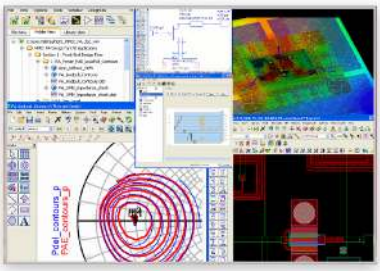
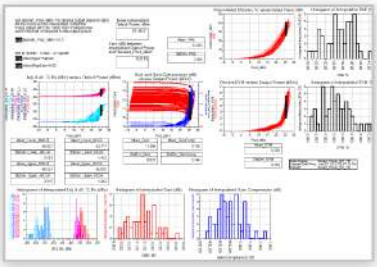
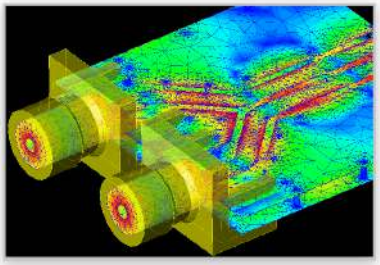
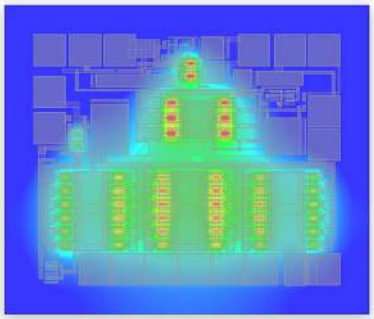
# Keysight Technologies
# Keysight EEsof EDA
# Advanced Design System









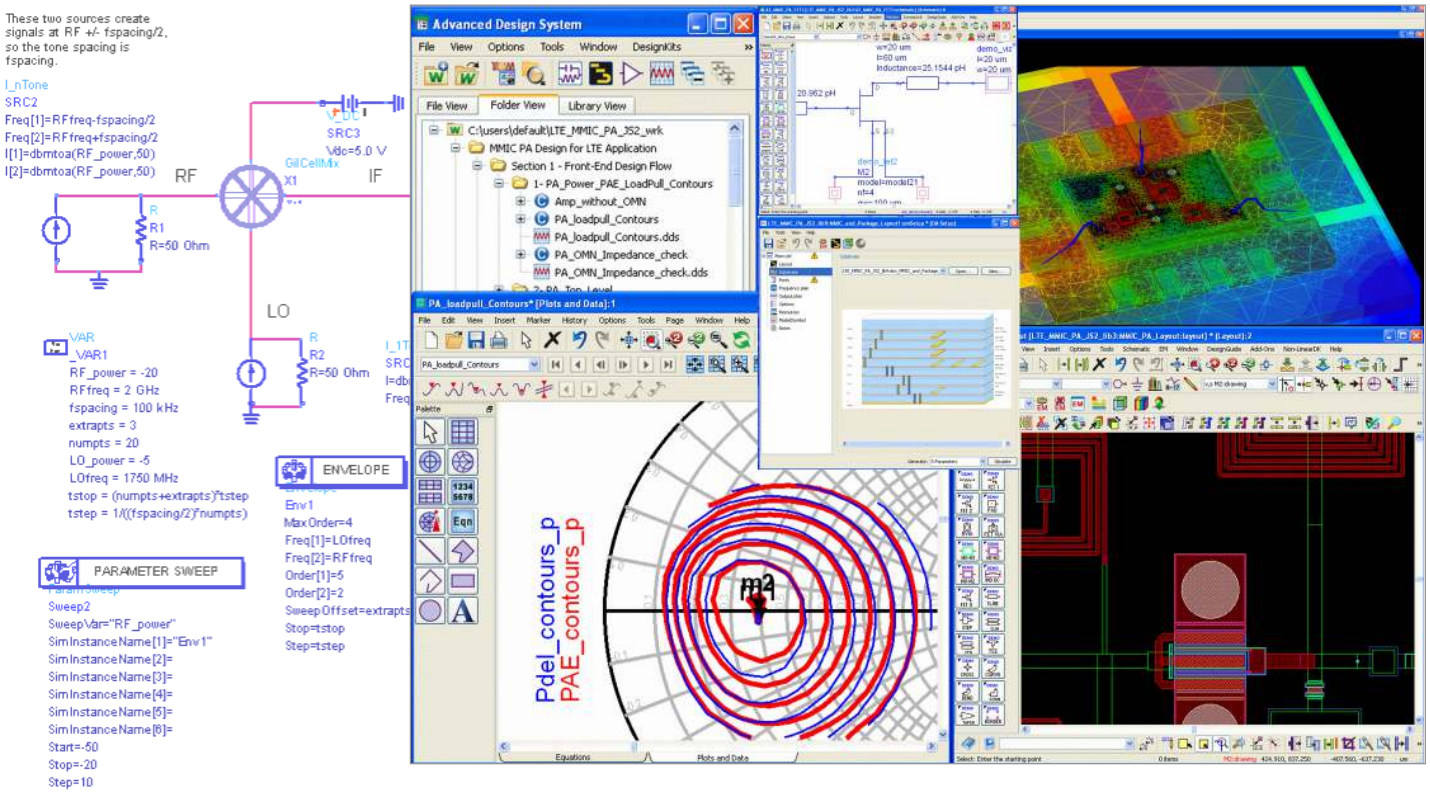
The Industry's Leading RF, Microwave and High-Speed Design Platform

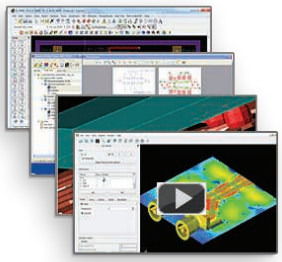
KEYSIGHT TECHNOLOGIES

# Advanced Design System

## Powerful. Easy. Complete.

The Keysight Technologies, Inc. Advanced Design System (ADS) is the world's leading electronic design automation (EDA) software for RF, microwave, and high speed digital applications. In a powerful and easy-to-use interface, ADS pioneers the most innovative and commercially successful technologies, such as X-parameters* and 3D EM simulators, used by leading companies in the wireless communication and networking and aerospace and defense industries. For LTE-A, 802.11ac, PCI Express®, USB3, radar, and satellite applications, ADS provides full, standards-based design and verification with Wireless Libraries and circuit-system-EM co-simulation in an integrated platform.



### Watch ADS 30-Second Demos...

Watch our 30 second videos to learn about popular usability innovations we've made in ADS to increase your productivity.

www.keysight.com/find/eesof-ads-30-second-demos

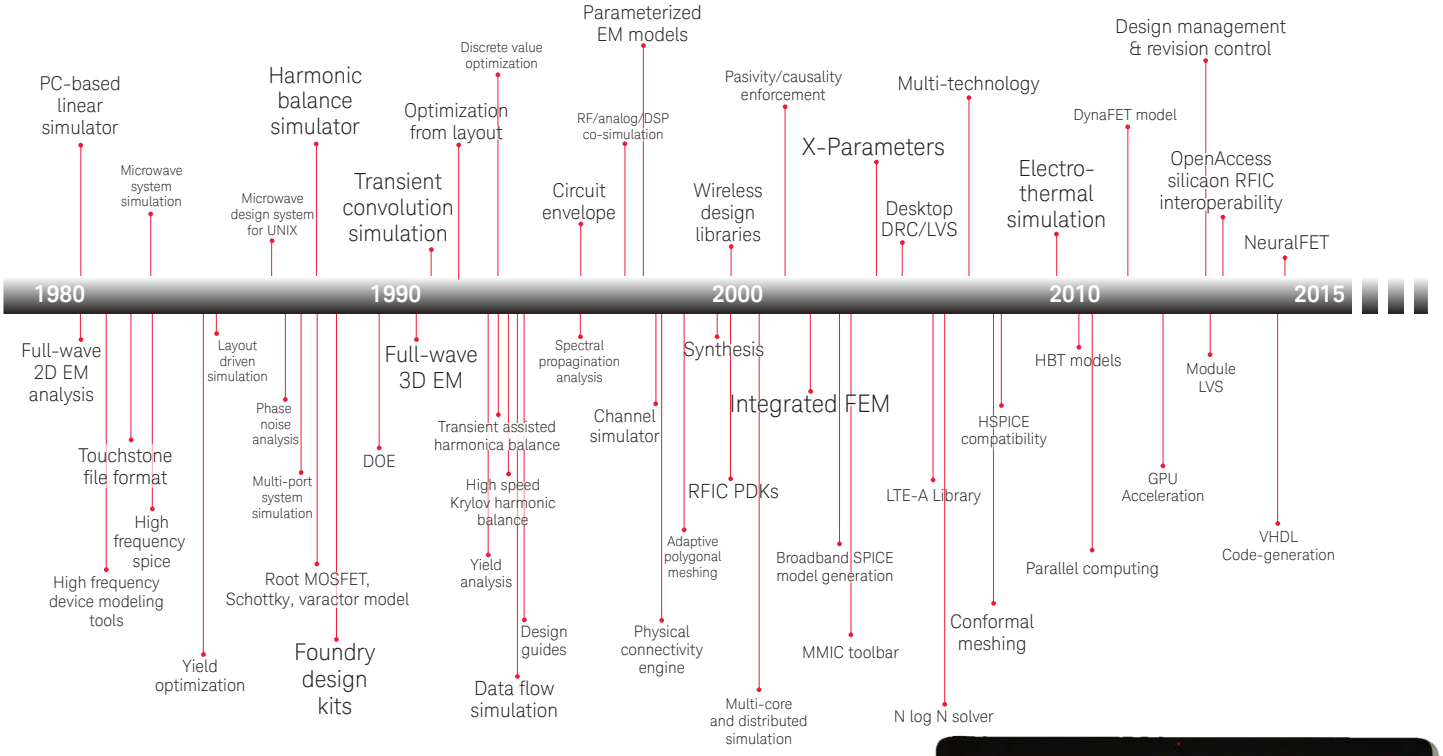
* "X-parameters" is a trademark of Keysight Technologies, Inc. The X-parameter format and underlying equations are open and documented.

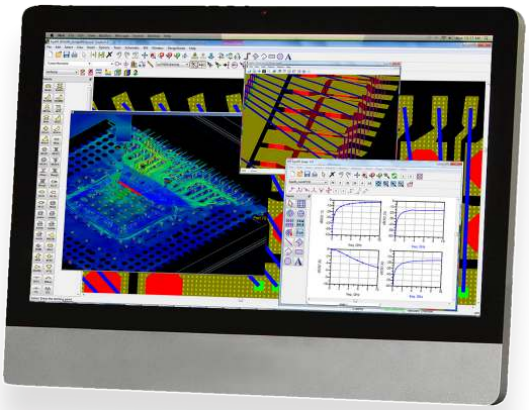
## The Industry's leading technology, and much more

Only ADS offers a solution that combines schematic, layout, circuit, electro-thermal co-simulation and three full-wave 3D EM technologies for IC, package, laminate/PCB and 3D EM component co-design in a single-vendor, integrated platform solution that can dramatically improve productivity and significantly reduce costs.

To shorten your design cycles, ADS provides a huge amount of application-specific data. Over 300 examples cover everything from specific application circuits to tutorials on how to get the most out of ADS. DesignGuide integrate the experience and best practices of leading designers to provide you with wizards, pre-configured set-ups and displays, and step-by-step instructions for design applications, and give you easy access to the power of ADS from day one.

## More than 30 Years of Enabling Innovation



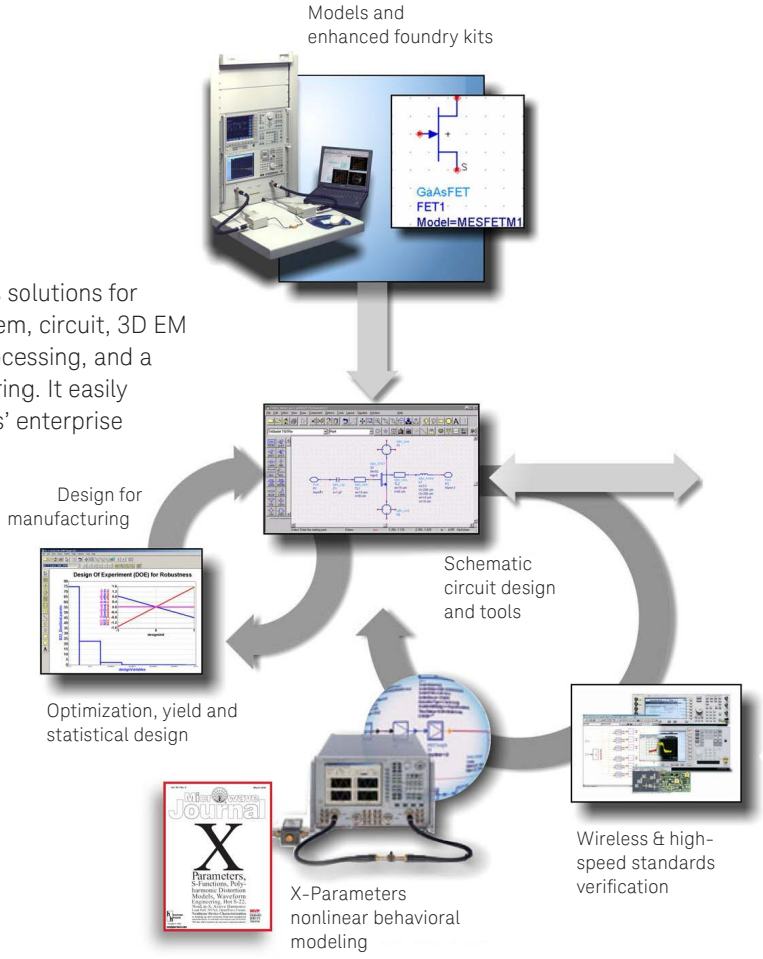
# Design with Confidence

## Anticipate success with fast, accurate, and easy first-pass simulations

### ADS key highlights

- Complete set of fast, accurate and easy-to-use simulators enable first-pass design success
- Easy-to-use, application-specific DesignGuide encapsulate years of expertise
- Exclusively endorsed by leading industry and foundry partners
- Complete schematic capture and layout environment
- Innovative and industry-leading circuit and system simulators
- Direct, native access to 3D planar and full 3D EM field solvers
- Broadest RF and MW process design kit (PDK) coverage, endorsed by leading foundry and industry partners
- EDA and design flow integration with companies such as Cadence, Mentor and Zuken
- Optimization Cockpit for real-time feedback and control when using any of 12 powerful optimizers
- X-parameter model generation from circuit schematic and Keysight's Nonlinear Vector Network Analyzer (NVNA) for nonlinear high-frequency design
- Up-to-date Wireless Libraries for design and verification of the emerging wireless standards

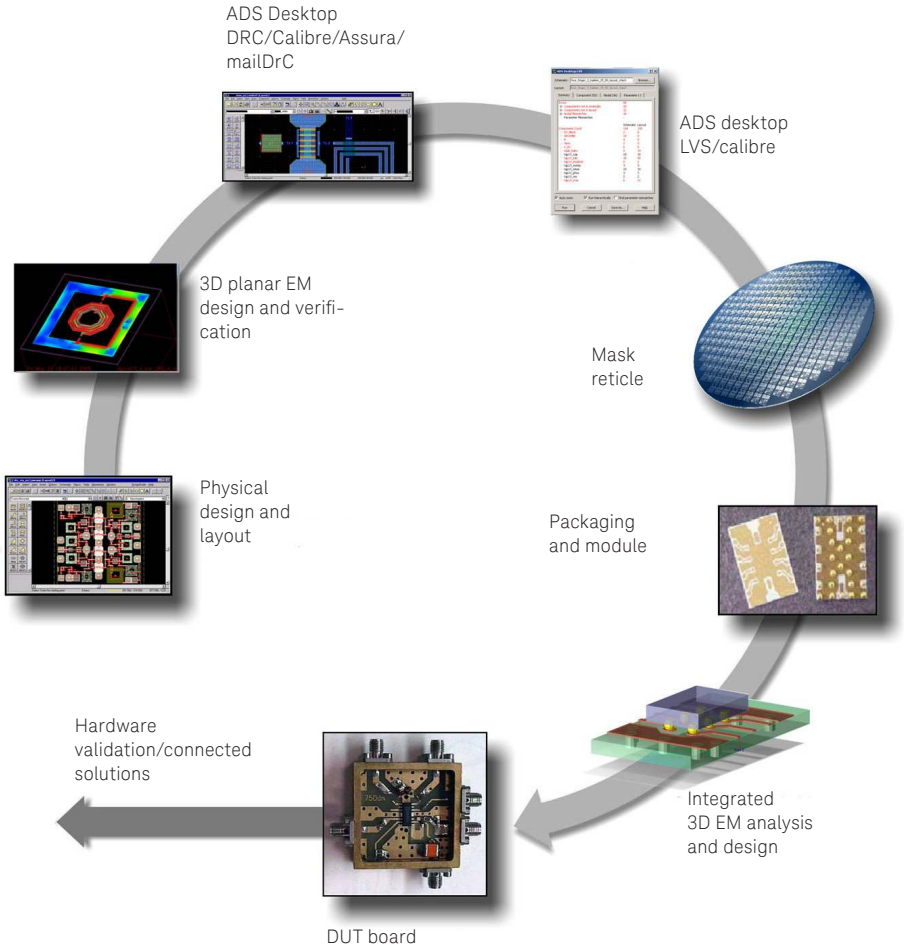
The ADS platform comprises solutions for design entry, synthesis, system, circuit, 3D EM simulation, analysis/post processing, and a complete flow to manufacturing. It easily integrates with the designers' enterprise IC or PCB framework.



# Accelerate your design process with Keysight EEsof foundry partners

## RFIC and MIMIC foundry partners

Keysight EEsof EDA works closely with foundries to offer you high-frequency PDKs in Si, SiGe, GaAs, InP and GaN processes. Complete front-to-back ADS PDKs, including DRC rules and Momentum stack-up files, for all GaAs, InP and GaN processes, as well as a broad range of SiGe and RF-CMOS processes are available.







**Keysight EEsof**
**68%**
of the RF design market

*"Keysight EEsof is the leading provider of RF, Design and Simulation tools."*

Gary Smith,
EDA's 2012 market trends report

# Complete Design Flow

## Create robust designs with first pass success and high yield

### Innovative and industry-leading simulation technologies

Figure 1

- S-parameter linear frequency-domain simulator
- Harmonic balance nonlinear frequency-domain simulator
- Circuit envelope hybrid time-/frequency-domain nonlinear simulator
- Transient/convolution time-domain simulator
- Momentum 3D planar EM simulator
- Finite Element full 3D EM simulator
- X-parameter generator simulator
- Signal Integrity Channel simulator
- Keysight Ptolemy system simulator

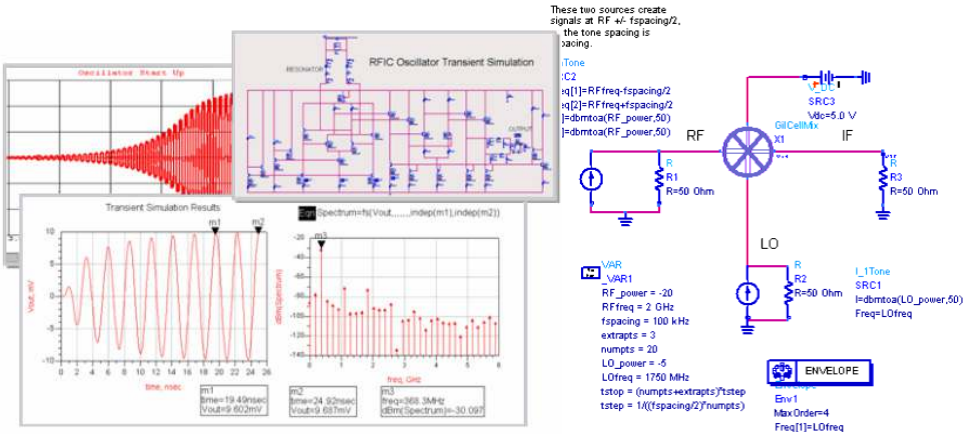



Figure 1

### Post Processing with Data Display

Figure 2

A powerful Data Display capability allows you to learn about your design's performance by post-processing and analyzing the data without re-running simulation. Countless built-in functions simplify the process. For added flexibility, you can even write your own functions (e.g., for the creation of load-pull contours, gain circles or eye diagrams).

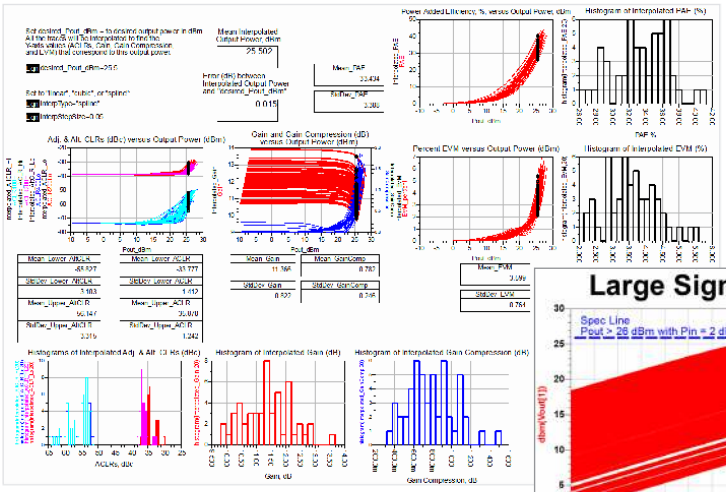


Figure 2

### Optimizing Your Design

Figure 3

Once your initial design is done, ADS optimizers can further improve its nominal performance. The ADS optimization cockpit provides an interactive environment with multiple optimization variables, interactive tuning and progress controls. Using it, you can achieve optimal performance while gaining design insight into the optimized variables versus the goals.



Figure 3

### Making Your Designs More Robust

Figure 4

ADS features unique and easy-to-use statistical tools to pinpoint problems during design. Yield sensitivity histograms help identify the most sensitive design components and how best to set their specifications to improve manufacturing yield.

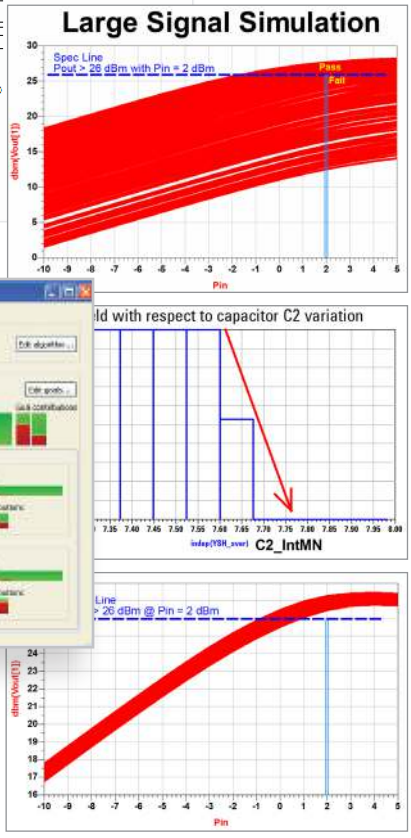



Figure 4

## Eliminate costly layout errors using ADS's advanced LVS and DRC tools

### Easy Layout in Your Foundry's Specific Process

Figure 5

ADS offers a full-featured tool for generating production ready RF layouts. With the largest number of fully endorsed foundry design kits, ADS helps you layout your design in your foundry's specific process. The MMIC Toolbar and layout command line editor, available in all enhanced foundry PDKs, ensures layout editing commands are easily accessible and provide a full suite of layout verification tools.

### Catch Errors Early with ADS Desktop DRC and LVS

Figure 6

ADS Desktop design rule check (DRC) enables you to determine whether your physical layout satisfies foundry design rules. Use ADS Desktop layout vs. schematic (LVS) to verify no discrepancies exist between the layout and schematic, to identify missing components and easily find and correct connections in your schematic or layout. Component based LVS on module designs with nested technology finds module-level wiring and pin swap errors. ADS also supports DRC/LVS with Calibre and Assura directly from the ADS cockpit.

### Integrated Electro-Thermal Solver

Figure 7

ADS provides a full 3-D thermal solver that is tightly integrated with the ADS layout environment and circuit simulators. Simply add the Electro-Thermal controller to the ADS schematic, start a circuit simulation and the integrated thermal solver will run in the background. No more manual export of IC layouts to stand-alone thermal solvers; no more manual import of temperature data into the circuit simulators.

### Innovative Multi-technology Capability

Figure 8

ADS capabilities enable tradeoffs to be made interactively on the IC, laminate, packaging, and printed circuit boards being designed or co-designed together. Circuits designed in multiple technologies can be combined and simulated at both the circuit and full 3D EM level.

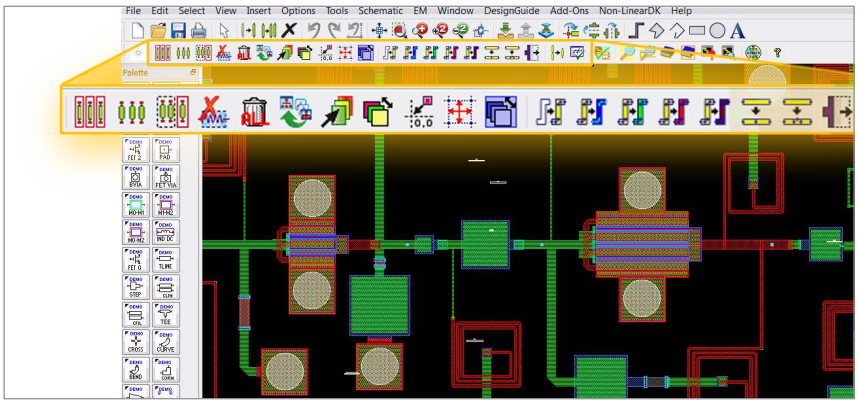



Figure 5

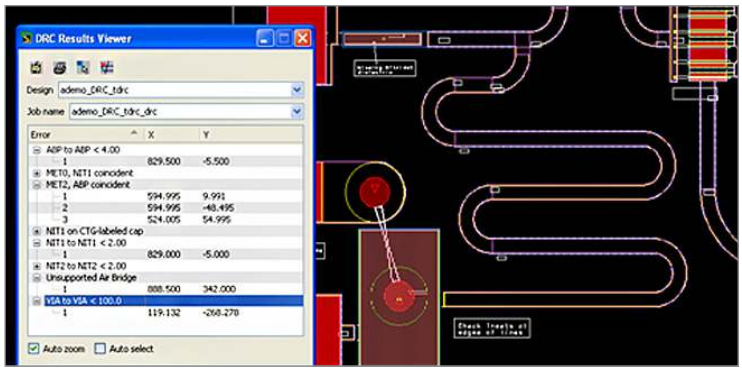



Figure 6

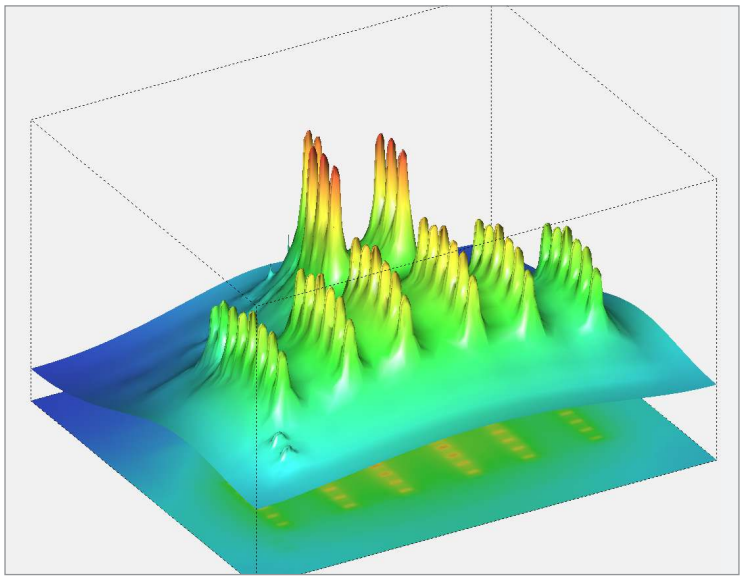


Figure 7

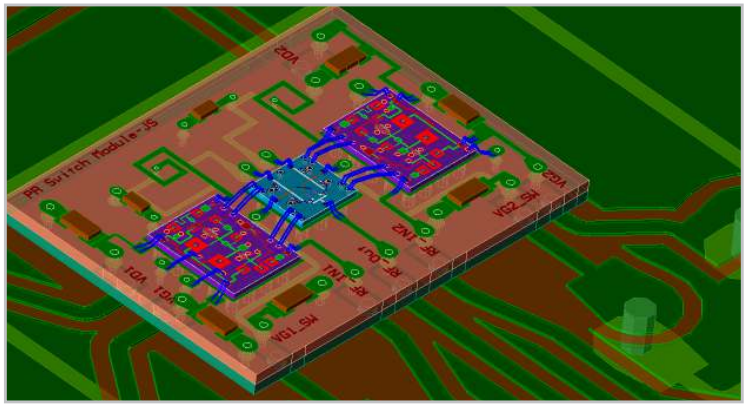


Figure 8

# Integrated 3D EM

## 3D EM modeling and simulation environment is integrated with the ADS design flow

Keysight offers multiple EM simulation technologies that are directly integrated into the ADS design flow. This allows seamless co-simulation between schematic, layout and 3D components without leaving the circuit design flow. It is especially convenient for RF module designs where 3D interconnects and packaging must be simulated along with the circuit.

### Momentum 3D Planar EM Simulator

Figure 9

Keysight's Momentum is the leading 3D planar EM simulator used for passive circuit modeling and analysis. It accepts multilayer design geometries and uses frequency-domain Method of Moments (MoM) technology to accurately simulate complex EM effects (including coupling and parasitic), improving performance and increasing confidence that manufactured products will meet specifications.

Momentum features the latest NlogN and multi-threading solver algorithms to deliver the fastest, highest capacity 3D planar EM simulation. Integrated with ADS, it allows EM simulation (along with circuit and system co-simulation or co-optimization) to account for proximity or radiation effects of planar structures. Results can be visualized as surface currents or radiated fields for insight into the location of problem areas.

### Finite Element Method Simulator

Figure 10

The Keysight FEM simulator element provides full-wave 3D EM simulation capabilities to both ADS and its companion 3D EM simulation software, Electromagnetic Professional (EMPro). FEM is a frequency-domain technique that can handle arbitrary shaped structures, employing both direct and iterative solvers, and linear and quadratic basis functions, to solve a broad range of problems. The same FEM simulator engine is available in both ADS and EMPro.

### Advanced Model Composer

Momentum and FEM are paired with Keysight's parameterized passive model generation capability, Advanced Model Composer (AMC). AMC allows you to create EM-based custom libraries of 3D models not available in standard simulation libraries. AMC libraries retain the accuracy of EM simulation, but simulate and optimize at the speed of circuit simulation through smart interpolation across the parameterized EM database.

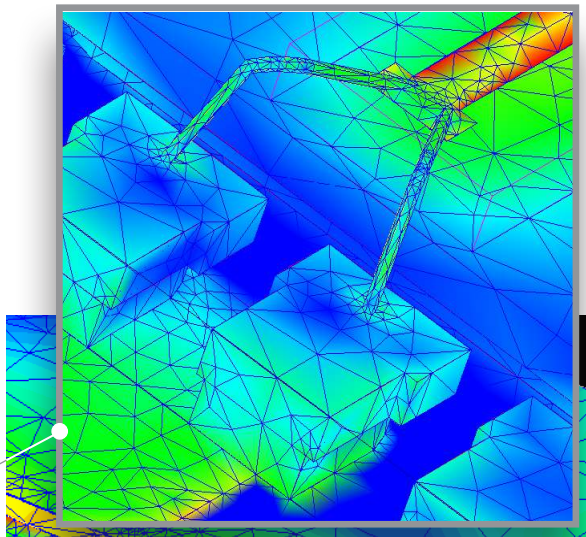


Figure 10

Keysight's FEM simulator includes both direct and iterative solvers, and linear and quadratic basis functions, to solve a broad range of problems.

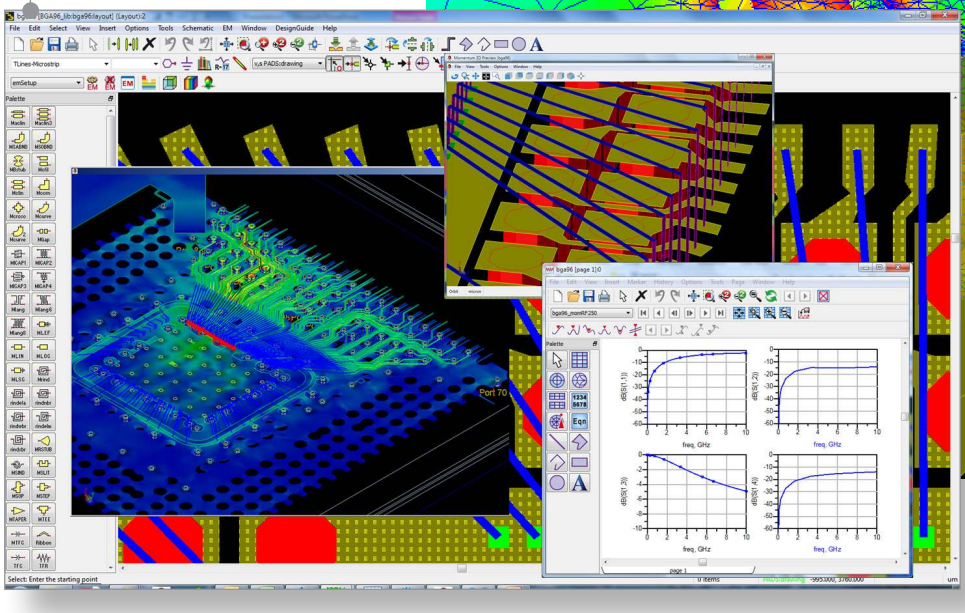


Figure 9

Momentum provides the most efficient and fastest 3D planar EM simulation capability, integrated with ADS through a common design entry, simulation and optimization user interface.

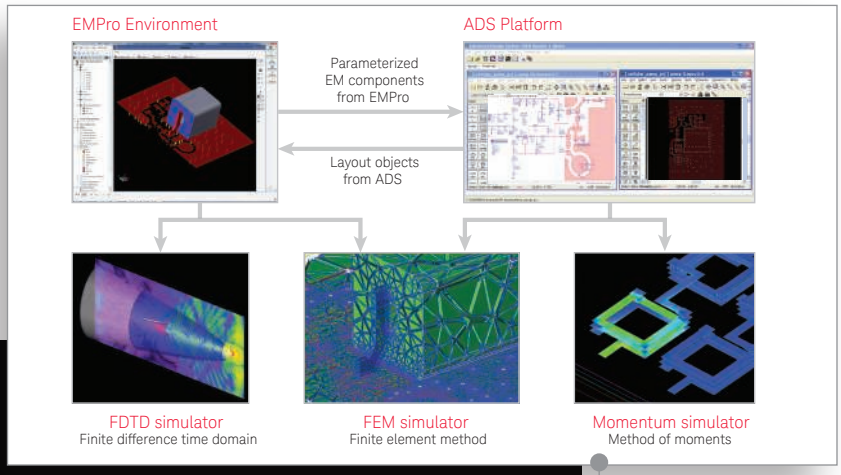



Figure 11

Keysight provides multiple EM simulation technologies integrated with the ADS design flow.

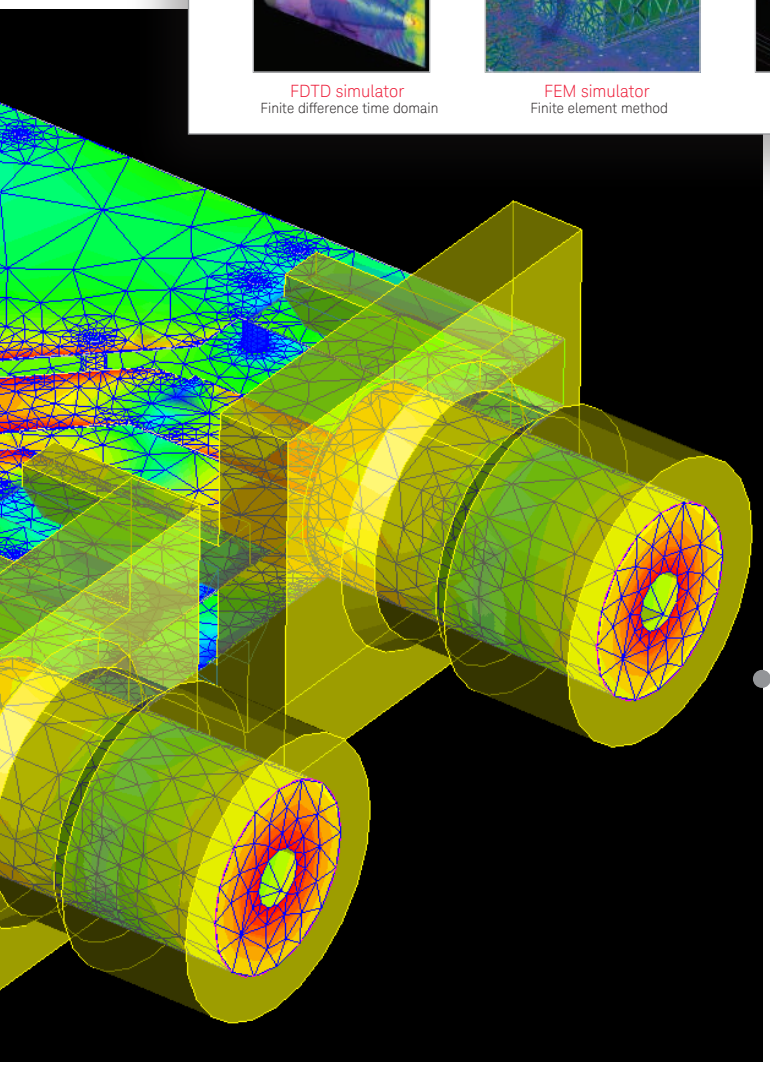


Figure 12

EMPro's 3D EM technologies complement 3D planar simulators such as Keysight Momentum for connectors, packaging and RF components.

## Create custom 3D components for simulation with ADS layout designs

### EMPro—ADS's Companion 3D EM Simulation Software

Figures 11 & 12

EMPro is a 3D modeling and simulation environment for analyzing the 3D EM effects of high-speed and RF/microwave components. EMPro features:

### Common database integration with ADS

3D objects in EMPro can now be saved as ADS libraries, containing cells for use directly in ADS. For example, an SMA connector cell created in EMPro will have an emModel view that can be placed directly in an ADS schematic and used for circuit/EM co-sim, and a layout view that can be placed on an ADS layout design (e.g., PCB layout) for full 3D simulations in ADS.

### Full 3D drawing environment

EMPro provides the flexibility of drawing arbitrary 3D structures and the convenience of importing existing CAD files. You can create 3D shapes, add material properties, set up simulations, and view results—all within the EMPro environment.

### High capacity time- and frequency-domain simulation technology

3D structures can be analyzed in EMPro using the same FEM simulator available in ADS. For electrically large problems, such as antennas and some signal integrity analyses, the Finite Difference Time Domain (FDTD) simulator can be used.

# Most Complete Solution

## Industry-leading tools for your high-frequency and high-speed applications

### RF & Microwave Design Flows

Keysight's RF and microwave design and simulation tools provide the most complete solution for creating robust designs with first-pass success and high yields. ADS provides accurate models and powerful simulation technologies for circuit- to system-level designs. Seamlessly integrated circuit and EM simulation tools flow from schematic entry to production and verification. A complete set of the most accurate wireless verification tools in ADS provides true circuit verification to all wireless standards.

### RFIC/MMIC Design

Figure 13

ADS provides the most complete set of advanced simulation tools, seamlessly integrated into a single environment, that flows from schematic entry to tape-out and packaging. These tools enable you to verify, prior to fabrication, that your RFIC/MMIC meets all specifications in its final package.

All major MMIC foundries offer complete front-to-back ADS PDKs, and also a broad range of SiGe/BiCMOS and CMOS-SOI PDKs are available.

### RF Module Design

Figure 14

As the market and technology leader in RF module design solutions, Keysight EEsof EDA offers the best co-design platform and methodologies for designing RF modules with high confidence. ADS offers designers the best way to reduce risks of design failure due to unexpected parasitics.

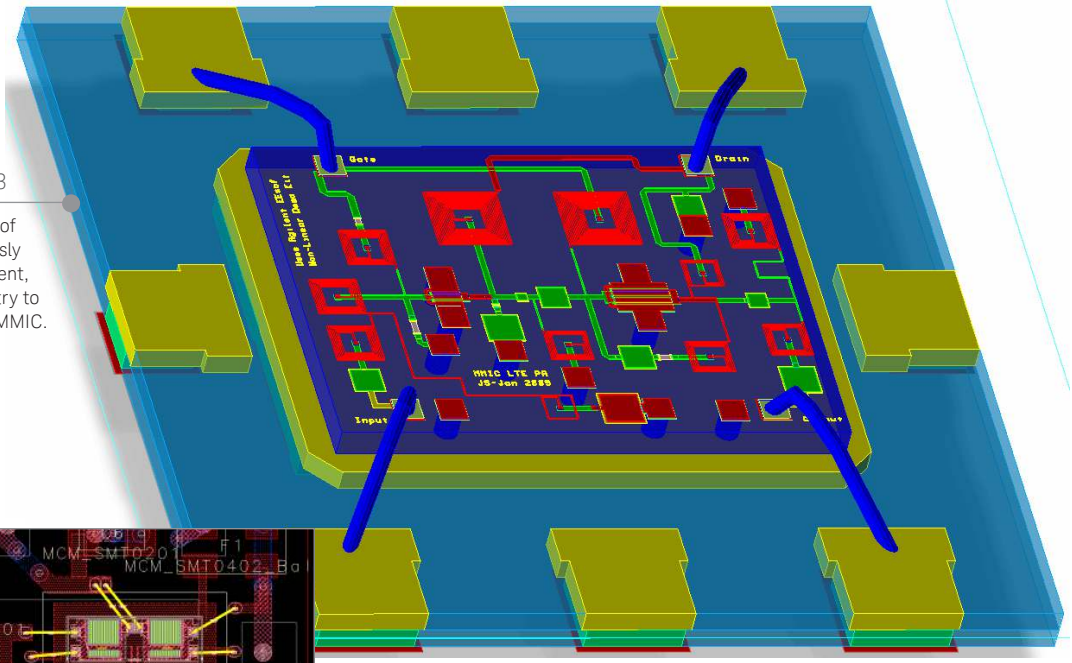



Figure 13

ADS offers a complete set of advanced simulation tools, seamlessly integrated into one single environment, which flows from schematic entry to production and packaging of the MMIC.

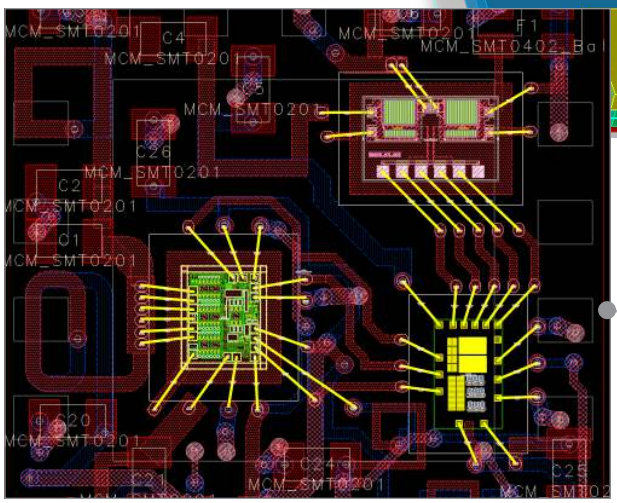



Figure 14

ADS offers designers the best solutions and methodologies for confidently designing RF modules.

# Accelerate your design with the industry's most complete set of simulation tools and model libraries

## High-Speed Digital Design

Figure 15

ADS offers two bundles that put applicable simulators, libraries and capabilities into the hands of high-speed digital engineers. SystemVue generates IC models compliant to the IBIS-AMI standard. ADS provides the most scomplete data link analysis for standards like PCI Express, Ethernet, DDR, HDMI, and USB. It enables complete chip-to-chip link analysis by co-simulating individual components, each at its most appropriate level of abstraction (link, circuit, layout, or geometry). S-parameter models, based on frequency-domain measurements, can be accurately imported into time-domain circuit and channel simulations, avoiding causality and passivity issues. Ultra-low BER contours can be generated in seconds, not days, resulting in dramatically reduced product design cycles.

## RF Board Design

ADS provides proven board design solutions with very accurate models and simulation technologies covering circuit, EM and system level designs. It offers the widest variety of synthesis capabilities to explore alternatives quickly and balance RF performance, parts count and board area, within seconds, while also helping designers assess the cost-effectiveness of making versus buying a commercial component.

Accurate model libraries in ADS support different simulation domains for various applications. Behavioral models (important for initial system-level designs) can be extracted from datasheets, measurement or simulation. ADS's robust layout artwork translators ensure a smooth hand-off to PCB manufacturing for RF board designers.

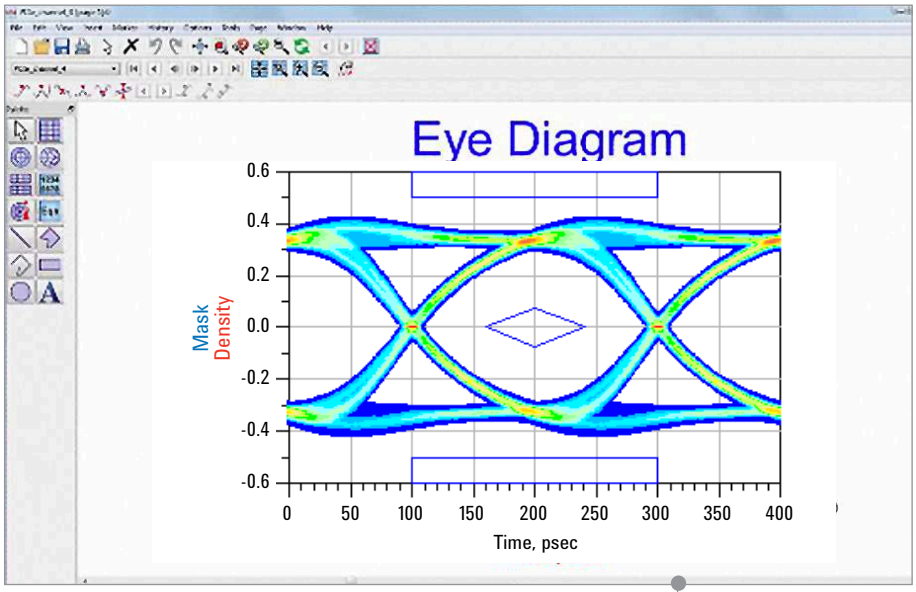



Figure 15

The ADS Eye Probe diagram allows you to calculate parameters using algorithms drawn from those on Keysight instruments.

Keysight EEsof EDA actively engages with component manufacturers to create model libraries that provide access the latest models and technologies, including:

Analog Devices
Avago
AVX
Banpil
CEL
Coilcraft
Cyntec
DT Micro
DuPont
Freescale
Hittite
Johanson
KOA Speer
Metelics
Mini-Circuits
Mitsubishi
Modelithics
Motorola
Murata
NEC
Panasonic
Polyfet
Samsung
Samtec
Samyoung
Siemens
Taiyo Yuden
TDK
Temwell
TFT
TI
Toshiba

For an updated list, refer to:

**www.keysight.com/find/eesof-vendor-libraries**

# Integrated Solutions

## Achieve enterprise-wide integration with your design process

### Design Flow Integration—Partners for Complete Success

Keysight EEsof EDA aligns with key EDA vendors and frameworks to provide enhanced solutions that complement your investment. The open and flexible ADS environment ensures that a wide range of design flows are supported. ADS supports design flows based on a Cadence, Mentor or Zuken flow, for example, using industry-standard formats. Our expanding list of partners goes well beyond standard relationships and is part of an ongoing effort to provide best-in-class tools and technology that work in an integrated environment.

### ADS Board Link—Next Generation PCB Integration Solution

ADS Board Link (ABL) provides a bi-directional interface for layouts, schematics and libraries between ADS and enterprise PCB tools. It supports import and export of libraries and technology information (e.g., units, resolution, layers, purposes, and substrates), as well as design data. ABL design transfer between tools is high-fidelity and preserves all data and original objects.

### Silicon RFIC Schematic Interoperability with Virtuoso

Figure 16

- Bi-directional schematic interoperability with Virtuoso
- Bring Virtuoso schematics in ADS and simulate RF performance
- Front-end design in ADS and layout implementation in Virtuoso

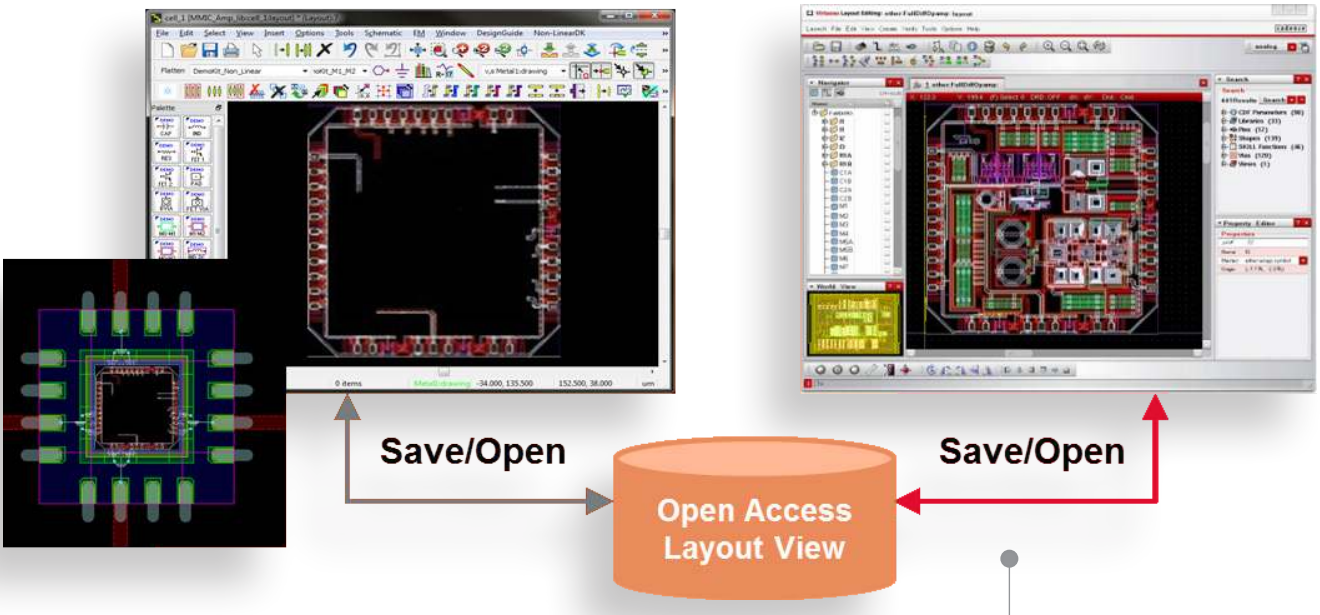



Figure 16

ADS enables users to edit and simulate designs created in Cadence Design System's Virtuoso software.

# Seamless integration with Keysigh's EDA tools and measurement instrumentation

## X-parameters Enable Rapid Design Optimization

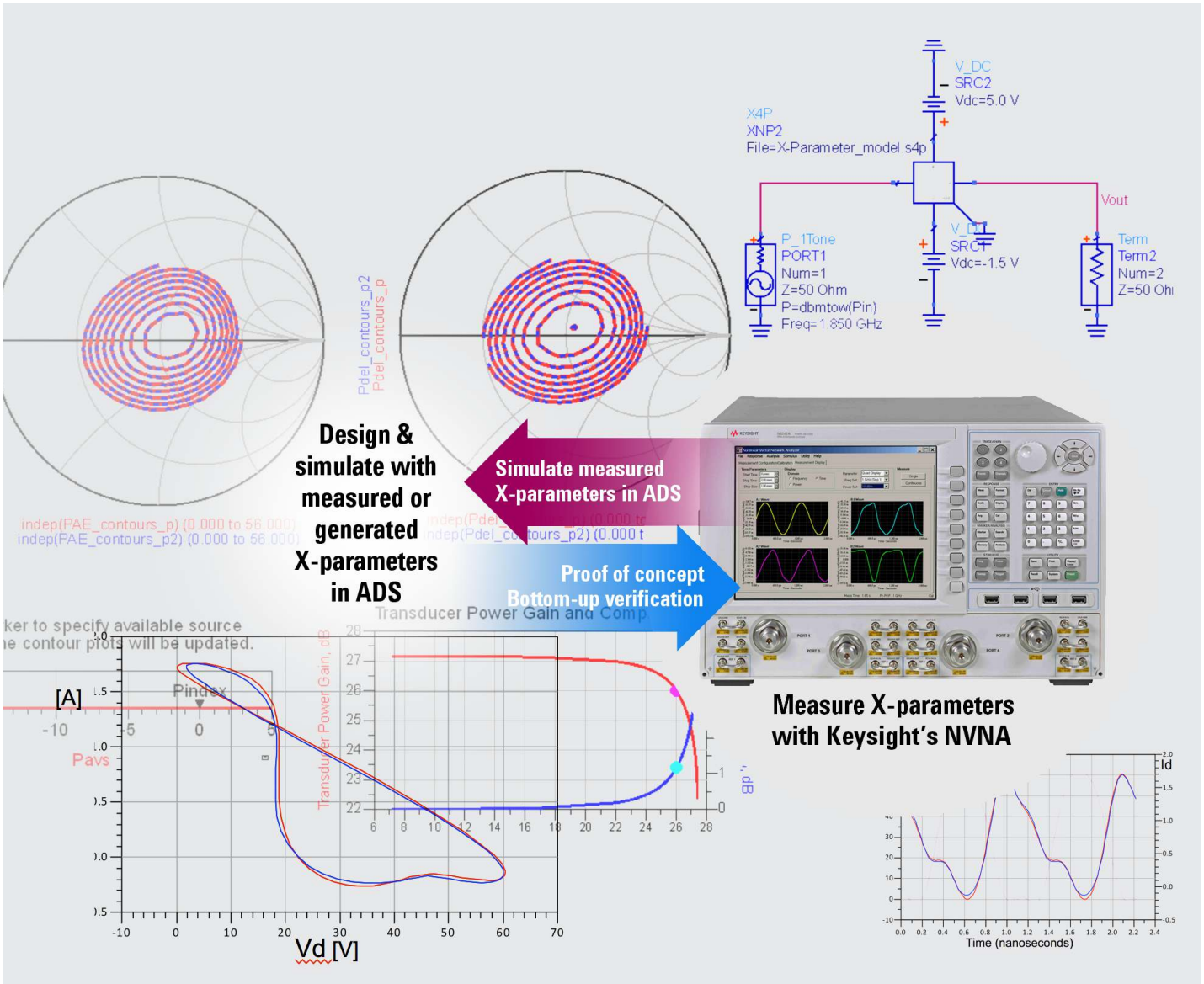
In high-frequency and high-speed designs, X-parameters overcome the system-level inaccuracies that often occur when using overly simplified behavioral models to simulate complex, nonlinear circuits. The use of X-parameters produces highly accurate nonlinear models—from either measurements or simulations—that can be passed through the design chain for quick and accurate simulation and optimization of system-level performance.

## Wireless Verification Test Benches (VTB)

Wireless VTBs provide circuit design verification solutions for the newest and most challenging multi-band, wide-bandwidth standards (LTE, LTE-A and 802.11ac) with a dramatically simplified user interface. VTBs and the underlying simulation technology are based on the SystemVue dataflow simulation technology and also allow system architects to develop custom VTBs for use by circuit designers in ADS.

## Easy Links to Instrumentation

The integration of ADS with Keysight test instrumentation enables the seamless sharing of signals, measurements, algorithms, and data between the virtual software and physical hardware domains. Designers use this linkage to simulate and evaluate design trade-offs and what-ifs, and then turn the simulated signal into an RF test signal on the bench for hardware test.



# World-class Support

## Accelerate success with convenient product bundling plus comprehensive support and training services

### World-class Support

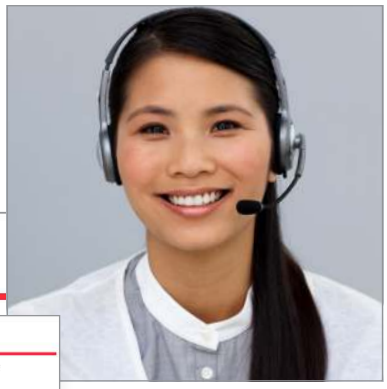
Keysight Technologies is committed to customer satisfaction. We are dedicated to providing the right software, support and consulting solutions to increase your engineering productivity and advance your long-term success. Whether a novice or experienced user, Keysight's customer support offerings can help you every step of the way. They include software and user manual updates via download or on CD-ROM, worldwide technical support via telephone, fax, e-mail, and the worldwide web. Keysight also offers dedicated support engineers in many countries to provide you with local language support. Phone support is available Monday through Friday, worldwide.

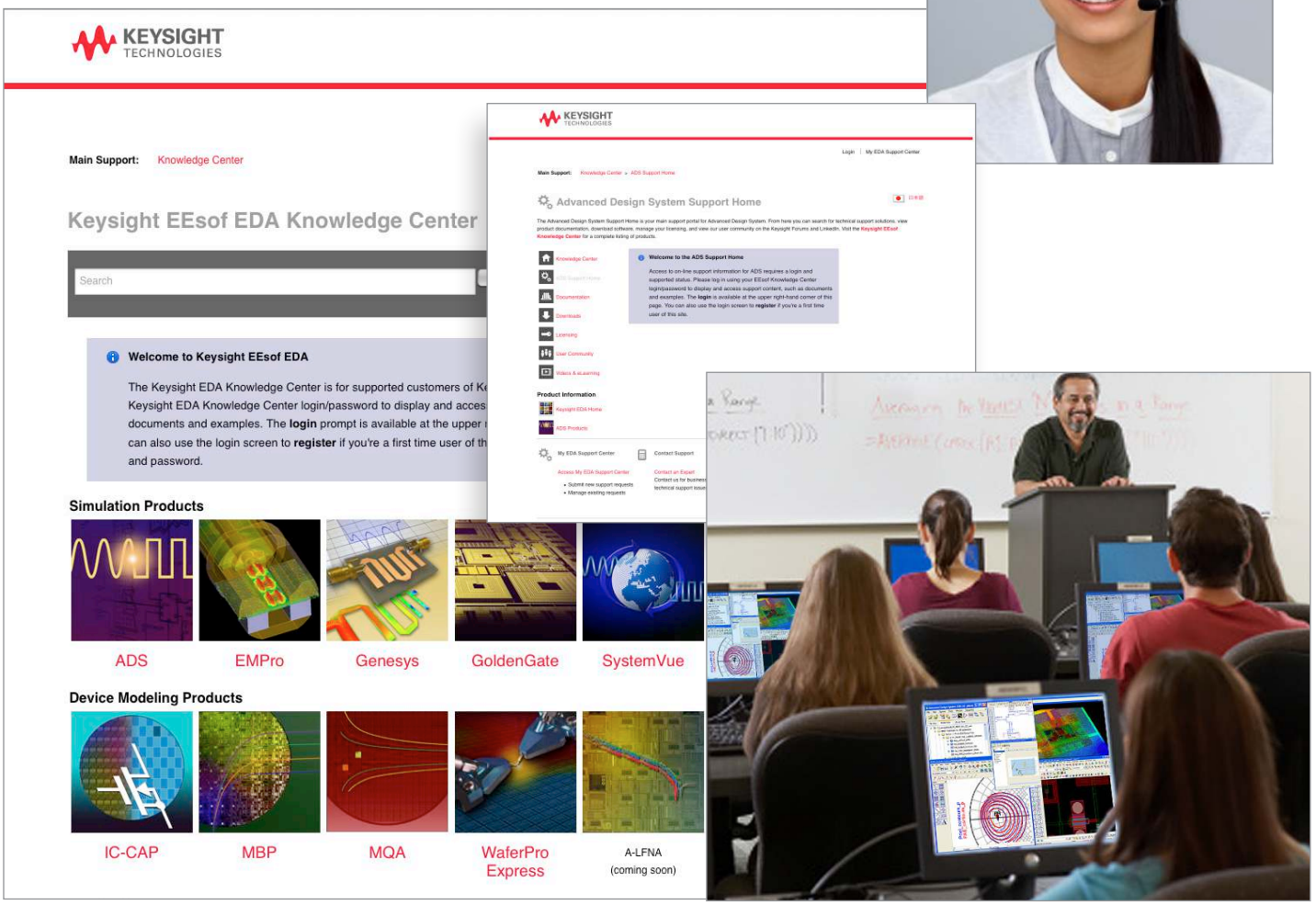
### Training

Keysight EEsof EDA offers a full range of classroom courses, as well as live and self-paced e-learning courses, that provide instruction on the use of EDA software in a wide variety of applications. Live classes are conducted by experienced design engineers and focus on in-depth software operation and design examples. They also cover introductory and advanced microwave, RF, system and signal integrity design techniques. Self-paced e-learning courses allow you to set your own timetable. If travelling to a regularly scheduled class is problematic, or you have a group of designers that might benefit from a common class, your field sales representative can arrange an on-site class.

### Knowledge Center

The Keysight EEsof Knowledge Center is an around-the-clock resource for designers. It contains thousands of support documents and hundreds of downloadable examples created by support engineers to supplement the ADS application examples and documentation. Maintenance Service Releases—with updates to previously released software versions—are also available for download. A tracking feature allows you to submit and manage your support cases and related defect and enhancement requests.

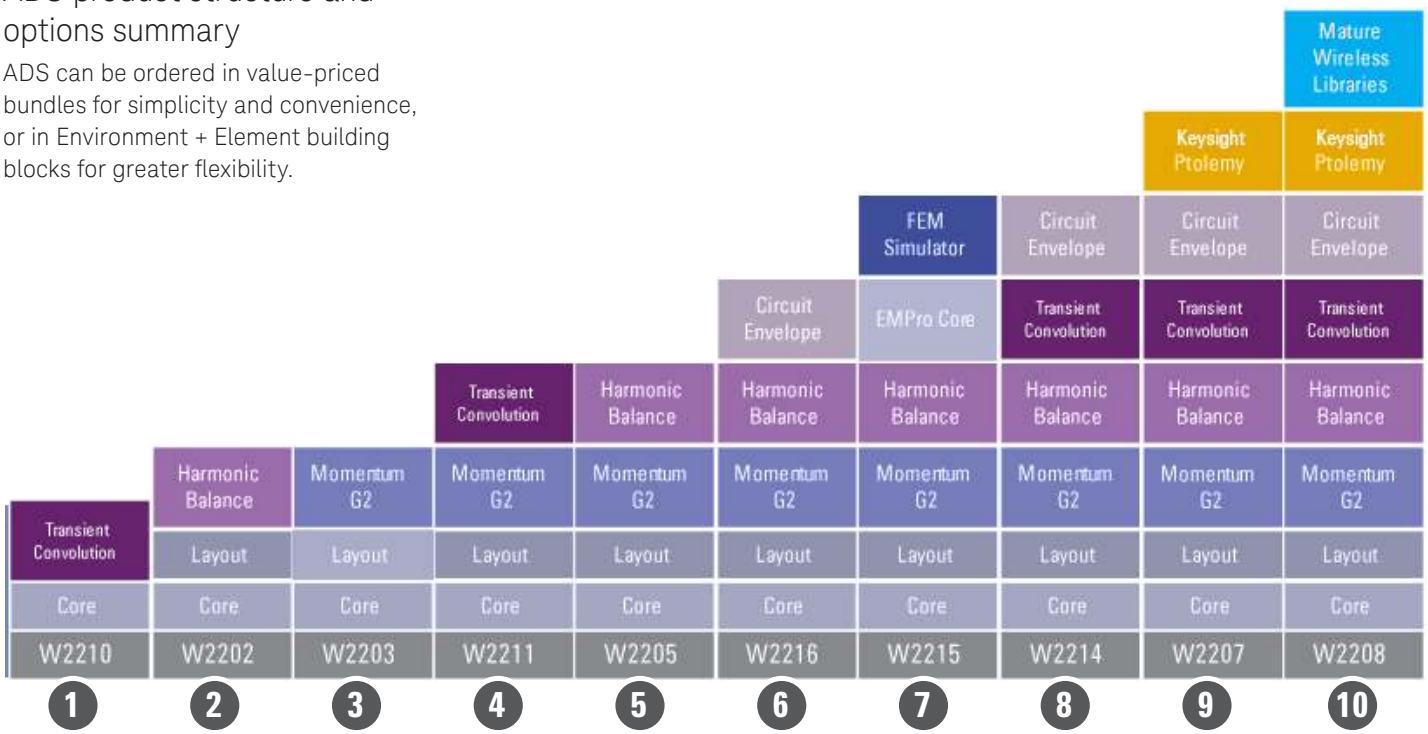




# Purchase what you need today; add greater functionality as your needs evolve

## ADS product structure and options summary

ADS can be ordered in value-priced bundles for simplicity and convenience, or in Environment + Element building blocks for greater flexibility.




## ADS Environment + Elements

Configure a flexible ADS package that's right for you. Choose an ADS Environment plus any combination of the following individual Element building blocks.

### ADS Core Environment

W2200 ADS Core

W2201 ADS Core + Layout

### EM Simulation Elements

W2341 Momentum G2

W2343 Momentum Turbo

W2342 FEM Simulator

### Circuit & System Simulation Elements

W2300 Harmonic Balance

W2301 Circuit Envelope

W2306 Linear Simulator Element

W2349 Electro-Thermal Simulator

W2361 Keysight Ptolemy

W2362 RF Architect & Synthesis

### Model & Library Elements

W2304 Verilog-AMS Compiler

W2305 X-Parameter Generator

W2363 Mature Wireless Library

W2364 2G/3G Wireless Library

W2365 Wireless Networking Library

W2366 Integrated Wireless Library

W2367 WiMedia Wireless Library

W2368 3GPP-LTE Wireless Library

W2369 WVAN Wireless Library

W2371 Asia DTV Wireless Library

### High-Speed Digital Design

W2302 Transient/Convolution

W2307 Controlled Impedance Line Designer

W2312 Transient Distributed Computing 8-pack

W2324 High Capacity Layout Pre-processor

W2500 Transient/Convolution GT

### Verification Test Benches

W2385 Wireless Networking (802.11ac)

W2390 LTE-A Verification (Rel 10 & 11)

W2388 LTE 3GPP (Rel 8 &9)

W2381 VTB Engine

### Additional Recommended Products

W2401 EMPro Core Environment

W2402 EMPro Core + FEM

W2319 ADS Silicon RFIC Interoperability

W2320 ADS Advanced Layout

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