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Agilent Technologies

MBP

Implementing MOSRA Models in MBP

Application Note

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Implementing MOSRA Models in MBP

Application Note

This application note describes how to implement a MOSRA model in Model Builder Program (MBP). **Note**: This document was originally released for MBP V201.1.0 in July 2011.

Introduction

Device models are relevant to the actual fabrication process. MBP offers an environment for MOS reliability analysis in general and MOSRA in particular. With this environment, the user can measure device performance degradation over time and evaluate stress effects.

This document provides information on the raw data format and MOSRA simulation and parameter extraction. For more information go to www.agilent.com/find/eesof or contact your local Agilent office. The complete list is available at: www.agilent.com/find/contactus.

Raw Data Format

The data format for MOSRA analysis is similar to that of general measurement data in MBP. A sample of MOSRA data is as follows:

condition{corner = tt,date = oct_20_02,instrument=(hp4145, probe_station),
mode=forward, ***datatype= mosra, version=1.0****, type=nmos}*
Page (name=ids_vgs_vbs,x=vgs,p=vbs,y=ids) { vds=0.05, w=10.0, L=0.13,
T=25.0 }
stress (time=0.0, vds=2.0, vgs=1.0, vbs=0.0)
curve { 0.0 }
0.0 5.000E-14
0.05 5.002E-14
0.1 5.010E-14
0.15 5.055E-14
0.2 5.315E-14
.....

Here, the keyword **datatype** should be specified as **mosra** and **version=1.0** corresponds to the MOSRA level. The keyword **stress** defines the bias condition and the duration of the aging test.

MBP also supports another kind of MOSRA data, which allows the user to take the aging span as the variable. For example:

*condition{corner = tt,date = oct_20_02,instrument=(hp4145, probe_*
station),mode=forward}
Datatype{S_target}
Version{2.1}
type{nmos}
Delimiter{,}

Instance{L, W, T}
Strss_Condtion{S_vgs=1, S_vds=2, S_vbs=0, S_time}
Input{Vgg=2, Vdd=2, Vbb=-1,Vdlin=0.05}
Data{ w, l, t, S_vgs, S_vds,S_vbs, S_time, vth_lin, vthsat, Idlin, Idsat, Ioff, gm }
10, 2, 125, 1, 2, 0, 0, 0.728628, 0.697769, 7.348435E-5, 8.848617E-4, 2.029162E-12, 4.2957E-4
10, 2, 125, 1, 2, 0, 1e5, 0.728985, 0.698127, 7.343337E-5, 8.8407E-4, 2.028872E-12, 4.2903E-4
.....

Here, ***Datatype{S_target}*** means the data type is DP data. Note that all of the variables in this kind of MOSRA data need to start with S_. For example, the gate-to-source voltage (vgs) during an aging test should be named as ***S_vgs***.

All of the data, including instance parameters, bias conditions, timing nodes, and physical quantities, is stored in the ***Data*** session.

As shown in Figure 1, several IMV pages have been pre-defined in MBP to help the user better understand stress data trends.

Figure 1. Pre-defined IMV pages for stress data

MOSRA Simulation and Parameter Extraction

MBP invokes the external simulator (Synopsys HSPICE) for MOSRA model simulation. Note that the user must make sure HSPICE has been installed properly before the simulation.

Choose Model Type

Choose *Model -> Select Model* from the main menu and select *Reliability* in the pop up window. The user must then select one core model in the upper *Core Model Selection* section and MOSRA in the lower *Reliability* section (Figure 2).

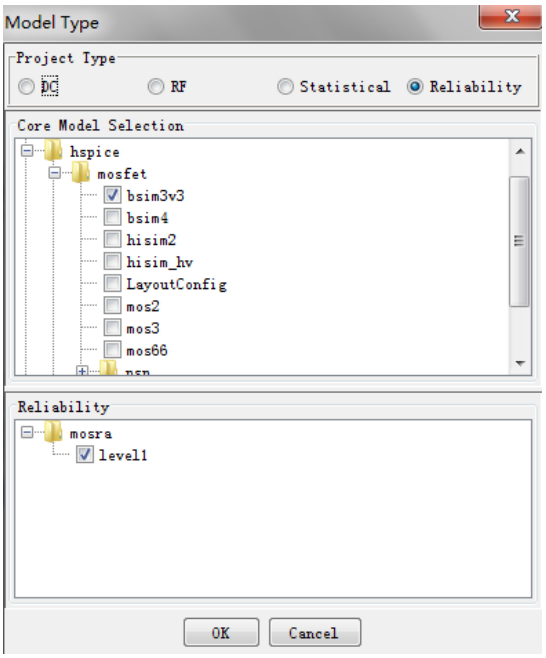

Figure 2. Selecting MOSRA analysis

Model Parameters Panel

After setting up the model type, MBP merges the selected core model and MOSRA model. For example, as shown in the *Parameters* panel of Figure 3, the upper model (**mosra model**) is a MOSRA level 1 model and the lower one (**nmos**) is a BSIM3V3 core model. By clicking any model, the corresponding parameters will show on the right side of the window.

Figure 3. Model viewer for MOSRA

Load Model

In the main menu, choose *File* -> *Model* -> *Load* to load the model. A window named *MOSRA Compose Dialog* will pop up, as shown in Figure 4.

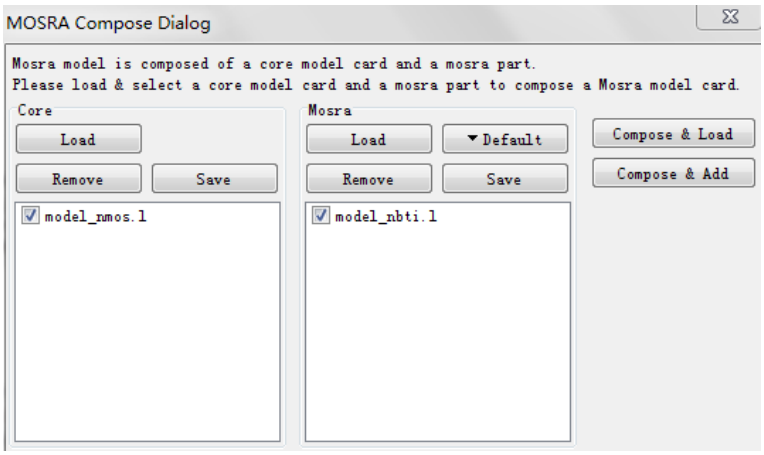

Figure 4. MOSRA compose dialog window

A complete MOSRA model consists of two parts: the core model and the MOSRA model. The user can deal with these two parts separately. Click *Remove* to delete the existing models and click *Load* to load other models. After loading the models, click *Compose & Load* to replace the current MOSRA model.

Then, choose *File -> Data -> Load* from the main menu to load the data file. The window with the MOSRA model and data is shown in Figure 5.

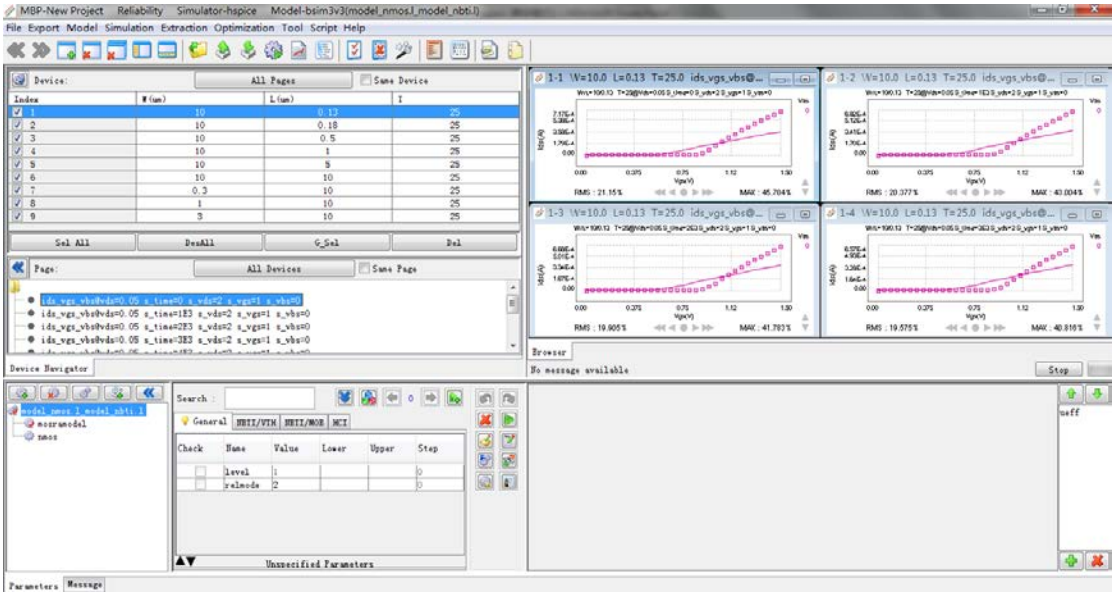

Figure 5. Load data

Now the user can select model parameters and adjust them to fit the measurement data.

MBP allows the user to compare two MOSRA models. The user simply clicks *Compose & Add* to append a MOSRA model for comparison. Select the two models and click the *Compare* icon to compare them (Figure 6).

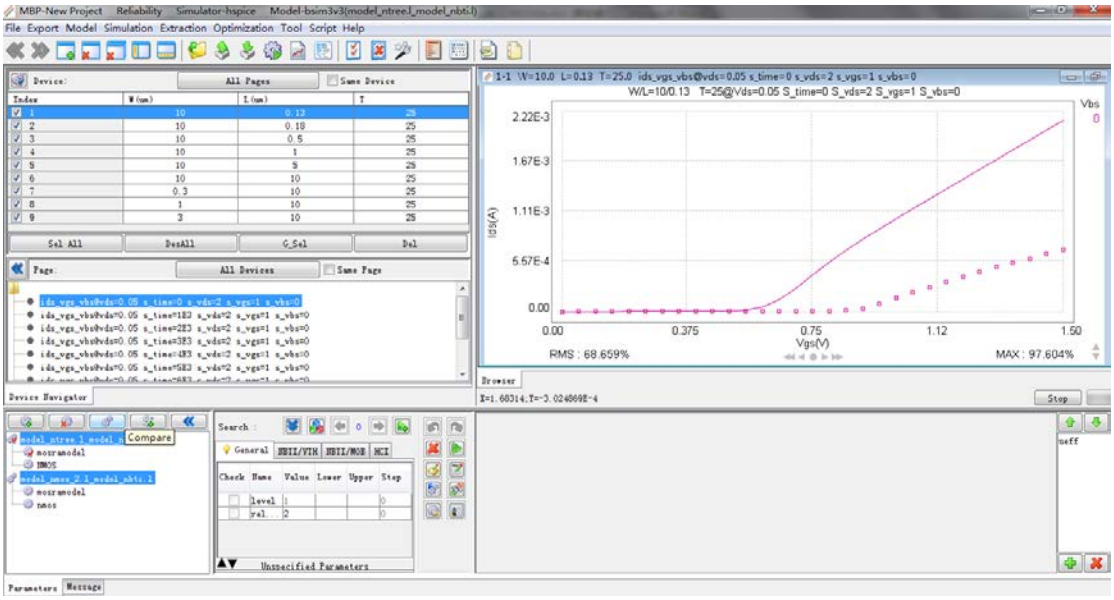

Figure 6. Compare two models

The result is shown in Figure 7.

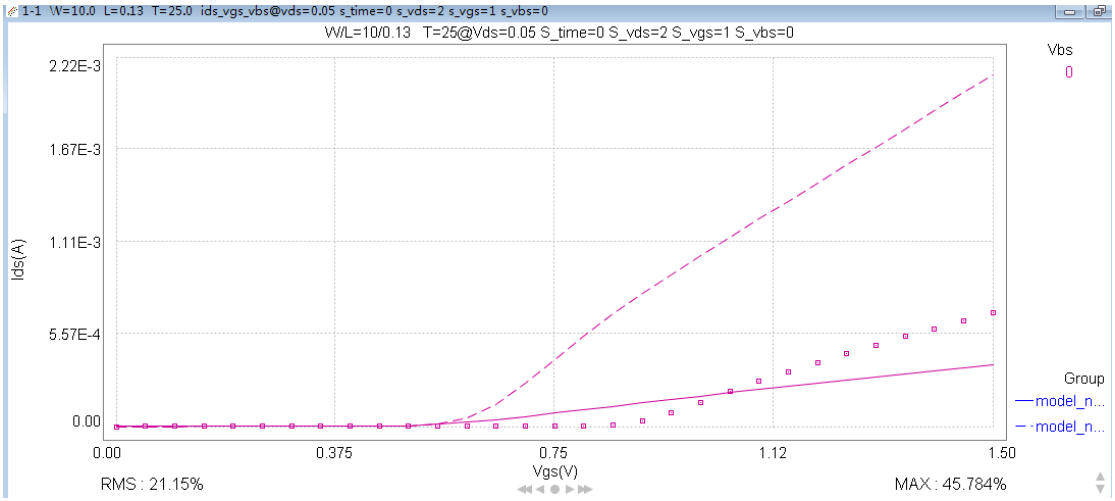

Figure 7. Comparison result

Run Task Tree

MBP also provides a built-in automatic extraction flow (task tree) for the MOSRA model. Task tree can be enabled by choosing *Extraction -> Task Tree* from the main menu. After loading the task tree, the user could run the flow automatically, or step by step. Task tree will select devices, region and parameters for optimization automatically. The task tree optimization window is shown in Figure 8.

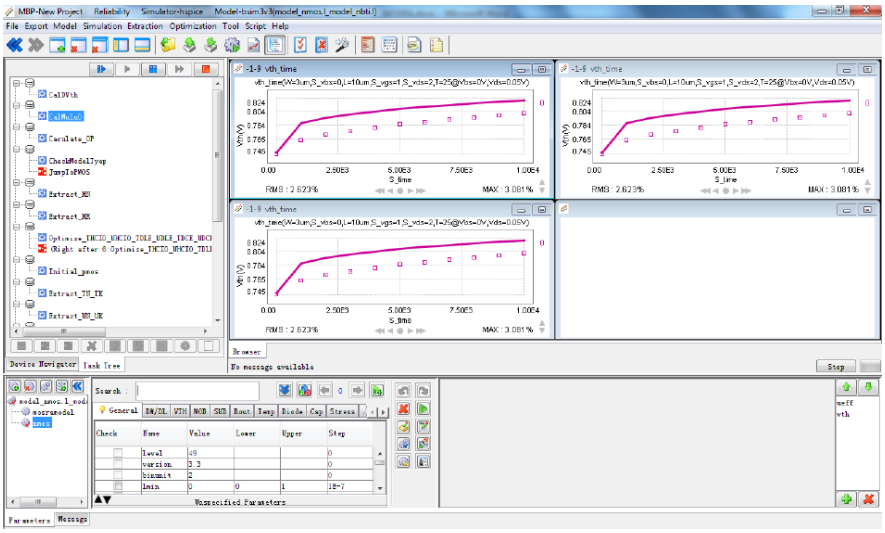

Figure8. Task tree of a MOSRA model