



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
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Technical Specification of High power device characterization lab.

IIT Bombay presently has a full-fledged RF and DC characterization lab. This includes RF characterization of up to 40GHz and DC characterization up to 200V and 1A.

The future technology is towards high efficiency, smaller size, high power device development. This includes research and development on technologies based high power MOSFET, GaN etc.,

This demands for high power DC characterization capabilities extending up to and above 3kV and 500A. This includes measurement of packaged devices and on wafer devices. The measurements include High voltage IV measurements, High current IV measurements, CV measurements with 3kV of bias and Qg measurements.

Keeping this in mind the existing characterization lab must be upgraded with high power device analyzers and with appropriate accessories, probe stations etc., with the below specifications.

Specifications for high power device measurements setup	
The measurement setup should be capable of IV measurement up to 3kV and up to 500A, CV measurements up to 3kV bias and Qg measurement should be possible.	
The instrument should be based on SMUs fit in to a single mainframe with built in controller, software/firmware to control the instrument and large in-built display	
The main instrument should be upgradable up to 10kV and up to 1500A in future.	
The instrument that would be supplied should be seamlessly compatible with existing Keysight/Agilent device modelling tool: IC-CAP	
Parameter	Specifications
Mainframe	
Number of slots	Ten or more
Ground unit	Should include a Ground unit apart from the ten slots for SMUs
Ground unit sink current	at least 4A should support Kelvin connection with Kelvin connectors
Interlock	Interlock provision should be available for user protection
Display	15-inch touch screen display.
Interfaces	GPIB, LAN, USB and VGA output
Operating system	Should come with windows 7 or better
Test fixture	
A Fixture for IV testing of discrete device should be provided supporting up to 500A and appropriate connector 3 pin inline package device should be provided. Should also provide with a universal test fixture for building custom test fixtures.	
Should have built in selector to select between High voltage and high current based on measurement	



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without changing physical connection	
The measurement fixture should be compatible with thermal plates from Intest corp. for measurement up to 250-degree Celsius enabling us to upgrade this in future	
IV capabilities on different port should support the following using SMUs and accessories as an entire system	
High voltage capability	Voltage Up to 3kV with minimum measurement resolution of 200uV Current measurement up to 4mA and measure resolution of up to 10fA.
Future Upgrade for high voltage capability	System should allow upgrading the high current capability for high voltage SMU for up to 2A at 1.2kV range at least with 4uA measurement resolution
High Current Capability	Up to 500A with measurement resolution of 500uA Voltage up to 60V with measure resolution of up to 100uV Pulse capability of up to 10us Pulse width
Gate/Base Bias	30V, 1A with pulse width of 10us. Current measurement resolution of 10pA.
Gate charge measurements of Nch mosfet should be possible at room temperatures	
Vds at high voltage from 0 to 3kV Vds at high current from 0 to 60V Id at high current from 0 to 350A Qg 1nC to 100uC with 10pC of resolution All necessary adapters and cables for discreet device and for connecting to standard high-power probe station should be provided. Software should support control of the instrument to measure and report total Qg.	
CV measurement capability	
The integrated system should be capable of measuring Capacitance with the below specification	
Frequency Range of the capacitance measurement Unit	1 kHz to 5 MHz with 1mHz(minimum) resolution with accuracy of 0.008%
In built DC Bias	0 to ± 25 V
Measurement parameters must also include	Cp-G, Cp-D, Cp-Q, Cp-Rp, Cs-Rs, Cs-D, Cs-Q, Lp-G, Lp-D, Lp-Q, Lp-Rp, Ls-Rs, Ls-D, Ls-Q, R-X, G-B, Z- θ , Y- θ
Fixture	Fixture of CV measurement to be provided for standard packaged devices supporting 3kV bias and measurement up to 1MHz. Automatic capacitance selector should also be included to automatically switch between the right resources to the right terminal for Ciss, Coss and Crss measurement and add appropriate bypass capacitor and blocking resistors whenever necessary
Other accessories	



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Other accessories including high voltage cables, Ground unit cables, capacitance measurement unit cables, Universal resistance boxes, Probe adapters and any other adapters necessary for above mentioned connections for both packaged devices and on wafer measurements to the specified ranges and measurements should be included	
Gan Current Collapse measurement	Instrument setup should be upgradable to have GaN current collapse measurement capability with stress voltage of up to 3kV and on current of up to 20A.
Software or Firmware	
Software to control the instrument and other accessories for setting up measurements, performing measurements, displaying and analyzing data and management of measurement data must be included	
Flexibility of performing the above, either from the software installed within instrument or external controller should be there	
Should have self-test, self-calibration and diagnostic menu	
Graphical display, automated analysis capabilities and data generation to Excel and image for analysis and reporting	
Should support oscilloscope view	
Should have readymade measurement setup in the form of library for at least Id-Vds, Rds-Id, Id-Vgs, Vth, Cgs, Cds, Cgd, Current collapse, Breakdown, QSCV for Mosfets	
Should allow tracer test mode	Should allow interactive sweep control using a rotary knob present on the instrument itself, like a curve tracer allowing sweep in positive direction, negative direction or in both directions
Should have the provision for sequencing multiple tests without external programming	
Operating temperature range	5 to 40 degrees Celsius