Model Builder Program (MBP)

Complete Silicon Turnkey Device Modeling Software
Introduction

Model Builder Program (MBP) is a complete modeling solution that integrates SPICE simulation, model parameter extraction and model library generation. MBP supports the latest standard models including BSIM-BULK, BSIM-CMG and BSIM-IMG for logic, analog and RF designs. Besides compact models, MBP also supports the macro (subcircuit) model and Verilog-A model.

MBP provides automatic extraction packages. The script environment enables extraction flow customization, device target definition and 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, Gummel-Poon, VBIC, and MEXTRAM model extraction and optimization flows
- Support for the advanced multi-gate FET models: BSIM-CMG, BSIM-IMG and UTSOI
- Turnkey modeling packages for model re-centering and SRAM cell model generation
- Open interface enables users to customize modeling flows and internal functions using scripting
- Built-in macro model optimization capabilities incorporating high voltage 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 modeling packages to extract MOSRA (level 1 and level 3) 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**

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<tr>
<th>Windows and Linux</th>
<th>HSPICE and Spectre</th>
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<th>Models</th>
<th>Supported operations</th>
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<tr>
<td>MOSFET</td>
<td>BSIM3, BSIM4, BSIM-BULK, PSP, HiSIM2, HiSIM_HV, EKV3</td>
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<td>SOI</td>
<td>BSIMSOI3, BSIMSOI4, UTSOI</td>
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<td>MGFET</td>
<td>BSIM-CMG, BSIM-IMG</td>
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<td>BJT</td>
<td>Gummel-Poon, VBIC, MEXTRAM, HiCUM</td>
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<td>Diode (level 1, 3) and Juncap2, Resistor (R2 and R3), Inductor, MOSVAR and MIM capacitor, JFET</td>
<td>Sub-circuit modeling, High voltage, Layout effect, RF model, Monte-Carlo model, Process variation, Mismatch</td>
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**Optimizer**

- Superior optimization technology balancing speed and accuracy
- Internal optimizer supports the optimization of general models, subcircuit models, design spec, and intermediate variables (IMVs)

**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

**Automated model extraction flow**

- Automated extraction and optimization steps are implemented for the industry standard models
- The flow is fully customizable
- 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 user-defined targets vs. W/L/T. For example, the parameters 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

Corner tweaking
- Construct corner library from either model card or library template
- Optimize the selected devices and targets for all the corners
- Corner spec edit, import and export
- Pre-defined targets and plots for tweaking or automated optimization

Re-centering
- Enables to define the acceptance criteria and display the fitting error in different colors
- Presents both error table and IMV plots at the same time
- Targets and plots customization with MBP Script
- Supports exporting the error table in an Excel file

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

MBP script
- MBP script enables GUI operation application, plot manipulation, data re-organization, IMV target definition, and extraction flow customization
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
- MBP’s internal functions can be customized, such as math transforms and RMS definitions 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 efficiency 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 variation model extraction flow considers 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 allows parallel simulation for user defined TCL script
- Circuit-based model extraction base on the figure of merits of benchmark circuit (ex. RO stage delay, dynamic power, leakage power)
- The turnkey reliability modeling package to extract MOSRA (level 1 and level 3) HCI and BTI models
- SRAM model generation package allows to optimize NMOS&PMOS transistor models and memory cell model in one MBP session
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, Gummel–Poon, resistor, capacitor, diode, JFET and macro model are included by default.

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<tr>
<th>Models</th>
<th>Description</th>
<th>Modules</th>
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<td>CMOS modeling</td>
<td>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.</td>
<td>W8602EP/ET MBP BSIMSOI Model Generation Software</td>
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<td>W8603EP/ET MBP PSP Model Generation Software</td>
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<td>W8604EP/ET MBP HiSIM2 Model Generation Software</td>
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<td>W8605EP/ET MBP HiSIM_HV Model Generation Software</td>
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<td>W8615EP/ET MBP BSIM Model Generation Software</td>
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<td>W8616EP/ET MBP BSIM-CMG Model Generation Software</td>
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<td>W8617EP/ET MBP BSIM-IMG Model Generation Software</td>
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<td>W8618EP/ET MBP MOS66 Model Generation Software</td>
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<td>BJT modeling</td>
<td>General extraction package for the VBIC, HICUM, and MEXTRAM bipolar models.</td>
<td>W8606EP/ET MBP VBIC Model Generation Software</td>
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<td>W8607EP/ET MBP HICUM Model Generation Software</td>
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<td>W8609EP/ET MBP MEXTRAM Module Generation Software</td>
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<td>CMOS and BJT modeling</td>
<td>General extraction package for the popular CMOS (PSP, BSIMSOI, HiSIM2, and HiSIM_HV) and BJT (VBIC, HICUM, and MEXTRAM) models.</td>
<td>W8624EP/ET MBP Silicon Model Extraction Package</td>
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<td>Stress modeling</td>
<td>Complete flow for layout-dependent stress effect model generation and optimization.</td>
<td>W8611EP/ET MBP Stress Model Extraction Software</td>
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<td>RF modeling</td>
<td>RF parameter extraction packages for MOSFETs, BJTs, capacitors, diodes, inductors and resistors.</td>
<td>W8612EP/ET MBP RF Model Extraction Software</td>
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<td>Reliability modeling</td>
<td>Extraction packages for MOS Reliability Analysis (MOSRA) and TSMC Model Interface (TMI) aging model generation.</td>
<td>W8614EP/ET MBP Reliability Module MOSRA - TMI Software</td>
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<tr>
<td>Statistical modeling</td>
<td>Statistical and mismatch model extraction packages for MOSFETs, BJTs, resistors and capacitors.</td>
<td>W8620EP/ET MBP Statistical Model Generation Software</td>
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<td>Viewer module</td>
<td>A graphical user interface (GUI) that enables you to view model simulation results and generate reports.</td>
<td>W8619EP/ET MBP Viewer Software</td>
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<td>SRAM modeling</td>
<td>Turnkey model extraction package for static random access memory (SRAM) cell which consists of multiple NMOS and PMOS transistors.</td>
<td>W8622EP/ET MBP SRAM Memory Modeling Software</td>
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<td>Model re-centering</td>
<td>A turnkey package for model re-centering (also known as re-targeting) base on new spec.</td>
<td>W8626EP/ET MBP Model Targets Re-centering Software</td>
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For more information on Keysight EEsof EDA’s Model Builder Program (MBP), visit: [www.keysight.com/find/eesof-mbp](http://www.keysight.com/find/eesof-mbp)