SILVACO

DEVICE CHARACTERIZATION AND MODELING

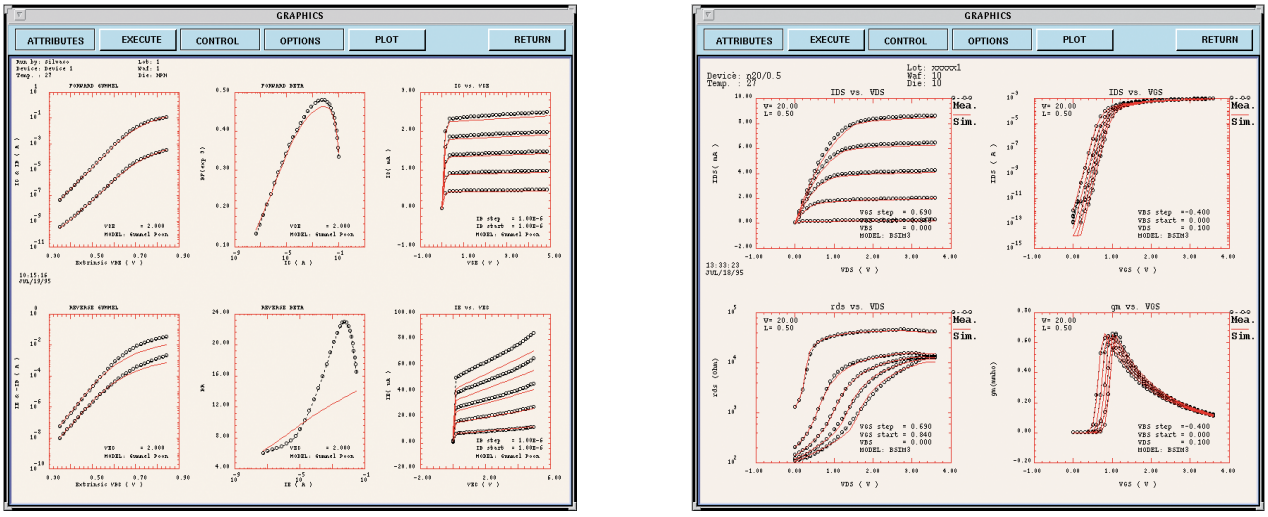
UTMOST III generates accurate, high quality SPICE models for analog, mixed-signal and RF applications. UTMOST III is in use worldwide by leading IDMs, foundries and fabless companies to perform data acquisition, device characterization, model parameter extraction and model verification.

- **UTMOST III supports the characterization and model extraction for MOS, BJT, Diode, JFET, GaAs, SOI and TFT devices**
- **UTMOST III provides the widest selection of measurement equipment from a variety of vendors**
- **Fully interactive, semi-automated or batch-mode operation is supported**
- **Real-time model tuning using the rubberband feature**
- **Integrated with Silvaco TCAD Software and SPAYN statistics program for smooth development of pre-silicon models**
- **Supports all leading SPICE simulators**
- **Silvaco's strong encryption is available to protect valuable customer and third party intellectual property**

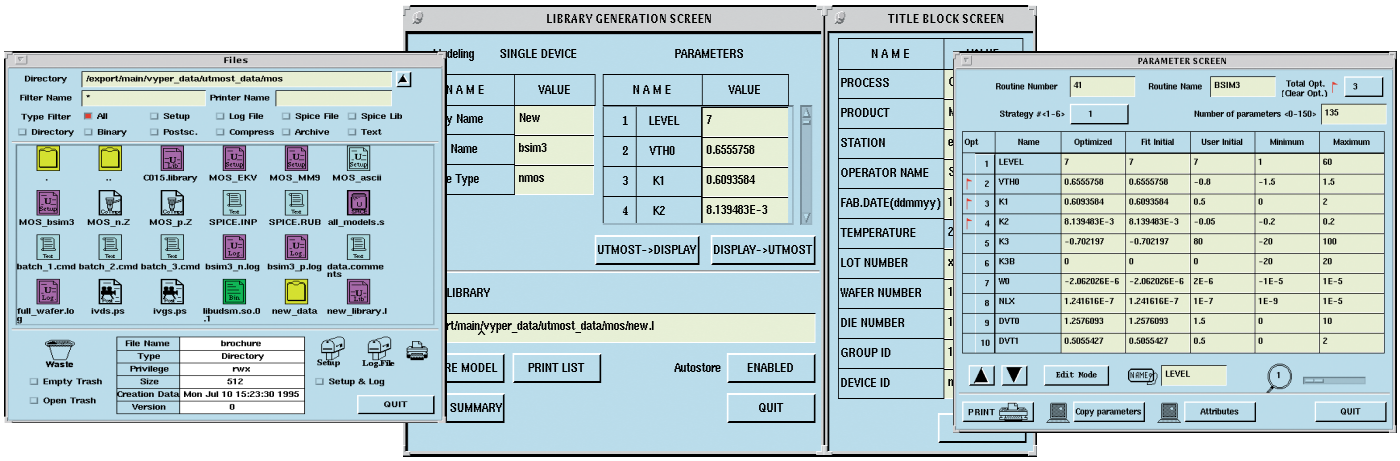
TOKEN

Test and Analysis Environment

- Flexible measurement and analysis environment for device characterization and model generation
- Supports widest selection of instrument drivers, prober drivers, device models, operating platforms, and commercial circuit simulators
- Splits device characterization and/or modeling problems into separate measurement and analysis tasks
- Stores measured results in measurement log files for future analysis (search, averaging) so that valuable probe time is minimized
- Common data sets can be used to extract more than one model type
- Supports single test or step-and-repeat operation
- Extracts parameters by using comprehensive library of built-in extraction algorithms, flexible user-defined local optimization strategies, more interactive global optimization procedures, or a combination of all three
- Stores extracted parameters in multiple formats, including SPICE library formats that can be read back into UTMOST III as an initial estimate during future model extractions



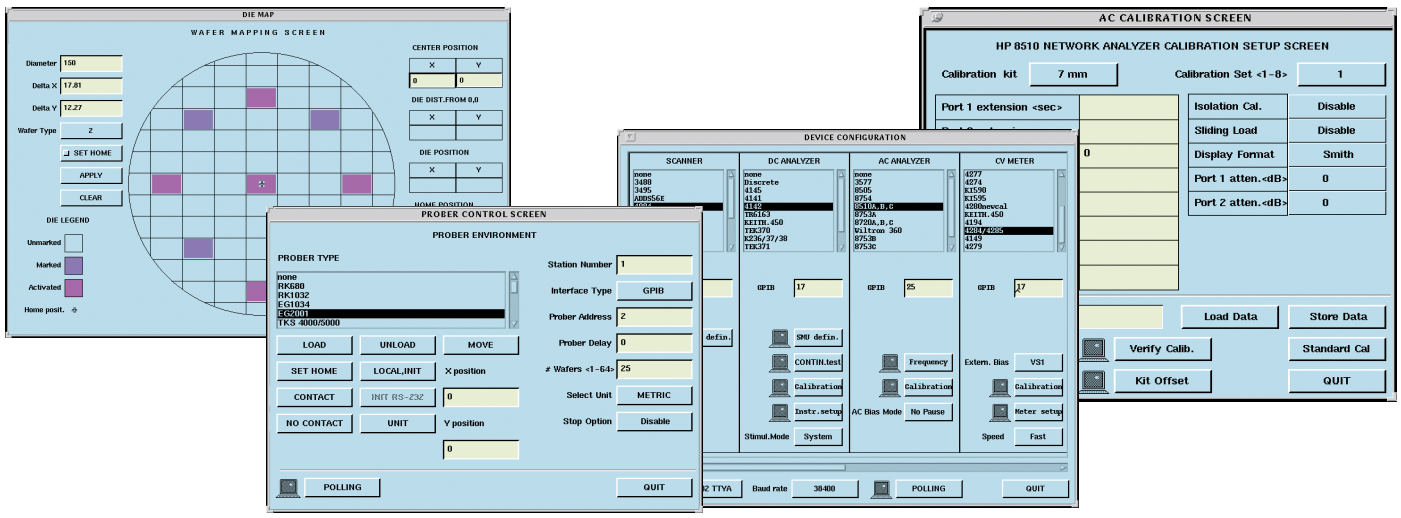
UTMOST III acquires measured or TCAD simulated data, extracts parameters, and delivers accurate, high quality SPICE models.



UTMOST III addresses the practical needs of device characterization and modeling engineers with a flexible, productive workflow

Data Acquisition

- Drives most commonly used DC analyzers, AC analyzers, capacitance meters, switching matrix controllers, pulse generators, and oscilloscopes
- Controls most commercial automatic and semi-automatic probers
- Drives many temperature ovens and hot chucks
- Fully interactive, semi-automatic, or batch-mode operation
- Step-and-repeat operation, including wafer cassette control
- Comprehensive selection of DC, AC, transient, and capacitance test routines for MOSFET, BJT, Diode, JFET, GaAs, SOI, TFT, and HBT modules
- Performs all required measurements on packaged devices or on wafer
- Interfaces to process and device simulators and to the SPAYN Statistical Parameter Analysis tool
- Supports the widest variety of models and circuit simulators



UTMOST III provides intuitive and comprehensive menus to select and drive all of the required instruments for device data acquisition.

UTMOST III supports the widest selection of instruments

DC Analyzers
B1500A
HP4141
HP4142
HP4145
HP4155/56
Keithley 236
Keithley 237
Keithley 238
Keithley 4200
Keithley S450
Tektronics 370/370A
Tektronics 371/371A

AC Analyzers
HP3577
HP8505
HP8510A,B,C
HP8720A,B,C,D,E
HP8722D
HP8751
HP8753A,B,C,D,E
HP8754
Wiltron 360

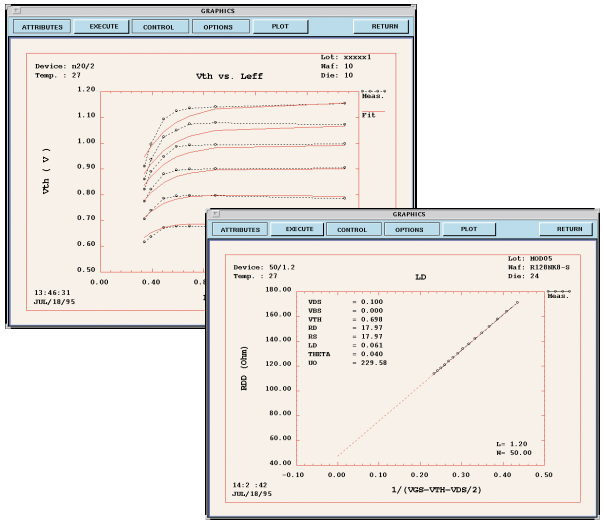
Scanners
B2200/B2201
HP3488
HP3495
HP3852A
HP4084
HP4085
HP4086
Keithley 705
Keithley 706
Keithley 707
Keithley 7002
RACAL 1251

Capacitance Meters
B1500A-B1520A
HP4262
HP4271
HP4284
HP4285
HP4192
HP4194
HP4274
HP4275, HP4276, HP4277
HP4279
HP4280
HP4294A
E4980A
Keithley 590
Keithley 595

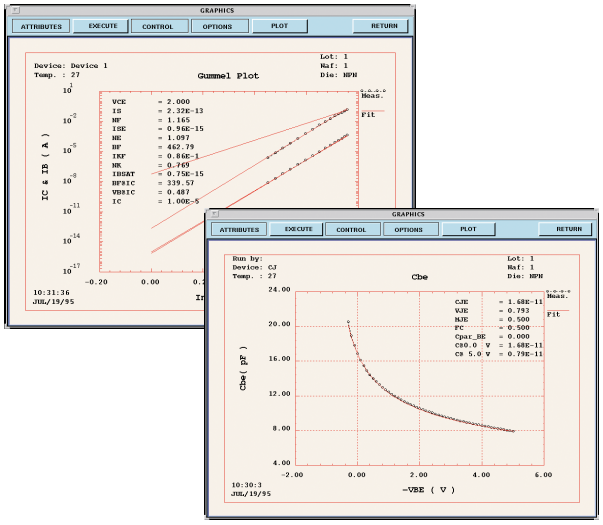
Probers
Alessi 4500
Alessi 5500
Cascade Summit
Electroglas 1034
Electroglas 2001
Electron
Karl Suss (PE100/PA200 II)
RK 680
RK 681
RK 1032
TKS 3000
TKS 4000
TKS 5000
TKS 6000
Tokyo
Wentworth MP-1100

Parameter Extraction

- Includes comprehensive set of DC extraction routines for process-monitor and device model parameters
- Flexible local optimization procedures for any supported model as substitute or supplement to built-in routines
- Supports bipolar routines to extract resistances, breakdown, saturation, leakage, forward and reverse gain, early voltage, knee current, bipolar junction capacitance, and basic Gummel-Poon parameters from DC measured characteristics
- Provides AC extraction routines for cut off frequency, forward and reverse transit time, base resistance, and excess phase parameters
- Extracts DC MOSFET parameters including length reduction, width reduction, threshold voltage, low-field mobility, body effect, velocity saturation, resistance, breakdown, and subthreshold slope parameters
- Supports the extraction of overlap and junction capacitance parameters



UTMOST III extracts MOSFET parameters, including BSIM4.



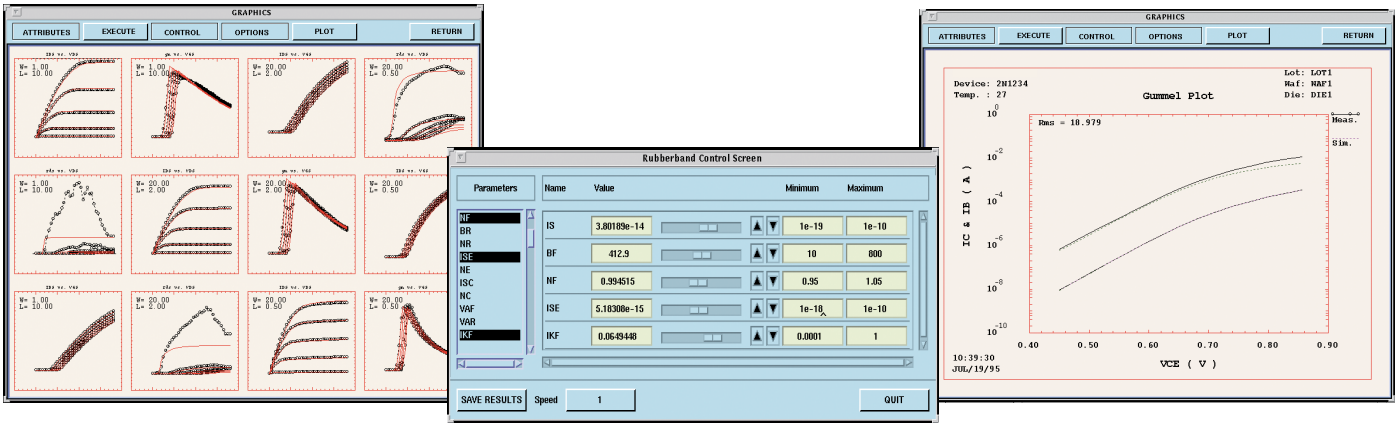
UTMOST III extracts parameters for Bipolar (above), Diode, JFET, GaAs, SOI, TFT, HBT, and passive devices for RF.

Advanced Parameter Extraction

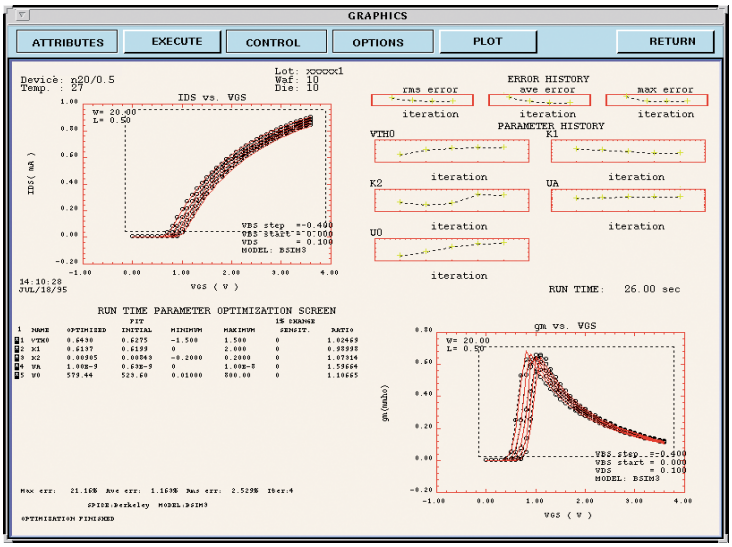
- SOI module permits characterization of all transistor properties, including 4/5 terminals device, bipolar parasitic effects, and Body or BackGate currents
- Measured s-parameters can be converted to h, z, and y-parameters
- Supports standard, calibration and two step de-embedding procedures for correct measurement of s-parameters
- Includes special extraction algorithms for the extraction of BSIM1, BSIM2, BSIM3, BSIM4, MOS9 and MOS11 parameters, for single or multiple geometries
- Universal multi-target / multi-geometry measurement routine for SOI and MOS technology
- Gate current measurement and parameter extraction routine for BSIM4, MOS11

Parameter Optimization

- Offers flexible local optimization facility and global parameter optimization boundary boxes
- Optimize multiple device geometries simultaneously (up to 36 devices) and mix device currents and conductances as optimization targets
- Rubberband interactive parameter extraction enables modeling engineers to observe the effects of parameter variations on device characteristics
- Supports single or multi-geometry optimization with graphical updating of simulated characteristics
- Supports multi-step optimization all in real-time
- Supports graphical parameter sensitivity and quality-of-fit information



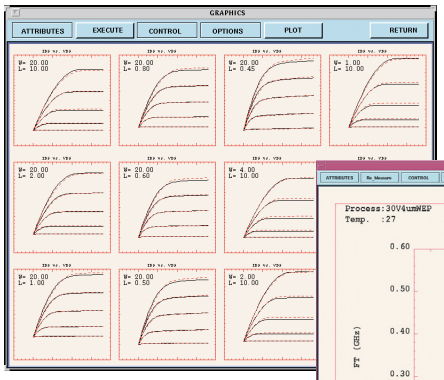
Optimized MOS model (left), Rubberband user interface (middle), and Optimal Bipolar model results (right).



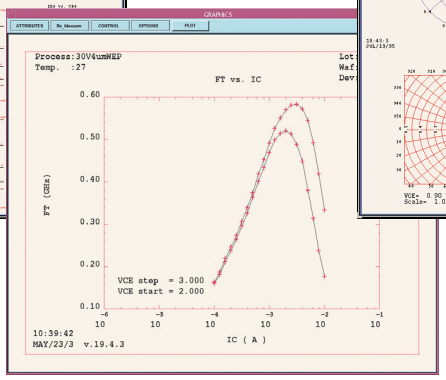
UTMOST III supports Levenberg-Marquadt and Downhill Simplex optimization methods.

Model Generation

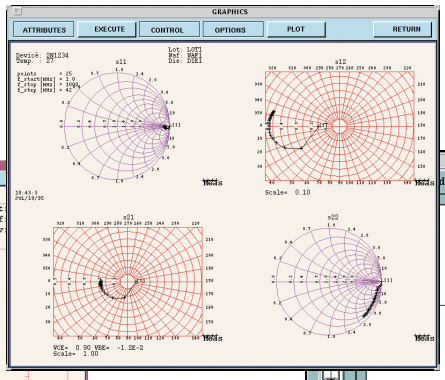
- Supports widest selection of commercially available device models
- Generates models for SmartSpice, HSPICE, Spectre and ELDO
- Offers fast built-in SPICE simulation library (ModelLib statically linked: cannot benefit from flexibility as UTMOST IV)
- External SPICE mode allows you to connect to any SPICE simulator
- Supports the conversion of model parameter sets from one model to another
- Macro modeling and parameter extraction is available for devices which cannot be adequately modeled by any existing device models
- User-defined models linked dynamically
- Support for SmartSpice interpreter models
- Fast simulation using ModelLib Model and Fast internal solver



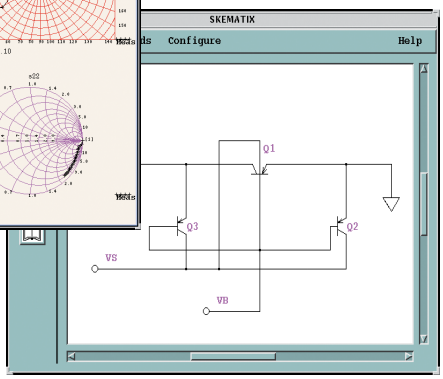
BSIM4
Multigeometry extraction.



F_T **vs** I_C for Bipolar RF device.



s-parameter
for RF
Bipolar device.



Macro Modeling capability.

Supported SPICE Models

MOSFET models

Berkeley Level 1
Berkeley Level 2
Berkeley Level 3
BSIM1
BSIM2
BSIM3
BSIM4
BSIMMG
BSIM5
PSP Level 1000
Philips Level 9
EKV
LDMOS Level 20
Philips Level 11
User models
HV MOS Level 88
HiSIM
Philips 30
Philips 31

Bipolar models

Gummel-Poon
Quasi RC
IGBT
QBBJT MEXTRAM
HBT
HICUM
MEXTRAM504
User models
Mextram 503
VBIC95
Philips Modella

SOI model

Honeywell
FLORIDA FD
FLORIDA NFD
BSIM3SOI FD
BSIM3SOI DD
BSIM3SOI PD
STAG SOI
CEA/LETI
User models

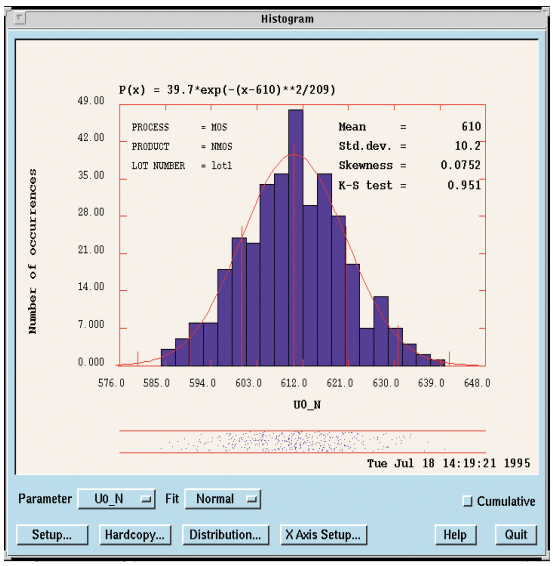
MESFET model

JFET
Statz
Curtice 1
Curtice 2
User models
TriQuint
TriQuint 3
Parker-Skellen

TFT models

Amorphous TFT
Polysilicon TFT
RPI a-Si
RPI p-Si
User models

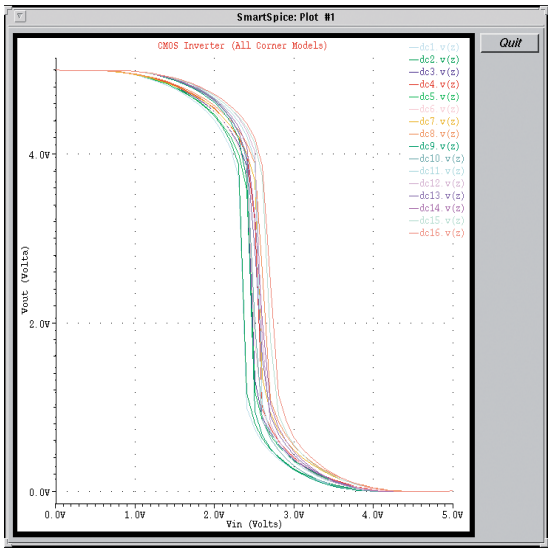
Batch-mode operation.



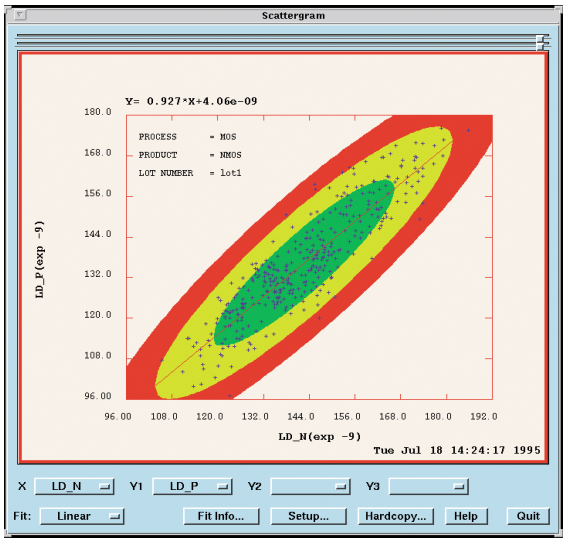
Mobility histogram.

UTMOST III Operation

- Operates in manual, semi-automatic, automatic, and batch mode operation
- Includes technology modules for MOS, Bipolar, Diode, JFET, GaAs, SOI, TFT, and HBT
- Automatically converts TCAD device characteristics from TCAD process and device simulations
- Performs detailed parameter extractions on TCAD data in batch mode to develop nominal and worst-case models for a process under development
- Stores model parameters and device characteristics in SPAYN format for statistical parametric analysis and worst-case model definitions



Statistical slew of MOS.



Scatter plot of drain length.

Spice Modeling Services

- Leader in supplying accurate SPICE models from wafers or packaged parts
- Aggressive in providing cost effective models with rapid turnaround
- Model extraction provided for MOS, Bipolar, Diode, JFET, GaAs, SOI, TFT, HBT
- Extraction of DC, AC (s-parameters), capacitance, temperature, noise, SPICE parameters
- Temperature range from -55 degrees C to + 150 degrees C
- All commercially available SPICE models supported
- Model validation in accordance with Global Semiconductor Alliance (GSA), Compact Modeling Council, and IEEE test procedure #P1485 recommendations
- Worst-case and corner model generation

UTMOST III Inputs/Outputs

SILVACO

HEADQUARTERS
4701 Patrick Henry Drive, Bldg. 2
Santa Clara, CA 95054 USA
Phone: 408-654-4309
Fax: 408-496-6080

JAPAN	jpsales@silvaco.com
EUROPE	eusales@silvaco.com
KOREA	krsales@silvaco.com
TAIWAN	twsales@silvaco.com
SINGAPORE	sgsales@silvaco.com

CALIFORNIA	sales@silvaco.com 408-567-1000
MASSACHUSETTS	masales@silvaco.com 978-323-7901
TEXAS	txsales@silvaco.com 512-418-2929
ARIZONA	azsales@silvaco.com 480-947-2900

WWW.SILVACO.COM

Rev. 101410_21