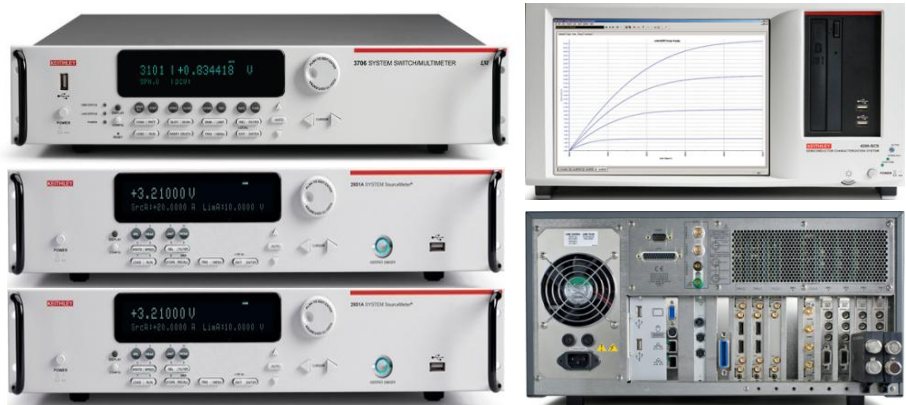


## HiPowerDev

- Flexible and scalable structure: **semiconductor characterization and measurement main unit**, model Keithley 4200-SCS, **low power source measurement unit**, model Keithley 2600, **high current source**, model Keithley 2651A, max. 50A, **high voltage source**, model Keithley 2657A, max. 1,000V, **test fixtures for high power devices under test**, model Keithley 8010 **High Power Device Test Fixture** and/or model OFRIM Engineering **OE\_HighAmp/Temp**.
- **TestDevices** system includes additionally the **Keithley 3700 System Switch/Multimeter** which performs multi-channel resistance and temperature measurements in conjunction with an original test fixture, model OFRIM Engineering, **OE\_HighAmp/Temp**.
- **TestDevices** system has a configurable structure based 2 different measurement base unit: 4200-SCS and 2600 and includes high power sources, models Keithley 2651A and 2657A, in accordance with the device design engineers needs and type of DUT.
- **OE\_HighAmp/Temp** test fixture offers U, I, Resistance, 2W and 4W, and Temperature, max 250 °C, measurement capabilities.
- **TestDevices** accept different types and forms of DUT, included SMD type.

## Automatic system for I-V, C-V, Pulse Characterization and Temperature measurement



The automatic system for I-V, C-V, Pulse characterization and temperature measurement, **HiPowerDev**, is designed for automatic test and measurements for high power semiconductor device characterization and testing with additional temperature and 4-wire resistance measurement capabilities for all terminals of device under test, DUT. The last 2 capabilities of the system require the original test fixture, model **OE\_HighAmp/Temp**.

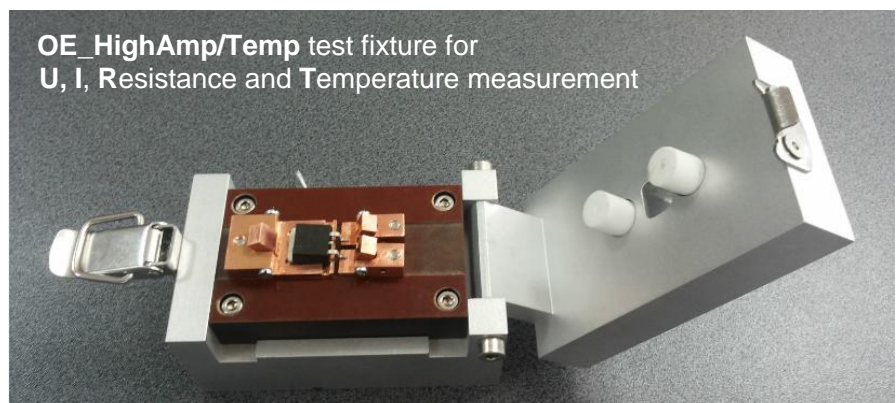
The main area of applications for the **HiPowerDev** system is:

- High Power semiconductor device characterization and testing
- Characterization of GaN and SiC, LDMOS, and other devices
- Reliability studies on power devices
- Incoming inspection and device qualification

The system has a flexible structure and could includes different types of Keithley Instrument products as 4200-SCS, 2600 Series, 3700 Series and an original test fixture, **OE\_HighAmp** and **OE\_HighAmp/Temp**, produced by InterNET Ltd company, OFRIM Group member, see [www.ofrimgroup.com](http://www.ofrimgroup.com).

Characterizing and testing of high power semiconductor devices asks to the device design engineers equipment that can support complete and complex tests of a power device. The high power characterization systems series, **HiPowerDev**, are available in two main forms — complete systems, customized by us based the customer's technical specifications and building blocks which are Keithley Instruments products, mainly, plus different type of test fixtures, that must be configured and integrated by the user or by us and completed with software made by customer or by us.

We offer and promote our **HiPowerDev** system as an open system because the existing turnkey system versions, which can be set up and running quickly, can be quite expensive and limited in the breadth of testing that can be performed.



OE\_HighAmp/Temp test fixture for U, I, Resistance and Temperature measurement

- Possibility to command and control additional equipments.

### ▪ Technical specifications:

- Configurable power levels:  
From 200V to 3kV  
From 1A to 100A
- Wide dynamic range:  
From  $\mu\text{V}$  to 3kV  
From fA to 100A
- Capacitance-voltage methods:  
 $\pm 400\text{V}$  multi-frequency C-V  
200V ramp rate C-V  
20V very low frequency (VLF) C-V
- DC or pulsed I-V to  $50\mu\text{s}$
- Temperature measurement of DUT, require OE\_HighAmp/Temp test fixture
- 4-wire resistance measurement capabilities for all terminals of DUT, require OE\_HighAmp/Temp test fixture
- High voltage and high current channels have both 24-bit precision A/D converters and 18-bit high speed ( $1\mu\text{s}$ ) digitizers
- Test management software includes both trace mode for real-time control and parametric mode for parameter extraction

**HiPowerDev** system configurations are complete solutions configured with a variety of Keithley Instruments high quality instruments, cables, test fixtures, and software.

This building block approach offers the advantages of easy upgrading or modification to meet changing test needs. Additionally, these instruments and accessories can be used across different test system platforms, such as for reliability or device qualification testing.

**HiPowerDev** system configurations include everything necessary for the characterization engineer to develop a complete test system quickly. The configurations support both parametric and trace test modes, thus including the best of a curve tracer and a parameter analyzer.

## Structure and operation principle of TestDevices system

The structure of TestDevices allows two ways of operation:

- 4200 Mode**, when the coordinator unit is Keithley 4200-SCS unit
- 2600 Mode**, when the coordinator unit is Keithley 2600 unit

Also, each operation mode accepts different high power measurement unit types and numbers of each: 2651A units, only, 2657A units, only, 2651A and 2657A units on the same time.

For high performance and complex characterization tests, the structure type a, 4200 Mode, can offers C-V characterization capabilities, additionally. The 4200-SCS must include, in this case, the option 4210-CV.

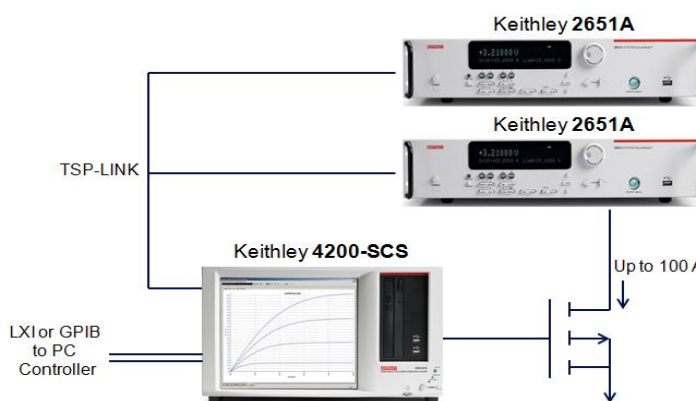
TestDevices can perform the characterization tests by using different test fixture offered by Keithley Instruments as Model 8010 High Power Device Test Fixture or / and by InterNET Ltd., OFRIM Group member, as the original test fixture, Model OE\_HighAmp/Temp.

The **Model 8010** is shipped with two 8010-DTB Device Test Boards installed. The boards include connections for TO-247 and axial-lead devices. The Model 8010 is also shipped with an 8010-CTB Customizable Test Board, which allows you to add your own connections. In addition, you can purchase the 8010-DTB-220 Device Test Board for use with three-terminal TO-220 or TO-247 devices.

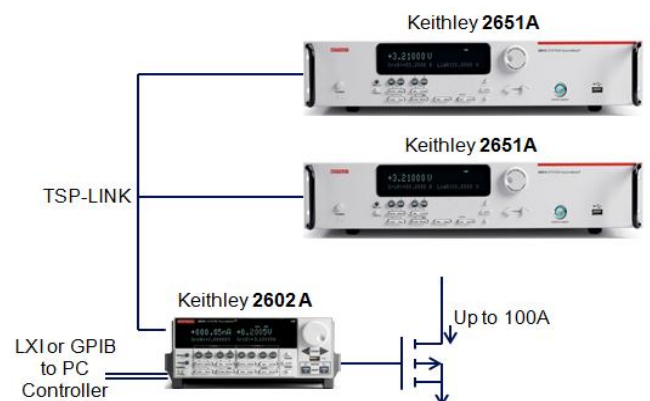
### 8010 Test Fixture



This board is limited to 1000 V, only, but the Model 8010 offers flexible, safe test fixture for up to 3kV and 100A.



**Mode a:** 4200SCS measurement unit



**Mode b:** 2600 measurement unit

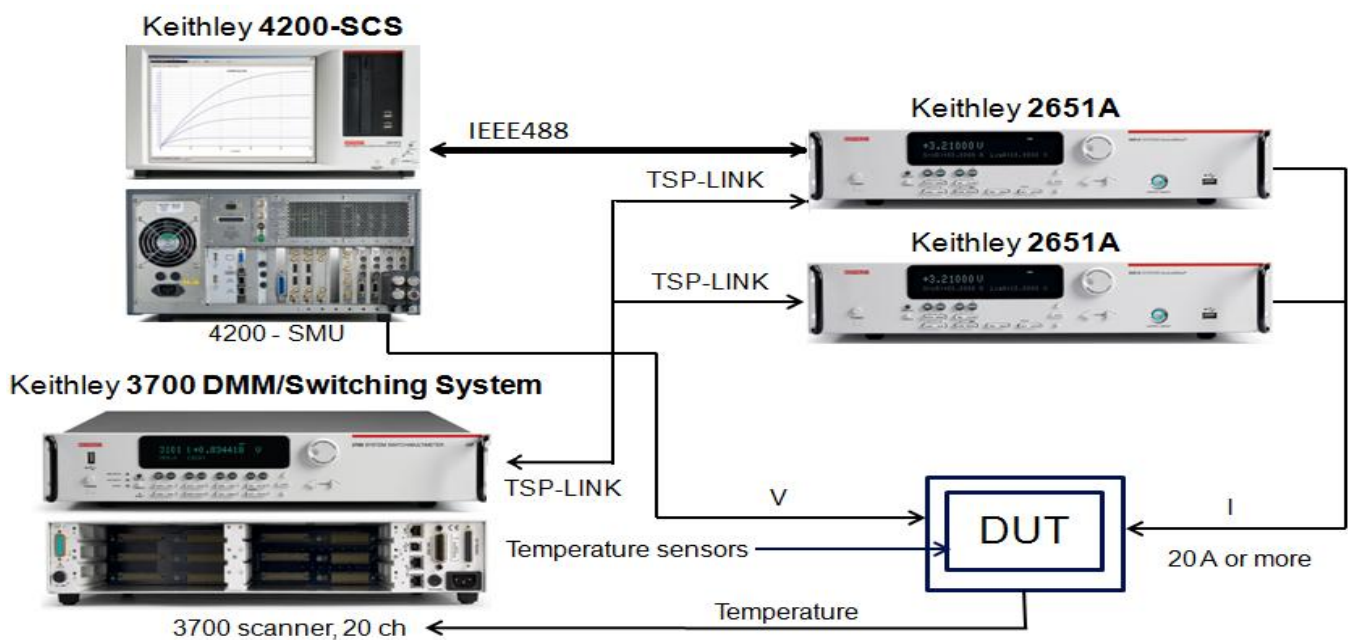
The Model **OE\_HighAmp/Temp** High Power Device Test Fixture offers **U, I, Resistance**, 2W and 4W, and **Temperature** measurement capabilities in connection with 4200-SCS or 2600, 2651A or 2657A and **3700 System Switch/Multimeter**.

**TestDevices** plus **Temp Option** ( Keithley **3700 System Switch/Multimeter**, in connection with Model **OE\_HighAmp/Temp** test fixture ) offers to the device design engineers a flexible and customized equipment that can support multi-channel resistance and temperature measurements.

The **Temp Option** add the temperature sensor, model thermocouple type K, to the test fixture and allows to the system to determine for temperature of DUT package, mainly.

The Model **OE\_HighAmp/Temp** test fixture can offers multi-point temperature measurements by the direct contact of the temperature sensors with DUT. Also, by his direct window access to the surface of DUT package, the test engineers could use an **airstream system** to deliver controlled temperature with speed and precision to his DUT ( small and large devices, modules, PCBs and assemblies ).

The structure of **HiPowerDev/Temp** system with Keithley 4200-SCS, 2 x Keithley 2651A high current source, Keithley 3706A system switch with 7 ½ digit DMM, front panel display and keypad plus 3721 Dual Multiplexer card extension and OFRIM Engineering **OE\_HighAmp/Temp** test fixture, see below, perform high current I-V characterization measurement, max. 40Adc and 100A pulse and package temperature measurements for model **SMD TO-263** device.



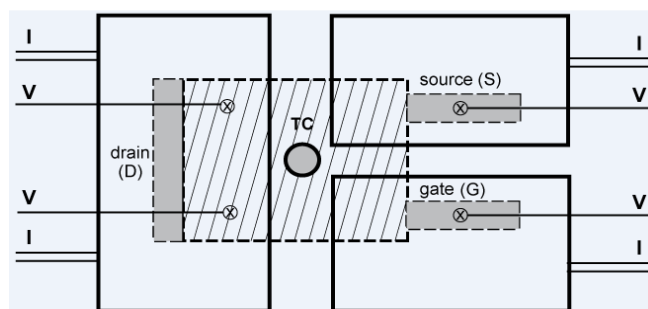
## Structure of Model OE\_HighAmp/Temp High Power Device Test Fixture

The actual Model **OE\_HighAmp/Temp** Test Fixture support model **SMD TO-263** devices, see picture, for **high current I-V** measurements, **Resistance**, 2W and 4W and package **Temperature** measurement. The test fixture has a flexible system of connections and the test engineer has complete electrical access to each plot by 2 types of wires, one for high current injection and another one for voltage measurement. The places of measurement points respect the **4-wire I-U method** specifications to assure high performance and accurate measurements. We show below the schematic structure of **OE\_HighAmp/Temp** Test Fixture

To achieve these characteristics, InterNET has developed a set of precision cables to connect the instruments to the test fixture. For the high current channel, special low inductance cables provide fast rise time pulses to minimize device self heating effects. The **OE\_HighAmp/Temp** provides an shielded environment that allows for both low current, high voltage testing and high current, low voltage testing. Included with the test fixture are high performance connectors that mate with the precision cables.

**OE\_HighAmp/Temp** Test Fixture support model **SMD TO-263** devices.

Each terminal has I and V connection type and the package has contact with the temperature sensor, TC type K

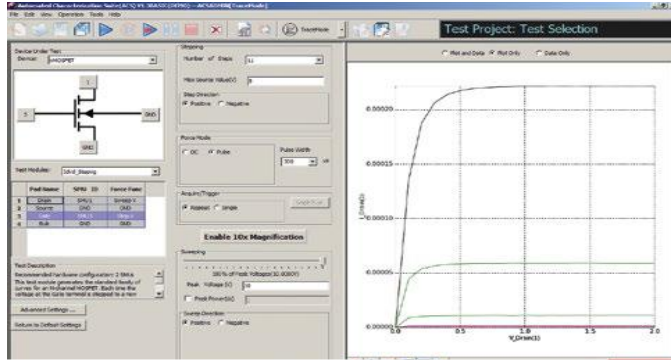


OE\_HighAmp/Temp general schema

SMD TO-263 type

## Semiconductor Parametric Test Software for Component and Discrete Devices

Keithley ACS Basic Edition software is specifically tuned to take advantage of the high performance capabilities of the Keithley instrumentation and includes several sample libraries for performing common high power device tests. Unlike other systems, the software allows the user almost unlimited flexibility in configuring all of the measurement channels to create tests far beyond what a traditional curve tracer could achieve.



Trace mode supports interactive testing of a device.

InterNET TestPower software use the high performance capabilities of the Keithley Test Environment Interactive (KTEI) Software Package and offers characterization tools that include all of the key elements necessary for power device characterization and DUT temperature measurement. This software package could be customized and updated by request.

### Ordering Information

#### System components

- 4200-SCS, Semiconductor Characterization System
- 2600, System SourceMeter® SMU Instrument
- 2651A, High Current SMU Instrument
- 2657A, High Voltage SMU Instrument
- 3706A, System Switch/Multimeter
- 8010, High Power Device Test Fixture
- OE\_HighAmp/Temp, Power Device Test Fixture and Temperature measurement
- ACS Basic Edition software
- TestPower software

## Main technical features Keithley 2651A SourceMeter

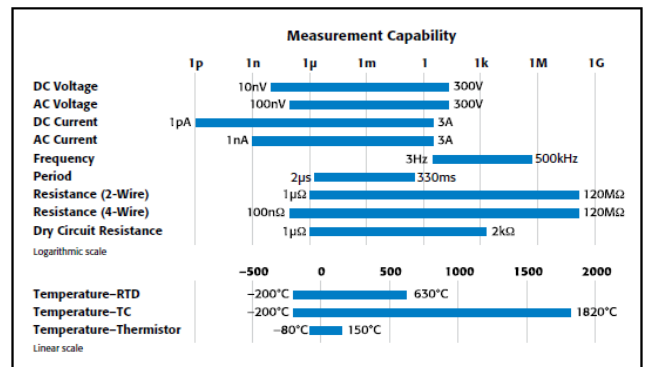
### VOLTAGE ACCURACY

Range	Programming Resolution	Accuracy ±(%rdg. + volts)
100.000 mV	5 $\mu$ V	0.02% + 500 $\mu$ V
1.00000 V	50 $\mu$ V	0.02% + 500 $\mu$ V
10.0000 V	500 $\mu$ V	0.02% + 5 mV
20.0000 V	500 $\mu$ V	0.02% + 5 mV
40.0000 V	500 $\mu$ V	0.02% + 12 mV

### CURRENT ACCURACY

Range	Programming Resolution	Accuracy ±(%rdg. + amps)
100.000 nA	2 pA	0.1 % + 500 pA
1.00000 $\mu$ A	20 pA	0.1 % + 2 nA
10.0000 $\mu$ A	200 pA	0.1 % + 10 nA
100.000 $\mu$ A	2 nA	0.03% + 60 nA
1.00000 mA	20 nA	0.03% + 300 nA
10.0000 mA	200 nA	0.03% + 6 $\mu$ A
100.000 mA	2 $\mu$ A	0.03% + 30 $\mu$ A
1.00000 A	200 $\mu$ A	0.08% + 3.5 mA
5.00000 A	200 $\mu$ A	0.08% + 3.5 mA
10.0000 A	200 $\mu$ A	0.08% + 6 mA
20.0000 A	500 $\mu$ A	0.08% + 8 mA
50.0000 A	2 mA	0.08% + 50 mA

## Keithley 3706A System Switch/Multimeter



### Characterization System

- 2600-PCT-1 Low Power
- 2600-PCT-2 High Current
- 2600-PCT-3 High Voltage
- 2600-PCT-4 High Voltage and Current
- 4200-PCT-2 High Current + C-V
- 4200-PCT-3 High Voltage + C-V
- 4200-PCT-4 High Voltage and Current + C-V
- 4200-TestDevice High Current
- 4200-TestDevice High Current + Temp



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