

PROBE

WORKSTATION



PROBE WORKSTATION

The ProbeWorkstation is a powerful, dedicated system for electrical characterization of semiconductor devices and advanced materials in SEM and FIB.

The optimal combination of our market-leading nanomanipulation and probing products provide you with a versatile, integrated solution for failure analysis and R&D applications requiring stable, low-current measurements.

The system is optimized for electrical measurements on semiconductor technologies down to 7 nm and beyond. It offers unsurpassed stability, extreme precision, and the flexibility to allow you to configure your setup to meet your specific needs.

APPLICATIONS

Failure analysis

Qualifying high κ gate materials

Low-current transistor testing

Four-point probing

EBIC, EBAC, RCI, EBIV, EBIRCH, and Active Potential Contrast analysis

Current Imaging

Characterization of advanced materials and structures e.g. nanowires, ultra-thin films

Nanoscale assembly and manipulation

COMPONENTS

Up to eight micromanipulators with low-current measurement capability

Precision substage with three axes for independent sample positioning

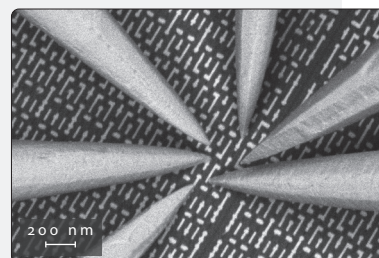
Shuttle load-lock platform

EBIC Characterization System

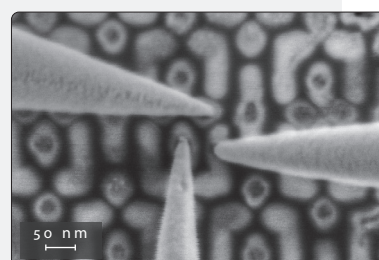
Advanced Probing Tools GUI:
An advanced software suite for maximum probing efficiency - including the following modules:

- iProbe
- Live Contact Tester
- Tip 2 Tip Tester
- Transistor Test
- Safe Tip Approach
- EBIC control
- Current Imaging module
- Keithley Remote access
- Tip Cleaning

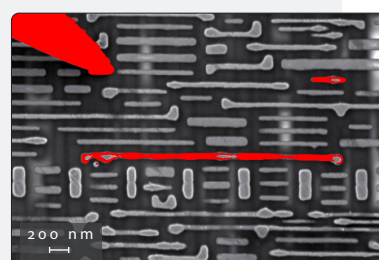
Electronics rack



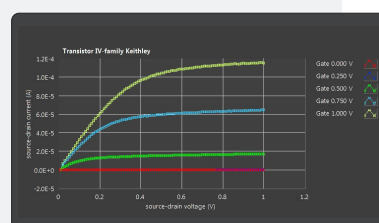
Six probes in contact with a 14 nm sample



Three probes in contact with a 7 nm sample



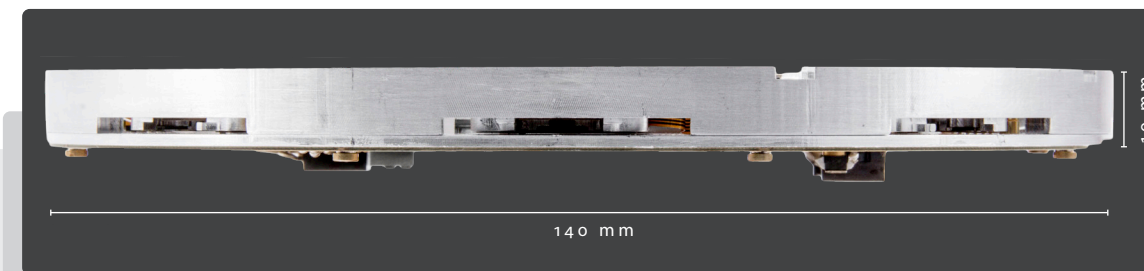
EBAC imaging on a 7 nm device



I-V curves from a transistor built in 7 nm technology



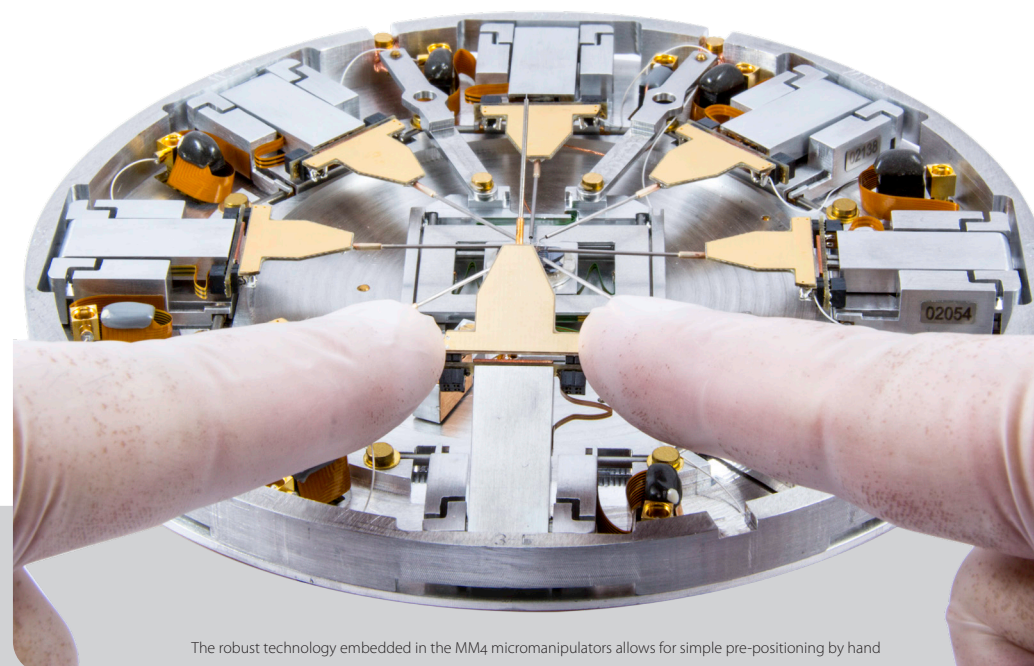
Current Imaging map on 22 nm technology
The arrow indicates the location of a leaky gate...



Actual size Side view of the Prober Shuttle with eight probes

Next generation technology has allowed us to dramatically reduce the size of our micromanipulators. This innovation, coupled with our new Shuttle platform, has enabled the creation of the world's smallest load-lock compatible probing system.

A load-lockable system offers the advantages of higher throughput, fast probe tip exchange, reduced sample contamination and unrestricted access to the microscope when the probe system is not required.



The robust technology embedded in the MM4 micromanipulators allows for simple pre-positioning by hand

Contact us at info@kleindiek.com

or find your local agent at www.kleindiek.com

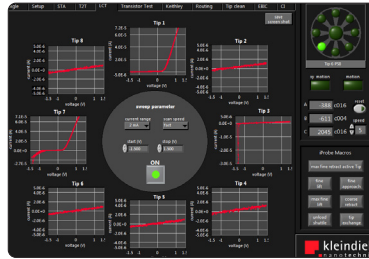
Advanced Probing Tools

A suite of hardware and software components for electrical probing with ease.

The totally redesigned and rebuilt iProbe control interface is now fully integrated into the Advanced Probing Tools software suite. It includes a series of macros for driving the probe tips. The streamlined interface allows intuitive control of all micromanipulators as well as the substage using the microscope's mouse and keyboard.



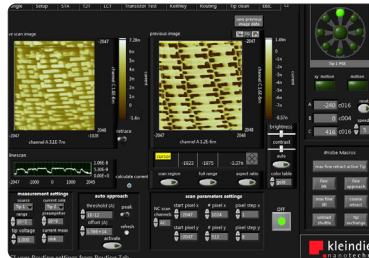
The APT wizard provides detailed, animated step by step instructions for a number of tasks.



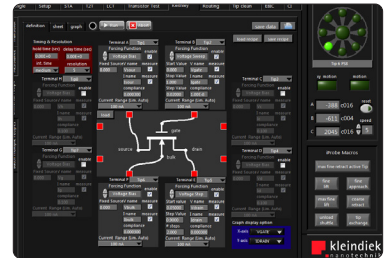
The Live Contact Tester yields real-time visual feedback on each tip's contact to the substrate



Transistor Tester: ultra-fast scans on the contacted transistor in order to validate the probes' positions



The Current Imaging system is used to generate current maps - similar to pico-current cAFM.



The integrated Keithley recipe builder allows creating and storing pre-configured recipes that can be run in batches

System Features

- SEM and FIB **load-lock compatibility** – for fast cycle times and increased chamber cleanliness.
- Simple integration into your existing SEM or FIB/SEM tool.
- Streamlined, **low-leakage triax cabling** between 19" electronics rack and SEM flange
- Software controlled **signal switching matrix**, no rewiring necessary
- Completely **nonmagnetic materials**: compatible with any SEM/FIB (including "immersion lens" type columns)
- **Low profile design** allows for small working distances down to 2 mm - enabling **low-kv imaging**
- Probing at FIB tilt for in-situ **circuit edit** applications
- Compact, extremely stable design guarantees < **1 nm/min drift**: ready for **7 nm and beyond**
- Live Contact Tester provides real time IV-traces: **quickly optimize contact resistance**
- Integrated Scanning Probe Microscope: **Current Imaging** module can be used to scan a probe or the substage using well-defined current paths
- Electrical Fault Isolation using **EBIC**, EBAC, EBIV, RCI, EBIRCH, etc. Easy integration using the microscope's auxiliary video input, EBIC image acquisition by SEM software.
- Tip Clean module provides a means for **decontaminating tips in-situ**
- Single **unified software interface** (APT) for driving the probe tips and controlling all measurement functions (incl. Keithley 4200 operation)
- Vacuum side hardware **compatible with in chamber plasma cleaning** (Evactron, IBSS, FEI, ...)
- Keithley recipe builder for **custom recipes** and batch processing
- Air side hardware housed in 19" electronics rack that can be parked out of the operator's sight - thus contributing to a **tidy work environment** as well as making it easy to **move the nanoprobe** from one tool to the next

Precision positioning capabilities

- Probe operating range A 5 mm, B 90°, C 5 mm
- Probe Resolution A < 0.02 nm, B < 0.5 nm, C < 0.02 nm
- Substage operating range X 9 mm, Y 9 mm, Z 0.7 mm
- Substage resolution XYZ < 0.02 nm
- Low drift 1 nm/min
- Fast pre-positioning by hand
- No backlash, creep or reversal play

EBIC Characterization System

- Detect 'opens' in integrated circuits
- Visualization of *p-n* junctions
- Localize resistivity changes in via chains
- Adjustable video output level
- Gain 10⁴ to 10¹⁰ V/V

Current Imaging System

- Similar to cAFM and pico-current imaging
- Generate map of current flow
- Arbitrary current paths configurable
- Quickly navigate to ROI in SEM
- Generate images in a manner of seconds
- Quickly locate opens/shorts/leakages in scanned area

Probe needles

- Tungsten needles with tip radii down to 5 nm
- Individually packaged in protective atmosphere and ready for use without further processing
- pre-bent tips available upon request
- easy tip exchange outside the microscope

A = LEFT/RIGHT
B = UP/DOWN
C = IN/OUT