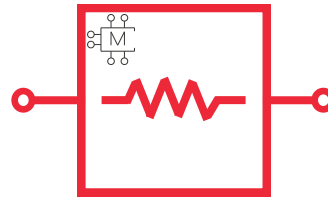


- Model Features\***
- Broadband validation: (DC – 60 GHz)
  - Equivalent circuit based
  - Substrate scalable: ( $0.9 \leq H/Er \leq 17$  mil)
  - Part value scalable (50 to 100 Ohms)
  - Land Pattern (Pad) scalable
  - Developed for microstrip interconnects
- \* See Technical Notes for more details



**RES-PPI-2010BB-001**  
**(50 to 100 Ohms)**  
**0201 Body Style**

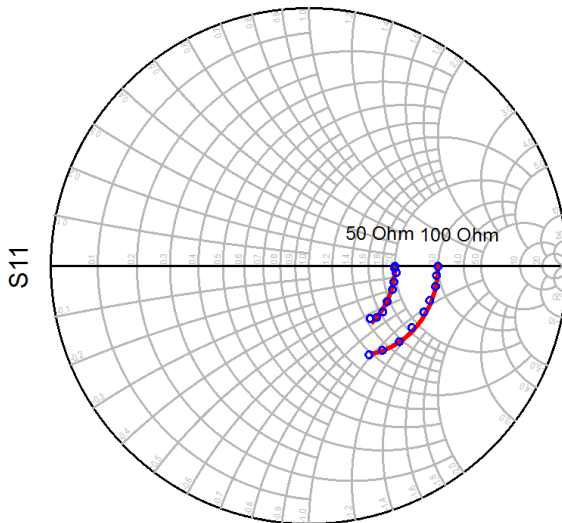
## Model Description

The RES-PPI-2010BB-001 is a substrate scalable Microwave Global Model™ for the Passive Plus P/N R35-2010BB R1 (Recessed Pad) flip chip resistor family (additional information is available at <https://www.passiveplus.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. A single, substrate scalable and pad scalable Microwave Global Model™ is available which accurately emulates all resistor values within the valid resistance range. A Sim\_mode switch allows pad stack effects to be disabled.

Model simulation may vary slightly based on simulator used.

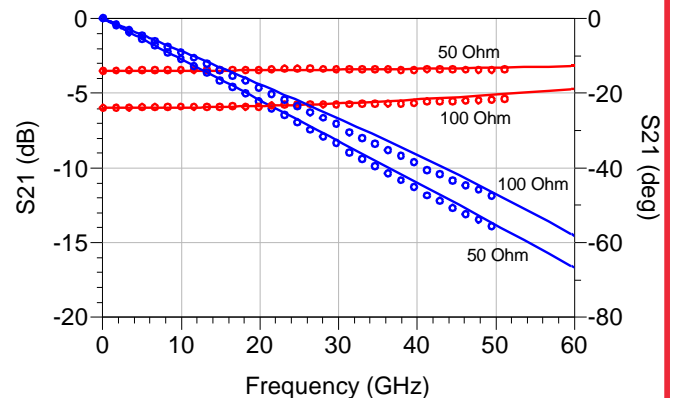
The pad dimensions used to develop datasheet plots are: Length = 4.0 (0.102), Width = 10.0 (0.254), Gap = 13.0 (0.330). Units in mil (mm).

## S11 (Model vs Measurement)



Legend: Lines - Model, Symbols - Measured data. S11 response for 50 Ohm and 100 Ohm resistors from 0.1 to 60.0 GHz on 4 mil Rogers 4350B

## Transmission Coefficient and Phase



Legend: Lines - Model, Symbols - Measured data. S21 magnitude and phase response for 50 Ohm and 100 Ohm resistors from 0.1 to 60.0 GHz on 4 mil Rogers 4350B



## Technical Notes

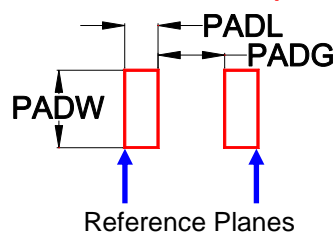
- Two-port S-parameters were measured using a vector network analyzer and on-board probing with calibration referenced to the outside edges of the component pad stack.
- Resistors were measured in a 2-port series configuration using a 50-ohm microstrip test fixture. Models for alternative interconnect configurations (e.g. coplanar waveguide) are available upon request.
- Nominal part value range (50 to 100 Ohm)
  - Tolerance on low value: 1%
  - Tolerance on high value: 1%
  - Actual part value range (49.5 to 101 Ohm).
- Pad scalable models are validated with S-parameter measurements within the recommended pad range.
- Substrates used to extract the models: 4 mil Rogers 4350B, 20 mil Rogers 4350B, and 60 mil Rogers 4003C.
- Measurement validated substrate range of substrate height and dielectric constant ratios based on substrates used to develop model:
  - $0.9 \leq H/Er \leq 17$  (mil)
  - $0.02 \leq H/Er \leq 0.43$  (mm)
- Model validated to 60 GHz. Highest frequency for measurement validation: 55 GHz (4 mil Rogers 4350B), 25 GHz (20 mil Rogers 4350B), and 10 GHz (60 mil Rogers 4003C).
- Multiple simulation modes (Sim\_mode) are available - full mode, ideal mode and no pad stack.

## Resistor Values (Ohms)

50	100
----	-----

Highlighted resistor values are measurement-based models. Table shows 2 part values in the model range based on manufacturer's datasheet.

### PC Board Footprint



$$4.01 (0.102) \leq PADL \leq 8.01 (0.2036)$$

$$10 (0.254) \leq PADW \leq 14.0 (0.3556)$$

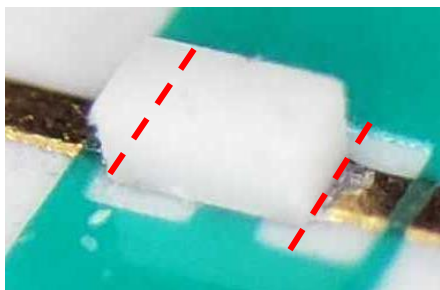
$$13.0 (0.33) \leq PADG \leq 13.0 (0.33)$$

Units in mils (mm)

### Model Input Parameters

- R - Nominal component value in ohms. 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 to remove pads 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)
- R\_Discrete - Discrete input parameter based on manufacturer available part values can be used for tuning and optimization. Overrides R input parameter.

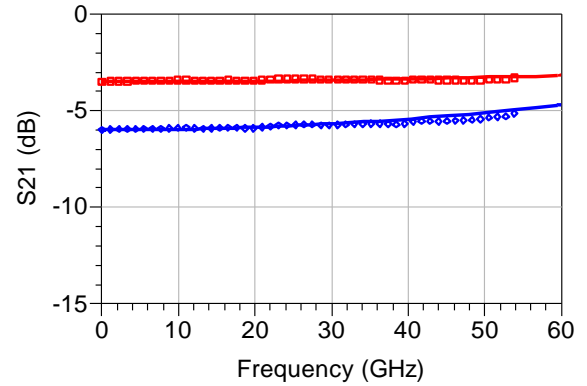
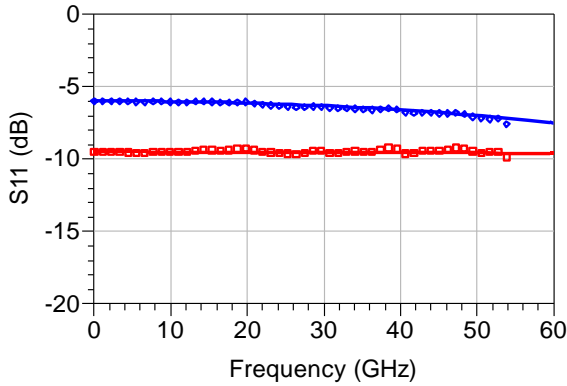
### Device Image



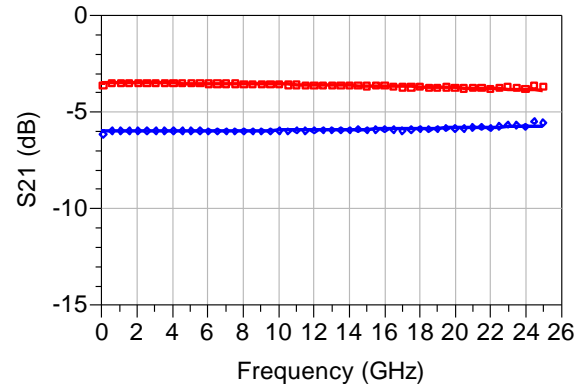
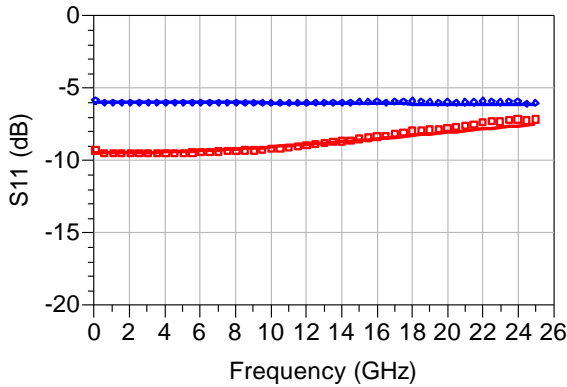
Reference planes at pad edge

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

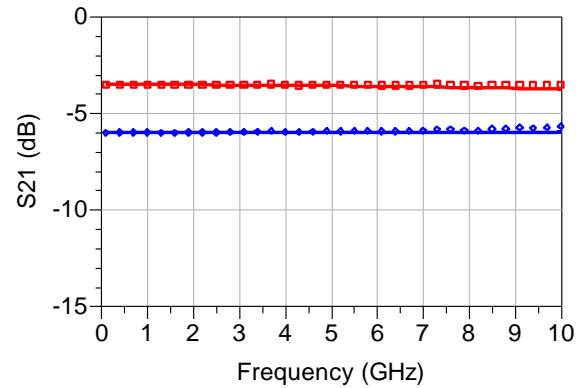
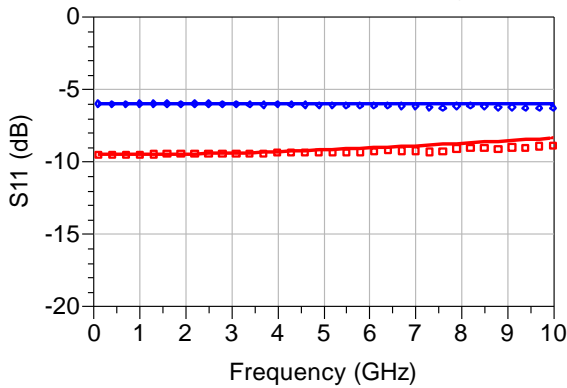
4 mil Rogers 4350B (H/Er = 1.0 mil):



20 mil Rogers 4350B (H/Er = 5.4 mil):



60 mil Rogers 4003C (H/Er = 16.7 mil):



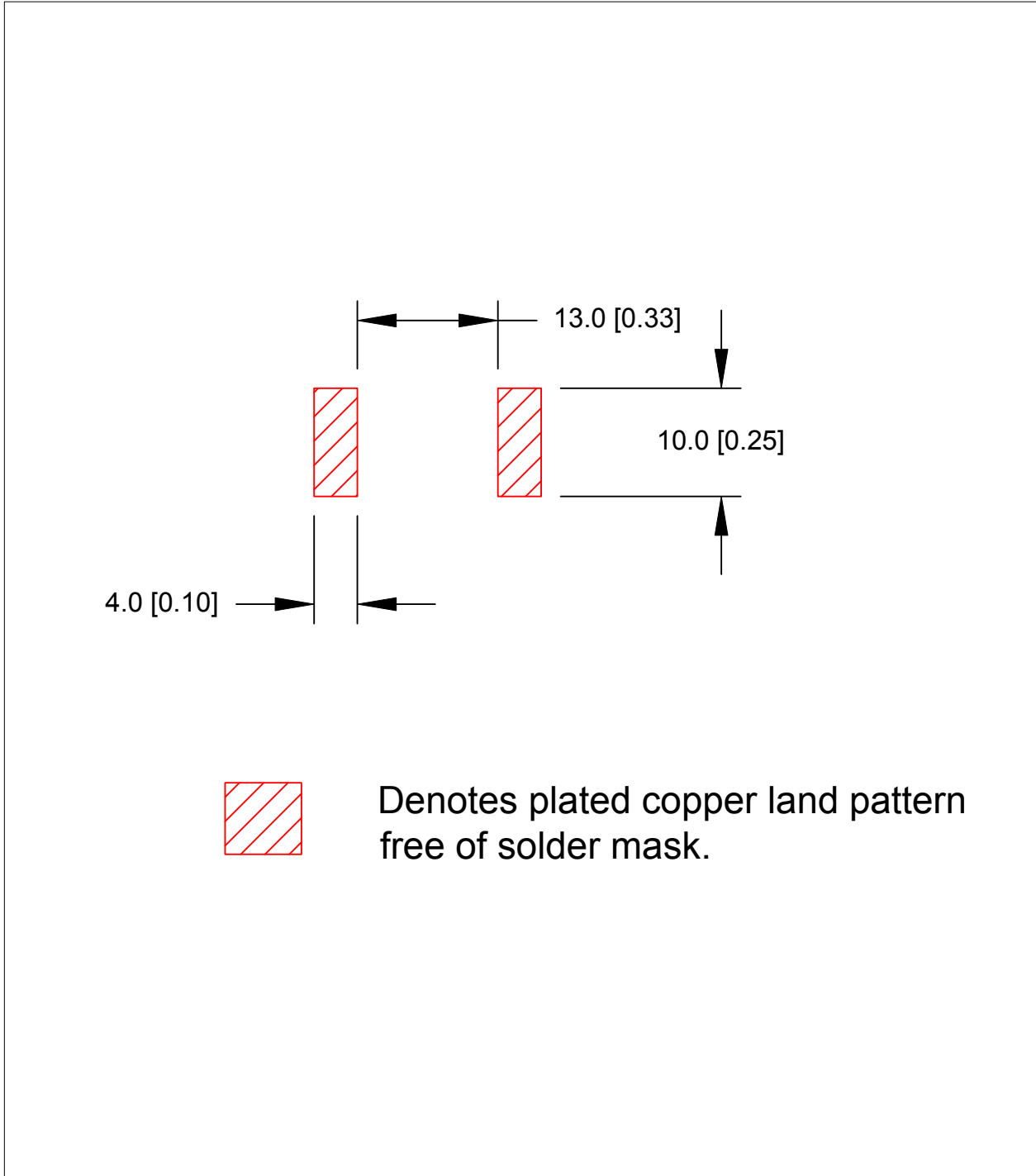
Legend: □ 50 Ω, + 100 Ω, Solid lines - Model data, Symbols - Measured data



## Model and Datasheet Revision Notes

- |           |  |
|-----------|--|
| 1/06/2021 | Original model and datasheet development |
| 3/08/2021 | Updates to plot legend                   |

# NOMINAL FOOTPRINT



Title Modelithics, INC.

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

Scale  
NOT TO  
SCALE

Drawn by  
MDLX

File Name RES-PPI-2010BB-001\_datasheet.dwg

Date 11-13-2020

Sheet 1

Rev  
**1**