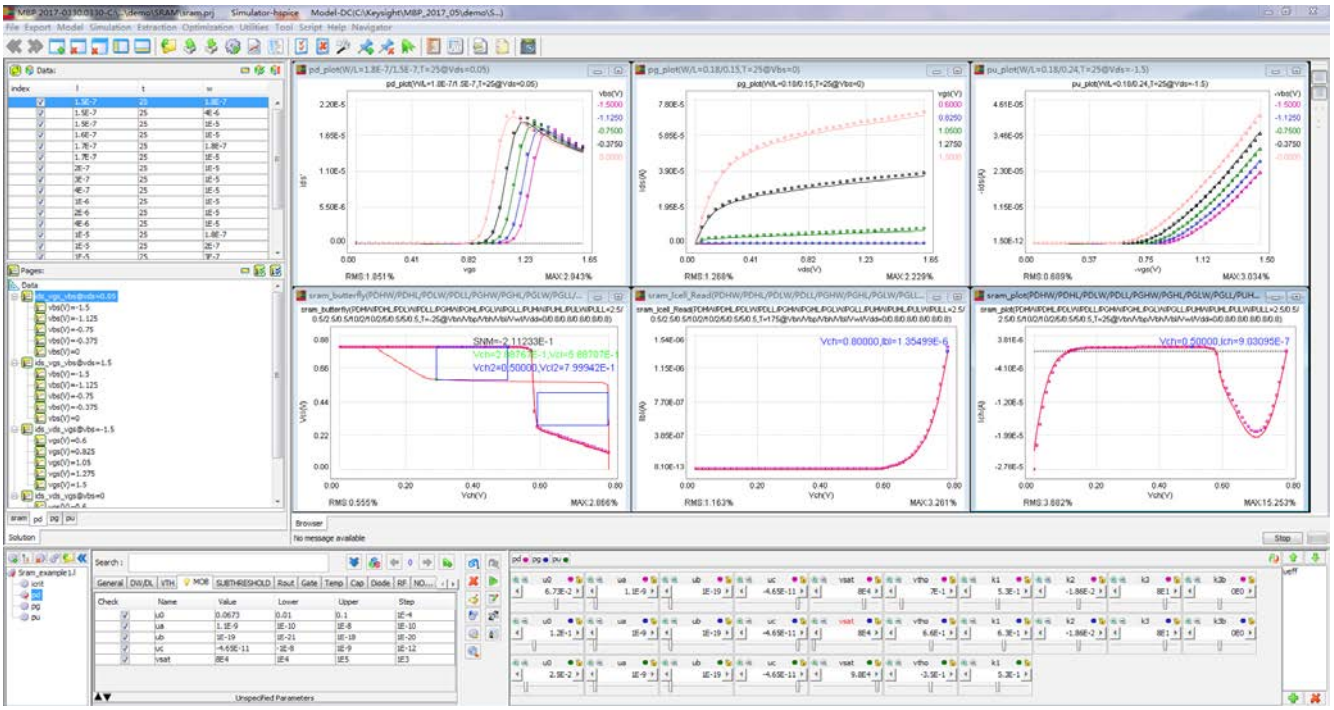
Keysight Technologies
Model Builder Program (MBP)

Complete Silicon Turnkey Device Modeling Software



KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Introduction

Model Builder Program (MBP) is a complete modeling solution that integrates SPICE simulation, model parameter extraction and optimization. MBP supports the industry standard models including BSIM-BULK, BSIM-CMG and BSIM-IMG for DC, AC and RF applications. Besides compact models, MBP also supports the macro (subcircuit) model and Verilog-A model.

MBP provides automatic extraction packages. The open interface enables optimization flow customization, device target definition and the ability to define GUI operations. With its superior optimization technology and advanced features, MBP provides the most comprehensive, accurate and efficient modeling solutions, especially for silicon devices.

Key features

- Fully automated BSIM-BULK, BSIM3, BSIM4, BSIMSOI, PSP, HiSIM2, HiSIM_HV, GP, VBIC, and MEXTRAM model extraction and optimization flows
- Support for the advanced multi-gate FET models: BSIM-CMG, BSIM-IMG and UTSOI
- Turnkey model extraction package for static random access memory (SRAM) cell which consists of multiple NMOS and PMOS transistors
- Open interface enables users to customize modeling flows and internal functions using scripting
- Built-in macro model optimization capabilities incorporating HV and layout effect modeling
- The industry's most complete variation modeling solution to generate statistical and mismatch models base on either silicon data or technology spec
- Reliability package to support industrial MOSRA and TMI aging models
- Equipped with superior optimization technology balancing speed and accuracy
- Excellent usability with a friendly user interface, efficient model file management and model library support
- Integrated modeling data flow across Keysight Technologies's device modeling platform

MBP Specifications

OS and simulators	Models		Supported operations
Windows and Linux HSPICE and Spectre	MOSFET	BSIM3 BSIM4 BSIM-BULK PSP HiSIM2 HiSIM_HV EKV	– Automatic model extraction and optimization – Macro model optimization – Intermediate Variables such as (Vth vs. L, Idsat vs. T, etc) optimization – Model extraction based on Design Spec (No IV/CV is needed) – Model library import, optimization and export – Both internal and external simulators available – Model tweaking for both global and binning model – Model file management and conversion between simulator formats – Scripting capability
	SOI	BSIMSOI3 BSIMSOI4 UTSOI	
	MGFET	BSIM-CMG BSIM-IMG	
	BJT	GP (Gummel Poon) VBIC MEXTRAM HiCUM	
	Diode (level 1, 3) and Juncap2		
	Resistor (R2 and R3)		
	Inductor		
	MOSVAR and MIM capacitor		
	JFET		
	Sub-circuit modeling	High voltage Layout effect RF model	
	Monte-Carlo model	Process variation Mismatch	

Optimizer

- Superior optimization technology balancing speed and accuracy
- Internal optimizer supports the optimization of general models, subcircuit models, Design Spec, and Intermediate variables

Macro modeling

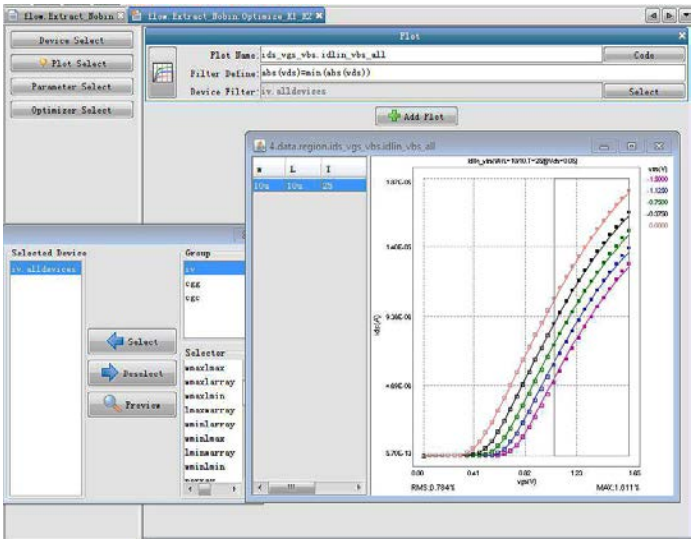
- MBP provides the fastest optimization speed for macro modeling
- Equipped with predefined templates for high voltage device modeling and layout effect modeling such as STI and WPE
- Enables optimization of macro variables and model parameters together at fast speed
- Supports all popular simulator formats

Task tree

- Automatic extraction and optimization steps are implemented for all industry standard models
- Customize the extraction and optimization flow using simple Java programming

GUI-based custom model extraction environment

- Fully interactive GUI to adjust an automated model extraction flow
- No coding or compilation is required
- Extraction step adjustment supported for data/region selection, model parameters, graphs and optimizer settings



MBP Specifications (Continued)

IMV and DP

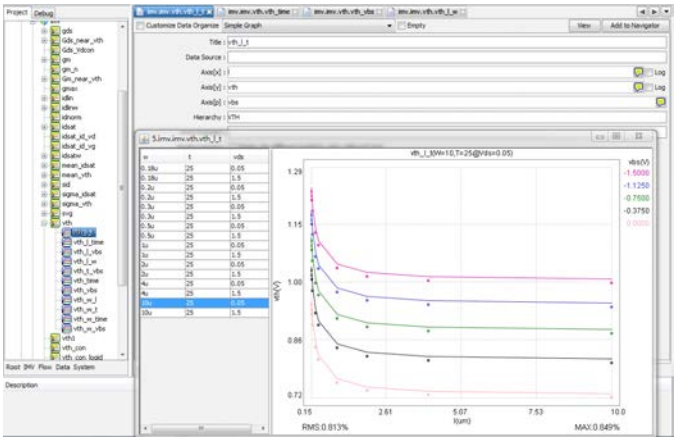
- MBP enables users to optimize on Vth, Idsat, Ioff or any device targets of user deined vs. W/L/T. For example, NLX, DVT0, and DVT1 can be optimized directly on Vth vs. L curve at different Vbs
- MBP enables loading Device Parameter data and using it as a target to tweak model parameters

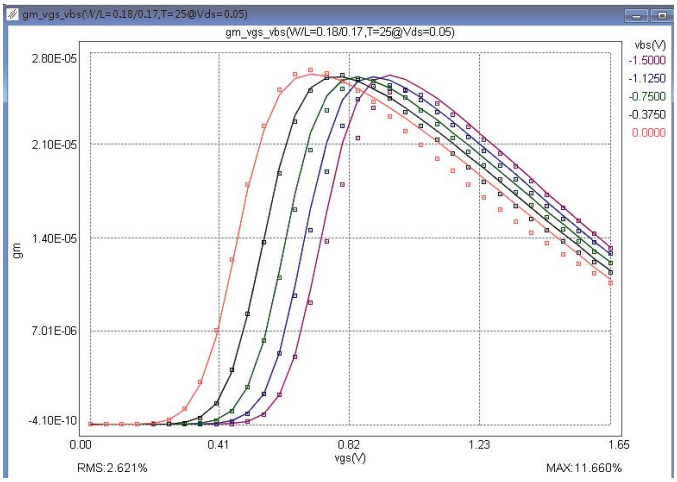
Model tweaking

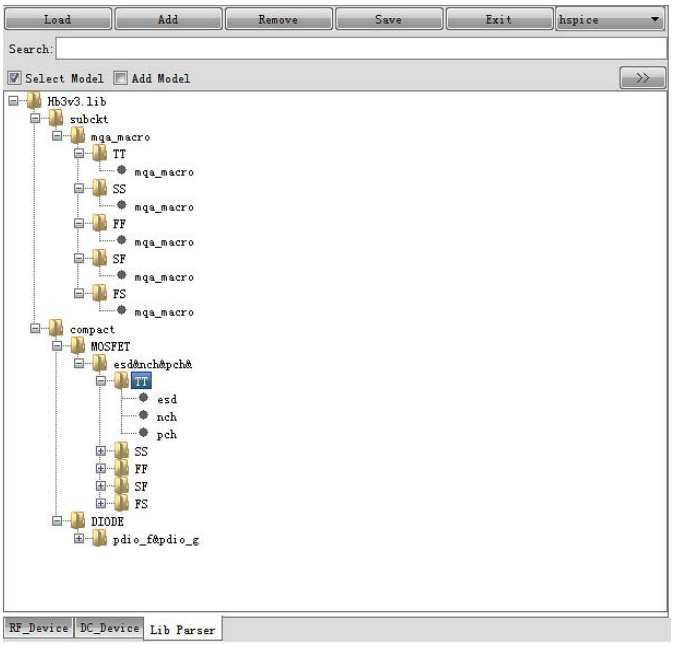
- The smart model tweaking module enables easy model retargeting according to new specifications
- Supports both the model card and model library
- Supports tweaking binning model library without damaging the continuity

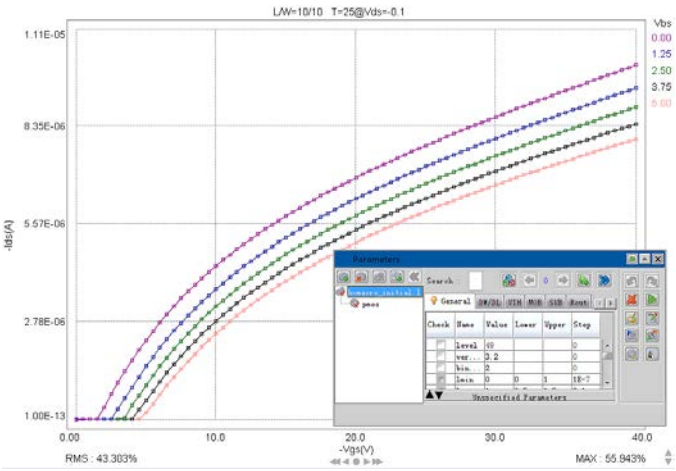
MBP script

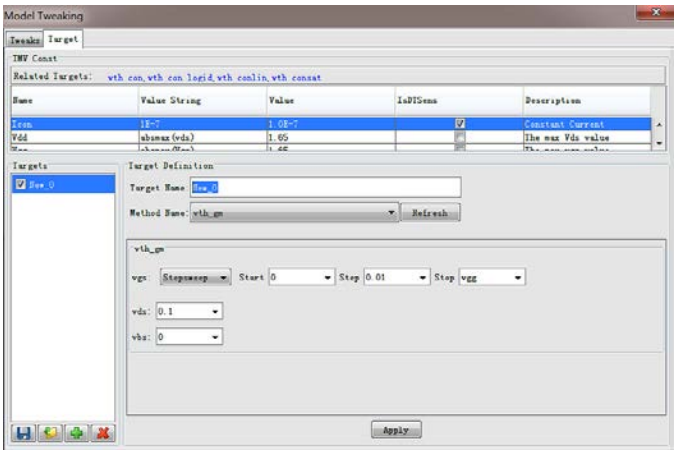
- MBP script enables GUI operation application, plot manipulation, data re-organization, IMV target definition, and extraction flow customization











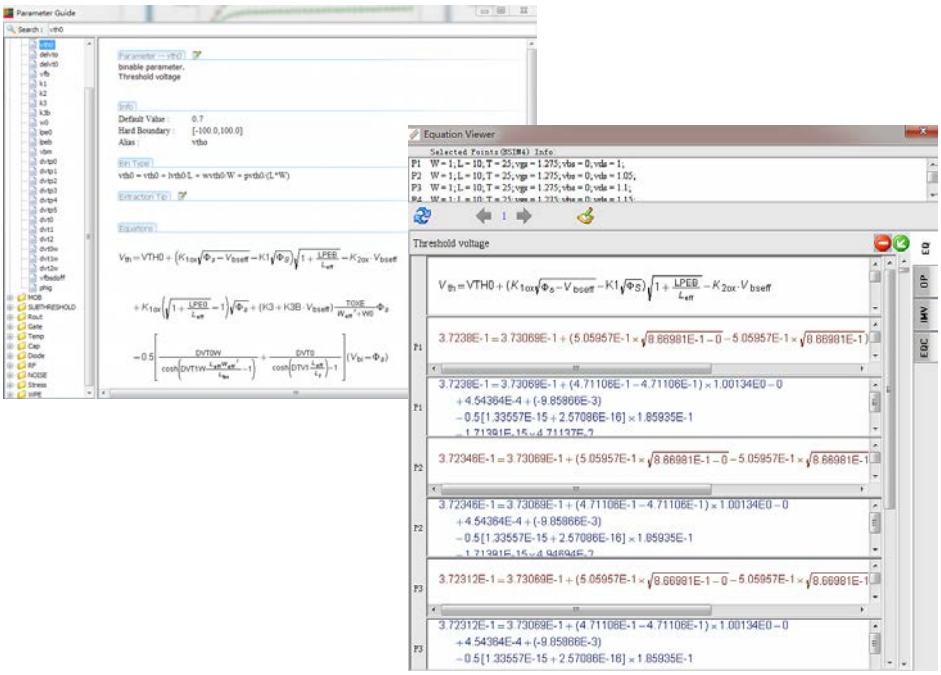
Lib parser

- Directly import and export model libraries of HSPICE and Spectre format
- Load and tune model libraries directly

MBP Specifications (Continued)

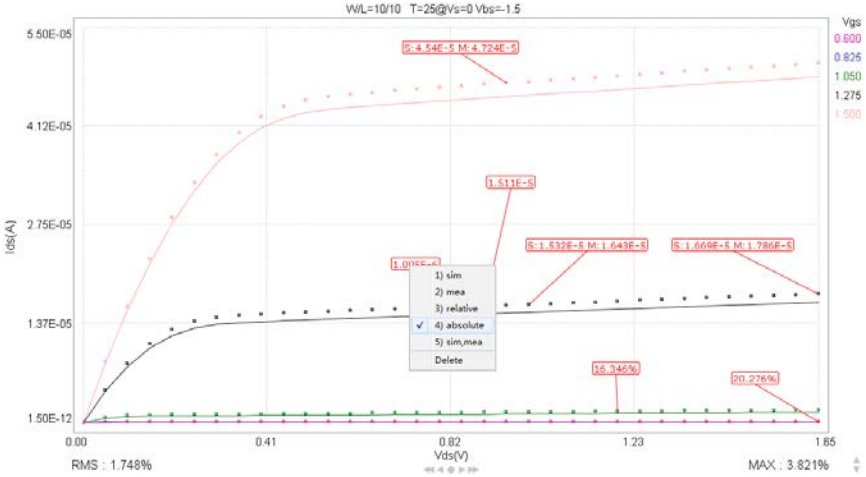
Best usability

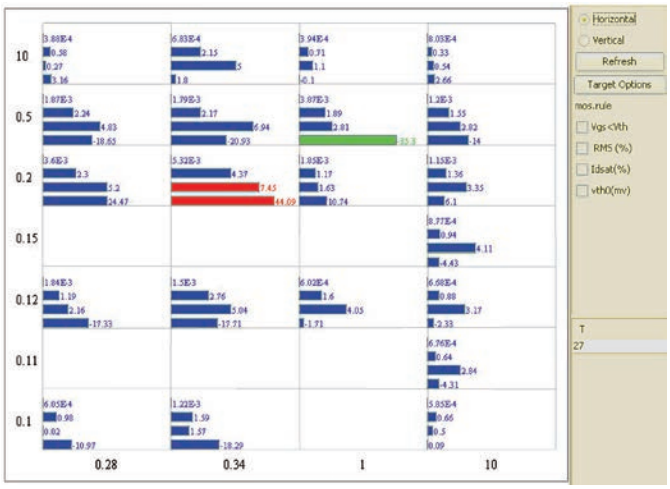
- Flexible and simple device navigation
- Equation viewer enables easy debugging of model issues on the fly
- Easy parameter selection and optimization
- Model comparison function enables in-progress model comparison during model extraction process
- Error monitor provides global view of fitting error
- Data checking module guarantees data integrity
- MBP's internal functions can be customized, such as math transforms and RMS deinitions through the open interface
- Parameter Guide allows to look up parameter related informations such as definition, default value, boundary, and equations.

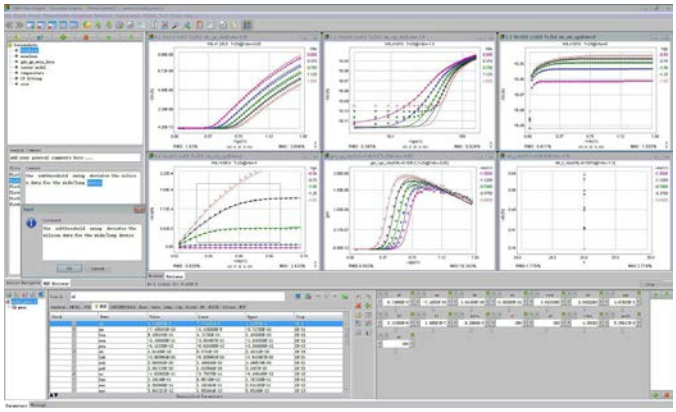


Modeling SOP enablement

- Allows to set model extraction policies
- Improves eficiency in team collaboration during model extraction iterations
- Allows for standardized model review process
- Helps the modeling team improve customer communication and shorten project turn-around time

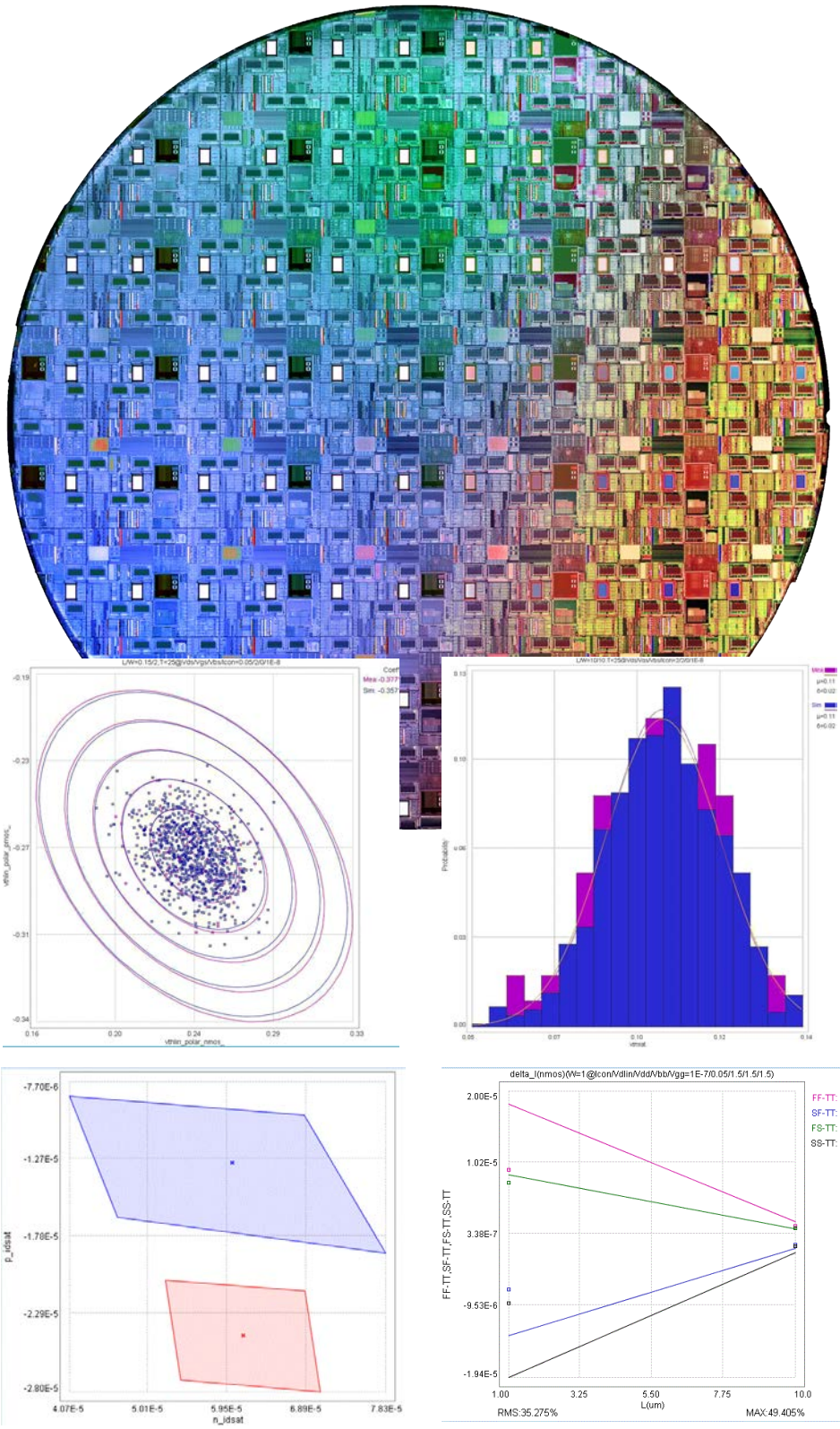






Comprehensive Modeling Package

- Monte-Carlo model support for global statistical and local mismatch models
- Complete PCA-based variation model extraction flow to support N/P correlation
- RF module enables accurate modeling of devices for RF applications
- Scalable inductor model generation
- State-of-the-art subcircuit modeling approach for high voltage device modeling
- Stress (layout dependent effects) module enables parallel simulation
- Circuit-based model extraction base on the figure of merits of benchmark circuit (ex. RO stage delay, dynamic power, leakage power)
- The new corner tweaking module improves the modeling efficiency by integrating necessary functions into one package
- SRAM model generation package allows to optimize NMOS&PMOS transistor models and memory cell model in one MBP session



Product Structure

Model Builder Program (MBP) is a one-stop solution that provides both automation and flexibility for silicon device modeling.

Core Environment includes all the necessary components for data loading, model simulation, parameter extraction, model generation and reporting. Simulation can be performed by either the internal engine or external simulators (e.g. HSPICE, Spectre). The extraction packages for BSIM3, BSIM4, GP bipolar, resistor, capacitor, diode, JFET and macro model are included by default.

– W8601EP/ET Model Builder Program Core Environment

Models	Description	Modules
CMOS modeling	General extraction package for the BSIMSOI, PSP, HiSIM2, HiSIM_HV, BSIM-BULK (formerly known as BSIM6), BSIM-CMG, BSIM-IMG, and Level 66 HVMOS models.	W8602EP/ET MBP BSIMSOI Model Generation Software W8603EP/ET MBP PSP Model Generation Software W8604EP/ET MBP HiSIM2 Model Generation Software W8605EP/ET MBP HiSIM_HV Model Generation Software W8615EP/ET MBP BSIM6 Model Generation Software W8616EP/ET MBP BSIM-CMG Model Generation Software W8617EP/ET MBP BSIM-IMG Model Generation Software W8618EP/ET MBP MOS66 Model Generation Software
BJT modeling	General extraction package for the VBIC, HICUM, and MEXTRAM bipolar models.	W8606EP/ET MBP VBIC Model Generation Software W8607EP/ET MBP HICUM Model Generation Software W8609EP/ET MBP MEXTRAM Module Generation Software
CMOS and BJT modeling	General extraction package for the popular CMOS (PSP, BSIMSOI, HiSIM2, and HiSIM_HV) and BJT (VBIC, HICUM, and MEXTRAM) models.	W8624EP/ET MBP Silicon Model Extraction Package
Stress modeling	Complete flow for layout-dependent stress effect model generation and optimization.	W8611EP/ET MBP Stress Model Extraction Software
RF modeling	RF parameter extraction packages for MOSFETs, BJTs, capacitors, diodes, inductors and resistors.	W8612EP/ET MBP RF Model Extraction Software
Verilog-A model support	Support for Verilog-A model loading and tweaking.	W8613EP/ET MBP Verilog-A Model Support Software
Reliability modeling	Extraction packages for MOS Reliability Analysis (MOSRA) and TSMC Model Interface (TMI) aging model generation.	W8614EP/ET MBP Reliability Module MOSRA - TMI Software
Statistical modeling	Statistical and mismatch model extraction packages for MOSFETs, BJTs, resistors and capacitors.	W8620EP/ET MBP Statistical Model Generation Software
Viewer module	A graphical user interface (GUI) that enables you to view model simulation results and generate reports.	W8619EP/ET MBP Viewer Software
SRAM modeling	Turnkey model extraction package for static random access memory (SRAM) cell which consists of multiple NMOS and PMOS transistors	W8622EP/ET MBP SRAM Memory Modeling Software

For more information on Keysight EEsof EDA's Model Builder Program (MBP), visit: **www.keysight.com/find/eesof-mbp**

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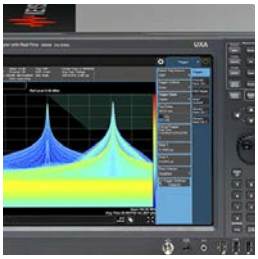


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