint



Denotes plated copper land pattern free of solder mask.



Title Modelithics, INC.

CONTROLLING DIMENSIONS - MILS (0.001")
[METRIC DIM - mm] FOR REFERENCE ONLY

Scale
NOT TO
SCALE

Drawn by
MDLX

File Name IND-CHL-0805-002_datasheet.dwg

Date 5-12-2016

Sheet 1

Rev
1