RIFLE

engineering tester for non-volatile memory cells and arrays

Best tool for NVM Product and Technology Research and Development

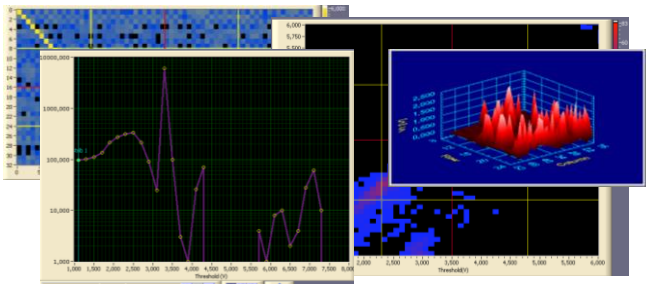
RIFLE has been designed for obtaining fast and reliable results in non-volatile memory technology and product development. Created by Active Technologies principally for research activities and supported by NplusT in industrial applications, RIFLE became a world-wide reference for the segment.
The flexible architecture, powerful analog resources and the true-interactive-testing concept make a difference over the competition, which focus on mass production. The best cost-performance ratio and the lack of need of lab facilities allow the "per-engineer" installation.

- RIFLE is used today for testing and characterizing almost all NVM technologies and product interfaces:
  - Single cell, test arrays, products,
  - NAND, NOR, NROM, PCM, eFlash, RRAM technologies,
  - Single-level and multi-level cells,
  - Parallel, multiplexed, serial, JTAG and custom interfaces;
- in a wide range of applications:
  - Package and wafer level.
  - Technology and product development.
  - Failure analysis.

Straightforward Engineering

RIFLE's software environment provides the higher level support to the device engineers, to obtain the results in the fastest and easiest way.

- True interactive testing: every single test function is available on a powerful graphical interface. After selecting the function and inserting the test parameters, a test is executed on a single click and the results are displayed in a graphical way. As an example, selecting the "VT Map" function and defining "SECTOR 0" for the memory area and the Vt range and step size, the bitmap showing the color-coded vt level of every single cell is displayed.
- Test flows can be composed using the graphical VI language, where every single operation is represented by an icon. An other option is the implementation of test flows in C++ language, running under supervision of the NplusT Test Execution Environment. This software has a client-server architecture so the user interface can run on a workstation outside the laboratory where RIFLE is installed.
- Device drivers, implementing the basic test functions in a way specific for the given device, are developed in C++ language using Visual Studio and are supported by an extensive library. During test, the powerful debug features of the environment can be used, like breakpoints, on-the-fly code changes, … This methodology has been proven significantly more efficient than standard test development methods.



Excellent Analog Performance

Non volatile cells are analog devices, as a consequence, a tester should provide enhanced tools for analog signal generation and high-speed high-accuracy current measurements.
RIFLE offers several types of arbitrary waveform generators, with very fast edges and with extremely wide voltage range. Short, fast and controlled pulses are essential when working on NAND or PCM test arrays.
The millions of billions of cells which need to be characterized require very fast measurement circuits. RIFLE's PMU is able to take samples at every 14 nanoseconds parallel at 8 channels. A few nA reproducibility enables the characterization of NAND and RRAM cells as well.

Extensive Built-In Functionality

Using RIFLE, a wide range of test functions are available, once the low level device specific codes have been implemented. As an example, the test programmer has to tell the system how to read the device at a certain threshold level, and RIFLE generates the distribution, edge lookup and bitmapping functions from it.
RIFLE is natively connected to the BARNIE data analysis environment which includes the BarnieMAT topologic array analysis tool. Measurement results can be sent on-the-fly to BarnieMAT via TCP-IP connection. As BarnieMAT receives the data, it can trigger automatic processing functions on it. RIFLE can also log test execution results in an XML-based datalog which can be loaded in BARNIE and post-processed.

N·PLUS·T
KNOWLEDGE AND TECHNOLOGY

Customers shall enjoy working with our tools.
User experience is the heart of success
of our fast, creative and efficient solutions for the semiconductor industry.
NplusT Semiconductor Application Center srl

Technical Specification

Architecture

Structure:	Desktop
Supply:	220V or 110V AC No laboratory facility required
Multi-master:	Integrated PC Embedded RISC processor 132 Mbyte / sec DMA transfer
Extensions:	High speed serial link to drive specific external circuits

Software

Test Execution:	RIFLE Control software supporting true interactive testing NplusT Test Execution Environment (option)
Test Flow Development:	Labview VI language C / C++ (option)
Device Driver Development:	C / C++ Visual Studio 2008 NplusT Test Library
Datalog:	XML based
Data Analysis:	BARNIE connection via TCP-IP or off-line
Prober Control:	Driver available for the common automatic and semi-automatic probers

Power Supplies

Channels:	2
Voltage Range:	1.2V .. 4.5V
Current:	up to 2A each
Over-current Protection:	fixed at max current
Accuracy:	25 mV
Settling Time:	10 msec
Current Measurement:	via PW0

Waveform Generators

Channels:	up to 16 channels
Standard Type:	-12V .. +12V 100 mA 25 mV accuracy 100 MHz 256ksamples buffer 10 nsec rise time
High Voltage Type:	-9V .. +36V 50 mA 25 mV accuracy 100 MHz 256ksamples buffer 100 nsec rise time
High Power Type:	1.2V .. 4.5V 500 mA 25 mV accuracy 100 kHz 256ksamples buffer

Digital Signals

Channels:	32 bidirectional data lines 32 address lines 16 output-only control lines 8 input-only monitor lines Clock generator
Levels:	Vih linked to one of the supplies, selectable per bank Vil tied to GND Vth approx. 50% of Vih Edge skew max 5 nsec
Data Source:	1k vector buffer Fast DMA on the data lines
Formatting:	10 nsec vector time 5 nsec edge placement (control lines)
Clock Generator:	Programmable period and duty cycle 400 MHz max speed 1.25 nsec resolution

Measurement Unit

General	operation modes: • current force voltage measurement • voltage force current measurement • high impedance voltage measurement 70 MHz sampling rate 1k buffer event or software triggerable
PMU	2 or 8 channels behind the data lines and on external inputs measurement ranges: • -1uA .. +1uA • -100uA ..+100uA • -500uA .. +500uA • -1.2V .. +1.2V • -12V .. +12V
PW0	1 channel behind all other lines measurement ranges: • -500uA .. +500uA • -5mA .. +5mA • -50mA ..+50mA • -1.2V .. +1.2V • -12V .. +12V

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