Modelithics®
World's Best RF & Microwave Simulation Models

Modelithics® mmWave & 5G

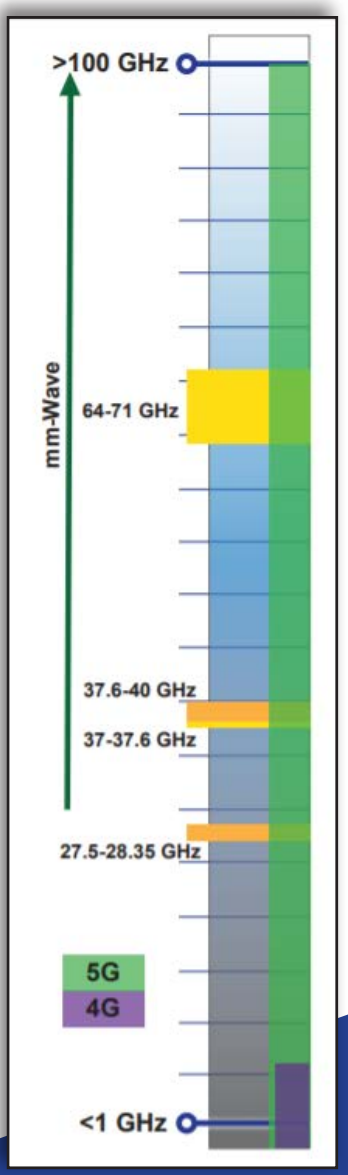
Modelithics® mmWave & 5G Library

Overview

The Modelithics mmWave & 5G Library is a collection of models focused on supporting the next generation of cellular communication standards. All models in the mmWave & 5G Library are **validated to a minimum of 30 GHz, with some validated up to 125 GHz!** Modelithics models offer unique scalability features and parameter options to provide for advanced design analysis. They also capture real-world parasitics over broadband frequency ranges based on the specific design properties. These highly accurate and feature-rich simulation models are compatible with multiple popular electronic design automation (EDA) software tools.

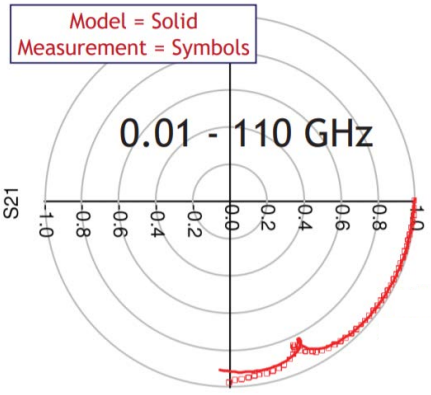
Library Features

- **Measurement-Based** - Each equivalent circuit model is developed using multiple specialized measurements under device-specific test conditions.
- **Scalable** - With the exception of a few ultra-broadband S-parameter models, passive resistor, capacitor and inductor models in the Modelithics mmWave & 5G Library are Microwave Global Models™, offering substrate, pad, and part-value scaling. Many capacitor models also offer selectable orientation. Active device models are non-linear and may include bias and/or temperature dependence.
- **Optimizable/Tunable*** - Some model parameters, such as part value, can be set up for tuning or optimization to analyze and quickly reach design goals.
- **Compatible with Statistical Analysis*** - Effects of component tolerance can be evaluated using the model tolerance parameter, and the models are compatible with Monte Carlo simulation tools for yield analysis.
- **Well-Documented** - Each model comes with a comprehensive model datasheet that lists recommended model validity parameters, test fixture and measurement details, and model-to-measured data plots.

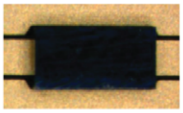


Multiple EDA Tool Compatibility

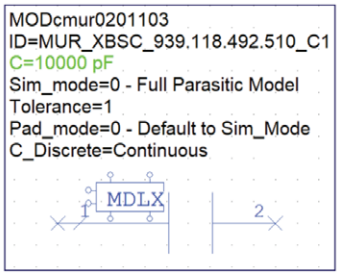
Keysight Technologies' Advanced Design System (PathWave ADS), Cadence® AWR Design Environment, Keysight Technologies' PathWave RF Synthesis (Genesys), Ansys® HFSS™, Sonnet® Suites™, and Cadence Virtuoso® Spectre RF®.



Model vs. measured S21 (dB) of Murata Integrated Passive Solutions XBSC ultra broadband silicon capacitor (model CAP-MUR-0201M-103)



Capacitor and fixture (above), example model symbol (right)



Example List of Components in the Modelithics® mmWave & 5G Library**

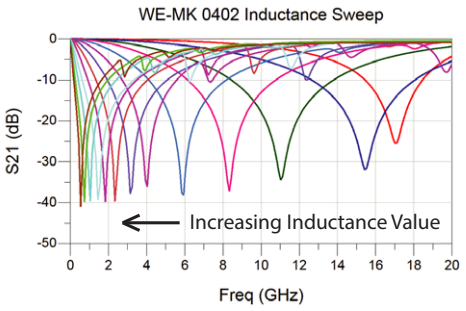
CLR				SPAR		NLD
API Inmet (Resistors) ANC50-100W, ANC50-50W, NPC20-40S	**IMS (Resistors)** RC3-0402PW, RC4-0302PW, NDX-1020EZ	**Piconics (Inductors)** CCxxxTxxK240G5-C	**KEMET (Capacitor)** CBR05	**Gowanda (Inductors)** C050FL, C050SMC, C100FL, C100SM, C100SMC, C225FL	**Murata (Capacitors)** UBSC 935 151 423 510, UBSC 935 151 723 510, UBSC 935 151 424 610	**MDT** MP6250-P2715
AVX (Capacitors) 0101YA, 02013A, 0201YC, 0201YD, 0402xU, 0603xU, 0805xU, Accu-P, CU01, SQCA(NP0), SQCA(X7R) **ATC (Capacitors)** 200A, 400Z, 700A **ATC (Resistor)** 504L	**TDK (Capacitor)** C0402C0G	**Presidio (Capacitors)** 0402UP, 0603UP, BB0201X7R103M, BB0402X7R104M2, BB0502X7R104M	**Murata (Inductors)** LQP02TQ, LQP02HQ, LQP02HQ, LQG15HS			**Skyworks** SMS7630-006LF, SMS7630-061, SMS7630-079LF
	TDK (Inductors) MHQ0402PSA, MHQ1005P		**Murata (Capacitors)** GQM155C, GJM022, GQM187, XBSC 939 118 492 510-xxS, UBSC_935_151_423_510, UBSC935_151_424_610, UBSC_935_151_723_510	**SOTA (Resistors)** S0202AF50R0FEB, S0303AF50R0FWB	**Mini-Circuits (Splitters)** EP2C+, EP2K+, EP2K1+, EP2W+, EP2W1+, EPQ-133+	**Virginia Diodes** WBandSingleAnode, WBandZBD Schottky
	Knowles - DLI (Capacitors) C04BL121X, C04UL, C06BL, C06CF, C08BL, C08BL102X, C11UL, Milli-Cap, Opti-Cap **Knowles - Syfer (Capacitors)** H Range	**Würth Elektronik (Capacitors)** WCAP-CSMH (X7R), WCAP-CSRF (NP0)		**IMS (Attenuators)** A-0402WA-C, IMS2652, A-0603-C, IMS2533, VDR3725SG		**NLT**
Coilcraft (Inductors) BCL, BCR, 0402AF, 0402DF, 0805HP		**Würth Elektronik (Inductors)** WE-CAIR, WE-KI, WE-KIHC, WE-MK, WE-TCI	**Samsung (Capacitors)** CL02CxxxxxxA, CL02CxxxxxxG		**Mini-Circuits (Filters)** XBF Series, XHF Series, XHF2 Series, XLF Series	**CEL** CE3512K2
Exxelia (Capacitor) SHF251xxx	**Passive Plus (Capacitors)** 0603N, 0805N, 1111N, 01005BB104, 0201BB104, 0708N	**Würth Elektronik (Ferrite Beads)** W-CBA 0402 High Current, W-CBA 0402 Wide Band, W-CBA 0603 High Current	**Smiths Interconnect (Resistors)** CRxxxxD, CTxxxxD	**SLC**		**MWT** MwT-7 MESFET
Darfon (Capacitor) C0402NP0			**Taiyo Yuden (Capacitors)** EMK042, TVS042	**Barry (Package)** QFN5532-050x 5mm	**Southwest Microwave (Connectors)** 1092-01A-5, 1093-04A-5	**Qorvo** FPD750, TGF4350
			Vishay (Capacitors) VJ0402D, VJ0603D	**RJR Polymers (Package)** QFN01 LCP	**Mini-Circuits (Attenuators)*** RCAT, YAT	

**Available in the SELECT+ library for Keysight ADS and Cadence AWR Design Environment. Available in the SLC Library for all other simulators*

More to come! New models are added continually. Visit our website for an updated complete list (www.Modelithics.com/Model/mmWave5G**). See available Pre-Release models (**www.Modelithics.com/Model/PreRelease**). Available models may vary between simulators.

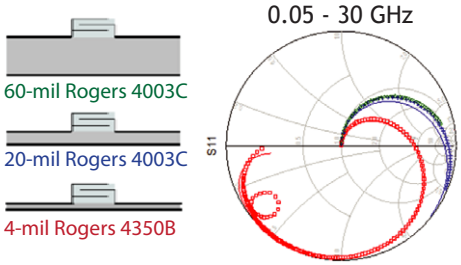
Advanced Model Features* for More Accurate High Frequency Design

Part Value Scaling



S21 part value sweep for Wurth WE-MK 0402 inductor model (IND-WTH-0402 -001)

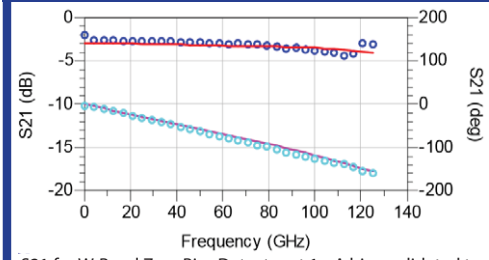
Substrate Scaling



S11 for 3.6nH inductor. Symbols=measurement, Line=model. Red=4-mil Rogers 4350B, Blue=20-mil Rogers 4003C, Green=60-mil Rogers 4003C

S11 model vs. measurement for Wurth WE-KI 3.6nH inductor to 30GHz. Models scale over a wide substrate range.

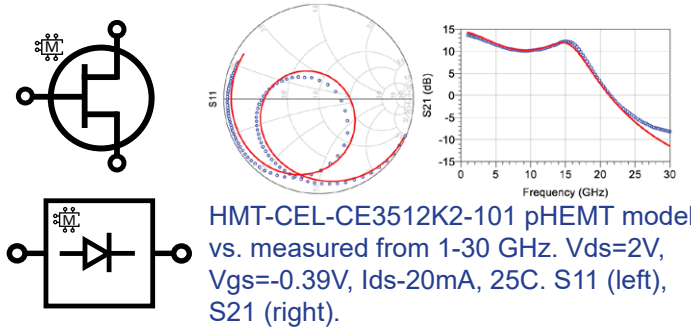
mmWave Validation



S21 for W-Band Zero Bias Detector at 1mA bias, validated to 125 GHz. Symbols=measurement, Line=model. Red=Model mag (dB), Blue=measured mag (dB), Pink=Model phase (deg), Light Blue=measured phase (deg)

S21 magnitude and phase for Virginia Diodes W-Band ZBD model (SKD-VDI-FLCH -002), validated to 125 GHz.

Non-Linear Models



HMT-CEL-CE3512K2-101 pHEMT model vs. measured from 1-30 GHz. Vds=2V, Vgs=-0.39V, Ids-20mA, 25C. S11 (left), S21 (right).

* Features may vary by model, component type and simulator

Visit the **mmWave & 5G Library** page on the Modelithics website to:

- Explore the current list of available component models
- View model datasheets
- Browse literature collection for application notes, presentations, etc.
- To request a FREE* trial of the mmWave & 5G Library, visit:

www.Modelithics.com/model/mmWave5G

*with approval

Modelithics® mmWave & 5G