Modelithics®

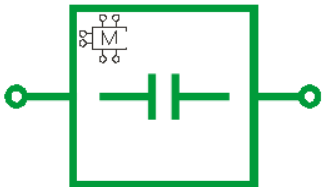
surface mount chip capacitor model

CAP-PPI-0708N-001

Model Features*

- Broadband validation: DC – 40 GHz
- Equivalent circuit based
- Substrate scalable:(0.9 ≤ H/Er ≤ 16.5 mil)
- Part value scalable: (1.0 to 100 pF)
- Land Pattern (Pad) scalable
- Validation: Equivalent series resistance
- Developed for microstrip interconnects

** See Technical Notes for more details*



CAP-PPI-0708N-001
(1.0 to 100 pF)
0708N Body Style

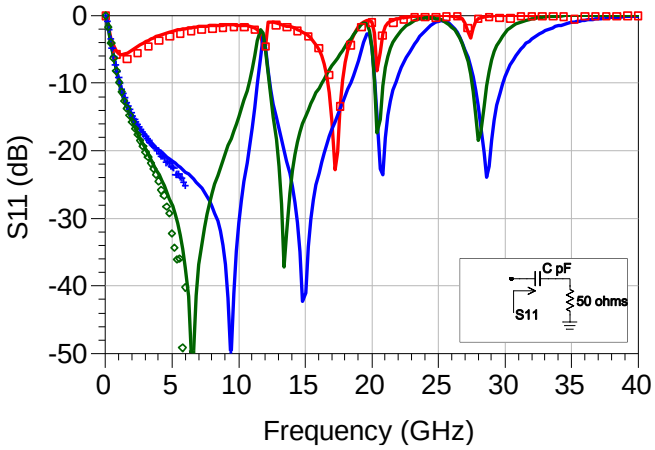
Model Description

The CAP-PPI-0708N-001 is a substrate scalable Microwave Global Model™ for the Passive Plus P/N 0708N surface mount chip capacitor family (additional information is available at 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. 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 emulates all capacitor values within the valid capacitance range. A Sim_mode switch allows pad stack effects to be disabled.

Model simulation may vary slightly based on simulator used.

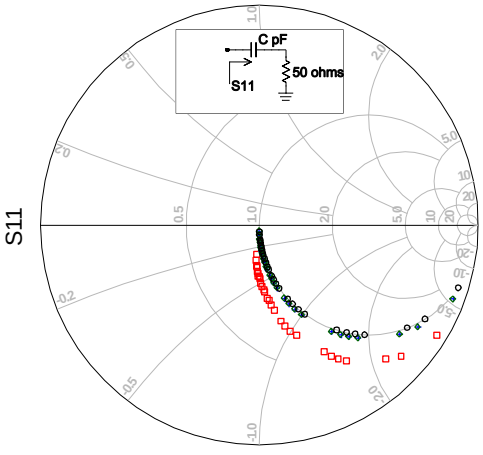
The pad dimensions used to develop datasheet plots for the model are: length = 20.0 (0.51), width = 100.0 (2.54), gap = 28.0 (0.71). Units in mil (mm).

Frequency Sweep



Legend: □ 4 mil Rogers 4350B, + 40 mil Rogers 4003C, ◊ 60 mil Rogers 4003C, Lines - Model, Symbols - Measured data. Measured data stops at highest valid frequency for each substrate. S11 for a 4.3 pF capacitor mounted on various substrates from 0.05 to 40 GHz.

Part Value Sweep



Legend: □ 4 mil Rogers 4350B, + 40 mil Rogers 4003C, ◊ 60 mil Rogers 4003C, O Ideal
Model S11 at 0.5 GHz for capacitor values from 1.0 to 100 pF on various substrates compared to an ideal capacitor 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.
- Capacitors 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 (1.0 to 100 pF)
  - Tolerance on low value: 0.25 pF
  - Tolerance on high value: 5%
  - Actual part value range (0.75 to 105 pF).
- Pad scalable models are validated with S-parameter measurements within the recommended pad range.
- Substrates used to extract the models: 4 mil Rogers 4350B, 40 mil Rogers 4003C, and 60 mil Rogers 4003C.
- Validated substrate range of substrate height and dielectric constant ratios based on substrates used to develop the model:

  0.9 ≤ H/Er ≤ 16.5 (mil)
  0.03 ≤ H/Er ≤ 0.42 (mm)
- Equivalent series resistance (ESR) was measured using a Boonton model 34A coaxial resonator line.
- Highest frequency for measurement validation: 40 GHz (4 mil Rogers 4350B), 6 GHz (40 mil Rogers 3003C), and 6 GHz (60 mil Rogers 4003C)
- Multiple simulation modes (Sim_mode) are available - full mode, ideal mode and no pad stack.

Device Images

Top View

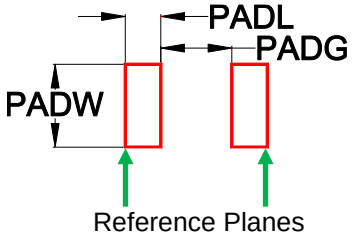
Side View

Capacitor Values (pF)

1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7
1.8	1.9	2.0	2.1	2.2	2.4	2.7	3.0
3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2
6.8	7.5	8.2	9.1	10	11	12	13
15	16	18	20	22	24	27	30
33	36	39	43	47	51	56	62
68	75	82	91	100			

Highlighted capacitor values are measurement-based models. Other models found via interpolation. Table shows 53 part values in the model range based on manufacturer's datasheet.

PC Board Footprint



16.0 (0.41) ≤ PADL ≤ 43.0 (1.09)
92.0 (2.34) ≤ PADW ≤ 108.0 (2.74)
12.0 (0.31) ≤ PADG ≤ 40.0 (1.02)

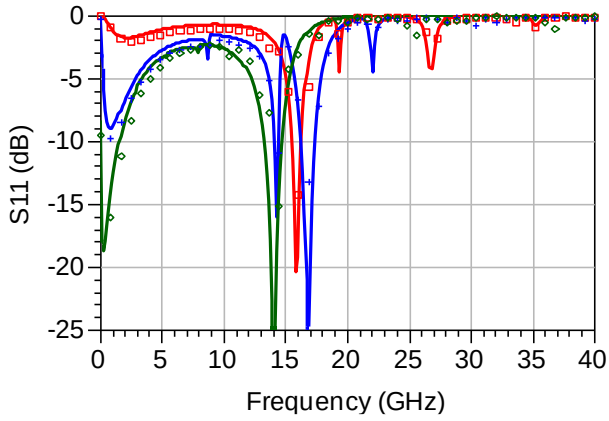
Units in mil (mm)

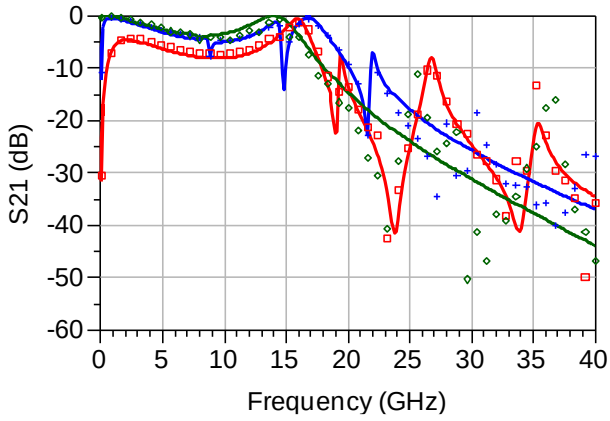
Model Input Parameters

- C - Nominal component value in pF. 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)
- C_Discrete - Discrete input parameter based on manufacturer available part values can be used for tuning and optimization. Overrides C input parameter.

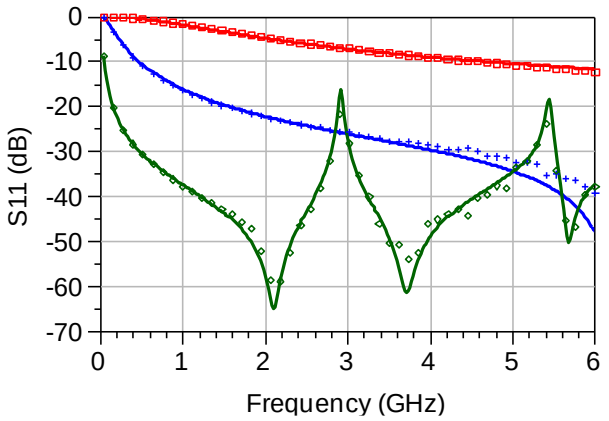
Model vs. Measured Series 2-port S-parameter Data

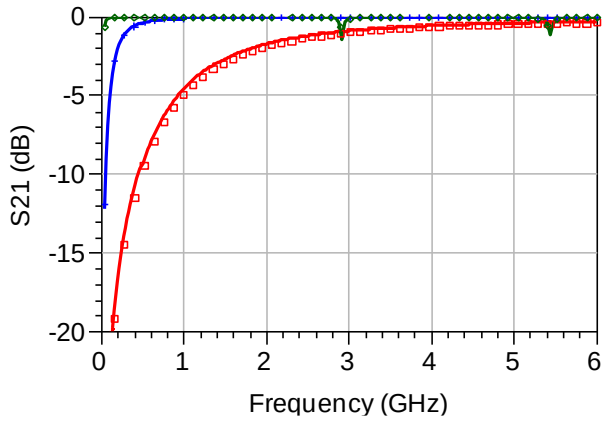
4 mil Rogers 4350B (H/Er = 0.9 mil):



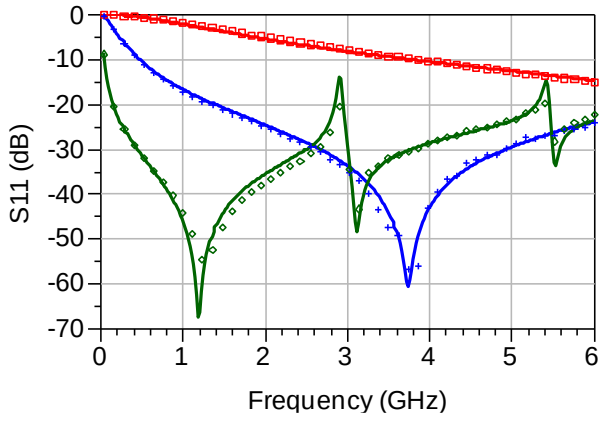


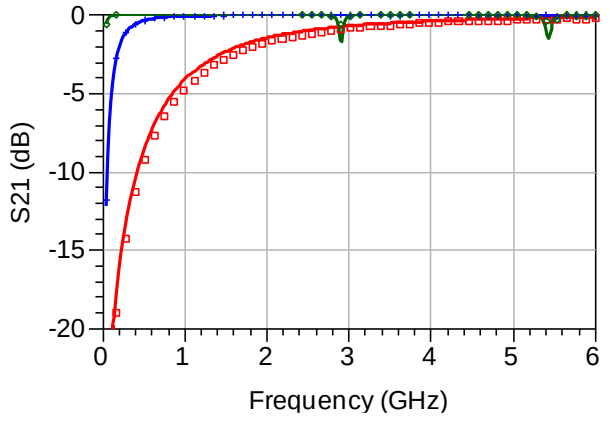
40 mil Rogers 3003C (H/Er = 13.3 mil):





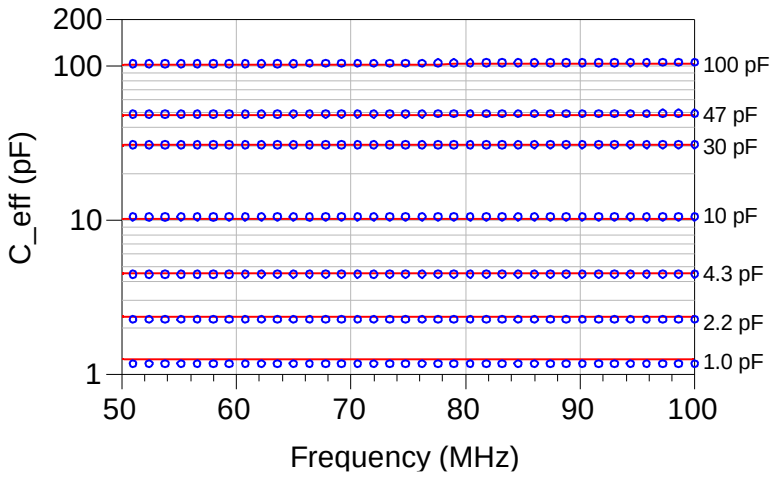
60 mil Rogers 4003C (H/Er = 16.5 mil):





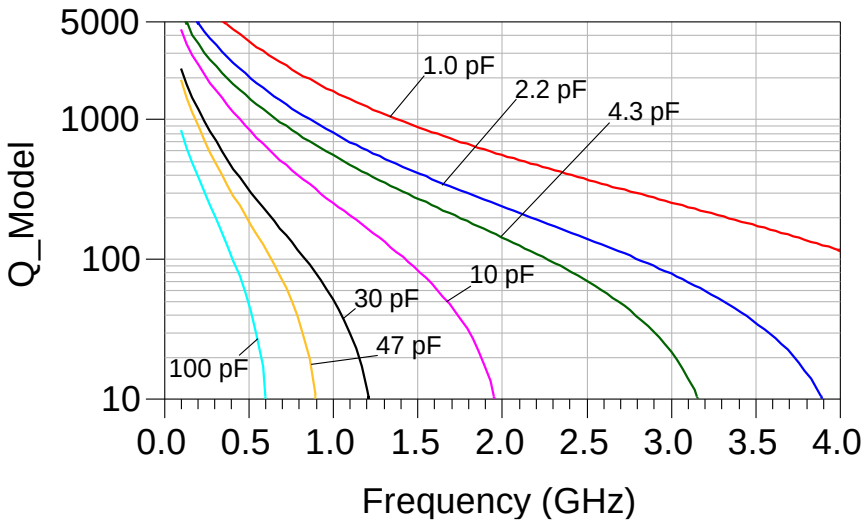
Legend: □ 1.0 pF, + 10 pF, ◊ 100 pF, Solid lines - Model data, Symbols - Measured data

Effective Capacitance



Legend: Red solid lines - Model response on 60 mil Rogers 4003C
Blue symbols - Measurement on 60 mil Rogers 4003C
Note: Plot shows selected values within the model range.

Simulated Q-Factor

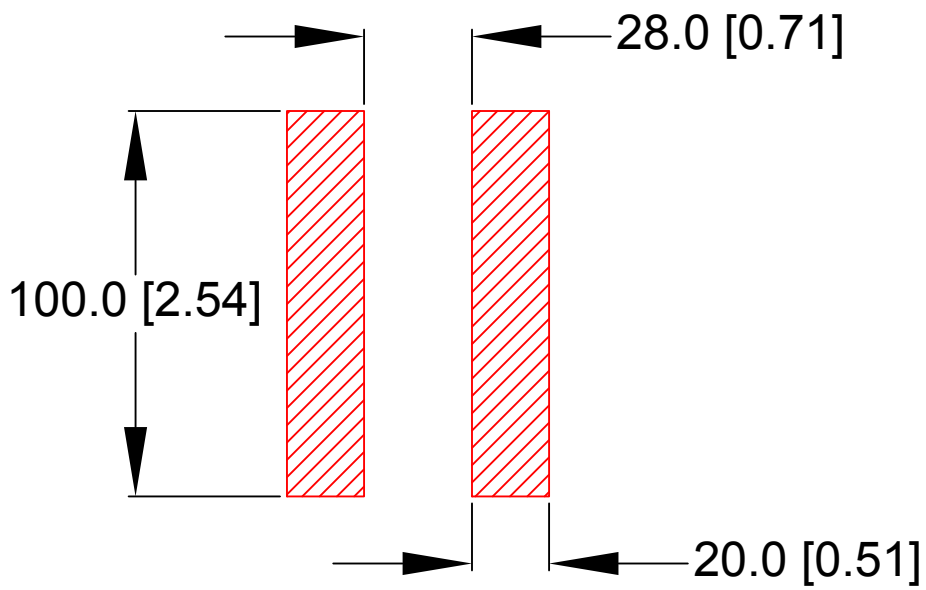


Legend: solid lines - Model response on 60 mil Rogers 4003C
Note: Plot shows selected values within the model range.

Model and Datasheet Revision Notes

01/11/2018 Original model and datasheet development

NOMINAL FOOTPRINT



Denotes plated copper land pattern free of solder mask.

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

Modelithics®			
Title: Modelithics, INC.			
Scale: NOT TO SCALE	Drawn by: MDLX	File Name: CAP-PPI-0708N-001_datasheet.dwg	Rev: 1
		Date: 01-11-2018	Sheet: 1