

Wafer-level reliability measurements speed your time to accurate results

TRENDS

IC device and process reliability have always been highly dependent on a thorough understanding of the underlying reliability physics. Today, new materials and shrinking device geometries are compounding the challenges of achieving fast and accurate reliability data. Advanced semiconductor processes have aggressively scaled devices with ultra-thin gate dielectrics, high-k materials and shorter channel lengths. Qualifying these scaled processes and devices requires fast and accurate data to assess the overall reliability and projected lifetime-in-use.



In step with the ITRS roadmap, Cascade Microtech's application experts have paid close attention to your mounting reliability measurement challenges. In-package reliability measurements can provide accurate data, but in the face of smaller market windows, the added time and expense of this methodology are unacceptable. Furthermore, interconnect and bond wire electrical issues can render in-package reliability data to be inaccurate and unreliable. Today, Cascade Microtech's advanced Wafer-Level Reliability (WLR) probing solutions are enabling multi-site reliability measurements that are more accurate than in-package measurements, and add the significant benefit of delivering the critical data much faster.

WLR CHALLENGES

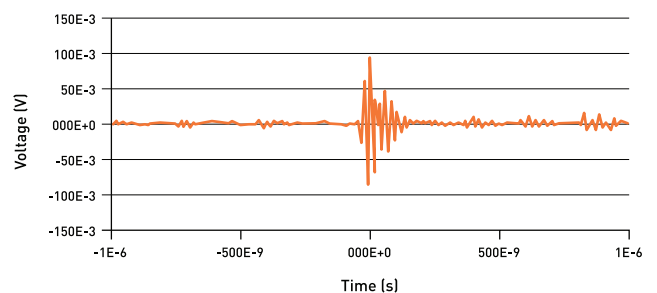
Smaller Test Pads As test-pad sizes scale down to $30\mu\text{m}^2$ and below, obstacles such as thermal expansion, wafer flatness, planarity and stepping accuracy have made it extraordinarily difficult to accurately land probe needles onto small pads with good contact during step-and-repeat wafer measurements. Additionally, needles with improper or non-repeatable pad "skate" or "scrub" will lead to inaccurate measurement data.

Thermal Measurements In order to increase IC performance, quality and yield, more and more reliability data is required. In turn, you need to make measurements at higher temperatures and over wider temperature ranges. To date, inadequate temperature range, slow thermal transition and limited thermal test capabilities have compromised user productivity, throughput, plus the quality and quantity of data collected.

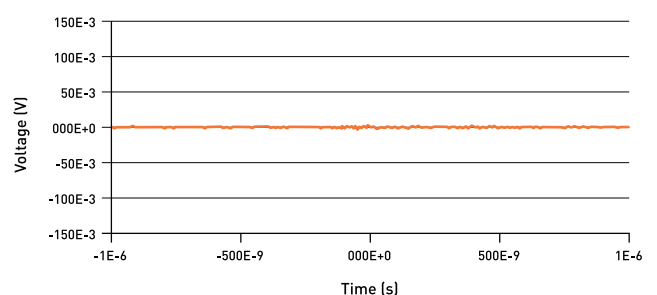
Multi-Site Testing For some reliability measurements, such as Time-Dependent Dielectric Breakdown (TDDB) measurements, parallel multi-site testing is essential to increase productivity and speed throughput. Yet existing multi-site testing solutions have been riddled with complex setup issues. It is very difficult to verify all needles are making proper contact when aligning today's advanced probe cards.

Low-Noise Measurements Today's lower operating and bias voltages, plus new materials have compounded the challenges of making accurate, low-level reliability measurements. To reliably detect low-level oxide soft breakdown parameters requires a state-of-the-art, low-leakage, low-noise probing system.

Chuck Noise with competitive solution at 200°C



Chuck Noise with PureLine™ at 200°C



As device operating voltages scale down, even small stress inaccuracies (10mV) can result in a 200x error. As this comparison shows, Cascade Microtech's PureLine ensures TDDB measurement accuracy by providing lower conducted emissions, ultra-low substrate noise and much better controlled stress voltage.

SOLVING TYPICAL WLR MEASUREMENT CHALLENGES

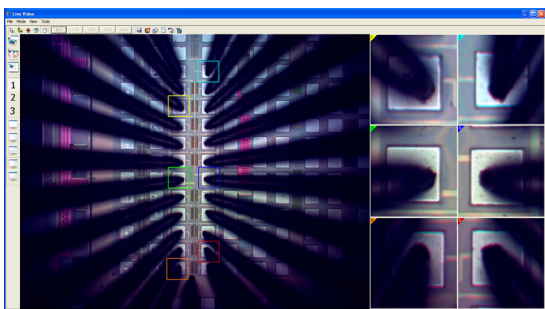
Characteristic	Test	Challenge	Cascade Microtech's Solution
Vth Stability	PMOS NBTI (negative bias temperature instability)	Requires measurements at maximum operating temperature	Low-noise, high-temp, multi-site probe cards
Hot-Carrier Injection	Charge Pumping (Icp)	Wafer chuck adds noise to bulk-substrate current	Ultra-low-noise injection thermal chucks
Ionic Contamination	Triangular Voltage Sweep (TVS) 300°C	Noisy and unreliable probes	High-temp, low-noise ceramic probes
Oxide Integrity – Soft Breakdown	Stress-Induced Leakage Current (SILC)	Low-leakage levels difficult to measure	Ultra-low-level measurement capability
Oxide Integrity	Single-Site, Time-Dependent Dielectric Breakdown (TDDB)	Time-consuming stress intervals	Multi-site probe card support – up to 54 sites

CASCADE MICROTECH'S WLR SYSTEM CONFIGURATION

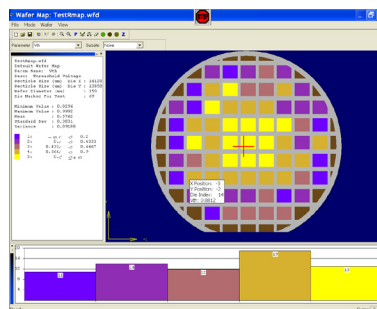
Probe Station	Summit 12K 200mm or Elite 300 300mm, semiautomatic probe station with MicroChamber®, AttoGuard®
Microscopy Systems	eVue™ digital imaging system Large-area travel microscope bridge
Thermal Systems	-65° to 300°C thermal chuck options
Probe Card Holders	Custom probe-card mounts for Celadon and other popular reliability probe cards
DC Probes and Needles	DCP-HTR, high-temperature triaxial probe

FEATURES & BENEFITS

200mm & 300mm Wafer Probing Stations	Each has been optimized for high-accuracy, on-wafer electrical measurements.
MicroChamber	Localized measurement enclosure provides electrostatic and electromagnetic shielding for noise-free measurements. Unlike large, cumbersome dark boxes, the MicroChamber enclosure provides a dark and electrically shielded environment, while allowing external access and control of microscope and probes.
AttoGuard	Integrated guarded shield extends the source measurement unit (SMU) guard over much of the wafer, reducing stray capacitance for faster and more accurate measurements. Such a guarded system reduces measurement electrical settling time.
eVue Digital Imaging System	True optical magnification radically improves wafer navigation, measurement setup, and probe contact accuracy. Unprecedented control over probe overdrive improves data accuracy.



With eVue, multiple perspectives of the device under test can be viewed simultaneously for easy and efficient large-area probe card setup and alignment.



Use Vth measurement data wafer map for pre-production reliability evaluation.

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