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An MPI Company

Pulsed IV

Tri-State | Pulsed S-Parameters | Long Pulse | High Power

AURIGA AU5 - 5th Generation Pulsed IV / RF Characterization System



AURIGA
PULSED IV

Introduction | Pulsed IV Measurements with Auriga AU5

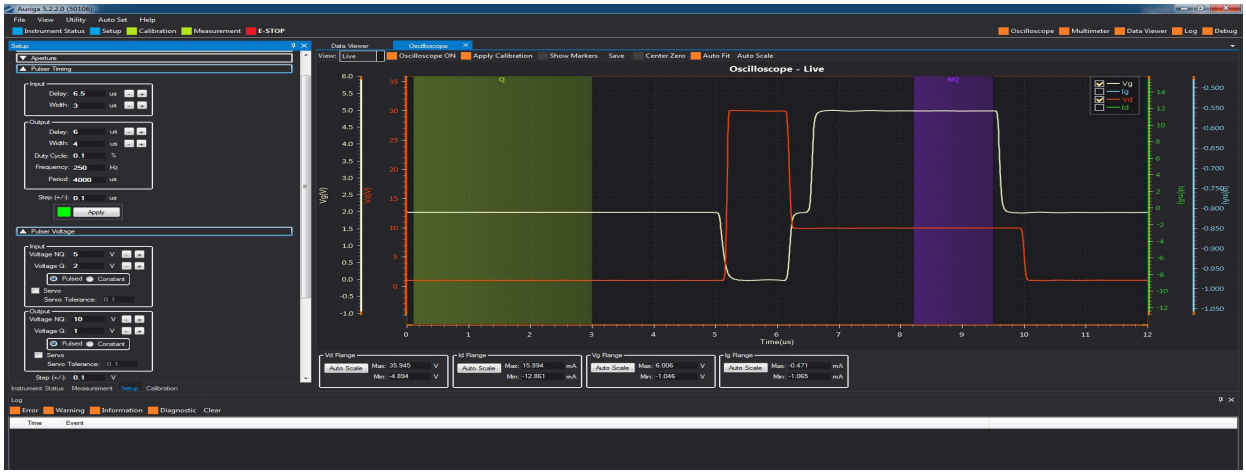
Auriga's 5th generation pulsed IV/RF characterization system delivers unparalleled performance, capturing measurements with incredible speed and accuracy. Pulsed IV (current-voltage) measurements have emerged as the preferred method of capturing current-voltage characteristics of active devices such as field effect (FETs) and bipolar junction (BJTs) transistors. With the growing popularity of higher-power devices, like GaN HEMTs, LDMOS, SiC, and graphene transistors, current and voltage requirements are constantly being pushed higher and higher.The AU-5 Pulsed IV/RF characterization System is supplied with a set of two external and interchangeable pulser heads. Their interchangeability enables this system to provide a variety of pulsed voltage and current ranges to provide the greatest resolution in the dynamic range of interest. External heads allow the pulser circuitry to be located closer to the device under test (DUT), minimizing any signal degradation due to transmission line effects. External heads enable the AU-5 mainframe to reside up to six feet away from the DUT. The AU-5 is supplied with four external power supplies. These supplies provide the Quiescent and Non-Quiescent voltages for both the gate (or base) and drain (or collector) and allow for a greater range of measurement alternatives.

Tri-State PIV

Due to the asymmetry in the time constants associated with capture and release of charges in "traps," in GaN devices, a conventional pulsed characterization is not sufficient in order to keep both the thermal and trapping states fixed.

To keep the trap state constant for a conventional PIV characterization a tri-state control of the standard pulses is developed where both at the gate and drain side a third state is excited just before the main pulse which acts as a pre-pulse. The pre-pulse is a non-overlapping pulse and is fully user controllable in terms of timing and voltage settings. The user can apply independently this voltage pre-pulse to impose a fixed directly controllable trap state.

The Pre-State is a short high voltage pulse used to activate the traps in the semiconductor. This short high voltage pre-pulse with no current flow pre-conditions the state of charges trapped at the conduction layer interface. Under these conditions of tristate excitation both thermal and charge trapping states are kept constant and hence it can be said that measurements are conducted in both isothermal and isodynamic states. The width of the pre-pulse, Quiescent and Non-Quiescent voltages state together with the parameters of main pulse are all independently adjustable. The user can adjust the delay (Δt) between the two pulses (Pre-State and On-State) down to 0s. All timing settings of the Tri-State Gate Pulser and Drain Pulser are independently adjustable.

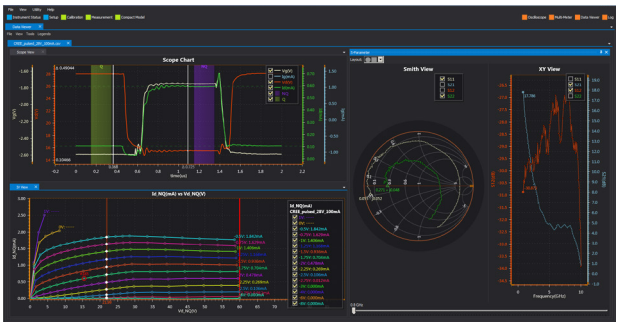


Basic Pulsed IV | Integrated Software



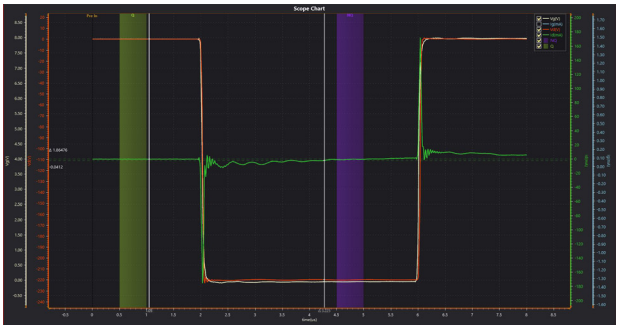
The AU-5 system comes with the integrated AU5 software for a streamlined setup, calibration, and measurement flow. The interface supports easy pulse adjustments and offers the preview before pulse application. The measurement scenarios can be easily switched, and the measurement results are displayed in real time. The software comes with integrated drivers for setup, measurement and viewing of Sparameters with the Vector Network Analyzers in the market. API access is provided for generating custom integration programs.

Pulsed S-Parameters | Optional RF Measurement Feature



The AU-5 has advanced triggering capabilities allowing the user to trigger a Vector Network Analyzer for linear S-parameter measurements used for compact model generation. The pulsed synchronization features can also be used to define the sequences for intricate applications like hybrid Pulsed active load pull and behavior model generation. The AU-5 also supports external triggering feature to operate in slave mode.

Negative Drain Pulse | Optional Measurement System



A new bipolar drain pulser head ± 220V, 2A is available which supports negative Drain pulse for PIV measurements targeted for PMOS devices. The existing Auriga systems can support negative Drain Pulse capability with the new bipolar Drain Pulser head and an easy software configuration.

Long Pulse | Optional Measurement Feature



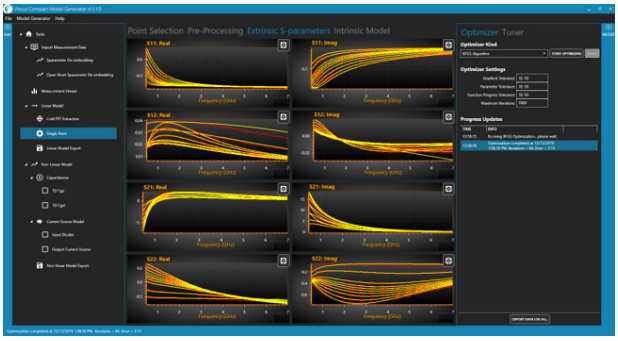
Transient pulse measurements are performed by sampling the signal at high speed to create a waveform of the signal versus time. These measurements are often made by oscilloscopes, but it can be also made by traditional DC-measurement equipment with ADCs running at very high speeds. Transient pulse measurements are very useful as they allow to investigate various device behaviors like self-heating and charge trapping.
Using the long memory depth of Auriga, it can measure a single pulse spanned over seconds/minutes and capture data over the time span set by the user. The software offers complete control of the pulse and sampling parameters. This feature is ideal for examining the effects of rapid bias changes on recovery performance.
The acquisition time for a long pulse must satisfy the following equation:

$$\text{Acquisition time} < \frac{10{,}000{,}000}{\text{Sample rate}}$$

Sample rate is typically ranges from 1 MS/s to 125 MS/s

Compact Modeling | Optional RF Measurement System

The Focus Compact Model (FCM) utility is a streamlined software package designed to be used with Focus' AURIGA high-end Pulsed-IV system, that is used to generate Compact Models for transistors from their Pulsed-IV and wideband pulsed Sparameter data. This is achieved by generating a network of lumped circuit elements that represent accurately the fundamental linear & non-linear behavior of the device over a broad range of bias and power range.
The result of the modeling is a netlist and compatible with commonly CAD tools used in RF Design, such as AWR Microwave office (MWO) and Keysight PathWave Advanced Design System (ADS).



High Power | 1200V & 2000V

The PHD1200/PHD2000 supports the industry's most advanced high-powered devices. Leveraging recent breakthroughs in component and pulser-circuit technology provides unparalleled speed, accuracy, and resolution. Dynamic on-resistance of the latest transistors can now be measured with precision. The PHD1200/PHD2000 operates with the AU-5 Pulsed IV/RF Characterization System; this compact and versatile test solution accurately simulates real life and delivers unparalleled performance, capturing measurements with incredible accuracy and speed.



Focus | Pulsed IV | Models & Specifications | Pulser Heads

Specifications	PHG20	PHG100	PHD220-2	PHD220-10	PHD220-30	PHD600-5	PHD1200-10	PHD1200-100
Max Voltage	±20 V	±100 V	220 V	220 V	220 V	600 V	1200 V	1200 V
Max Current Pulsed	±0.1A	±2 A	2 A	10 A	30 A	5 A	10 A	100 A
Max Current DC	±0.1 A	±0.5 A	0.75 A	2.5 A	2.5 A	0.5 A	0.1 A	0.1 A
Max error	0.1 %	0.1 %	0.1 %	0.01 %	0.01 %	±2 mA ±1 %*	±8 mA*	0.01 %
Max Power	2 W	40 W	40 W	1000 W	1000 W	1000 W	1000 W	5000 W
Min Pulse Width	200 ns	200 ns	200 ns	500 ns	500 ns	200 ns	750 ns	750 ns
Max Pulse Repetition Frequency (PRF)	310 KHz(V ≤20 V)	310 KHz (V≤100V)	80 KHz (V ≤220 V) 155 KHz (V ≤160 V) 310 KHz (V ≤110 V)	20 KHz (V ≤220 V) 70 KHz (V ≤110 V) 220 KHz (V ≤60 V)	20 KHz (V≤220 V) 70 KHz (V≤110 V) 220 KHz (V≤60 V)	4 KHz (V ≤600 V) 25 KHz (V ≤400 V) 80 KHz (V ≤200 V)	1.4 KHz (V ≤1200 V) 5 KHz (V ≤620 V) 28 KHz (V ≤200 V)	1.4 KHz (V≤1200 V) 5 KHz (V≤620 V) 28 KHz (V≤200 V)
Max Duty Cycle**	100 % (I ≤0.1 A)	5 % (I ≤2 A) 35 % (I ≤1.5 A) 70 % (I ≤0.75 A)	5 % (I ≤2 A) 35 % (I ≤1.5 A) 70 % (I ≤0.75 A)	1 % (I ≤10 A) 50 % (I ≤5 A) 80 % (I ≤2.5 A)	1 % (I ≤30 A) 50 % (I ≤5 A) 80 % (I ≤2.5 A)	5 % (I ≤5 A) 40 % (I ≤1 A) 100 % (I ≤0.5 A)		
Min Output Rise/ Fall***	23 ns @ 20 V	26 ns @ 100 V	36 ns @ 220 V	80 ns @ 220 V	80 ns @ 220 V	35 ns	76 ns @ 1200 V	76 ns @ 1200 V
Max Pulsed Width with Max Peak Current	∞	1 ms	1 ms	1 ms	1 ms	100 µs	100 µs	20 µs
Test Port Connector	BNC (f)	BNC (f)	BNC (f)	BNC (f)	BNC (f)	MHV (f)	MHV (f)	MHV (f)

* Current reading in the Software
** Tested with 20us pulse width
*** Tested with no load