4080 Series of Parametric Testers

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Introduction

Advanced measurement challenges require new solutions

Semiconductor manufacturing processes and new process technologies have created difficult challenges for production parametric test systems

- Variations in device parameters at and below the 20/28 nanometer level are much harder to control, and require much more parametric test data to be captured than in the past.
- The use of "technology boosters," such as high-k gate dielectrics, strained silicon or FinFET, necessitate more and different types of testing than in previous generations of silicon.
- The pulse generation requirements of state-of-the art flash memory cells have exceeded the capabilities of previously available parametric testers.
- With the continued demand for higher-speed operation of semiconductor devices, the measurement of gate delay and interconnect delay has become more important than ever.

These factors demand new and more innovative test methodologies to keep pace with the needs of production parametric wafer testing.

The 4080 Series Overcomes Difficult Process Test Challenges

Keysight's solutions represent a revolutionary improvement in production parametric testing. The 4080 series is designed to meet the measurement challenges presented by both current and cutting-edge semiconductor technologies.

The 4082A Parametric Test System is a high-throughput production parametric test system with advanced testing capabilities, high-frequency switching matrix option, a high-speed capacitance measurement option, and full support for SEMI factory automation standards.

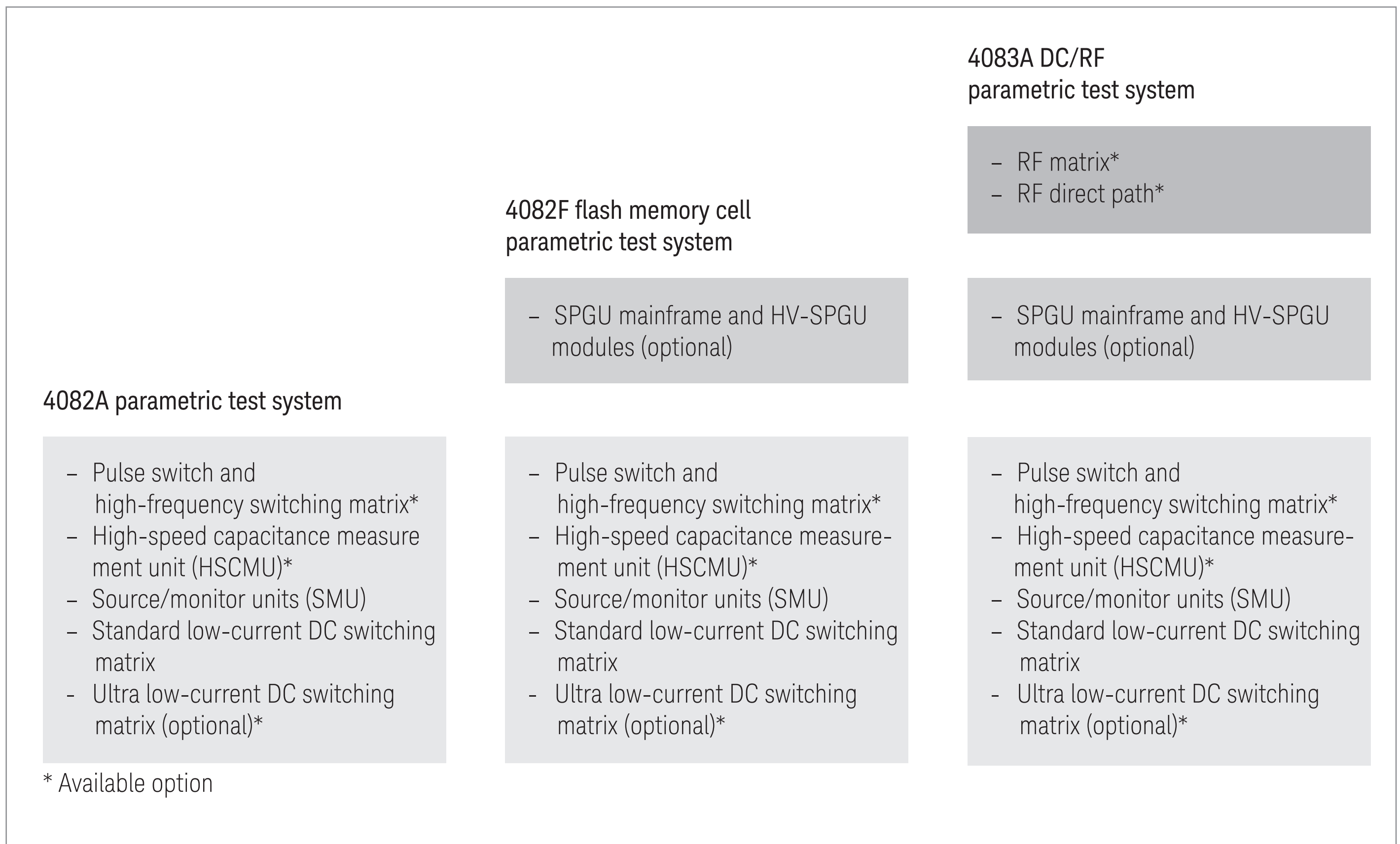
The 4082F Flash Memory Cell Parametric Test System supports new high-voltage semiconductor pulse generator (HV-SPGU) modules with pulsing capabilities, which are optimized for the characterization of state-of-the-art flash memory cell technologies.

The 4082A's and 4082F's revolutionary test capabilities provide benefits for both current and advanced production parametric test.

An efficient and complete parametric test solution requires exceptional software in addition to superior hardware. To meet these requirements, the 4080 series has a versatile system software environment that is compatible with SPECS or SPECS-FA test shells.

For users who have RF device testing needs by PNA Network analyzer, the 4083A offers optional 8 x 10 RF matrix capabilities which improves RF test throughput and extends probe card life for RF S-parameter measurement.

4080 Series of Parametric Testers



In addition to meeting the testing challenges of advanced processes, the flexible 4080 Series can also boost measurement throughput for existing process technologies.

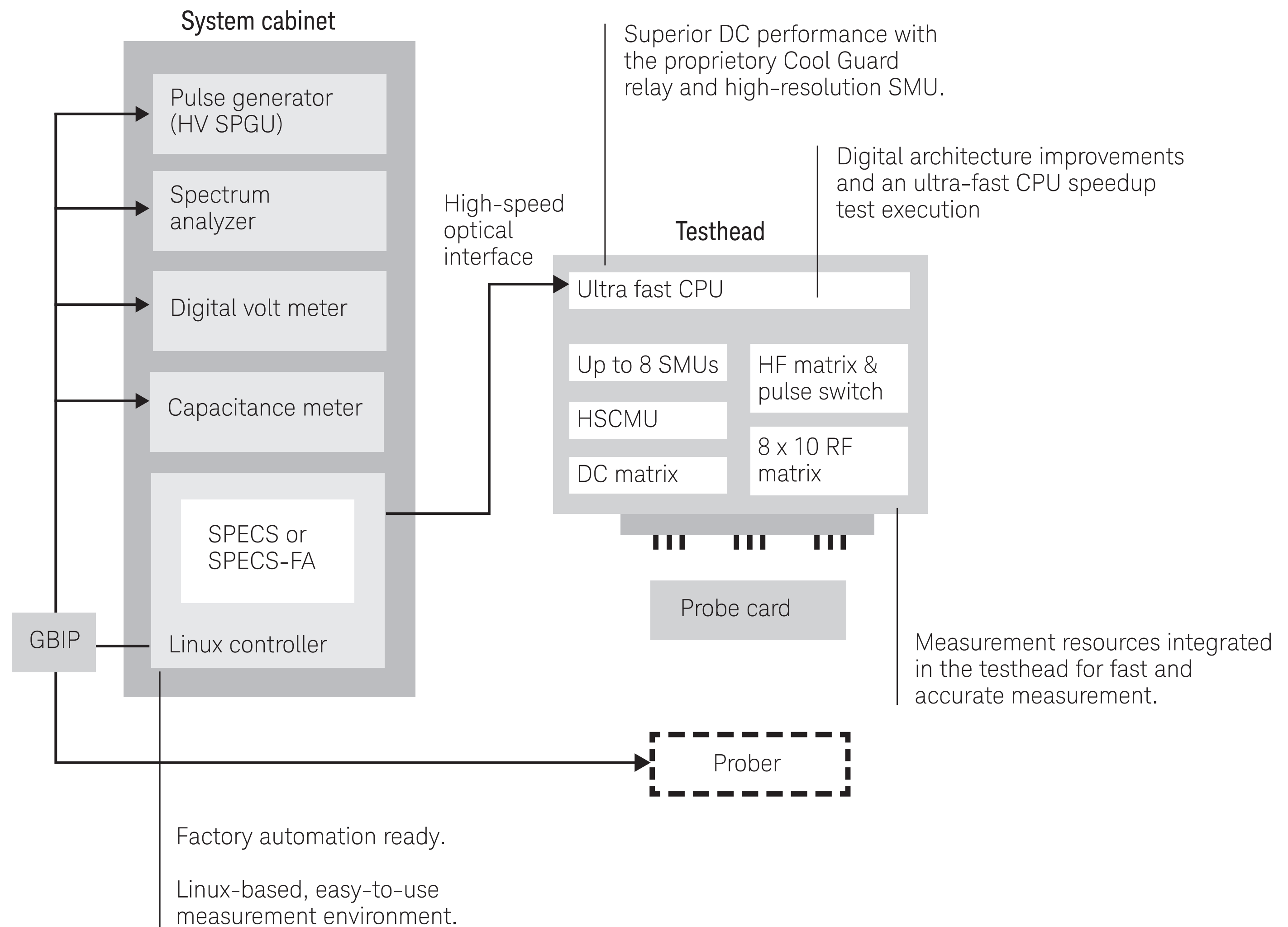
Innovative Design Increases Speed and Reduces Costs

Architecture improvements boost measurement throughput

The 4080 series employs cutting-edge architecture (including an ultra-fast CPU) that can yield speed improvements of up to 10 to 20 percent on test plans transferred from the 4070 series of testers.

This provides an immediate boost to measurement throughput without having to make any fundamental changes to the measurement methodology or to the test code being executed.

You can expand the test capacity of existing wafer fabs with the 4080 series and realize lower cost-of-test without having to change any of your SPECS or SPECS-FA test plans.



Code Reusability Enables Fast Production Ramp-up

Compatibility with existing platforms reduces transition costs

The SPECS and SPECS-FA test plans and algorithms created on 4070 series test platforms will run without modification on the Linux-based 4080 series. This minimizes transition costs, permits the reuse of existing code, and lowers the cost of ownership by enabling the use of lower-cost Linux workstations. It also enables existing wafer fabsto ramp up quickly and to take advantage of superior 4080 series performance to boost throughput. This compatibility protects your measurement investment by making it easy to transition from the 4070 series to the 4080 series and to maintain a mixed tester environment.

SPECS-FA provides seamless SECS/GEM integration

The SPECS-FA, the factory automation version of SPECS, offers all the features and capabilities of SPECS and fully supports SEMI automation standards E5 (SECS II), E30 (GEM), E87 (CMS), E39 (OSS), E40 (PMS), E90 (STS), and E94 (CJM). In addition, the SPECS-FA can report the status of both the 4080 series tester and the wafer prober in real time. This means the host controller always knows the exact status of the test cell. These capabilities have made SPECS-FA the de facto worldwide industry standard for 300 mm wafer fabs.

SPECS-FA is compatible with SEMI standards and enables the easy monitoring of each test cell in “lights-out” production environments.

Ideal Design Realizes Faster Throughput for Extreme Measurement Challenges

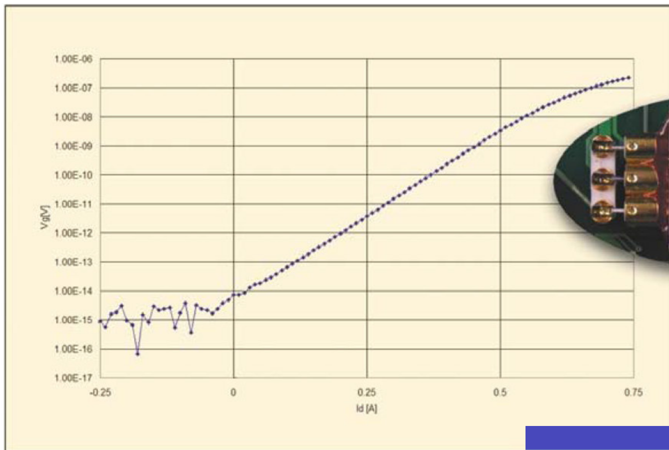
Advanced technology provides unmatched low-level measurement performance

All 4080 series testers support two types of DC switching matrix cards: a standard low-current version and an ultra low-current version (optional). Measurement resolution of 10 fAand 2 µVis achieved by using MPSMUs and the standard DC matrix card. The optional ultra low-current DC matrix card, which is based on Keysight's proprietary Cool Guard relay technology, enables measurement resolution down to 1 fA(using the HRSMUs) and 0.1 µV(using the supported DVM). With a current resolution of 1 fA, the 4080 series provides you with the means to evaluate true Nano scale devices. The 0.1 µV voltage resolution allows you to measure metal layers accurately with ease.

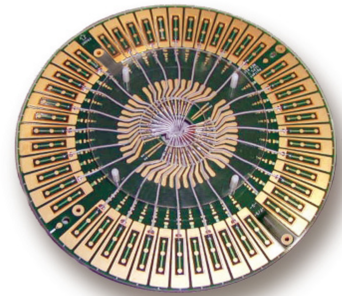
Total solution makes outstanding parametric test performance

In addition to the superior performance of ultra low-current measurement capabilities, dielectric absorption, noise floor and settling time are all reduced by total measurement environment from your test system which has ultra low-current measurement capabilities, ultra low-leakage probe card, and low-noise wafer prober, and this results in increased throughput. The low-current spot measurement capability of the 4080 series with low-current DC matrix card can be from 3 times up to 30 times faster than a standard low-current DC matrix card.

This ultra low-current measurement capability is essential for many leading-edge process technologies especially on 300 mm wafer, when evaluating important parameters such as inter-metal leakage and memory cell leakage currents.



Keysight's Cool Guard relay technology provides not only 1 fA current measurement resolution, but also improved measurement speed on the wafer evaluations.



Ultra low-leakage probe card

Core Platform Provides Powerful Measurement Capabilities

The 4080 Series covers a wide range of parametric test needs

The 4080 series offers a wide range of measurement capabilities required for fundamental parametric test. For example, you can easily perform DC and capacitance measurements such as Vth, Ids, Idoff, and Cox, to name just a few. The 4080 series supports three types of SMUs for DC measurement. The system supports up to eight source monitor units (SMUs). Each SMU is self-calibrating, and can be individually configured to force either current or voltage, as well as simultaneously measure either current or voltage.

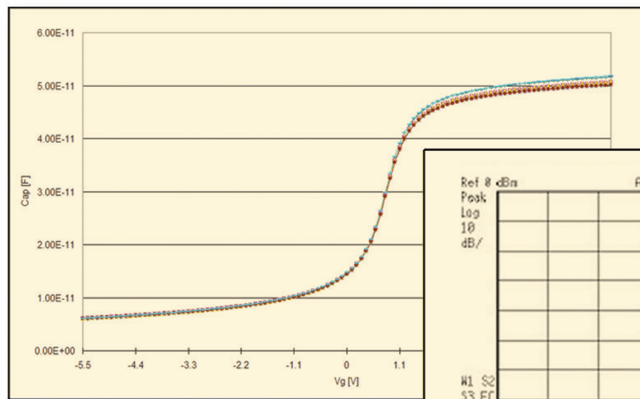
In addition, the 4080 series supports an optional high-speed capacitance measurement unit (HSCMU) module with 1 kHz to 2 MHz capacitance measurement capability.

External instruments creates enhanced measurement capabilities

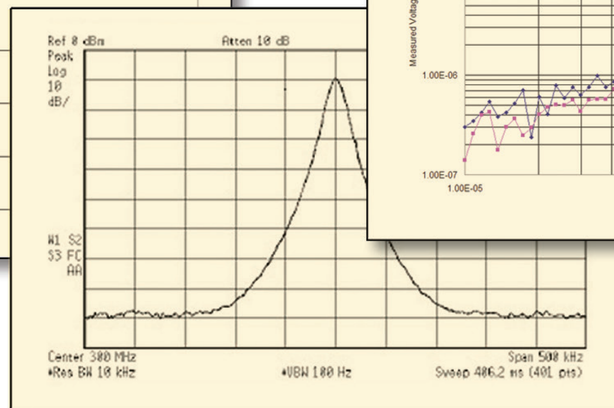
External instruments can be integrated into the system via six auxiliary input ports or forty eight extended path inputs. The extended path inputs allow the user to connect external signals directly to the DUT pins. Several other instrument options, such as a digital volt meter (DVM), a signal/spectrum analyzer and an external LCR meter, provide enhanced measurement capabilities.

The DVM measurement resolution of 0.1 µV is helpful in evaluating low-voltage applications such as Cu metal resistance, which is critical for determining RC delays.

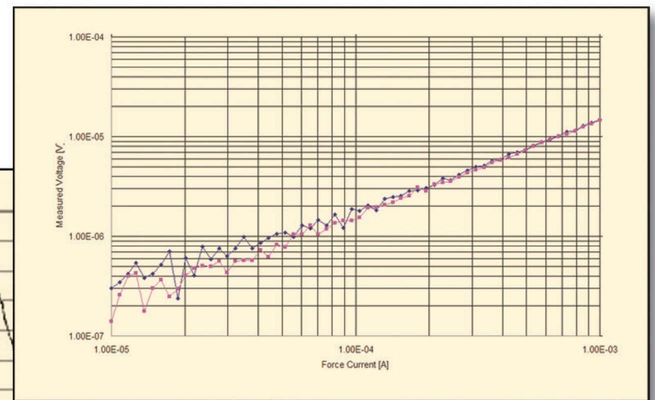
The signal/spectrum analyzer supports automated ring oscillator measurement in conjunction with an optional high-frequency (HF) matrix. This option gives you the ability to achieve accurate frequency measurements of hundreds of megahertz. This method provides a more easily automated and clear-cut frequency determination than you can achieve using either a frequency counter or oscilloscope.



CV measurement



Ring oscillator measurement



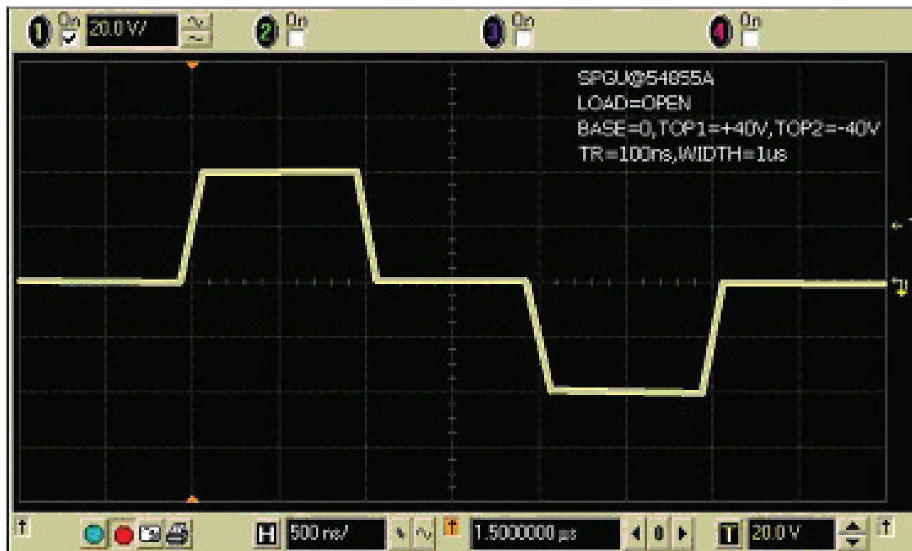
Low-voltage measurement

High Voltage SPGU in the 4082F Provides a Complete Flash Cell Testing Solution

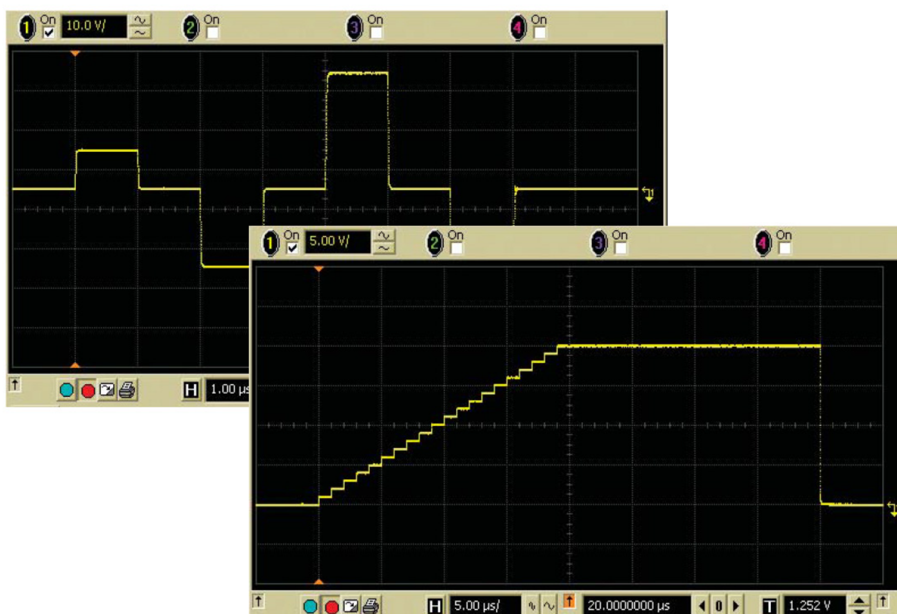
Fast and efficient production test of NAND and NOR flash technologies

The 4082F has the same superb parametric test capabilities as the 4082A. The 4082F test system supports a semiconductor pulse generator unit (SPGU) mainframe with high-voltage SPGU (HV-SPGU) modules that are fully integrated into the system hardware. The HV-SPGU offers best-in-class pulse generation capability for modern advanced flash memory testing. The powerful capabilities shown below enable you to meet almost any flash cell testing need from R&D to production.

Features	Benefits
Voltage output from –40 V to +40 V (80 Vpp)	Meets the needs of modern NAND flash memory test
Voltage resolution of 0.4 mV	Enables the creation of waveforms with accurate and precise pulse levels to characterize multi-level cell (MLC) structures and other advanced flash devices
Two channels per module, with up to five modules supported	Allows you to have up to ten independent, synchronized pulse channels for flash cell testing
Arbitrary Linear Waveform Generation (ALWG)	Supports creation of customized waveforms and permits characterization of next-generation flash device such as those using trapped-charge schemes



The HV-SPGU in the 4082F can output three-level waveforms at +/-40 V (80 V peak-to-peak), which enables the characterization of advanced NAND cell flash memory processes.

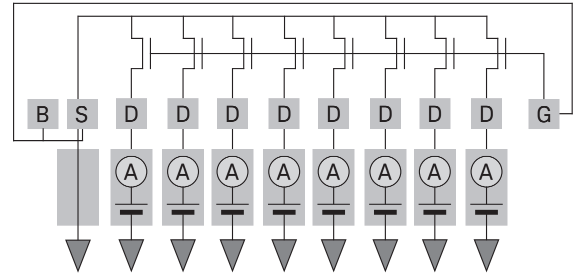


The arbitrary linear waveform generation capability of the HV-SPGU makes it easy to create complex waveforms to test novel non-volatile memory cells.

Advanced Asynchronous and Synchronous Parallel Test Technology Provides Unmatched Measurement Throughput and Lower Costs

Synchronously measure up to eight devices

The 4080 series testers support ultra-fast synchronous parallel measurement option. With the 4080 series, you can use all of the installed SMUs (up to eight) to make simultaneous synchronous measurements. Synchronous parallel measurement is an extremely efficient measurement technique when measuring a small array of devices (such as a group of resistors or transistors), where each device under test (DUT) requires only a single SMU.

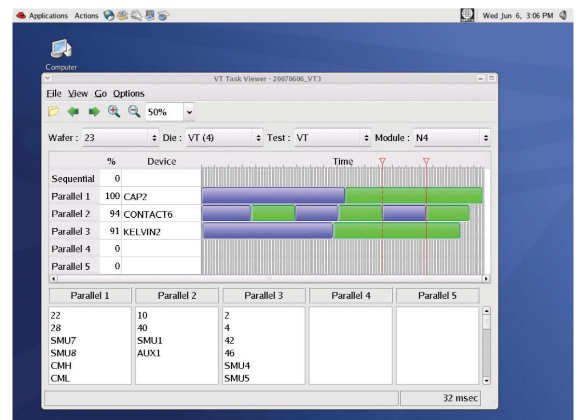


The 4080 series supports synchronous parallel measurement on up to eight SMUs. For example, when performing a BVdsssweep measurement, eight transistors can be measured at once.

Parallel test capabilities lower cost-of-test

Keysight's asynchronous and synchronous parallel test capabilities can reduce test times by 50 percent or more* over conventional serial techniques. The net result is dramatically improved throughput and lower cost-of-test.

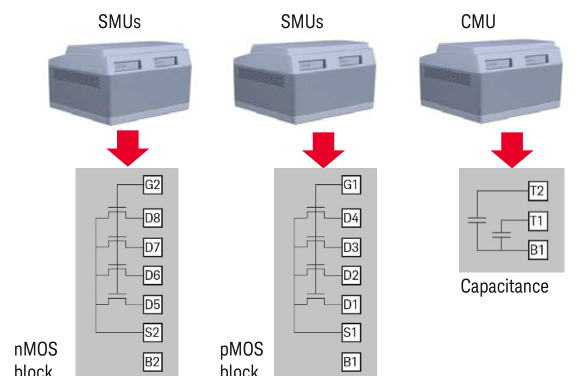
* Percent test time is reduced depends upon the TEG design and test plan optimization.



The 4080 series task view allows you to analyze the progress of tests running in parallel. This information can be used to identify bottlenecks and improve throughput.

Virtual multiple testhead technology dramatically improves measurement throughput

The 4080 series testers can provide powerful virtual multiple testhead technology that enables asynchronous test. This ground-breaking technology allows separate measurement tasks to run independently. Unlike conventional parallel test schemes, no measurement time is ever wasted. As soon as one set of resources finishes making a measurement it can immediately start the next measurement. The net effect is like having independent multiple testheads in a single tester, which greatly increases measurement throughput.



DC/RF Parametric Test Solution Provides All-in-one DC to RF Test Capability

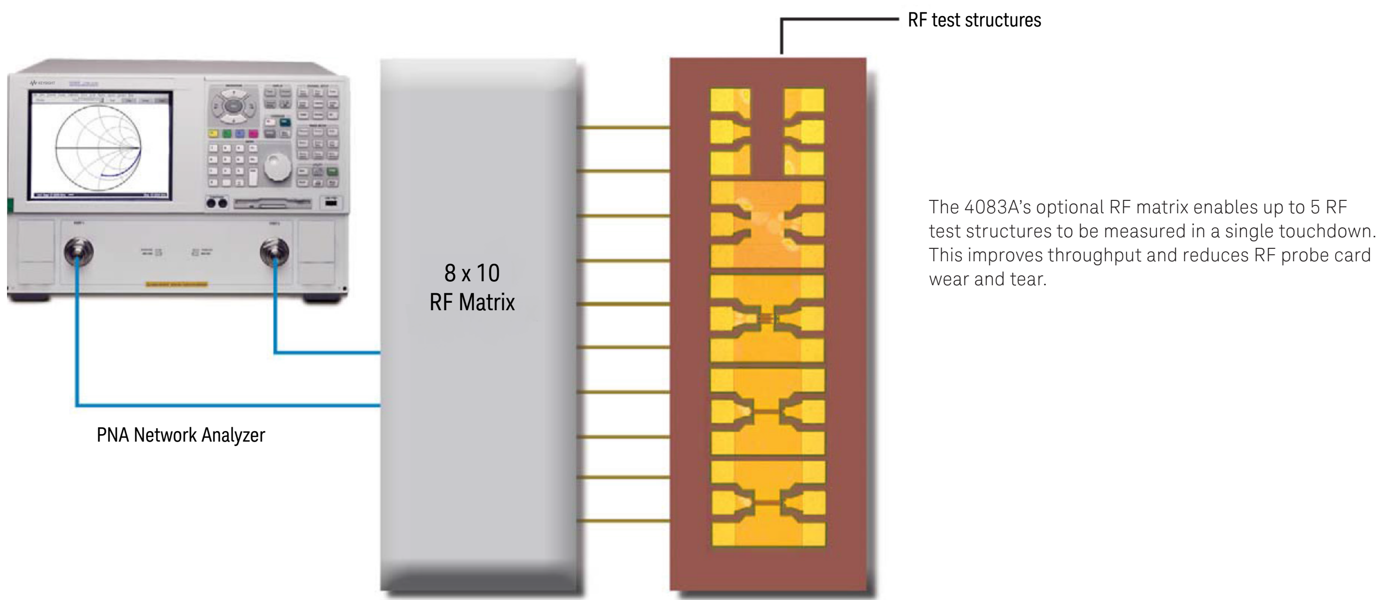
Advanced RF test capabilities improve throughput and reduce costs

Supporting all of the measurement capabilities of the 4082A and 4082F, the 4083ADC/RF Parametric Test System is de-signed to meet the most difficult characterization challenges posed by RF semiconductor devices. The 4083A supports an PNA Network Analyzer* for high-frequency S-parameter measurements up to 20 GHz, easily meeting the testing needs of modern RF devices. To help those unfamiliar with RF measurement, the 4083A is furnished with a library of both RF and RFCV algorithms. The 4083A is also the first production parametric tester to offer an 8 x10 RF matrix option integrated in the testhead that supports 20 GHz measurements. With the ability to measure up to five RF test structures in a single touchdown, the 4083A RF matrix both improves measurement throughput and increases probe card lifetime by reducing contact wear-and-tear.

*The 4083A does not include any Network Analyzer. For available models, please contact your local office.

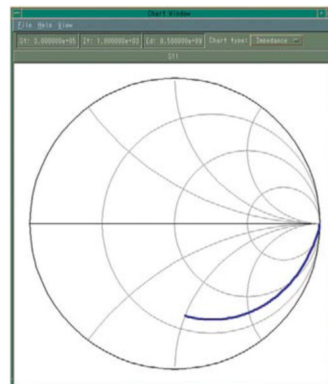
Production-ready capabilities

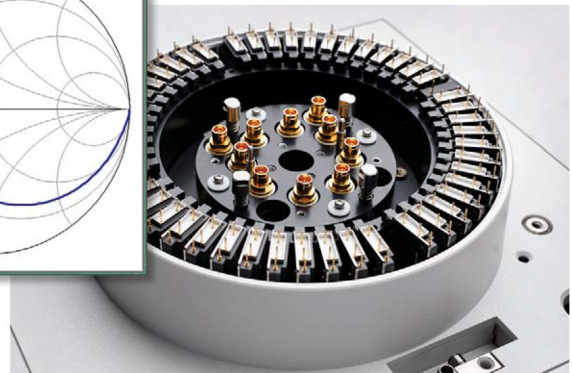
The 4083A can integrate into high-volume manufacturing environments. With 10 RF ports and up to 48 DC pins, the 4083A supports direct-docking style probe cards. This makes it easy for operators to change probe cards and it also supports the use of automated probe card changers. The 4083A also provides automated software to calibrate the RF measurement resources automatically (SOLT, SOL, and Open/Short de-embedding), and this software can easily be used by a technician or operator.



The 4083A's optional RF matrix enables up to 5 RF test structures to be measured in a single touchdown. This improves throughput and reduces RF probe card wear and tear.

The 4083A test head direct docking scheme supports 10 RF ports and up to 48 DC pins. It allows probe cards to be changed either by operators or automated probe card changers.



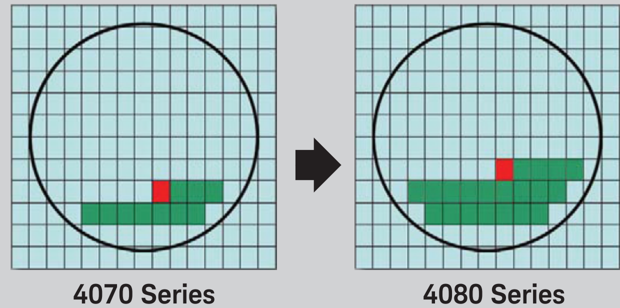


Are You Ready to Migrate to the Platform That Can Solve Your Most Difficult Parametric Test Challenges?

4082A

Next-generation parametric tester with unparalleled measurement throughput and accuracy

- Improved tester architecture can reduce test times by 10 to 20 percent
- Synchronous and asynchronous parallel test can improve throughput by 50 percent or more*
- 1 fA and 0.1 µV measurement resolution
- Optional HSCMU
- Ring oscillator measurement solution option

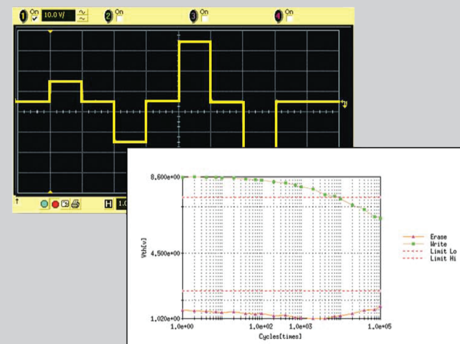


* Percent test time is reduced depends upon the TEG design and test plan optimization.

Keysight 4082F

Production-ready solution for state-of-the-art flash memory evaluation

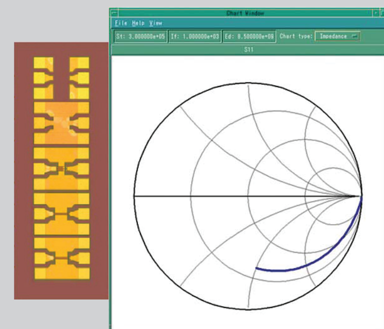
- Same measurement capabilities as the 4082A
- Integrated HV-SPGUs
  - Up to 10 channels total
  - ± 40 V output capability
  - Two or three level pulsing on each channel
  - ALWG capability
  - Fast and reliable operation



Keysight 4083A

Production RF measurements as easy as DC

- Same measurement capabilities as the 4082A and 4082F
- S-parameter and RFCV measurement via 10 RF ports
- Easy-to-use RF calibration routines
- Optional 20 GHz 8 x 10 RF matrix improves throughput and extends probe card life



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