

# Keysight Technologies

## 4080 Series of Parametric Testers



Are You Ready to Migrate to  
the Platform that Solves Your  
Toughest Test Challenges?

# 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 45 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 and strained silicon, 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.
- The RF testing needs of high-speed processes create both calibration and throughput restraints in production.

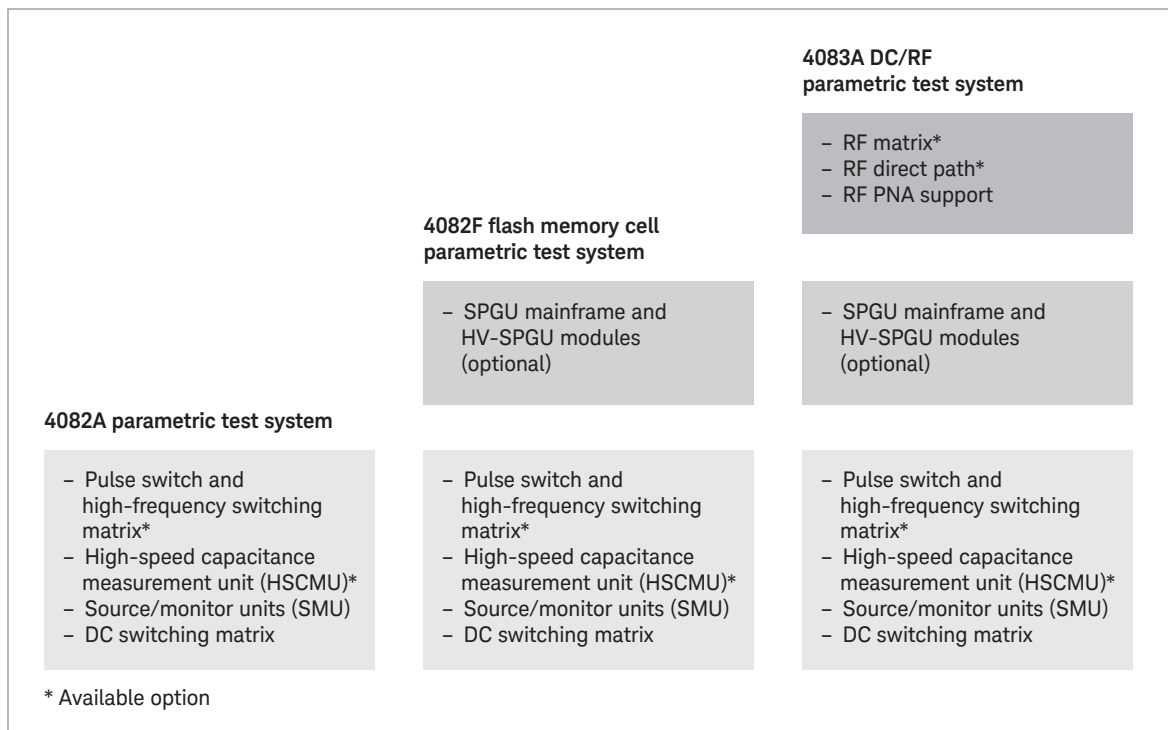
These factors demand new and more innovative test methodologies to keep pace with the needs of production parametric wafer testing.



## The Keysight 4080 Series overcomes difficult process test challenges

Keysight Technologies, Inc. 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 combines digital architecture improvements and an ultra-fast CPU with synchronous and asynchronous parallel test capabilities. This improves the throughput of both conventional and advanced processes. The 4082F 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. For customers who have RF device testing needs, the 4083A offers PNA support for RF S-parameter measurement with an optional 8 x 10 RF matrix. This provides unprecedented DC and RF test capability for both development and production parametric test.

### Keysight 4080 Series of Parametric Testers

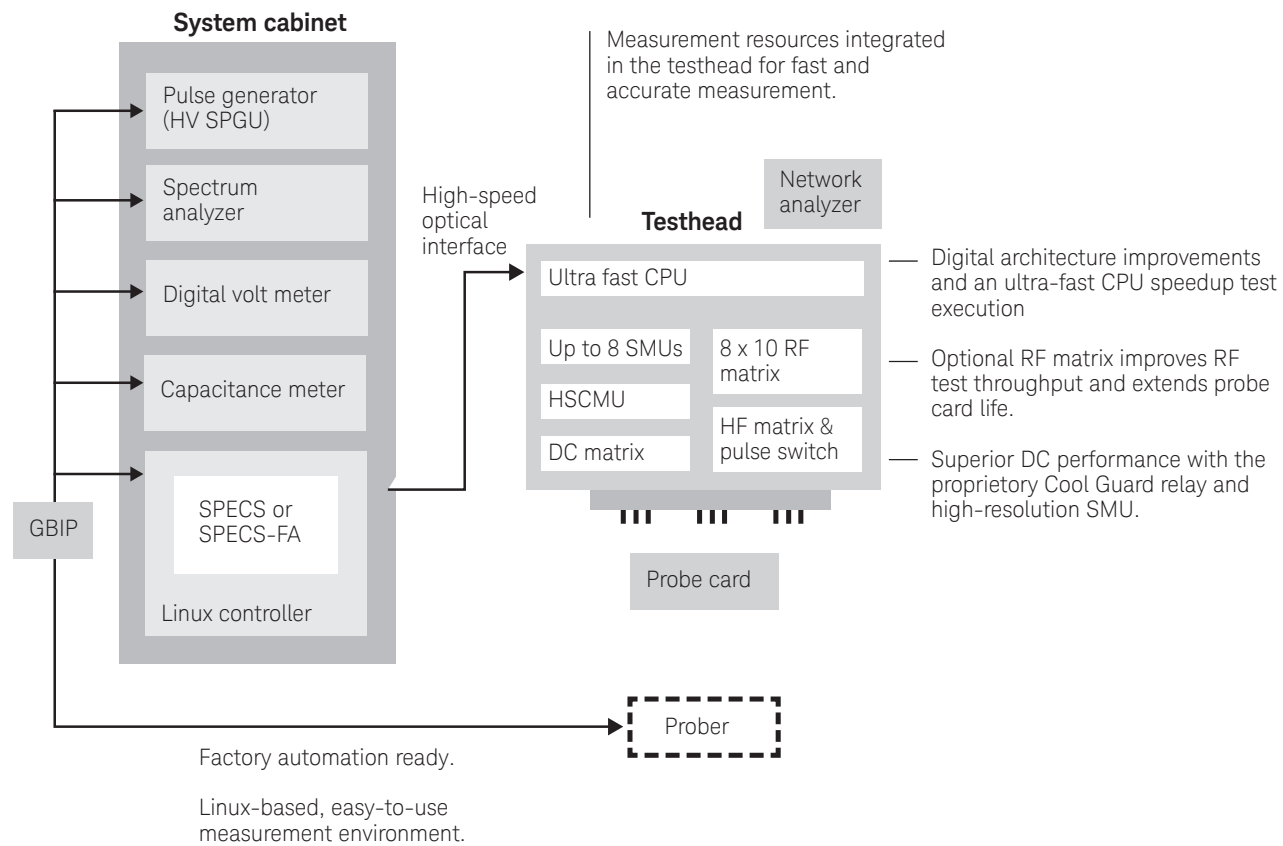


In addition to meeting the testing challenges of advanced processes, the flexible 4080 Series can also boost measurement throughput for existing process technologies.

## 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 Keysight 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.



## Core platform provides powerful measurement capabilities

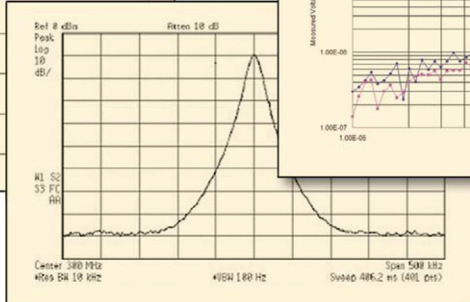
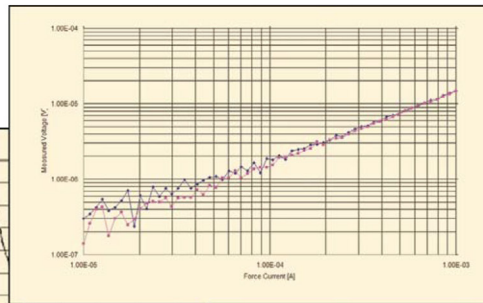
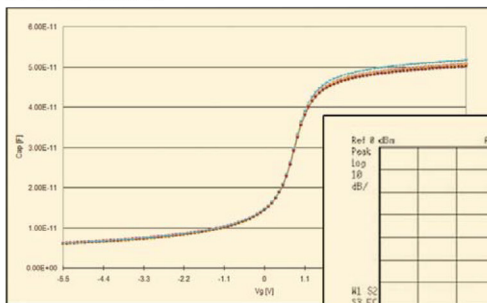
### The Keysight 4080 Series covers a wide range of parametric test needs

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  $V_{th}$ ,  $I_{ds}$ ,  $I_{doff}$ , and  $C_{ox}$ , to name just a few. The 4080 Series supports three types of SMUs for DC measurement. In addition, the 4080 Series supports an HSCMU module with 1 kHz to 2 MHz capacitance measurement capability. Several other instrument options, such as a digital volt meter (DVM), a spectrum analyzer and an external LCR meter, provide enhanced measurement capabilities. The DVM measurement resolution of 0.1  $\mu V$  is helpful in evaluating low-voltage applications such as Cu metal resistance, which is critical for determining RC delays. The spectrum analyzer supports automated ring oscillator measurement in conjunction with an optional high-frequency (HF) matrix.

### Advanced technology provides unmatched low-level measurement performance

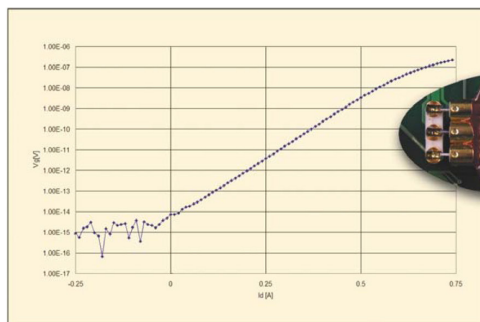
All 4080 Series testers support two types of DC switching matrix cards: a standard lowcurrent version and an ultra low-current version. Measurement resolution of 10 fA and 2  $\mu V$  is achieved by using MPSMUs and the standard DC matrix card. The ultra low-current DC matrix card, which is based on Keysight’s proprietary Cool Guard relay technology, enables measurement resolution down to 1 fA (using the HRSMUs) and 0.1  $\mu V$  (using the supported DVM). In addition, dielectric absorption, noise floor and settling time are all reduced, resulting in increased throughput. This ultra low-current measurement capability is essential for many leading-edge process technologies when evaluating important parameters such as inter-metal leakage and memory cell leakage currents.

CV measurement



Ring oscillator measurement

Low-voltage measurement



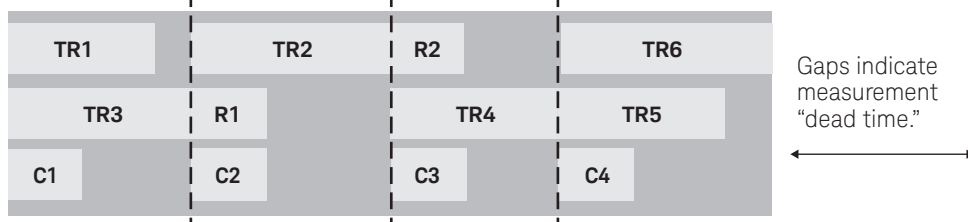
Keysight’s Cool Guard relay technology provides 1 fA current measurement resolution

## Advanced asynchronous and synchronous parallel test technology . . .

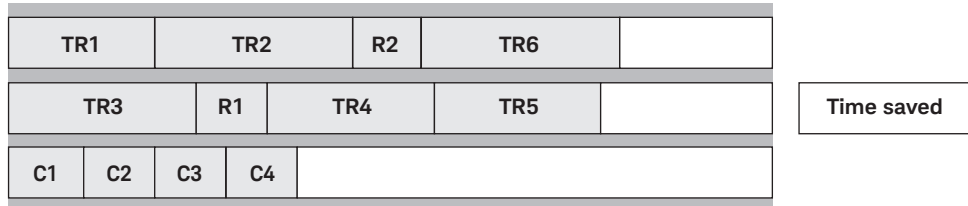
### Virtual multiple testhead technology dramatically improves measurement throughput

All 4080 Series testers feature 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.

#### Competitor's parallel test

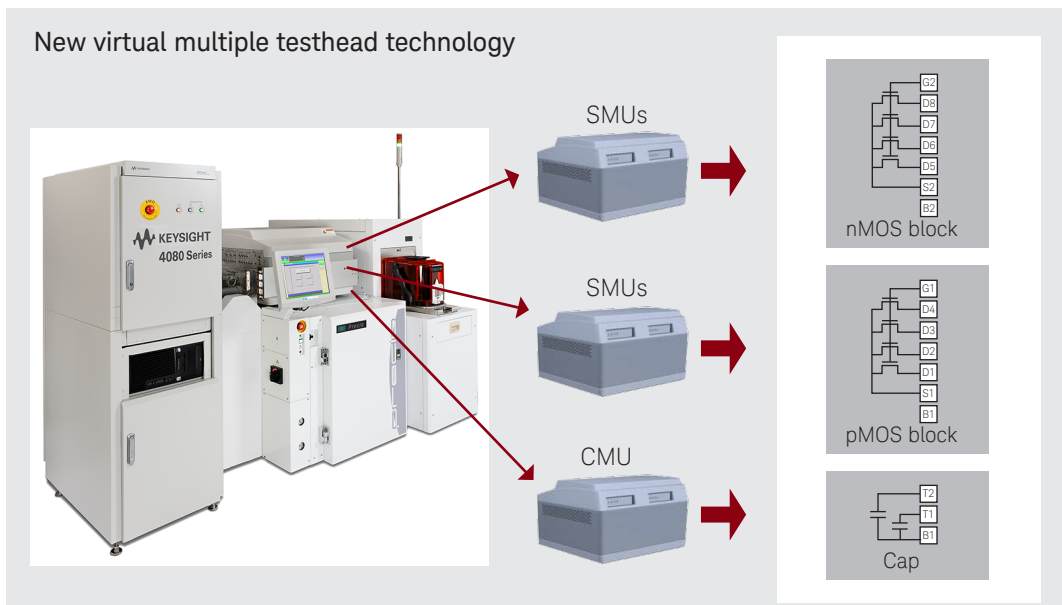


#### Keysight's asynchronous parallel test



Keysight's virtual multiple testhead technology eliminates measurement dead time and provides the fastest possible parallel testing throughput.

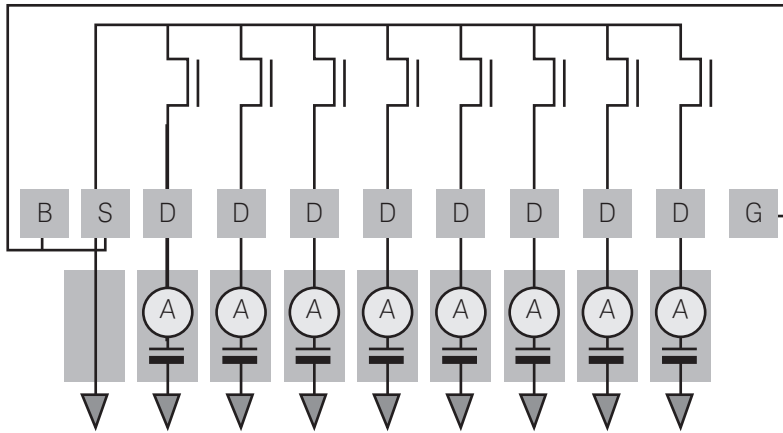
#### New virtual multiple testhead technology



## ... provides unmatched measurement throughput and lower costs

### Synchronously measure up to eight devices

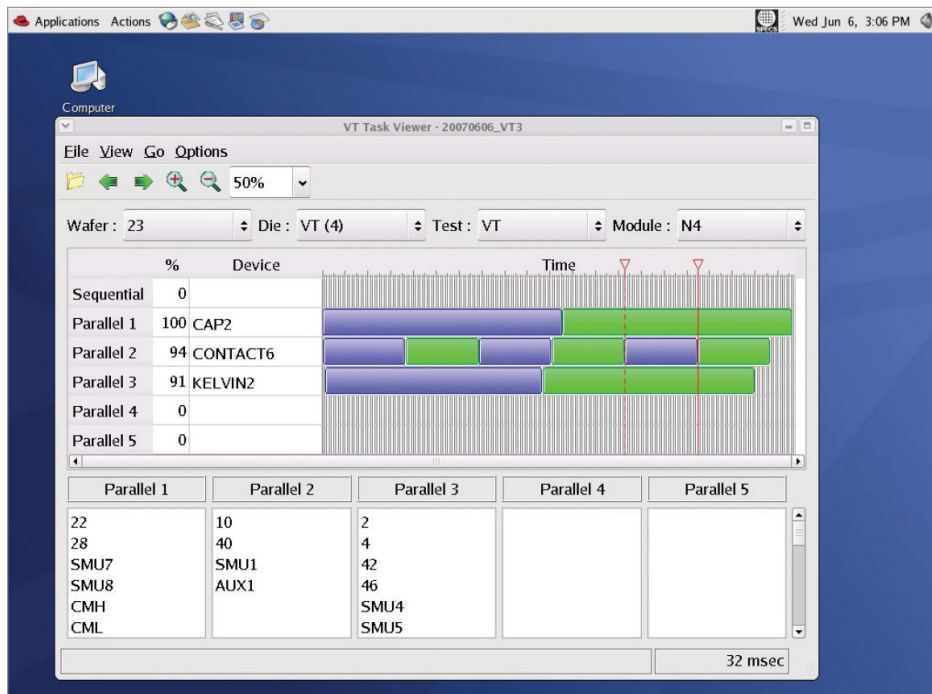
In addition to supporting asynchronous parallel measurement, 4080 Series testers also support ultra-fast synchronous parallel measurement. With the 4080 Series, you can use all of the installed SMUs (up to eight) to make simultaneous synchronous measurements. Synchronous parallel measurement is an extremely 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 BVdss sweep 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.



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.

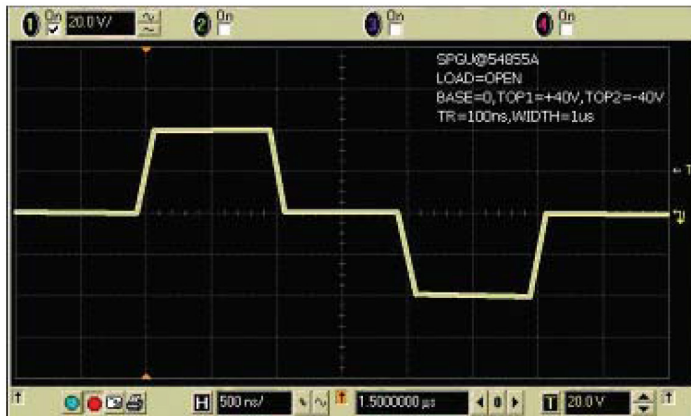
1. \*Percent test time is reduced depends upon the TEG design and test plan optimization.

# The Keysight 4082F is 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. It is the first production parametric test system to support a semiconductor pulse generator unit (SPGU) mainframe as well as high-voltage (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 multilevel 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 4082F's HV-SPGUs 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 4082F's HV-SPGUs makes it easy to create complex waveforms.



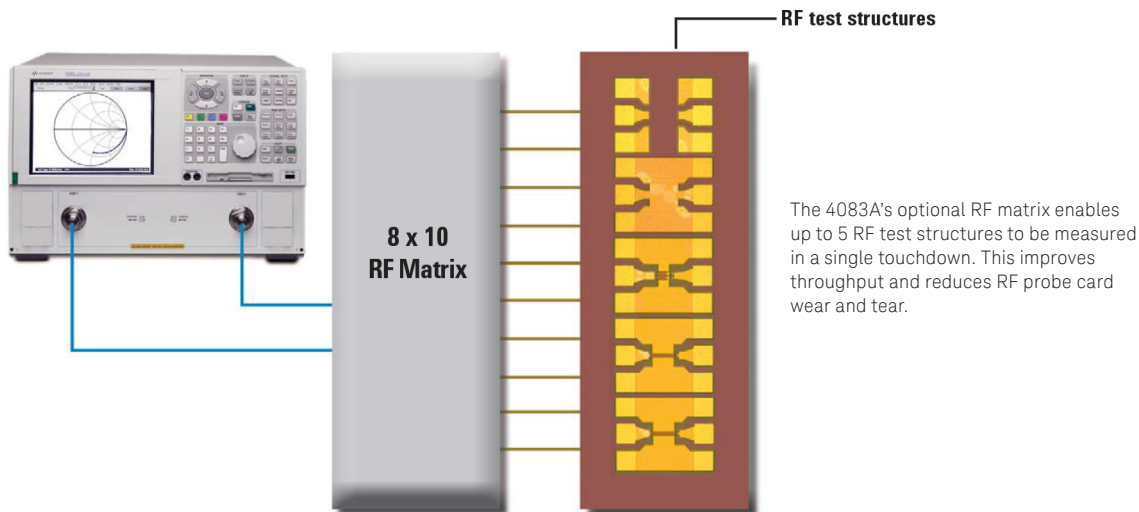
## The Keysight 4083A provides all-in-one DC to RF test capability

### Advanced RF test capabilities improve throughput and reduce costs

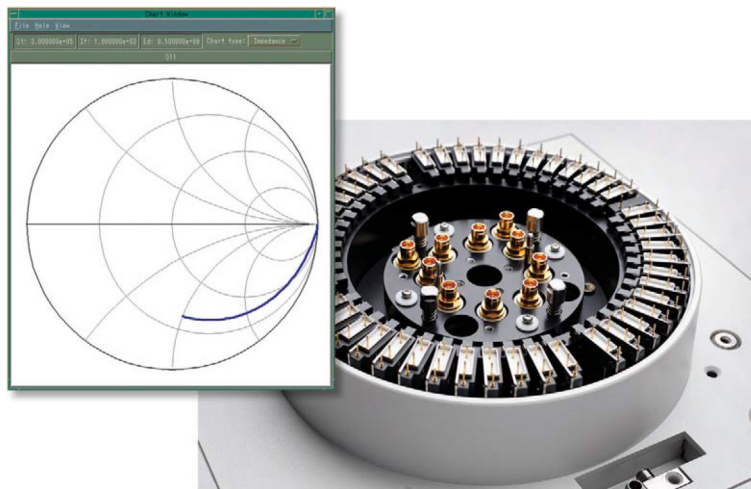
Supporting all of the measurement capabilities of the 4082A and 4082F, the 4083A is designed to meet the most difficult characterization challenges posed by RF semiconductor devices. The 4083A supports an Keysight PNA Network Analyzer for high-frequency S-parameter measurements up to 20 GHz, easily meeting 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.

### Production-ready capabilities

The 4083A easily integrates 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.

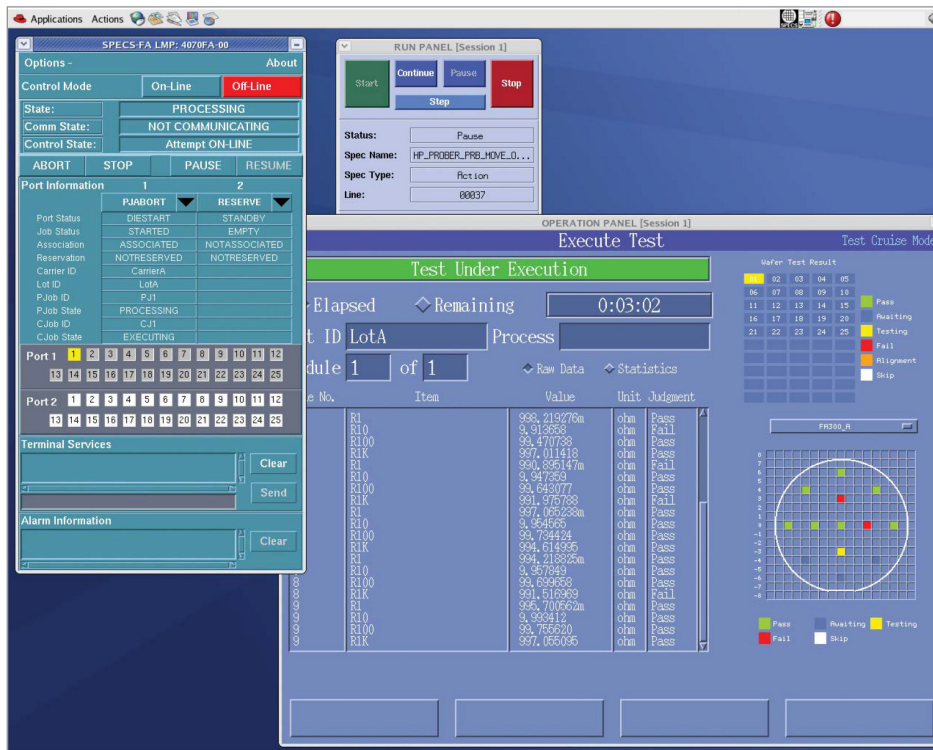
## Code reusability enables fast production ramp-up

### Compatibility with existing platforms reduces transition costs

Keysight 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 fabs to 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.

### Keysight SPECS-FA provides seamless SECS/GEM integration

Keysight SPECS-FA, the factory automation version of Keysight SPECS, offers all the features and capabilities of Keysight 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, Keysight 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 Keysight SPECS-FA the de facto worldwide industry standard for 300 mm wafer fabs.



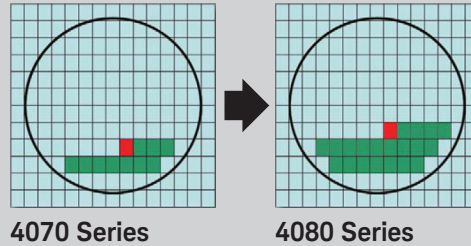
SPECS-FA is compatible with SEMI standards and enables the easy monitoring of each test cell in “lights-out” production environments.

## Are you ready to migrate to the platform that can solve your most difficult parametric test challenges?

### Keysight 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  $\mu$ V measurement resolution
- Optional HSCMU
- Ring oscillator measurement solution option

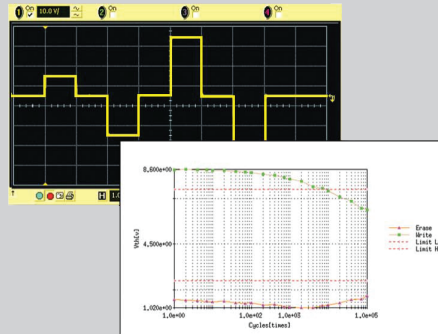


\* Percent test time is reduced depends upon the TEG design and test plan optimization.

### Keysight 4082F

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

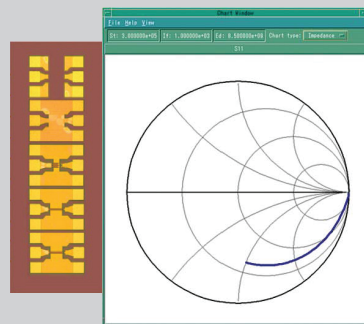
- Same measurement capabilities as the 4082A
- Integrated HV-SPGUs
  - Up to 10 channels total
  - $\pm 40$  V output capability
- Two or three level pulsing on each channel
- ALWG capability
- Fast and reliable operation



### Keysight 4083A

Production RF measurements as easy as DC

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



Contact your local Keysight representative to learn more about how the 4080 Series can lower your cost-of-test.

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