



# Interface System to Test Electrical Properties of Semiconductor Devices

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## Objective

•Create a semiconductor parametric analyzer interface system capable of measuring and testing the inherent electrical properties of semiconductor devices.

•The program needs to satisfy the following conditions:

- o2-4 channels
- oPerform parametric analysis
- oTest reliability
- oManipulate measured data
- oUser-friendly

•The design will eventually be used to test III-V semiconductor materials.

## Introduction

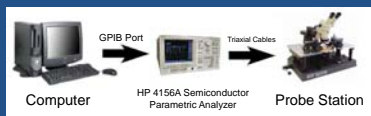
•Parametric analysis is a technique used to determine the effects an independent variable has on a separate range of values.

•A common example of this is a ID-VD curve with IG being the independent variable.

•A simplified form of this test involves only two channels and can be used with non-linear devices such as a diode.

## Methodology

•To achieve the desired conditions, the approach was to create a LabView VI capable of connecting to an HP semiconductor parametric analyzer and a probing station



## Results

•The final program is split into three links, each responsible for opening and running a different test.



•The process of making these tests includes:

- oFinding the appropriate instrument drivers
- oWriting in Boolean expressions
- oAdding any necessary loops
- oTesting the VI on controlled devices



### TEST 1

•The first test yields an ID-VG curve of either a MOSFET or another non-linear device.

•A voltage sweep is applied to the gate and then plotted against the drain current.

### TEST 2

•The VI allows the user to choose the sweep values, constant applied values, compliances, as well as which variables to graph.

•Can be used to display parametric testing with a family of curves.

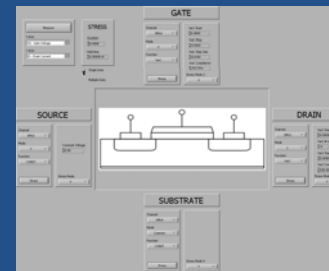
### TEST 3

•Tests the reliability of a semiconductor device by applying a constant stress to certain terminals and then running the necessary sweeps.

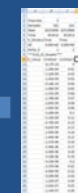
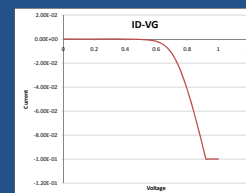
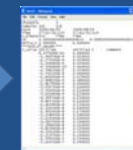
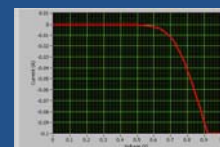
## Results

•In addition to having all of the test requirements, all three VI's are user-friendly, featuring:

- oReal-time parameter updating
- oAuto-scaling graphs
- oAbility to plot multiple data arrays

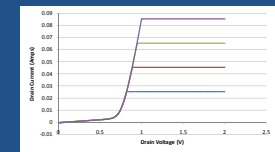


•The key-note facet of the interface is the ability to graph measured data, save the data as a text file, and import it into another form of representation.



## Discussion

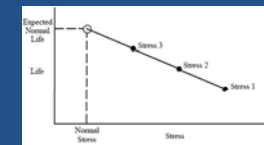
•The program was successfully used to acquire a family of curves from a four-channel parametric analysis.



•To further enhance the functionality and range of this tool, a couple of things could be added such as:

- oFinishing the reliability test
- oAutomatic default refreshing
- oThe integration of an HP 4284A Precision LCR meter

•When the reliability test is fully operational, it will be able to analyze the consistency of a device's threshold voltage by forcing a constant stress voltage; yielding important data such as the expected lifetime of the device



## Conclusions

•Barring a few final trials, the LabView VI's tests are completed and ready to be used.

•The test for reliability was unfortunately not fully completed.

•This program is simply another stepping stone to aiding further research pertaining to semiconductor devices and their innate qualities.