Automating On-Wafer Measurements with the new Agilent IC-CAP WaferPro

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WaferPro Webcast
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Agenda

• On-Wafer Semiconductor Devices Measurements Challenges
• Introducing IC-CAP Wafer Professional (WaferPro)
• WaferPro Technical Overview and Benefits
• WaferPro Demonstration (15 minutes)
• Q&A (15 minutes)
Measurement Challenges

Measurements for device modeling, characterization and verification are more accurate, extensive and more time consuming than production measurements. Measurement efficiency is becoming more and more critical as models for smaller technology nodes requires higher volume of measured data.

Data collection varies across temperature, spending several hours to acquire data at each temperature.

Need to support different test stations, device types, probe cards and a variety of measurement algorithms (DC, CV, RF and time domain). Data must be post-processed. Need to be flexible and organized.

IC-CAP WaferPro provides answers to these questions!
What is IC-CAP WaferPro?

Define and run Test Plans for automated measurement of semiconductor wafers.

- Designed in partnership with our customers, solves real measurement needs
- Add-On product that runs in the IC-CAP environment
  - Has application windows for managing test plan projects and wafer map.
  - Links to IC-CAP measurement, simulation and graphics engines.
  - Allows users to design and manage user-defined measurement algorithms
How WaferPro Works

IC-CAP Environment
- Measurement Routines, Data processing, Graphics
- Instrument Drivers
- GPIB/Opt Interface

WaferPro
- Wafer Map
- Device Tables
- Test Plan Definition
- Test Plan Run

Instrument Bus
- Prober
- Thermal Chucks
- Instruments & Testers

File System

Database (future)
How to increase measurement efficiency

1. Use High-Throughput Measurement Equipment
   - Automated Testers (e.g. Agilent 4080 Series, 41000)
   - Upgrade Equipment (e.g. Agilent 8510C to Agilent PNA)
   - Parallel Measurements

2. Optimize Lab Equipment usage
   - Unattended Measurements vs. Temperature
   - Full use of all the Test Stations

3. Optimize measurement algorithms
   - Adaptive measurements
   - Monitor results real time
   - Run prior simulated test to check test plan and routines
Support for full and semi-automated Probers

• IC-CAP WaferPro works out of the box for most wafer probers, switching matrixes and thermal chucks

• If needed, WaferPro Drivers are open and fully customizable to support any prober/thermal chuck or switching matrix that can be driven through GP-IB
### Supported Instruments/Probers

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<th>Wafer Probers</th>
<th>Switching Matrix</th>
<th>Thermal Controllers</th>
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<tr>
<td>Cascade PS21</td>
<td>Agilent 4070</td>
<td>Accretech</td>
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<tr>
<td>Cascade Summit</td>
<td>Agilent 4080</td>
<td>Cascade Summit</td>
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<td>Semi-automated Stations</td>
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<td>Accretech UF3000/UF200</td>
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<td>Tokyo Electron (TEL)</td>
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- All IC-CAP supported instruments works with WaferPro via GPIB control
- Parametric Testers 4070, 4080, 41000 Series
- DC Analyzers (B1500A, B1505A, E5270, 4142B, 4156C, etc)
- C-V Meters and Impedance Analyzers
- VNA (PNA, ENA, 8510C, etc.)
Measure 24/7 with unattended Automated Measurements Across Temperature

- A temperature change causes wafer and prober chuck to expand/contract in all directions causing miss-alignment between wafer and probe card. Probe cards tips will not land on pads or in case of height change, probe tips may not make good contact or even damage the contact pads.

- WaferPro utilizes Prober Software own re-alignment routine if available (best) → support for Cascade ReAlign/VueTrack© pattern recognition technology

- An internal algorithm facilitates a smoother temperature transition. The algorithm changes the temperature gradually and re-align multiple times. An option allows continuing alignment during measurements.
Unattended Testing Over Multiple Temps by Cascade Microtech

Utilize the nights and the weekends!

Increase significant the test cell efficiency & productivity!

Faster Results:
→ Faster Time to Market
→ Higher System Utilization

This slide provided by:
Lab Equipment Independent Test Plan (.xml format)

- Bench Config
- Wafer map
- Device Info
- Device Lists
- Meas Routines
- Wafer, Temp

WaferPro Testplan (.xml)

Bench 1

Fully-automated 407x Parametric Testers

Bench 2

Semi-automated B1500A + B2200A

Bench n

Etc.
Real time monitoring

Monitor location, status, results and data during execution.

Skip device, die or abort test plan when error result occurs

Status emails are sent during test plan execution.
Powerful and flexible measurements environment

- Users may create a Library of measurement algorithms (or Routines) for various device types (e.g. MOS, BJT, etc.) and conditions
- Supports sweep and spot, DC/CV and RF measurements.
- Supports the implementation of adaptive measurement algorithm (e.g. measure Vth first and then based on its value, modify the measurement settings or flow)
- Any n-terminal device (MOS, DIODE, passives, etc.) can be defined in the WaferPro environment
Before demoing... Wafer Terminology

- Photolithography
- Reticle
- Scribe Line
- Block (=Group of Subsites)
- Subsite (dx, dy)
- Die
  - *Multi-TEG Type Wafer
  - Pad

Agilent Technologies
WaferPro Key Benefits:

“By using WaferPro and the Agilent PNA, we cut our fT mapping test plan measurement time by 5x”

WaferPro customer

- Employ Parametric Systems to significantly cut the measurement time vs. bench top instruments
- maximize lab equipment usage (24/7) with automated measurements vs. temperature
- one software and one test plan to drive all the bench stations in the lab
- Real time monitoring provide updates on the measurement status
Where to find Information about WaferPro

IC-CAP WaferPro Webpage:
http://www.agilent.com/find/eesof-waferpro

WaferPro White Paper:

IC-CAP Device Modeling Software:
http://www.agilent.com/find/eesof-iccap

Download and trials: