

Agilent B1500A Semiconductor Device Analyzer

30 V-1 A Pulsed IV Measurement Using the Agilent B1500-A's 50 μ s pulsed MCSMU

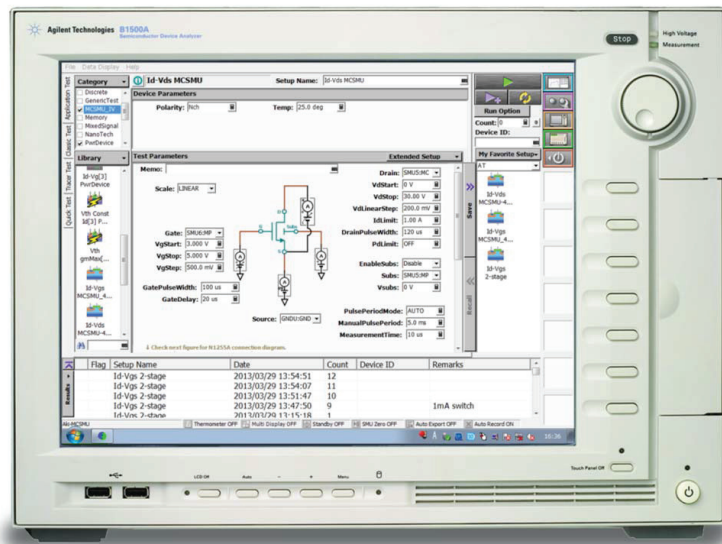
Technical Overview

Introduction

Recent demand for characterizing high to medium power devices on the new materials such as SiC and GaN, and Organic devices requires both high voltage and high current measurement capabilities. Unfortunately, conventional DC measurement techniques can create device self-heating that causes the measured device behavior to deviate from that exhibited under normal operating conditions.

Accurate characterization of these types of high-power devices requires pulsed current (I) and voltage (V) measurements with short measurement times. Until recently, solutions for pulsed IV measurement are limited for relatively wide pulse width in precise measurement or lower accuracy in narrow pulse.

The Agilent B1514A 50 μ s Pulsed Medium Current Source Monitor Unit (MCSMU), which is a one slot plug-in module for B1500A with minimum 50 μ s pulse width and 30 V-1 A (0.1A DC) maximum voltage and current output capability, improves these situations and allows you to focus on your real goal: parametric measurement and analysis.



Key Features

Up to 30 V / 1 A pulse
MCSMU can source 30 V and 1 A pulse into a load accurately. You can easily expand to new applications by just adding MCSMUs to your B1500A.

Min 50 μ s pulse width with 2 μ s resolution
You can improve the pulsed measurement with more than ten times narrower pulse width with the SMU technology. The minimum 50 μ s/30 V pulse (min 10 μ s programmable) enables the precision pulsed measurement with lower junction temperature which is closer to real operating condition.

Integrated voltage and current waveform monitoring capability for accurate pulsed measurement

You can further enhance your pulsed measurement accuracy by using new Oscilloscope View capability which can monitor both the output current and the voltage (IV) waveforms in minimum 2 μ s interval.

You can set the narrow pulses accurately and easily by optimizing the pulse timing parameters in real time by using this capability. The Oscilloscope View realizes the simultaneous current waveform monitoring in synchronize with the voltage waveform that is not easy even using an oscilloscope. The Oscilloscope View is available in the Tracer Test mode (Curve tracer operation), and you can monitor up to four waveforms.



Easy setup using Agilent EasyEXPERT software

Agilent EasyEXPERT software, included with the B1500A, is a powerful environment for device evaluation and data analysis. For pulsed IV measurements using the MCSMU modules, three application tests for high-power pulsed IV (Id-Vds MCSMU, Id-Vgs MCSMU, Id-Vgs MCSMU 2-stage) are available. Tracer Test mode includes several sample setups menu where you can start measurement sooner by interactively controlling the test.

Performance examples

Following demonstrates some of the pulsed IV measurement examples.

Oscilloscope view of 50 μ s pulsed IV measurement

Figure 1 shows the drain pulse waveforms of ID-VGS measurement. In this example, the drain is set for 10 V/50 μ s pulse and the gate is swept from 4 to 4.5 V (pulse base is 2 V) with 40 μ s pulse. Oscilloscope View shown in figure 1 monitors VDS, ID and VGS at the VGS setting of 4.5 V with 10 μ s delay. The measurement time window is shown in green bar. You can move the maker line at any measurement timing of the time scale and the data at the marker position can be read out in the marker readout area. The example shows the VGS, VDS and ID data in the marker readout area at the 48 μ s timing of the pulse where ID can be read as 646 mA. In this way, you can set the pulse timing accurately between the channels, and obtain the accurate result easily by using Oscilloscope View.

Example of Pulsed Id-Vd and Id-Vg measurement

Figure 2 shows an example of pulsed ID-VDS measurements for 1 A and 30 V.

- Id-Vd measurement is made using the Tracer Test mode with 170 μ s drain pulse. The setup is made by using Tracer Test mode Sample setups.

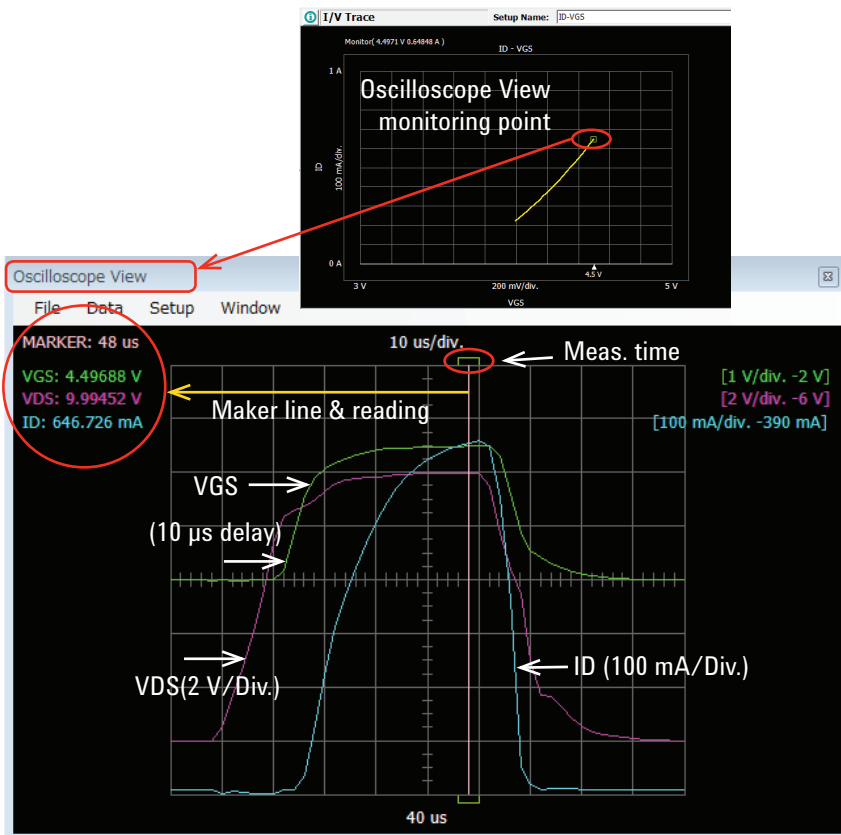


Figure 1. Example of 10 V/50 μ s drain and gate pulse of Oscilloscope View.

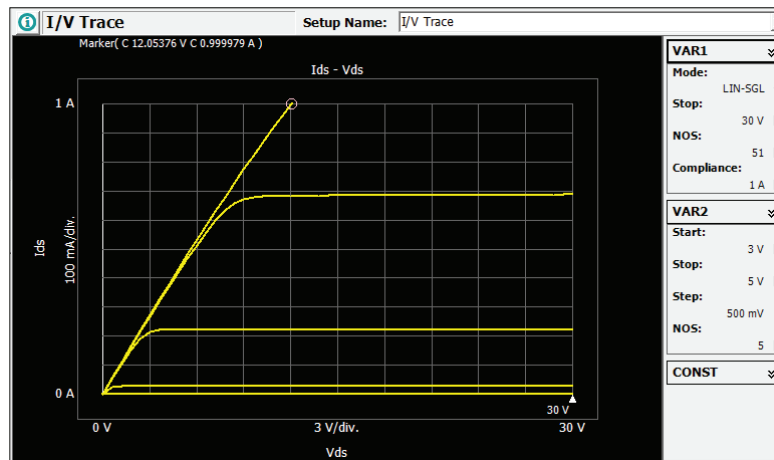


Figure 2. Id-Vds measurement example.

Figure 3 shows an example of pulsed Id-Vgs measurements with wide Id measurement features even under the pulsed measurement.

- The Id-Vg measurements cover a wide current range (Seven digits resolution from 100 nA to 1 A in the example)

- This measurement uses “Id-Vgs MCSMU 2-stage” application test (refer to Figure 3(a)).
- The measurement is made by combining two Id-Vg measurements inside the application test.

System Configuration

- B1500A Semiconductor Device Analyzer.
- 2 x B1514A MCSMU Modules and B1511A MPSMU Modules.
- EasyEXPERT/Desktop EasyEXPERT 5.5 or later* (Included with the B1500A).
- N1255A 2 channel connection box for MCSMU

N1255A 2 channel connection box for MCSMU shown in Figure 4 is used to convert the MCSMU outputs configuration (High and Low output terminals) to traditional SMU output connector format.

Conclusion

MCSMU Pulsed IV solution with N1255A 2 channel connection box for MCSMU provides the high power pulsed IV testing with a minimum $50 \mu\text{s}/30 \text{ V}$ short pulse without any other external equipment. By monitoring the pulse I/V waveform using Oscilloscope View function, you can set the narrowest pulse measurement precisely for accurate measurement.

You can get measurement results easily and quickly by connecting the N1255A's outputs directly to your DUT and by using the EasyEXPERT MCSMU pulsed IV application tests.

Agilent has several pulsed IV solutions to meet a wide variety pulse width and measurement requirements, so please refer to the Agilent Pulsed-IV Parametric Test Solution Selection Guide (5990-3672EN) to determine the best solution to meet your needs.

<http://cp.literature.agilent.com/litweb/pdf/5990-3672EN.pdf>

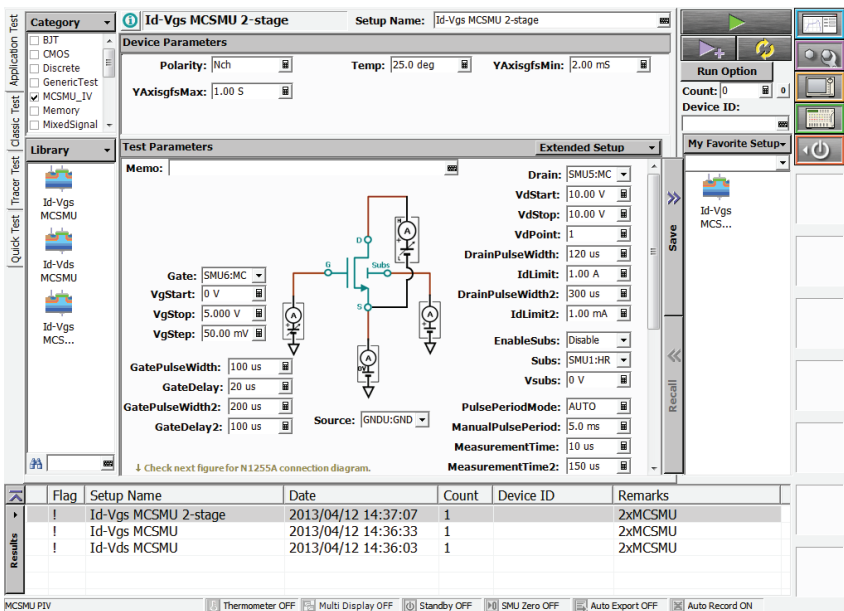


Figure 3. (a) "Id-Vgs MCSMU 2-stage" application test.

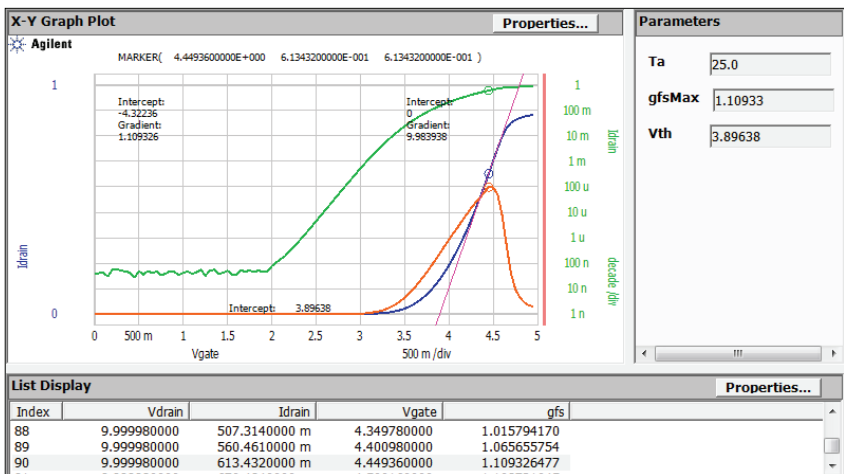


Figure 3. (b) Id-Vgs measurement example.

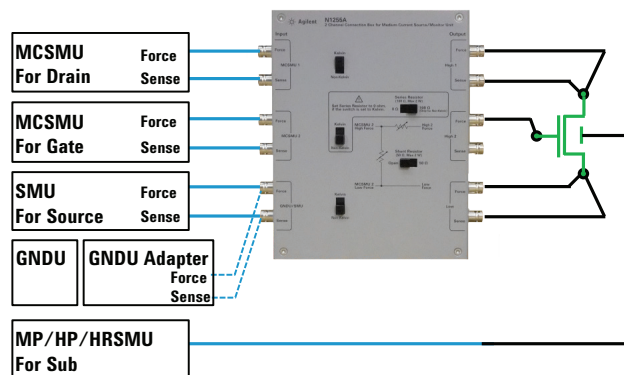
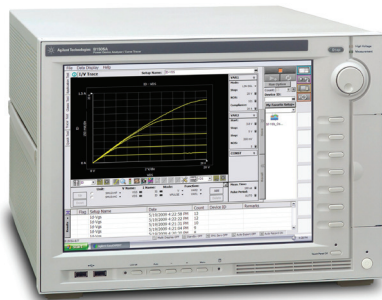


Figure 4. N1255A connection example.

If you need more measurement capabilities, the best choice is Agilent precision SMU products.



Agilent B2901A/B2902A/B2911A/
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