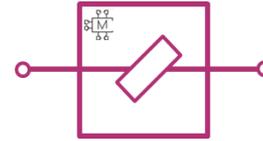# surface mount chip ferrite bead model

Model Features

- O— Broadband (DC to 6GHz)
- O— Equivalent circuit based
- O— Substrate scalable (1.0 ≤ H/Er ≤ 16.4)
- O— Part value selectable: rated 10 to 1800 ohms
- O— Bias Sensing Capability: Accurate impedance prediction up to 0.5 A
- O— Developed for microstrip interconnects

**FBD-CHL-0402-001
(10 to 1800 Ohms)
0402 Body Style**

Model Description

The FBD-CHL-0402-001 is a substrate and bias scalable Global Model™ for the Chilisin P/N SBY100505T surface mount chip ferrite bead 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, metal thickness, and pad dimensions are model input parameters. Accurate impedance and S-parameters vs bias are modeled over the valid frequency range at a temperature of 25 C. A Sim_mode switch allows pad stack effects to be disabled.

The pad dimensions used to develop datasheet plots for the model are: length = 0.32 mm, width = 0.51 mm, gap = 0.60 mm.

Impedance – Frequency Characteristics for Multiple Part Values
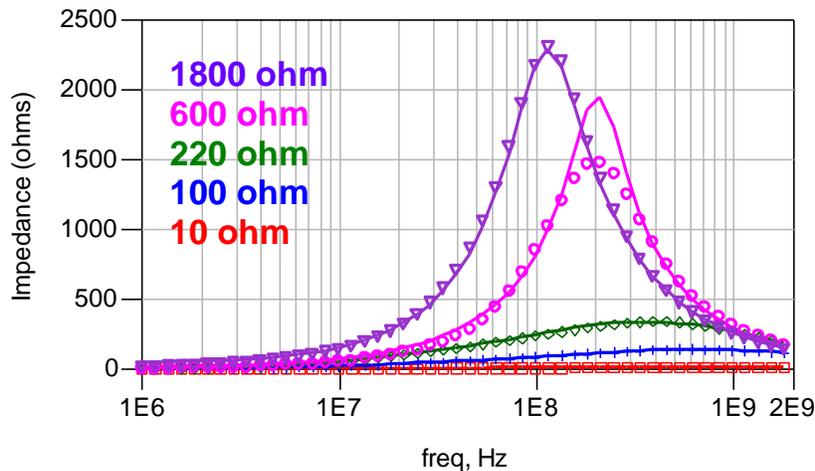
Legend: Bias = 0 A. 20mil Rogers 4003C.

Temperature: 25C

10 ohm (**Red**), 100 ohm (**Blue**), 220 ohm (**Green**), 600 ohm (**Pink**), 1800 ohm (**Purple**)

Solid lines - Model data, Symbols - Measured data acquired using an Impedance Analyzer.

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.
- Ferrite beads 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.
- The models were developed using the following land pattern dimensions: PADL= 0.32 mm, PADW= 0.51 mm, PADG= 0.60 mm. The pad scalable models are then validated with S-parameter measurements within the recommended pad range.
- Substrates used to extract the models: 4mil Rogers 4350B, 20 and 60mil Rogers 4003C.
- Typical range of valid substrate types (substrate height H in mils and dielectric constant Er):

  1.0 ≤ H/Er ≤ 16.4
- Highest frequency for measurement validation: 6GHz (4mil Rogers 4350B, 20 and 60mil Rogers 4003C).
- Impedance measurements over bias were performed using the Agilent HP 4291A Impedance Analyzer.
- Multiple simulation modes (Sim_mode) are available - full mode and no pad stack.
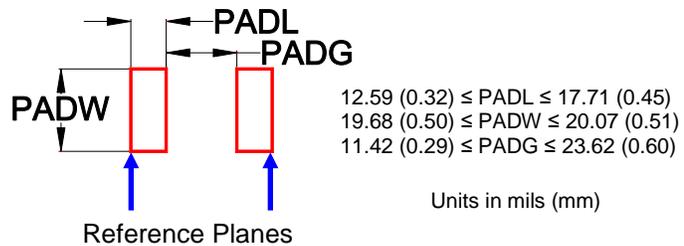
Device Image

Ferrite Bead Resistance Values (ohms)

10	40	60
70	100	120
220	300	600
1000	1800	

Highlighted resistance values are measurement-based models. Table shows 11 part values in the model range based on manufacturer's datasheet.

PC Board Footprint

12.59 (0.32) ≤ PADL ≤ 17.71 (0.45)
19.68 (0.50) ≤ PADW ≤ 20.07 (0.51)
11.42 (0.29) ≤ PADG ≤ 23.62 (0.60)

Units in mils (mm)

SBY100505T

Model Input Parameters

- Z - Nominal component value in ohms.
- Subst - Microstrip substrate instance name. The model will reference the named substrate instance to obtain values for H, Er, T and TanD.
- Pad_mode – 0 for default to Sim_mode, 1 for pads always in layout, 2 to remove pads in layout.
- Sim_mode - 0 for full parasitic model, 1 for removing pad effects.
- Tolerance - Tolerance of the part value. Use for statistical distribution.
- Pad_Width - Width of land pattern footprint.
- Pad_Length – Length of land pattern footprint.
- Pad_Gap - Pad-to-pad spacing (edge to edge).

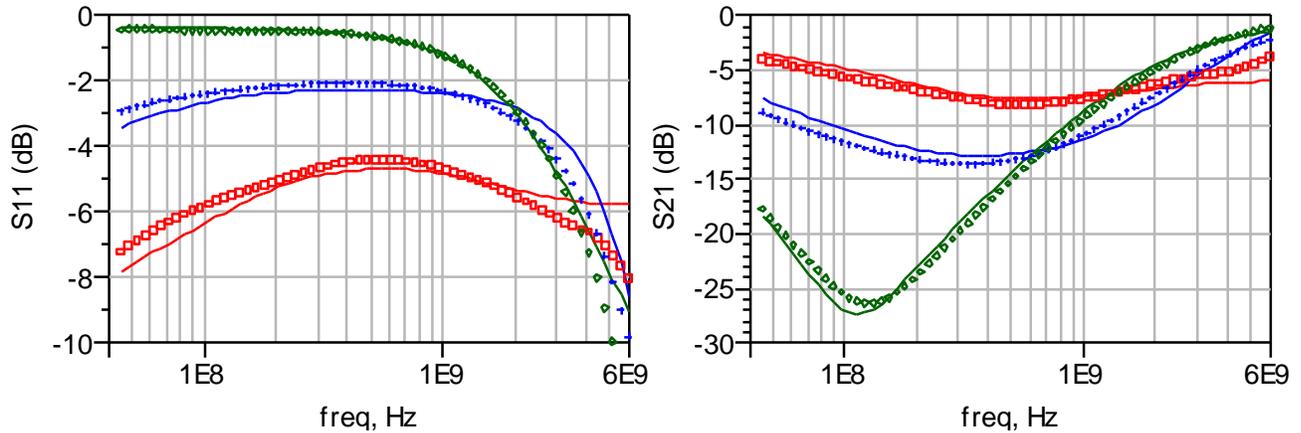# Series 2-Port S-Parameter Model vs. Measured Data

4mil Rogers 4350B (H/Er = 1.0)
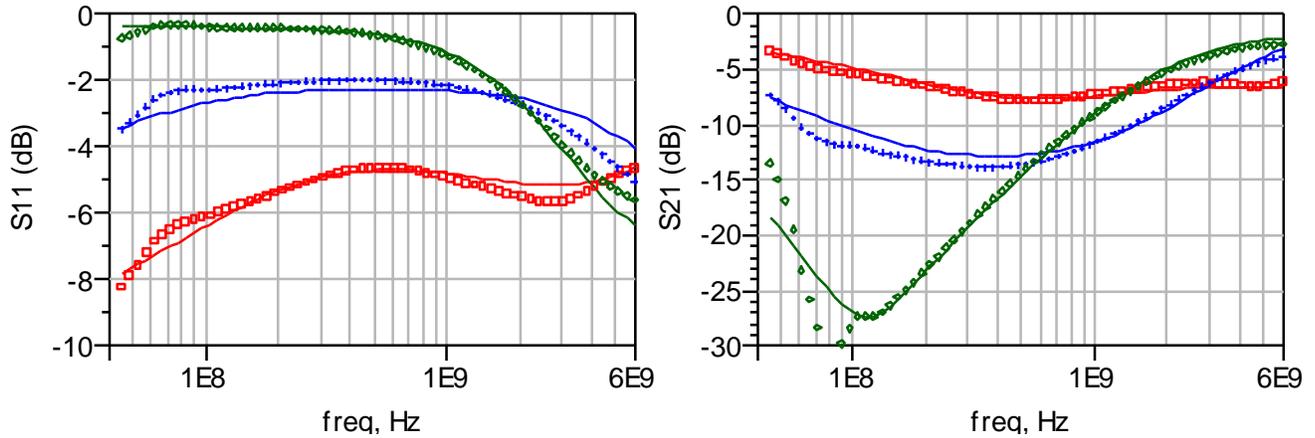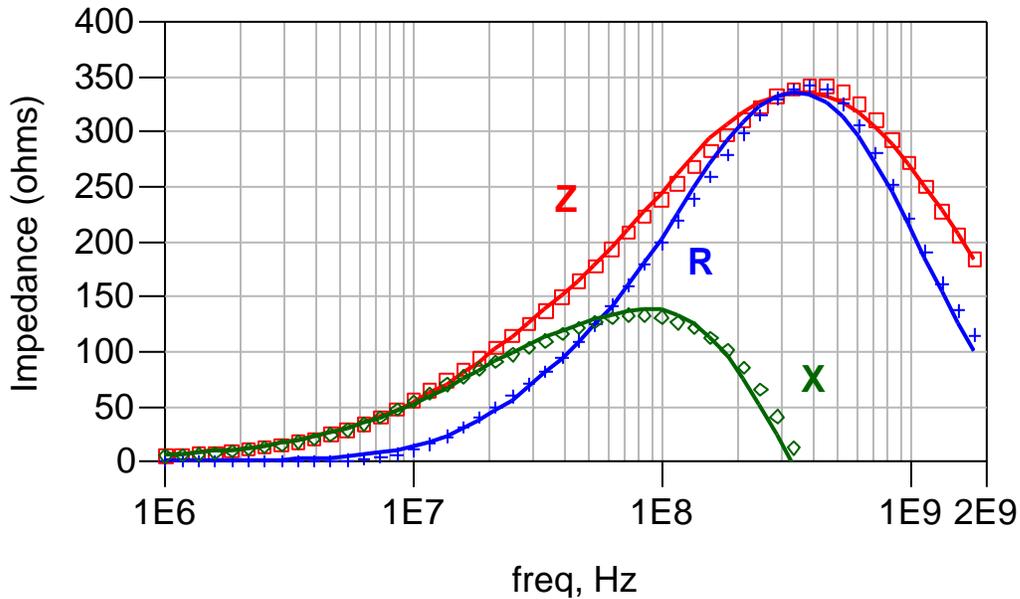

20mil Rogers 4003C (H/Er = 5.3)
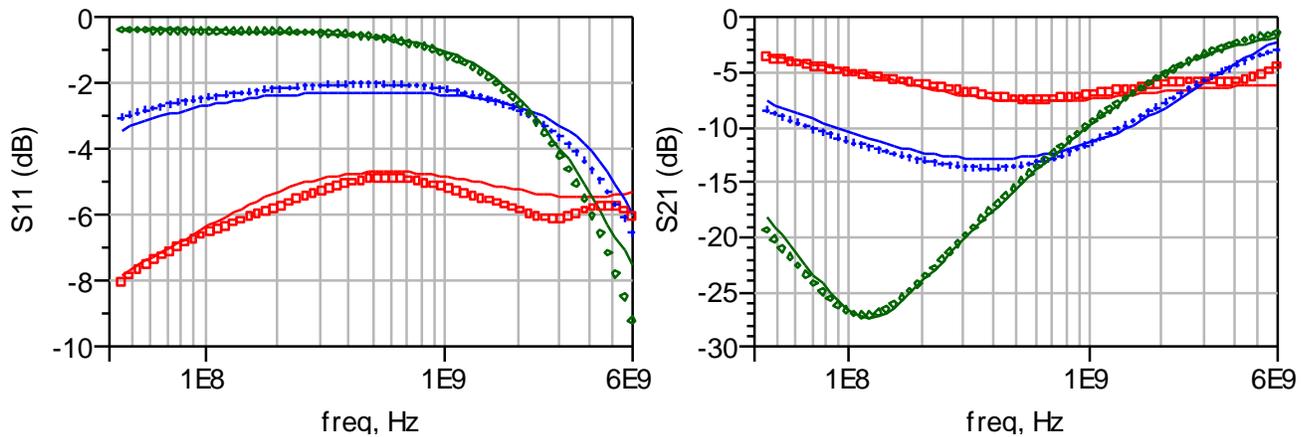
60mil Rogers 4003C (H/Er = 16.4)

Legend: 100 ohm (**red**), 220 ohm (**blue**), 1800 ohm (**green**) ferrite bead. Bias current = 0mA. Solid lines - Model data, Symbols - Measured data.

Temperature: 25C, H = substrate thickness in mils, Er = substrate dielectric constant.

Impedance-Frequency Characteristics: Zero Bias

Legend: **220 ohm** ferrite bead. 20mil Rogers 4003C. Bias: 0mA. Temperature: 25C.

Total impedance (**Red**), real impedance (**Blue**) and imaginary impedance (**Green**)

Solid lines - Model data, Symbols - Measured data acquired using a Vector Network Analyzer.

Model and Datasheet Revision Notes

03/25/2014   Original model and datasheet development

Nominal Footprint

12.6 [0.320]

20.1 [0.510]

23.6 [0.600]
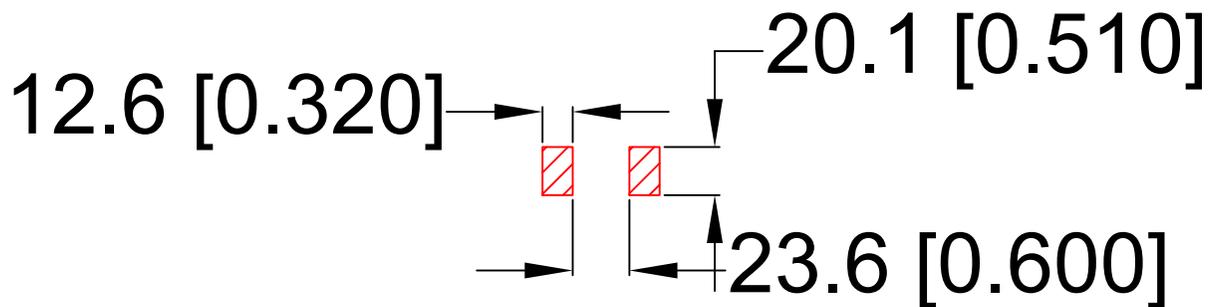
Denotes plated copper land pattern
free of solder mask.