SMU-04103 | SOURCE MEASUREMENT UNIT – PULSE ENABLED

PULSE-ENABLED SMU DEVICE ANALYSER
CH 1   CH 2   CH 3   CH 4
SENSE   SENSE   SENSE   SENSE
OUTPUT   OUTPUT   OUTPUT   OUTPUT
SENSE INPUT: ± 20V
OUTPUT: ± 10V, 3A

Introducing the SMU-04103

This versatile and durable module provides four channels of bipolar, ultra low-noise ±10V power output, with 3 Amp per channel available, and instrumentation-grade control. It supports both constant and pulsed power supplies (up to 5 Amps pulsed) and is optimized for advanced scientific applications, including semiconductor analysis, battery simulation, RF device biasing, and quantum technology. The device can be run in voltage or current control mode. The constant current control mode can work from 3 Amps down to 1pA.

Each channel features high-resolution ±20V analogue inputs that can be configured for either measurement or voltage sensing. Precise current measurements, from 5A down to 10pA, enable resistances exceeding 10 G-Ohms to be measured, all at an impressive sampling rate of 1 million samples per second. Pulse durations range from 1 microsecond to unlimited lengths, with intelligently adjustable pulse slopes to mitigate cable inductance. Multiple units can be stacked, offering synchronized operation with hundreds of channels, while trigger in/out connections allow for precise timing control.
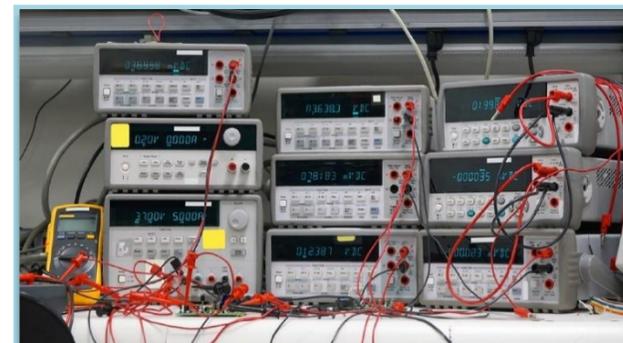
Equipped with robust onboard processing, the module offers seamless integration into automated test setups through USB or Ethernet interfaces, with support for C, LabView, and MATLAB for fast, efficient control.

Detailed Description

This module consolidates the functionality of multiple power supplies and multimeters into a single, high-performance system, delivering superior performance at a fraction of the cost compared to traditional desktop setups. It also eliminates the hassle of cable clutter and current loops. With onboard filtering, the module effectively removes RF noise that typically couples with circuits and cables. The power supply is fully isolated, with a shared ground across all four channels, eliminating the mains noise commonly found in standard setups (as shown on the right). A unified interface allows for quick, simultaneous control of all supplies, enabling fast and efficient measurements across any configuration.

No more complex, expensive setups

The hardware is highly adaptable, allowing reconfiguration with new processing algorithms. Its interconnected design supports a wide range of intelligent operations. It can function as a basic power supply, current sensing, and I/O card, or be reconfigured for advanced tasks such as amplifier bias control, transistor IV curve measurement, leakage current testing, and detecting potential static damage in devices. Pulse measurements, for high-power devices, can be conducted with pulse durations from 1 µS and longer.

The system is capable of collecting data from various sources, with an interface protocol that ensures simultaneous data transfer. It also includes a configurable audible alarm for alerts related to overcurrent, specific input voltages, or digital events. LED indicators provide clear visibility of all external connections, making it easy to monitor the module's status at a glance.
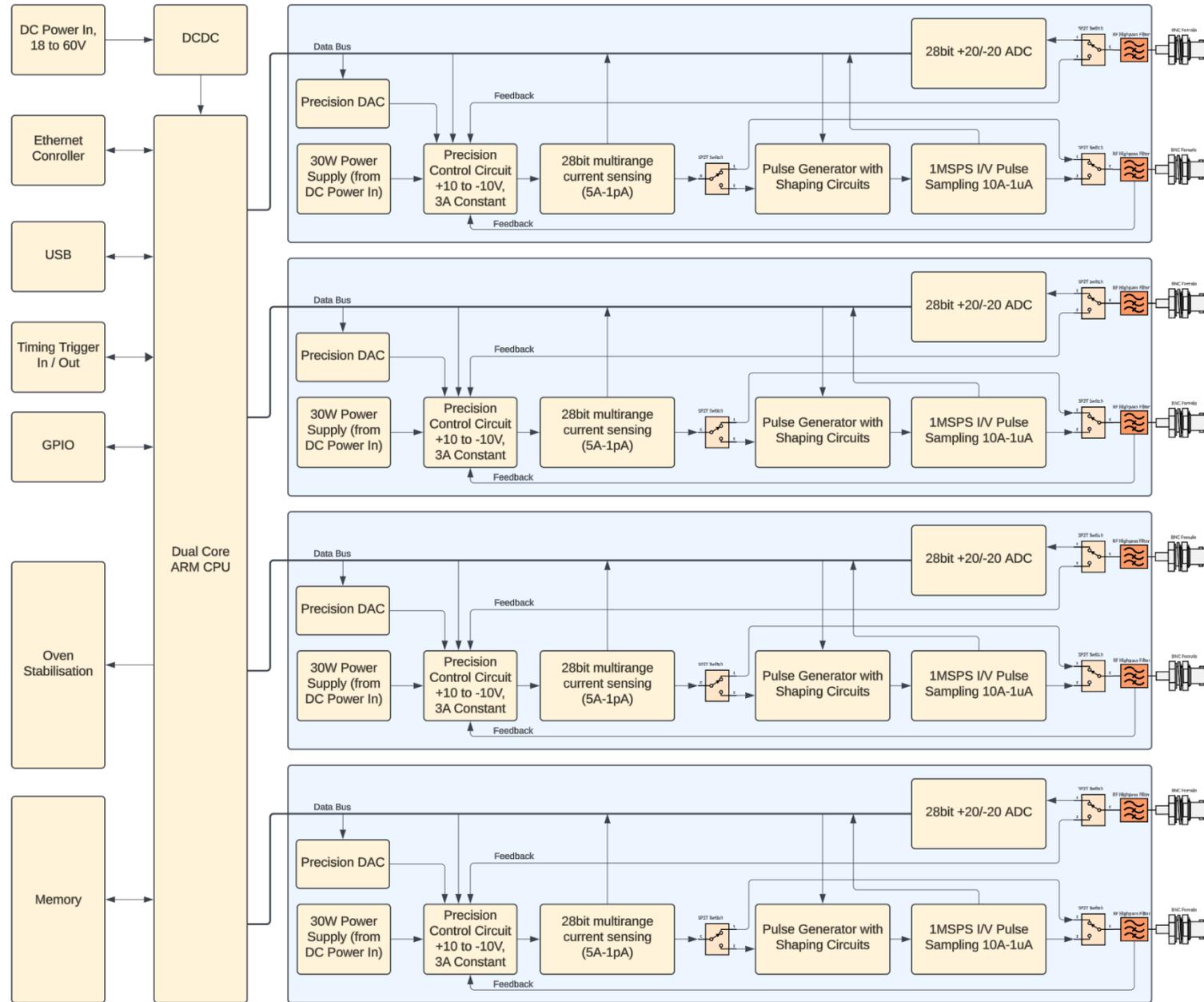
Use Cases

- GaN Device Characterization
- Transistor Measurements
- Gate Leakage Measurements
- Semiconductor Measurement
- Transistor Biasing
- Automated Test
- Flying Probe
- RF Development

- Board Bring Up
- On-Wafer Testing
- Scientific Measurements
- Quantum Computing
- Battery & IOT Characterization
- Battery Simulation
- Low-Cost Batch Production Test

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System Diagram

The devices block diagram is shown, each channel is identical and has a high-speed bus connected to a fast dual core processor for efficient control. All channels can be operated simultaneously. The outputs are ultra-low noise and feature low pass RF filters to remove any RF coupling from the devices being measured.

DC Power In, 18 to 60V → DCDC

Ethernet Controller

USB

Timing Trigger In / Out

GPIO

Dual Core ARM CPU

Oven Stabilisation

Memory

Data Bus

Precision DAC

30W Power Supply (from DC Power In)

Precision Control Circuit +10 to -10V, 3A Constant

28bit multirange current sensing (5A-1pA)

Pulse Generator with Shaping Circuits

1MSPS I/V Pulse Sampling 10A-1uA

28bit +20/-20 ADC

Feedback

SPDT Switch

RF Highpass Filter

BNC Female

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⚠ CAUTION: HOT EXHAUST! KEEP AT LEAST 30CM FROM WALL
IN   OUT   I/O   LAN   USB   PWR
TRIGGER
48V
4A MAX

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Key Features

DC Outputs	4 x -10V to +10V 3A Supplies with ground provided over BNC. Voltage or Current Modes & Pulsed Measurements. Configurable Ramp Rates and Current Limiting. Other features available on request by way of software updates.
DC Step Size	20µV Step Size on Voltage Outputs.
DC Accuracy	XFET Reference, MAX 3ppm/C, ±0.05%.
Current Measurement and Constant Current Tracking	1pA to 3A with 28bit log scale accuracy. Pulse measurement up to 5A for 100uS.
Sample Rate	Simultaneous measurement of all currents and analogue inputs, up to 10kSPS. Pulse measurement 1uS sample rate (1M samples per second)
Analogue Inputs	±20V Range with 24bit Resolution. BNC
Digital Ports	8 Reconfigurable pins as I/O, I2C, RS232, SPI, etc. Power Rail Configurable between 2.0V and 5.5V. 20 MHz Digital IO Speed per pin.
Control Options	Control via Ethernet or USB
Power	48V – 5A Max Input. Total Power Output: 120W (30W per channel)

All channels synchronized.

Key Features

- Outputs can source and sink current. Positive and Negative current can be measured.
- Outputs feature settable current limits, unit can be programmed to limit, trip or alert the operator. Settable range can extend down to 1pA.
- Unit features safe guards so max voltage or current can be set and the action to take can be configured.
- Internal memory can save measurements.
- New features can be added on request due to the extreme configurability of the hardware.

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Constant Voltage, Current and Power Mode
The module can control the output to be either constant voltage or constant current. When switching between these modes the device limits overshoot and protects the DUT. Custom software modules can be added to provide any simulation of power interface that may be required.

Pulse Measurement Capability
The power line outputs can be pulsed to measure high power devices. Pulse lengths upwards of 1us can be made. Maximum voltage rise/fall time is 10V in 100nS. 1MSPS of voltage and current are made during the pulses.

Controllable Start / Stop Rate (soft start)
The module can be configured for immediate or slow ramping to achieve the target output voltage. This is especially useful to minimize overshoot when high inductance lines are present.

Sequence Programming using Trigger In / Out
The module can be pre-programmed with a sequence of measurements, events and sweeps. The unit can be triggered enabling fast and aligned sequencing through large numbers of tests. Onboard memory is available for collection of large amounts of sample data.

Fast Sequence Sweeping
Voltage / Current for quick device characterization. IV curves can be taken for transistors, diodes and any semiconductor devices enabling leakage, ESD damage or verification of bond wire attachment. Multiple pins can be sweeps concurrently enabling ultra-fast die measurement. Analog Input can be used within the sequencing – for example diode measurement.

Programable Measurement Settle Time
The dwell time for a current or voltage sweep can be programmed to ensure the DUT is fully settled. This control can also be automated to ensure all data points are steady state measurements. This process ensures the most rapid of sweeps.

Accumulated Charge Measurements
for IOT and Accurate Battery Simulation. The unit can simulate accurate batteries for IOT measurements and assessment of battery performance under various conditions. The unit can detect Pico amp current draw with averaging and hundreds of samples / second allowing even the fastest of current blip to be measured.

Software Applications
is available for basic control and quick start of the unit. The unit can also be easily communicated with options using GPIB, RS232, USB, Ethernet via all programming environments (C / Matlab / Labview etc).

Additional Functionality
We can add as you require further software tools to enable any specific requirements that you may have, contact us for more information.

EECL Services

We have many customers who require a complete turnkey test solution. We can implement new firmware commands to enable custom measurements to be completed at the hardware level.

If you require anything just a little bit different to what is here, please get in touch – we may be able to make or modify it for you.
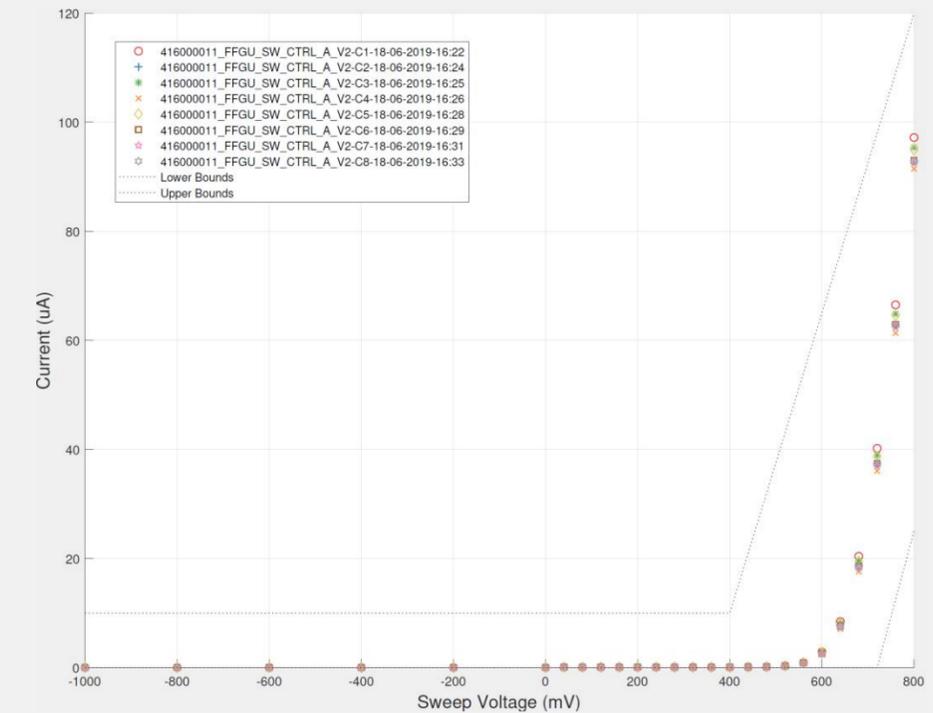
Measure Diode & Transistor IV Curves from nA to Amps on all pins simultaneously. Ultra-Fast Sweep – 1M Samples/Sec

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General Specifications

	Minimum	Typical	Maximum
Operating Temperature	10°C		40°C
Humidity	10%		80%
DC Jack Input Voltage		48V	
Idle Power Consumption		30W	
Output Power, max continuous		120W	
Output Voltage	-10.0V		10.0V
Output Voltage Resolution		20µV	
Output Current	0		3A (*5A)
Current Measurement Resolution		10pA, 28bit log scale to 5Amps. Negative and Positive Current	
Current Measurement Range	10 pA		3A (*5A)
Pulse Measurement Width	10µS		Inf
Pulse Rise Time	100nS		Inf
Pulse Current Sampling Rate			1 Msps
Standard Sampling Rate (Constant)			20 ksps
Weight		5kg	

* - Only Available in Pulse Mode

Analog Input Specifications

	Minimum	Typical	Maximum
Voltage Range	-20V		20V
Resolution		2µV	
Input Impedance		100 MΩ	

Analog Output Specifications

	Minimum	Typical	Maximum
Voltage Range	-10V		10V
Time to Settle	2µS		20µS
Current Range	10pA		3A (*5A)

* - Only Available in Pulse Mode

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Software

Our software suite seamlessly integrates with the module, providing a powerful and user-friendly interface for configuring and controlling the system. Compatible with C, LabView, and MATLAB, the software allows for effortless automation of complex tasks and real-time data acquisition. Users can set up power supplies, measurement configurations, and pulse parameters through an intuitive dashboard, with the ability to monitor all channels simultaneously. Advanced features include automated script execution, real-time graphing of voltage and current trends, and customizable trigger conditions for precise timing. The software also supports remote access via Ethernet or USB, enabling control from any networked location, making it ideal for both lab-based setups and large-scale distributed testing environments. Additionally, all data collected can be logged, exported, and analysed for detailed post-test reporting, streamlining workflows and improving efficiency.
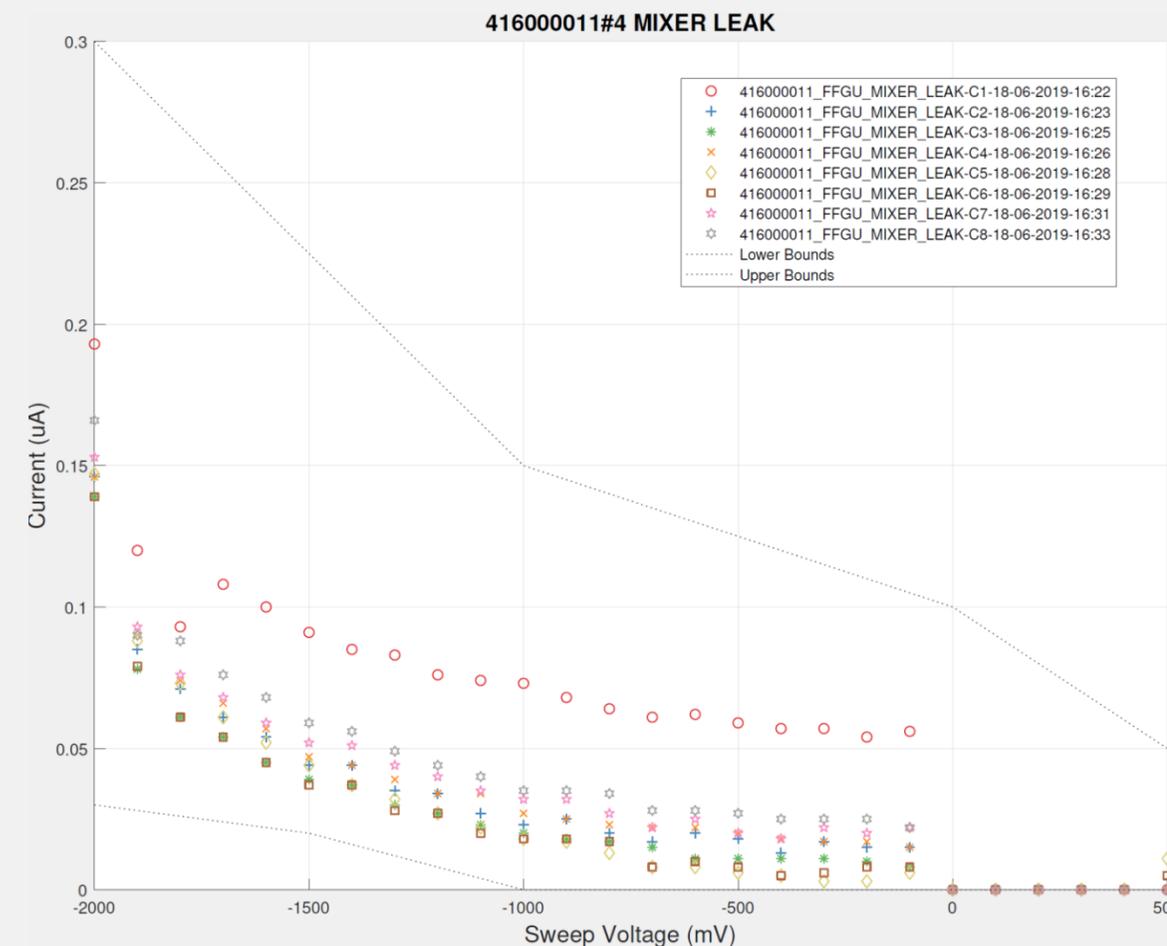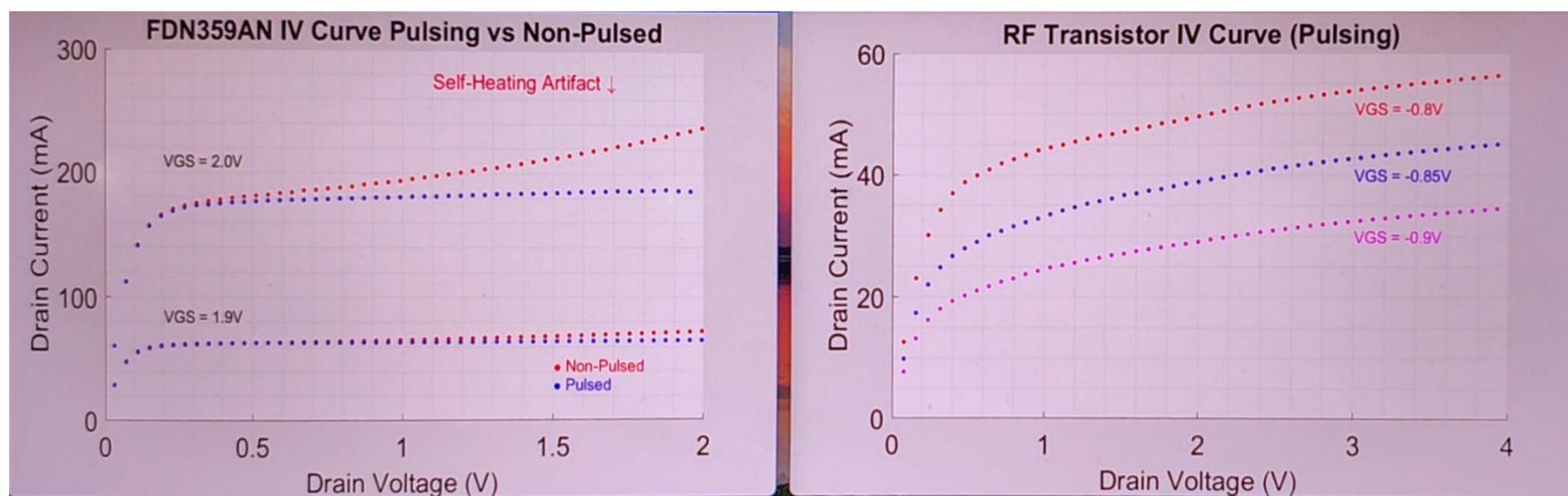
Sweep Device Performance, Above: DC Mixer leakage at RF ports

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Unit Dimensions

182mm

35mm

30mm

125mm

312mm

298mm

274mm

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OUTPUT   OUTPUT   OUTPUT   OUTPUT

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OUTPUT: ± 10V, 3A

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IN   OUT   I/O   LAN   USB   PWR

TRIGGER   48V
4A MAX