



# ProChek™ Semiconductor Process Characterization System



## Integrated Circuit Fabrication Process Qualification and Reliability Analysis

- Complete device-level characterization system
- Built-in testing protocols for NBTI, PBTI, TDDDB, HC, EM, SM
- User-programmable and configurable test conditions
- Makes “Fast NBTI/PBTI” measurements to observe annealing effects
- Independently verifies foundry PDK parameters
- Supports large array of test structures for highly parallel testing
- Available on-chip heaters accelerate test processes
- Interfaces with test structures on wafers or in packages
- Eliminates the need for expensive test equipment
- Suitable for both new and qualified CMOS, SiGe, and SOI process nodes
- Supports measurement of TID radiation effects

## Product Description

Ridgetop Group’s ProChek is an innovative system to qualify the performance and characterize the intrinsic reliability of deep submicron nanotechnology CMOS processes for microelectronics applications. ProChek is designed to provide fast and reliable measurement of critical electrical performance parameters. Subtle variations in these parameters can have significant adverse impact on the yield and performance of chips manufactured with modern semiconductor processes. ProChek also accelerates the process of gathering data concerning common degradation effects. These effects limit the lifetime of chips manufactured with all process nodes and some are exacerbated as feature sizes shrink.

The main components of the ProChek system are the test coupon and the benchtop system. Together they comprise a comprehensive solution that delivers results for some of the most difficult device-level characterization tasks. The test coupon is manufactured using the target fabrication process and can contain multiple arrays of test structures to be characterized under various conditions. In addition to the test structures, the test coupon incorporates an on-chip switching matrix to access, control, and observe the behavior of these test structures as they are stressed in parallel and measured individually. Several test coupon configurations are available to meet different cost

and performance targets: (1) all the test coupon functionality is integrated on a single chip to maximize precision and test throughput; (2) for characterization and qualification of newer processes, test coupon functionality may be divided across a test supervisor IC (TSIC) from a well-qualified process and one or more test chips (DUT IC) from the target process; and (3) a board-level interface to traditional test structures through a wafer probe card or package interface. Because the integrated and TSIC/DUT IC test coupons can also incorporate on-chip heaters to rapidly elevate the temperature of selected test structures to over 300 °C (and a Peltier device may also be controlled by ProChek), temperature-dependent effects are measured without the use of an oven.

Regardless of the selected methodology, ProChek can dramatically lower the overall test cost and quickly deliver a large database of test results for statistical analysis.



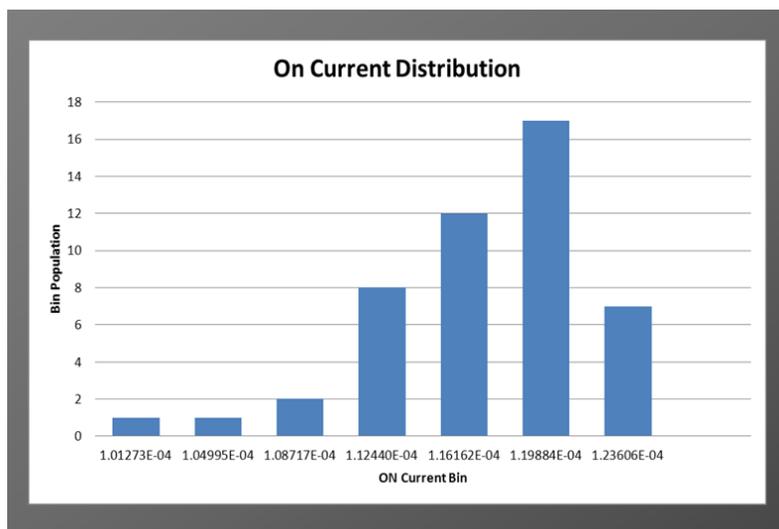
ProChek system

ProChek reduces or even eliminates the need for expensive test equipment in fabrication process characterization. Testing is performed using multiple precision stress-and-measurement instruments embedded in the powerful yet compact benchtop system. A test interface board connects the benchtop system to the packaged test coupon or to test structures residing on a wafer. The benchtop system is controlled by a host PC, which includes a graphical user interface set up and control application and results analysis tools. The ProChek benchtop system and the host software are universal and can be used with different types of test coupons across different processes and fabrication runs. For even greater test acceleration, multiple ProChek benchtop systems may operate in parallel, controlled by a single host PC.

The tight integration between the ProChek test coupon and the benchtop system enables an intuitive software interface so that programming using either pre-defined or user-specified test scenarios is quick and straightforward. ProChek is equipped with accelerated stress test setups targeting reliability concerns such as negative and positive bias temperature instability (NBTI, PBTI), time-dependent dielectric breakdown (TDDB), hot carrier (HC) damage, electromigration (EM), and stress migration (SM). ProChek even supports "fast NBTI/PBTI" measurements, observing the sub-microsecond onset of annealing effects, because it can switch from stress to measurement mode without missing a beat. The effects of total ionizing dose (TID) radiation can also be analyzed with ProChek, with the test coupon placed in a radiation chamber and connected to the benchtop system using the optional Environmental Chamber Test Cable (ECTC).

## Accuracy and Performance to Meet the Market's Needs

ProChek is designed to deliver the essential process-level characterization data to both the fabless IC vendor and the foundry. Fabless manufacturers and ASIC designers know that their foundry cannot always supply them with all the device-level characterization data they need to maximize IC performance, yield, and reliability. Foundries and integrated device manufacturers (IDMs) need to measure and monitor each fabrication process to ensure that any drift or excessive variations are quickly understood and addressed. For companies and organizations where electronic reliability and lifetime performance is of paramount concern, characterization of IC manufacturing processes is a must.



*Distribution of On Current in 48 NFET DUTs on three ProChek test coupons*

With its accurate instrumentation, portable hardware, flexible interface, and easy-to-use software, ProChek fits into virtually any process-level characterization flow.

## Additional Information

Ridgetop offers technical support to assist customers at every step in the process. Our design and support team has extensive experience in CMOS and SiGe bipolar IC design semiconductor process technologies, and practical, results-oriented engineering. We assist customers with product and applications training, design and implementation of ProChek test coupons, test planning and execution, and other support services to ensure that the ProChek experience is beyond expectations.

## About Ridgetop

Ridgetop Group Inc. is a leader in providing advanced electronic solutions for critical applications. Ridgetop was founded in 2000 with the purpose of introducing revolutionary tools to improve performance of mission-critical electronic systems.

With a strong management team and world-class technical staff, Ridgetop has established a stellar reputation serving its government and commercial customers with effective and practical "best of class" solutions.

**Need modified or custom design? Contact Ridgetop at +1 520-742-3300 to discuss your ideal solution!**

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