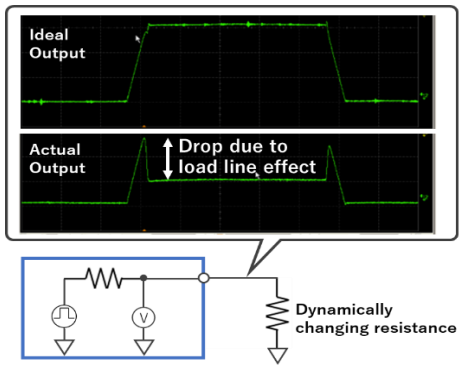
B1500A Device Parameter Analyzer for Advanced Nonvolatile Memories (NVMs)

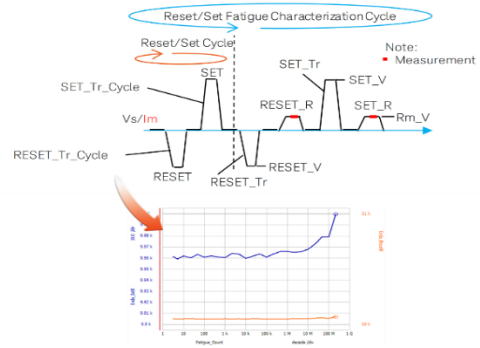
Enables Evaluation of Set (Write), Reset (Erase), and Endurance Characteristics

An accurate, quick, and effective evaluation is vital for fast time to market of high-performance, high-reliability advanced NVMs

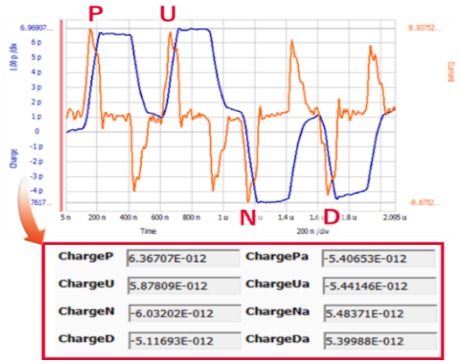
- Demand from the Internet of Things (IoT) and artificial intelligence (AI) requires high-speed processing (set [write] / reset [erase]), long lifetime, low power, and scaling down of NVM-embedded microcomputers.
- IoT and AI devices require fast time to market of advanced NVMs such as resistive random-access memory (ReRAM), phase-change memory (PCRAM), and ferroelectric RAM (FeRAM).
- Manufacturers must introduce new materials and processes to accelerate the development cycle and improve device performance and reliability.
- Accurate, fast, and effective electrical characterization helps developers quickly improve performance and reliability.



Ideal output and actual output with load line effect by a conventional instrument



Three-level pulse required in the ReRAM endurance test examples of challenges of advanced NVM development



Laborious analysis of measured data (FeRAM PUND)

Challenges of Advanced NVM Development and Evaluation

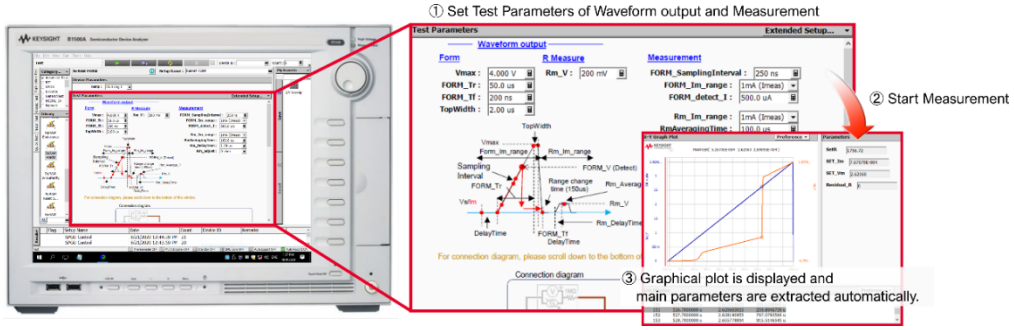
Challenges	Needs	Problems
• achieving accurate comprehension of device characteristics such as fast FORM and RESET-SET	• fast pulsed IV measurement for accurate measurements of device characteristics	• Conventional pulse generators (PG) and oscilloscopes cannot measure low current or fast phenomena because of insufficient measurement accuracy • Conventional systems cannot accurately evaluate memories, such as ReRAM, that dynamically change the resistance value in the measurement because of the load line effect of PG output impedance
• predicting long lifetime (maximum number of write (set) / erase (reset) cycle) of memories accurately in a short time and securing reliability	• shortened endurance test time	• Reading pulse configuration for every pulse polarity change makes the set (write) / reset (erase) cycle time-consuming
• accelerating development speed	• reduced time and effort for measurement and analysis	• Conventional instruments require you to do the following: • write measurement and automation programs • manually change instruments and wiring, depending on what you are measuring • import data to your computer to analyze it

KEYSIGHT TECHNOLOGIES

The B1500A device parameter analyzer solves advanced NVM characterization challenges with an all-in-one solution

The solution integrates source / measure unit, waveform generator / fast measurement unit (WGFMU), high-voltage semiconductor pulse generator unit (HV-SPGU), and EasyEXPERT group+ software.

- Get fast pulsed IV measurement with a wide range of conditions for accurate device characterization:
  - low current measurement, resulting from the minimum current measurement range of 1 µA
  - fast phenomenon and transition measurements, resulting from the minimum time resolution of 10 ns and the maximum sampling rate of 200 MSa/s
  - accurate characterization without a load line effect, resulting from the low output impedance
  - various advanced NVMs evaluation, resulting from the maximum ±40 V output voltage and minimum 10 ns setting resolution[1]
- Accelerate endurance test for accurate and quick lifetime prediction.
  - overhead reduction of write-erase cycle with three-level pulse and arbitrary linear waveform generation
  - fast and accurate fatigue characterization during the write-erase stress cycle
- Reduce time and effort for measurement and analysis:
  - ready-to-use application tests for advanced NVMs such as ReRAM (butterfly curve, FORM, RESET-SET, endurance), PCRAM (RESET-SET, endurance), and FeRAM (hysteresis, PUND, endurance)
  - automated test sequence without programming, powerful data analysis, and robust data management
  - automated switching between DC-IV and fast pulsed IV measurements without changing instruments or wiring



Ideal output and actual output with load line effect by a conventional instrument

Configurable measurement modules up to 10 slots in a box

1. The maximum voltage is ± 25 V when using HV-SPGU with RSU (Remote Sense Unit).

Summary

The B1500A enables accurate, quick, and effective evaluations for fast time to market of high-performance and high-reliability advanced NVMs.

- WGFMU enables device characterizations, allowing you to develop reliable, high-performance advanced NVMs in high-speed operations.
- HV-SPGU enables accurate and quick lifetime predictions for developing reliable advanced NVMs.
- GUI-based EasyEXPERT group+ and the B1500A's all-in-one measurement capabilities enable accelerated measurement and analysis of advanced NVM development.

Learn more at: www.keysight.com

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KEYSIGHT TECHNOLOGIES