TEMA WEB User Manual

Document No: TWEBUM091215
Date: 11/02/10

DISCLAIMER OF WARRANTY

THE SOFTWARE AND ANY RELATED DOCUMENTATION ARE PROVIDED TO YOU "AS IS" BASIS, WITHOUT WARRANTIES, EITHER EXPRESS OR IMPLIED, AND EXPRESSLY DISCLAIMS ALL REPRESENTATIONS, ORAL OR WRITTEN, TERMS, CONDITIONS, AND WARRANTIES, INCLUDING BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT. WITHOUT LIMITING THE ABOVE YOU ACCEPT THAT THE SOFTWARE MAY NOT MEET YOUR REQUIREMENTS, OPERATE ERROR FREE, OR IDENTIFY ANY OR ALL ERRORS OR PROBLEMS, OR DO SO ACCURATELY.

LIMITATION OF LIABILITY

NEITHER MERIDIAN SOFTWARE TECHNOLOGY (P) LTD NOR ANY OF ITS EMPLOYEES AND LICENSORS SHALL BE LIABLE FOR ANY DAMAGES CAUSED BY THE SOFTWARE, INCLUDING BUT NOT LIMITED TO INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, OR DAMAGES FOR LOSS OF PROFITS, LOSS OF SAVINGS, REVENUE, DATA, INCURRED BY CUSTOMERS OR ANY THIRD PARTY, EVEN IF DEVELOPER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

COPYRIGHT

Meridian Software Technology (P) Ltd.
email: support@meridiansoftech.com
Website: www.meridiansoftech.com

ACKNOWLEDGEMENTS

MATLAB® is a registered trademark of The MathWorks, Inc, USA
Windows XP® is a registered trademark of Microsoft Corporation, USA.
Spice is a Electronic Circuit Simulator, Copyright © University of California, Berkeley, USA (Under BSD License) .
Ngspice is a Electronic Circuit Simulator, Copyright © Open Source Software Package (Under BSD License)

Table of Contents:

1 Introduction

This manual describes about TEMA WEB Software product on a computer running Microsoft Windows. After successful installation (See “Installation Manual“ for installation of TEMA), you can run TEMA on specific system computer for which you have purchased license. This manual includes the following topics:

- Basics about TEMA WEB
- Describes the overview of the TEMA WEB inputs
- Describes about the data formats
- Describes spice parameters extraction function

1.1 What is TEMA WEB

The software TEMA (Tool for Electronic Model Automation) WEB is a EDA tool for automated SPICE modeling of advanced semiconductor devices (Diode, Bipolar, MOSFETs and Passives etc.) through web interface. The tool can be suitable for all kind of electrical modeling like dc, cv and rf at low/high temperature for on wafer or packaged semiconductor devices.

2 General

2.1 TEMA WEB Inputs

temaweb function_name data_file TEMP <-o out_file_name> action

Option:
<-o out_file_name> given, then output file written to this file otherwise default: output file written to the temaweb.out

2.2 Data File Format

Single sweep of data
%Header: xx xx

```
3.00E-01    1.09E-09
3.25E-01    2.87E-09
3.50E-01    7.53E-09
3.75E-01    1.98E-08
4.00E-01    5.21E-08
4.25E-01    1.37E-07
4.50E-01    3.60E-07
4.75E-01    9.46E-07
5.00E-01    2.49E-06
5.25E-01    6.54E-06
5.50E-01    1.72E-05
5.75E-01    4.51E-05
6.00E-01    1.18E-04
6.25E-01    3.09E-04
6.50E-01    7.96E-04
6.75E-01    2.00E-03
7.00E-01    4.73E-03
7.25E-01    1.01E-02
7.50E-01    1.89E-02
7.75E-01    3.10E-02
8.00E-01    4.59E-02
8.25E-01    6.28E-02
8.50E-01    8.12E-02
8.75E-01    1.01E-01
9.00E-01    1.21E-01
9.25E-01    1.42E-01
9.50E-01    1.63E-01
9.75E-01    1.85E-01
1.00E+00    2.07E-01
```

Multiple sweep of data

%Header: xx xx

```
3.00E-01    1.09E-09
3.25E-01    2.87E-09
3.50E-01    7.53E-09
3.75E-01    1.98E-08
4.00E-01    5.21E-08
4.25E-01    1.37E-07
4.50E-01    3.60E-07
.
.
.
8.25E-01    6.28E-02
8.50E-01    8.12E-02
8.75E-01    1.01E-01
9.00E-01    1.21E-01
9.25E-01    1.42E-01
9.50E-01    1.63E-01
9.75E-01    1.85E-01
1.00E+00    2.07E-01
```

%Header: xx xx

```
3.00E-01    1.09E-09
3.25E-01    2.87E-09
3.50E-01    7.53E-09
3.75E-01    1.98E-08
4.00E-01    5.21E-08
4.25E-01    1.37E-07
4.50E-01    3.60E-07
.
.
.
8.25E-01    6.28E-02
8.50E-01    8.12E-02
8.75E-01    1.01E-01
9.00E-01    1.21E-01
9.25E-01    1.42E-01
9.50E-01    1.63E-01
9.75E-01    1.85E-01
1.00E+00    2.07E-01
```

Function List

2.3 Diode Spice Parameter

2.3.1 diode_fwd_iv

Extraction of diode SPICE parameters related to forward Current-Voltage (IV) characteristics.

Syntax:

temaweb diode_fwd_iv temaweb.dat *TEMP < -o out_file_name> extract*

Input:

Inputs	Descriptions	Unit	Default
diode_fwd_iv	Name of the function	-	
temaweb.dat	Data file name, data contains V, I (col 1= V, Col 2= I)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
IS	Saturation current	A
N	Emission coefficient	
RS	Ohmic Resistance	Ohm

2.3.2 diode_cv

Extraction of diode SPICE parameters related to Capacitance-Voltage (CV) characteristics.

Syntax:

temaweb diode_cv temaweb.dat *TEMP < -o out_file_name> extract*

Input:

Inputs	Descriptions	Unit	Default
diode_cv	Name of the function	-	
temaweb.dat	Data file name, data contains V, C (col 1= V, Col 2= C)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
CJO	Zero-bias junction capacitance	F
VJ	Junction potential	V
M	Grading coefficient	
FC	Coefficient for forward-bias depletion capacitance	

2.4 Bipolar Spice Parameter

2.4.1 bjt_fwd_gum

Extraction of bipolar SPICE Gummel-Poon parameters related to forward Gummel (Ic & Ib vs. Vbe) characteristics.

Syntax:

temaweb bjt_fwd_gum temaweb.dat *TEMP* < *-o out_file_name*> *extract*

Input:

Inputs	Descriptions	Unit	Default
bjt_fwd_gum	Name of the function	-	
temaweb.dat	Data file name, data contains Vbe, Ic, Ib (col 1= Vbe, Col 2= Ic, Col 3=Ib)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
IS	Transport saturation current	A
NF	Forward current emission coefficient	
RE	Emitter Resistance	Ohm
ISE	B-E leakage saturation current	A

NE	B-E leakage emission coefficient	
BF	Ideal maximum forward beta	
BETA_MAX	Maximum forward beta	
IKF	Corner for forward beta high current roll-off	A

2.4.2 bjt_rev_gum

Extraction of bipolar SPICE Gummel-Poon parameters related to reverse Gummel (Ie & Ib vs. Vbc) characteristics.

Syntax:

temaweb bjt_rev_gum temaweb.dat *TEMP* < *-o out_file_name*> *extract*

Input:

Inputs	Descriptions	Unit	Default
bjt_fwd_gum	Name of the function	-	
temaweb.dat	Data file name, data contains Vbc, Ie, Ib (col 1= Vbc, Col 2= Ie, Col 3=Ib)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
IS	Transport saturation current	A
NR	Reverse current emission coefficient	
RC	Collector Resistance	Ohm
ISC	B-C leakage saturation current	A
NC	B-C leakage emission coefficient	
BR	Ideal maximum reverse beta	
BETA_MAX	Maximum reverse beta	
IKR	Corner for reverse beta high current roll-off	A

2.4.3 bjt_fwd_out

Extraction of bipolar SPICE Gummel-Poon parameters related to forward Output (Ic vs. Vc) characteristics.

Syntax:

temaweb bjt_fwd_out temaweb.dat *TEMP* < *-o out_file_name*> *extract*

Input:

Inputs	Descriptions	Unit	Default
bjt_fwd_out	Name of the function	-	
temaweb.dat	Data file name, data contains Vc, Ic (col 1= Vc, Col 2= Ic)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
RC	Collector Resistance	A
VAF	forward Early voltage	V

2.4.4 bjt_cbc

Extraction of bipolar SPICE Gummel-Poon parameters related to B-C junction Capacitance-Voltage (CV) characteristics.

Syntax:

temaweb bjt_cbc temaweb.dat *TEMP* < *-o out_file_name*> *extract*

Input:

Inputs	Descriptions	Unit	Default
bjt_cbc	Name of the function	-	
temaweb.dat	Data file name, data contains V, Cbc (col 1= V, Col 2= Cbc)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
CJC	B-C zero-bias depletion capacitance	F
VJC	B-C built-in potential	V
MC	B-C junction exponential factor	
FC	Coefficient for forward-bias depletion capacitance	

2.4.5 bjt_cbe

Extraction of bipolar SPICE Gummel-Poon parameters related to B-E junction Capacitance-Voltage (CV) characteristics.

Syntax:

temaweb bjt_cbe temaweb.dat *TEMP* < *-o out_file_name*> *extract*

Input:

Inputs	Descriptions	Unit	Default
bjt_cbe	Name of the function	-	
temaweb.dat	Data file name, data contains V, Cbe (col 1= V, Col 2= Cbe)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
CJE	B-E zero-bias depletion capacitance	F
VJE	B-E built-in potential	V
ME	B-E junction exponential factor	
FC	Coefficient for forward-bias depletion capacitance	

2.5 MOSFET Spice Parameter

2.5.1 mosfet_idvg

Extraction of MOSFET LEVEL (1,2,3 &6) SPICE parameters related to transfer (Id vs. Vg) characteristics.

Syntax:

temaweb mosfet_idvg temaweb.dat *TEMP VD W L < -o out_file_name> extract*

Input:

Inputs	Descriptions	Unit	Default
mosfet_idvg	Name of the function	-	
temaweb.dat	Data file name, data contains Vg, Id (col 1= Vg, Col 2= Id)		
TEMP	Temperature at which data measured	C	27
VD	Drain voltage at which idvg measured	V	0.1
W	Gate Width of a transistor	m	1.00E-005
L	Gate Length of a transistor	m	1.00E-005
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
VTO	Threshold voltage	V
KP	Transconductance parameter	A/V^2
UO	Surface Mobility	cm^2\Vs

2.5.2 mosfet_idvd

Extraction of MOSFET LEVEL (1,2,3 & 6) SPICE parameters related to output (Id vs. Vd) characteristics.

Syntax:

temaweb mosfet_idvd temaweb.dat *TEMP < -o out_file_name> extract*

Input:

Inputs	Descriptions	Unit	Default
mosfet_idvd	Name of the function	-	
temaweb.dat	Data file name, data contains Vd, Id (col 1= Vd, Col 2= Id)		
TEMP	Temperature at which data measured	C	27
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
RDS	Total Source and drain ohmic resistance	Ohm
LAMBDA	channel-length modulation (MOS1 and MOS2 only)	1/V

2.5.3 mosfet_cox

Extraction of MOSFET LEVEL (1,2,3 & 6) SPICE parameters related to gate voltage Capacitance (Cg vs. Vg) characteristics.

Syntax:

temaweb mosfet_cox temaweb.dat *TEMP W L < -o out_file_name> extract*

Input:

Inputs	Descriptions	Unit	Default
mosfet_idvd	Name of the function	-	
temaweb.dat	Data file name, data contains Vg, Cox (col 1= Vg, Col 2= Cox)		
TEMP	Temperature at which data measured	C	27
W	Gate Width of a transistor	m	1.00E-005
L	Gate Length of a transistor	m	1.00E-005
-o out_file_name	Option for output file name		temaweb.out

Output:

Outputs	Descriptions	Unit
TOX	Oxide Thickness	m
COX	Oxide Capacitance	F
NSUB	Bulk Doping Concentration	1/cm^3

3 Troubleshooting

This section provides information that can help you to solve common problems that you encounter during working with TEMA on a PC running Microsoft Windows.

a) Couldn't Find TEMA_HOME

This error message typically indicates that there is a problem in setting the TEMA_HOME Environment Variable. On computer systems, make sure your TEMA_HOME has been set correctly with a valid full path.

b) Couldn't Find License File

On computer systems, make sure your License File has been located at (**$TEMA_ROOT\license\license.key**) with a valid key.

c) Invalid License File

This error message typically indicates that there is a problem in your License File. Please contact the support by email at support@meridiansoftech.com.

d) Invalid MAC/Host ID

On computer systems, make sure your MAC/Host ID address is same as License File, which you obtained from Meridian Software Technology (P) Ltd.

e) Couldn't Start Matlab Interface

On computer systems, make sure MATLAB 7.0 or higher version is already installed and the MATLAB installation location has been set correctly in the menu **Setting > Matlab Setup**.

f) Simulation Failed

On computer systems, make sure simulator is already installed and each simulator installation location has been set correctly in the menu **Setting > Simulator Setup**.

Notes: