



Modelithics June 2006 Newsletter

**Visit us at BOOTH #715 during the 2006 International
Microwave Symposium in San Francisco**



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Visit us at IEEE IMS in San Francisco June 13-15

Please plan to stop by **Booth #715** during the 2006 [IEEE International Microwave Symposium June 13-15, 2006](#). Join us at the "World's largest and most exciting gathering of Microwave and RF professionals! Modelithics is excited to be a contributing exhibitor in an event designed to highlight the latest developments in wireless, RFIC and power amplifier technology.

Members of the Modelithics Team will be available to demonstrate our unique model libraries and answer questions. Stop by and pick up a library card for complimentary use of Modelithics high-accuracy model libraries, and register to win a flash-drive during our scheduled demonstrations!

Take a minute and meet with our management about the Modelithics Vendor Partner supplier program and other business development opportunities. It's a very busy week for everyone, so we encourage you to [request an appointment](#) to visit with our senior management.

We're hoping that you will stop by and explore how our high accuracy simulation models can speed up your design processes!

We look forward to seeing you in San Francisco!

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***New! * Pad Scalable Models with CLR Library Version 4.0**

The Modelithics CLR Library 4.0, the industry's first and only substrate- and part value-scalable surface mount model library, now includes pad scalability on selected components. The Modelithics Global Model™ has input parameters that allow users to specify custom pad dimensions to meet their design requirements. The 4.0 version will include 13 new models expanding the total library to 61 Global Models™. Additional models address inductors and capacitors from several vendors, including 0201's, 0402's, 0603's, 0805's, as well as DC blocking capacitors with vertical and horizontal orientation selection.

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Modelithics and MicroMetrics Collaborate for Enhanced Limiter Simulations

MicroMetrics and Modelithics™ are working together to create new non-linear models for the MicroMetrics line of high performance limiter diodes, including the MP7100, 7110 and 7120 series. The models will be valid for large-signal design allowing designers to better understand the temperature and power dependency of the RF behavior of these diodes for improved design.

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Modelithics Now Provides Direct Support of Eagleware/Agilent Model Libraries

With the acquisition of Eagleware-Elanix by Agilent Technologies, a transition is taking place such that Modelithics is now providing direct distribution and support of all model libraries and custom models for Eagleware/Agilent GENESYS and HARBEC simulation software, in the same way it continues to support Agilent ADS customer's needs for improved accuracy model libraries.

Since 2003, Modelithics substrate-scalable passive model libraries have been supplied by Modelithics Inc., and distributed by Eagleware-Elanix. By mutual agreement, Modelithics is now responsible for distribution and support of its active and passive models for both Eagleware/Agilent GENESYS and HARBEC simulators as well as Agilent ADS.

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Free Model Availability for Johanson Component Model

Modelithics and Johanson Technology announce the immediate availability of high accuracy models for Johanson Technology's 0201 inductor and capacitor products. Complimentary use of these models for qualified designers can be arranged by request at: <http://www.modelithics.com/mvp/Johanson/>. These models are also available in version 4.0 of Modelithics CLR Library of high accuracy passive surface mount component models (see <http://www.modelithics.com/products.asp> for more information).

In addition, Johanson Technology has contracted Modelithics to expand its offering of high accuracy substrate-scalable and parts-value-scalable Global Models for several other

components, including 0402, 0603 and 1111 case size capacitors, ceramic chip Inductors and wire wound Inductors. Scott Horton, Vice-President of Marketing at Johanson Technology commented that “we have been encouraged by the customer response to the value-added models provided by Modelithics along with our productive collaboration with Modelithics towards improving application-specific information for JTI’s customers.”

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Modelithics Releases High Accuracy Non-Linear Transistor Library for Applied Wave Research Microwave Office

Modelithics, Inc. (www.modelithics.com) has released a powerful and feature-rich NLD Library™ (Non-Linear Diode) for Applied Wave Research Microwave Office, with a strong collection of well-documented models for improved microwave design simulation. The library consists of models for Schottky, varactor and PIN diodes from leading diode manufacturers like Infineon, MA-Com, Microsemi, On-Semi and Toshiba. Models for other diodes, including step recovery diode (SRD) models, are available through special ordering. Unique features include substrate scaling and temperature dependence. Substrate scalable diode models are valid over a continuous range of substrate thickness and dielectric constant. Temperature dependent models include applicability over a wide range of operating temperatures. The models, which now fully integrate with AWR MWO, incorporate bias-dependent factors to describe non-linear I-V and C-V characteristics. They also predict harmonics and reflect variations with RF power, validated using gain compression and harmonic measurements.

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Modelithics Releases High Accuracy Non-Linear Transistor Library for Applied Wave Research Microwave Office

Modelithics, Inc. (www.modelithics.com) has released a powerful and feature-rich Non-Linear Transistor model Library for Applied Wave Research Microwave Office. The Modelithics NLT Library™ contains a strong collection of well-documented models for improved microwave design simulation. The library consists of high accuracy non-linear and noise models for BJT, HBT, MESFET, HEMT and LDMOS transistors from leading semiconductor manufacturers like Agilent/Avago, Eudyna/Fujitsu, Freescale/Motorola, Infineon, NEC, On-Semi and Philips. Models for other transistors including GaN and on-wafer foundry devices are available through special ordering. Unique features include substrate scaling, temperature dependence, and combined noise and non-linear modeling. Substrate-scalable transistor models are valid over a continuous range of substrate thickness and dielectric constant. Temperature dependent models include applicability over a wide range of operating temperatures and include bias-dependent self-heating effects. The models, which now fully integrate with AWR MWO, incorporate bias-dependent factors to describe non-linear I-V and C-V characteristics, predict harmonics and reflect variations with RF power, DC bias as well as source and load impedance. Many are validated against load-

pull, TOI and noise parameter measurements, depending on the device and its intended application.

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Filter Design with 0201 Components

Many microwave engineers embark on their first discrete design using relatively simple schematics with ideal, parasitic-free component models. In this unfortunate situation – almost guaranteed to result in hours of frustration *on the bench* – light bulbs may start popping when a major disconnect between reality and simulation surfaces: the ideal components take no account of size (in particular, the “electrical size” relative to a wavelength). It is the finite size of a component that ultimately creates so-called parasitic effects, those nuisance effects that, as one example, always make a capacitor appear *larger* than it is supposed to, or at least until the parasitics turn the capacitor into an inductor. On the other hand, as is often the case in nature, as you try to reduce certain deleterious properties, other characteristics worsen: resistive loss is a prime example, as larger physical size tends to work in favor of lower dissipation for hybrid components. This paper investigates the design and characterization of discrete low-pass filters, and the results confirm mostly what you would expect to find.

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Comparing Like Body-Style Parts from Different Vendors

Manufacturers of surface mount RLC's use different physical designs and manufacturing techniques. The difference in the materials and construction result in different quality factors, which are reported in most vendor data sheets. The design differences also lead to variations in resonant frequency, high-order resonant effects, and the impact of component-substrate interaction. Some examples of these types of vendor-to-vendor variations in component performance are discussed in the following using substrate scalable Global models from the Modelithics CLR library. The part values chosen for the examples are typical of those used for design in the 1-2 GHz frequency range, with important harmonic frequencies up to 5 GHz or higher. **See application note #12 on linked page.**

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Application Note: Tolerance in Surface Mount Varactor Diodes

The ability to specify tolerance in the nominal capacitance has been added to selected models in the Modelithics Non-Linear Diode (NLD) Model Library in order to emulate the variation typically specified in manufacturer data sheets. The feature will be included in additional models in future library releases. This application note briefly reviews this new capability and provides suggestions on how it should be used.

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Benchmark Filter Designs Demonstrate Improved RF Design Flow

Three benchmark filter circuits are introduced in this note that demonstrate how the

Modelithics CLR Library™ can predict performance precisely, improving design flow efficiency. The three filter circuits are:

- 1) 2.2 GHz low-pass
- 2) 900 MHz high-pass
- 3) 5.4 GHz band-pass

The filters were designed, fabricated and measured. Excellent agreement was obtained between measurement of the final product and simulations using Modelithics CLR Library models.

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Part Value Tolerance in Surface Mount Components

The part value tolerance specified by component manufacturers for surface mount RLC's is given as either a percentage of the nominal value (e.g. 1 pF +/- 20%), or as a +/- deviation (e.g. 1 +/- 0.2 pF). This type of specification generally carries with it the assumption that the part value distributions is Gaussian about the nominal value. In practice, however, the actual distribution may be bi-modal; instead of 1 +/- 0.2 pF the distribution may be closer to 0.9 +/- 0.1 pF and/or 1.1 +/- 0.1 pF. This type of distribution is sometimes referred to as "rabbit ears" and occurs when the manufacturer must selectively sort parts that are closer to the nominal value in order to supply the "tight tolerance" version of the components. Thus, tight tolerance parts tend to follow Gaussian distributions about the nominal value while looser tolerance parts tend to have bi-modal distributions.

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Award Winning PA Design Paper

The power amplifiers continues to be somewhat of an art yet to be reduced to a systematic repeatable design practice on a wide-scale basis, despite the many excellent treatments of the subject in the literature (e.g., [1]) and a number of courses. The general unavailability of sufficiently accurate models must properly treat the nonlinear and combined dc/ac analysis required for proper power compression and efficiency simulation under varied load and bias conditions. In this article, an accurate nonlinear transistor model is shown to form the basis for a systematic simulation-based design procedure for a microwave PA. As an illustration of the procedure, a high-efficiency PA was developed with excellent first-pass performance results. This circuit was designed using a nonlinear transistor model and passive component models commercially available from University of South Florida (USF) spin-out company combination with Agilent Technologies Advanced Design System software [4]. An 8-W PA with 62% efficiency was achieved at 1.3 GHz, without modification of the circuit. This circuit was awarded first place in an IEEE sponsored PA design competition. **(See "Model Based Power Amplifier Wins IEEE Competition.")**

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Become a Modelithics Vendor Partner (MVP)

We've established partnerships with many of the top RF/microwave device suppliers because they know that microwave designers need state-of-the-art models to achieve rapid design

success. Through our Modelithics Vendor Partner (MVP) program, we help these vendors by creating accurate and versatile simulation models and by supporting designers using these models on leading simulation software. The MVP program supports inclusion of vendor models in The Modelithics Library software, with options for Web-based model distribution, referring sample requests, and reciprocal Web linking. Join the growing list of leading vendors listed under Modelithics Designer Resources and get your parts into more new designs, faster. To find out how, contact Sales@modelithics.com

Estimate Your Return on Investment in Improved Models

Modelithics realizes that often money spent on improved model solutions has to be carefully weighed against alternative uses for your investments in improved design methods. To help managers and engineers with this decision process and estimate potential schedule and time saving improved modes can buy, we have developed a free ROI calculator that can be accessed from the following website: <http://www.modelithics.com/roi.asp>

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Modelithics on RF Globalnet

The latest Modelithics product information, publications, and other features can now be viewed on RF Globalnet, the Internet's leading source of technical information for the RF/microwave design industry, serving the needs of engineering professionals since 1996. While you're out surfing for components, visit the Modelithics area to obtain state-of-the-art models to help you get them designed in quickly. Sign up for the RF Globalnet email newsletter and get the latest industry news, technical articles, downloadable software, product info, and more delivered straight to your inbox! There's no better way for RF designers to stay on top of the news.

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About Modelithics, Inc.

Modelithics, Inc., based in Tampa, Florida, provides superior quality RF and microwave modeling and measurement services, and offers high-accuracy component model library products for use with electronic design automation (EDA) software. Services include Models-on-Demand™ custom modeling and measurements for RF components and semiconductor devices, model validation, library management, and consulting. Our team has superior know-how, the latest software, and extensive measurement facilities spanning DC to 110 GHz. Modelithics' quality of service, customer responsiveness, and reliability are reasons we can include many of the world's leading electronics manufacturers, including like ATC, Anritsu, BAE Systems, Harris, Honeywell, Johanson Technology, Motorola, Northrop Grumman, and Raytheon, among our customers.

The rapidly growing **Modelithics Library**™ contains the industries most accurate and well-documented measurement-based models for a wide range of semiconductor devices and passive components, in a variety of formats (packaged, on-wafer, chip-and-wire, and surface mount). Our library models are fully integrated with leading RF/Microwave EDA simulators. The library delivers more accurate design simulations that help to improve design efficiency of

high-frequency electronics circuitry, cut product development cost and time-to-market, and allow better allocation of engineering resources.

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For more information and sample models visit:

www.Modelithics.com

Precision Measurements and Models You Trust

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