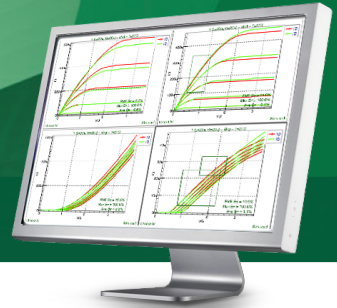


Utmost IV

Device Characterization and SPICE Modeling



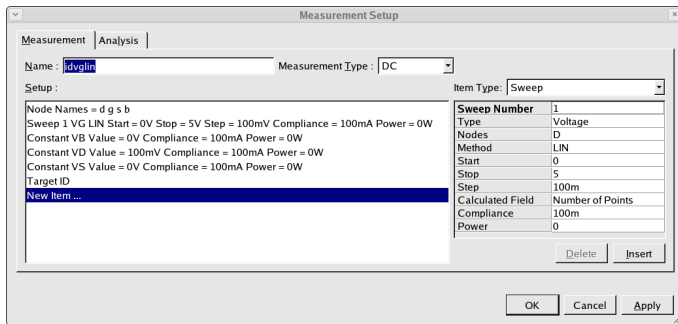
Building on many years experience, Utmost IV provides a powerful yet easy-to-use tool for the characterization of devices and the generation of accurate, compact models, macro-models and Verilog-A models for analog and RF applications.

- **Store your data in either the file system or in a database**
- **Automated measurement and SPICE model extraction of any device type**
- **Full control of all measurement conditions**
- **Over 100 different measurement instruments**
- **Open architecture instrument drivers can be modified or created by user**
- **Extract any compact, macro-model or Verilog-A SPICE model**
- **Combine direct extraction and parameter optimization techniques**
- **Simulate and optimize any combination of data including extracted data values**
- **Family of advanced optimizers, including genetic type optimizers**
- **High-speed multi-threaded SmartSpice interface**
- **Supports SmartSpice, HSPICE, Eldo and Spectre simulators**
- **Verilog-A model and extraction sequence co-development platform**
- **Integration with TCAD tools provides process simulation to SPICE model development flow**
- **Store, share and re-use data using optional Firebird relational database**
- **Easy data import from Utmost III legacy data, TCAD simulation files or competitor data files**

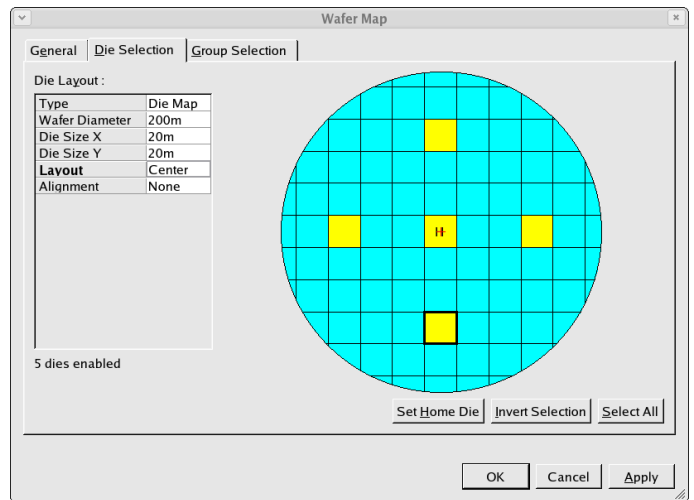
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Measuring Devices in the Acquisition Module

- Supports all types of semiconductor devices
- Perform any measurement and control all measurement conditions
- Variables can be used within measurement setups to increase re-usability
- Embed extractions in measurement sequence so that extracted result from one measurement can be fed into the conditions of another measurement
- Supports over 100 measurement instruments
- Open interface allows user to create new or modify existing instrument drivers
- Data can also be generated from simulation, which is useful when converting one model type to another



Flexible, easy-to-use interface can define any measurement.



Fully automated sequence of measurements.

Supported Measurement Instruments Include

DC Instruments

agilent_b1500
agilent_b1505
agilent_e5260
agilent_e5270
agilent_hp_4155a
agilent_hp_4155b
agilent_hp_4155c
agilent_hp_4156a
agilent_hp_4156b
agilent_hp_4156c
hp_4141
hp_4142
hp_4145
keithley_4200
tektronix_370
tektronix_371

LCR Instruments

agilent_b1500
agilent_b1505
agilent_e4980
hp_4274
hp_4275
hp_4276
hp_4277
hp_4279
hp_4280
hp_4284
hp_4285
hp_4294
keithley_590
keithley_595
quadtech_7600

AC Instruments

agilent_e5070a
agilent_e5070b
agilent_e5071a
agilent_e5071b
agilent_e5071c
agilent_n5242a
agilent_n5241a
agilent_n5244a
agilent_n5245a
agilent_n5247a
agilent_n5264a
agilent_n5231a
agilent_n5232a
agilent_n5234a
agilent_n5235a
agilent_n5239a
agilent_n5221a
agilent_n5224a
agilent_n5225a
agilent_n5227a
agilent_e8361c
agilent_e8362c
agilent_e8363c
agilent_e8364c
agilent_n5230c
agilent_e8361a
agilent_e8362b
agilent_e8363b
agilent_e8364b
agilent_n5230a
agilent_86038b
anritsu_37xxxD
hp_8510c

AC Instruments(con't)

hp_8719d
hp_8719es
hp_8720d
hp_8720es
hp_8722d
hp_8722es
hp_8753a
hp_8753b
hp_8753c
hp_8753d
hp_8753e
hp_8753es

Scanners

agilent_b2200
agilent_hp_e5250
hp_3235
hp_3488
hp_3495
hp_3852
hp_4084
hp_4085
hp_4086
keithley_7002
keithley_705
keithley_706
keithley_707
keithley_708

Probers

alessi_rel2500
alessi_rel4500
alessi_rel5500
alessi_rel6171
cascade_
summit_11500
cascade_
summit_12000
electrogilas_1034
electrogilas_2001
electrogilas_4080
electrogilas_
commander
karl_suss_pa200
karl_suss_pe100
rucker_kolls_680
rucker_kolls_681
rucker_kolls_691
signatone_
wavelink_350
tokyo_
seimitsu_3000
tokyo_
seimitsu_4000
tokyo_
seimitsu_5000
tokyo_
seimitsu_6000
tokyo_seimitsu_
amp90a
wentworth_uk
wentworth_us

Noise Instruments

hp_3561
hp_35660
hp_35665
hp_35670
hp_3589

Thermal Controllers

delta_9010
delta_9388
electrogilas_tc2000
ers_sp53
ers_sp62
etac_fx4050
micronics_wec10
ransco_900
temptronic_tp03000
temptronic_tp03100
temptronic_tp04100
tenney_junior
thermonics_t2420
thermonics_t2500
thermonics_t2600
thermonics_t2820
thermotron
triotech_tc1000
triotech_tc2800

Generating SPICE models in the Optimization Module

- SPICE model generation using any combination of direct parameter extraction or parameter optimization
- Supports all technologies
- Supports compact, macro-model or Verilog-A model extraction
- High-speed interface to SmartSpice simulator performs hundreds of simulations per second
- No simulation slowdown when using macro-models
- Selection of any combination of data targets to perform optimization
- Extract and display any device figure of merit, such as threshold voltage
- Plot, simulate and optimize device figures of merit
- Optimization sequence provides fully automated SPICE model generation mode
- Interactive rubberband sliders instantly show the effect of changing model parameters on the simulated characteristics
- Family of advanced local and global optimizers include:
 - Levenberg-Marquardt
 - Hooke-Jeeves
 - Genetic Optimizer,
 - Simulated Annealing
 - Parallel Tempering
 - Differential Evolution
- Hybrid optimization combines the power of the global optimizer with the speed of the local optimizer
- Define model parameters as values or as expressions
- Directly import models from hierarchical SPICE library files, including parameters defined as expressions
- Import and simulate process corner or other complex model formats
- Perform simulations using external model libraries

The image displays two screenshots from the SmartView software interface. The left screenshot shows the 'Model Library: project1' window with a table of parameters for an NMOS model. The right screenshot shows the 'Parameter Optimization' window with a list of parameters and their values, and the 'SmartView' window with four plots showing the optimization of various targets.

Model Library: project1

Mark	Name	Optimized	Fit Initial	User Initial	Minimum	Maximum
1	LEVEL	3	3	3		
2	VERSION	3.3	3.3	3.3		3.3
3	TNOM	27	27	27	-100	300
4	TOX	14n	14n	14n	5n	50n
5	XJ	150n	150n	150n	100n	1u
6	NCH	1.7e+17	1.7e+17	1.7e+17	5e+16	5e+17
7	NSUB				5e+15	3e+17
8	VTH0	700m	700m	700m	-2	2
9	K1	500m	500m	500m	0	1
10	K2	-18				
11	K3	80				
12	KCB	0				
13	WO	2.5i				
14	NLX	174				
15	DVT0W	0				
16	DVT1W	0				
17	DVT2W					

Parameter Optimization

Model: nmos Optimized Parameters: Iteration: 207 Error = 4.0%

Model/Parameter	Value	Minimum	Maximum
nmos/TOX	7.3043n	5n	50n
nmos/VTH0	444.98m	-2	2
nmos/K1	639.28m	0	1
nmos/K2	-21.136u	-19	14.901n
nmos/K3	100	1m	100
nmos/U0	40.697m	10m	100m
XJ	100p	100p	10n
nmos/LA	100p	100p	10n
nmos/LB	8.9745e-19	1e-21	5a
nmos/LC	45.958p	-100p	10n

SmartView

Four plots showing the optimization of various targets (ID, ID) against VGS and VDS. The plots show the relationship between the target and the input variables, with the optimization process adjusting the parameters to fit the data.

Rubberband optimization of any number of parameters. View and optimize any number of targets.

Custom Automation using the Script Module

- Combine the power of Utmost IV with the customization capability of JavaScript programming language
- Perform any measurement, simulation, extraction or optimization
- Access any database or file
- Export a script version of any Acquisition or Optimization project for rapid script development

Developing Verilog-A Models and Extraction Strategies

- Utmost IV is the perfect Verilog-A model development tool
- Modify Verilog-A model code and instantly see effect on simulated characteristics
- Use data from any source including measurement, TCAD process simulation or other SPICE model simulation to develop new Verilog-A model code and parameters
- Interactive rubberband sliders allow parameter limits to be quickly explored
- Compare model versions
- Side-by-side development of the Verilog-A model and the extraction strategy for the model

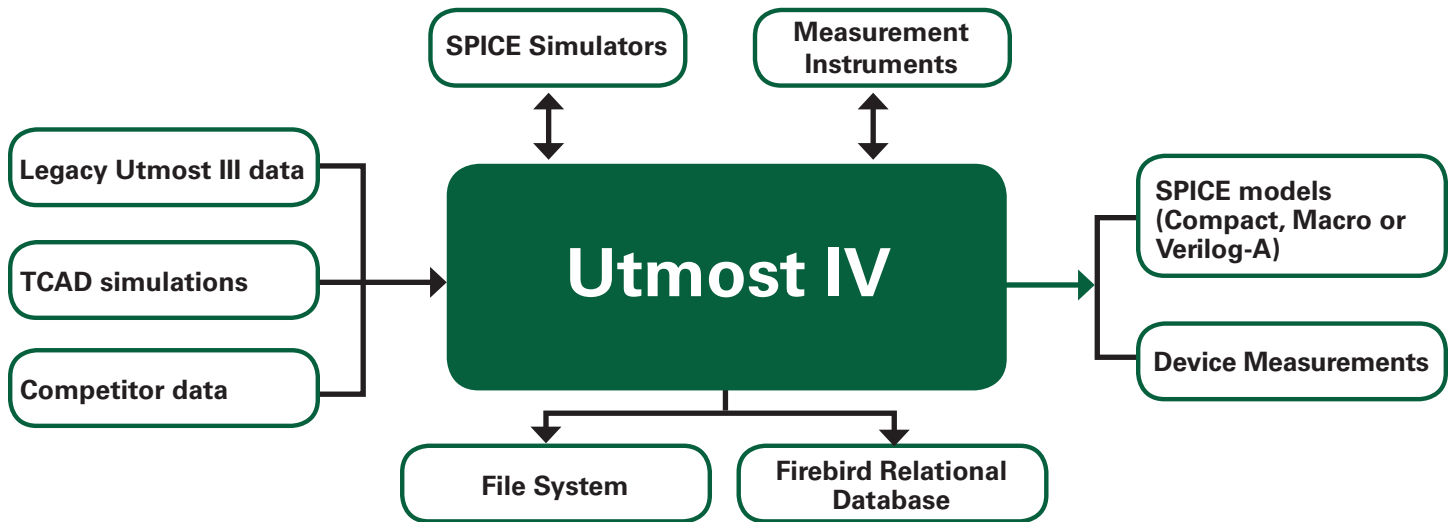
Using TCAD Simulations to Generate SPICE Models

- Full TCAD process simulation to SPICE model generation flow
- Provide 'level 0' SPICE models to designers even before the process is available
- Compare TCAD simulations with measured data from the process
- Combine TCAD and measured data to develop SPICE models
- Seamless integration with DeckBuild and VWF tools

Optional Relational Database Organizes Your Work

- As well as normal file storage, Utmost IV offers a relational database to store your measurement data and projects
- Avoids storage and duplication of thousands of separate data files in difficult to locate file systems
- Provide controlled access to information with full user and group permission settings
- Facilitates sharing and easy retrieval of data
- Database is proven Borland Firebird relational database

Utmost IV Inputs/Outputs



SILVACO

HEADQUARTERS

4701 Patrick Henry Drive, Bldg. 2
 Santa Clara, CA 95054 USA
 Phone: 408-567-1000
 Fax: 408-496-6080



CALIFORNIA

sales@silvaco.com
 408-567-1000

MASSACHUSETTS

masales@silvaco.com
 978-323-7901

TEXAS

txsales@silvaco.com
 512-418-2929

JAPAN

jpsales@silvaco.com

EUROPE

eusales@silvaco.com

FRANCE

eusales@silvaco.com

KOREA

krsales@silvaco.com

TAIWAN

twsales@silvaco.com

SINGAPORE

sgsales@silvaco.com

CHINA

cnsales@silvaco.com

WWW.SILVACO.COM