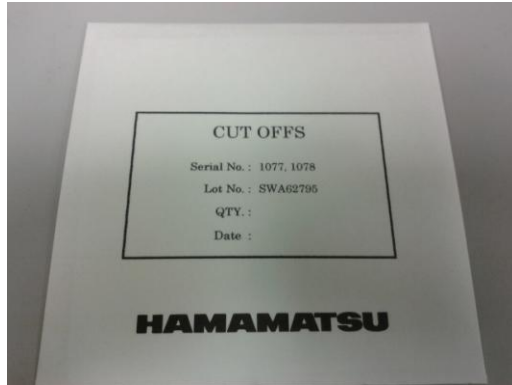


Probe Station No:1 Procedure  
Instructor: Selcuk Cihangir  
Edit-2012

1. You will receive a package like this one (more like an envelope). Try not to bend it too much.



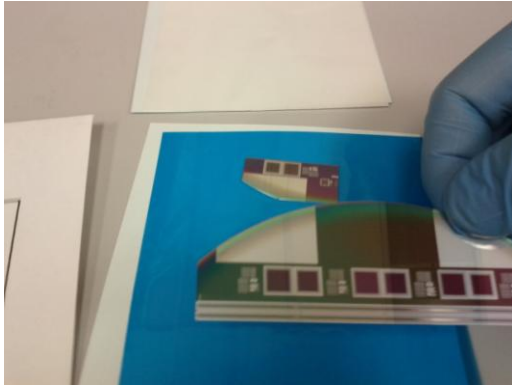
2. Make sure you wear clean-room gloves before you open the envelope. This is what you will find inside:



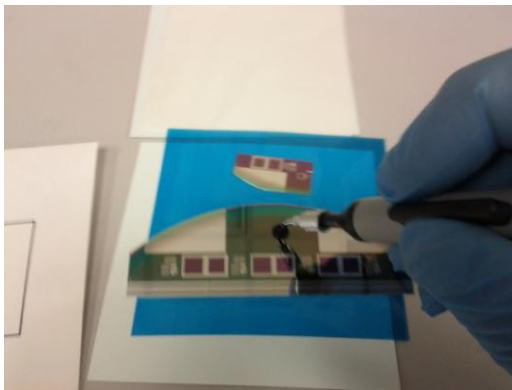
3. You now have to work with the part shown in the bottom picture. First peel off the paper from the dicing sticky blue tape (the silicon will remain on the blue sticky tape):



4. Finally something difficult. You have to remove the long silicon device from the dicing tape. An assistant will be there to help you out. Remember that silicon is a crystal and it is very fragile.

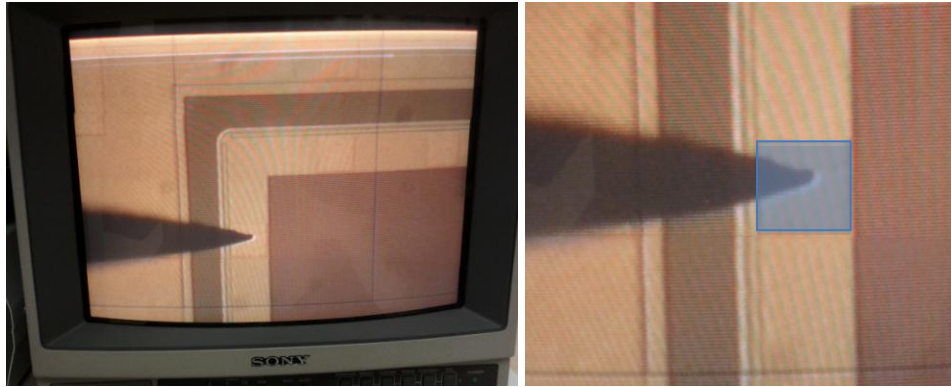


5. With the vacuum pen take the long silicon device and place it on the Chuck of the probe station with the same orientation as in the picture:

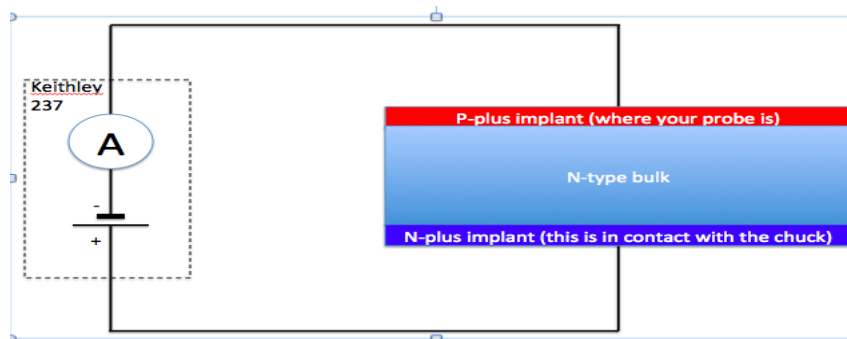


Turn ON the vacuum that holds the device under test on the chuck. If you hear hissing noise than you are not covering well the vacuum pattern. Try again or ask for help.

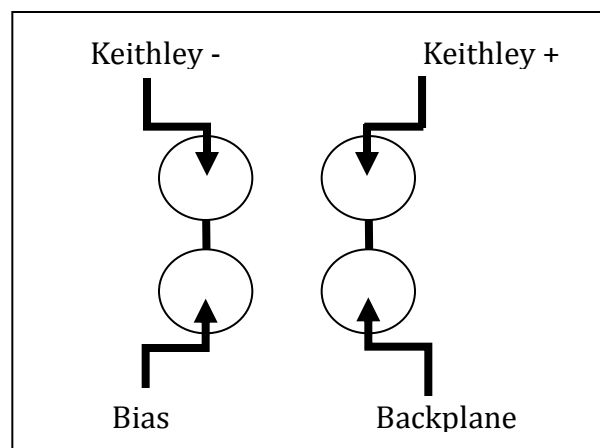
6. Spend some time getting familiar with the microscope, with the monitor showing the same image you can see through the microscope and also with the micropositioners that hold the probe-tips. Your goal is to place a probe (one on the left-hand-side) on the bias pad of the Diode. The picture below is to be used as a guid. In principle any point on that rim is a bias point but you need to place the probe on one of the small squares that do not have the SiO<sub>2</sub> passivation layer.



7. Now you have to do the connections for the IV curve on the DIODE according to the following schematic and instructions:



You will connect cables/leads to the grey box inside the dark box, on the left hand side, for IV measurement as shown below schematically:



Make the connections for IV measurement. Make sure that the 1 M $\Omega$  resistor is not in the circuit.

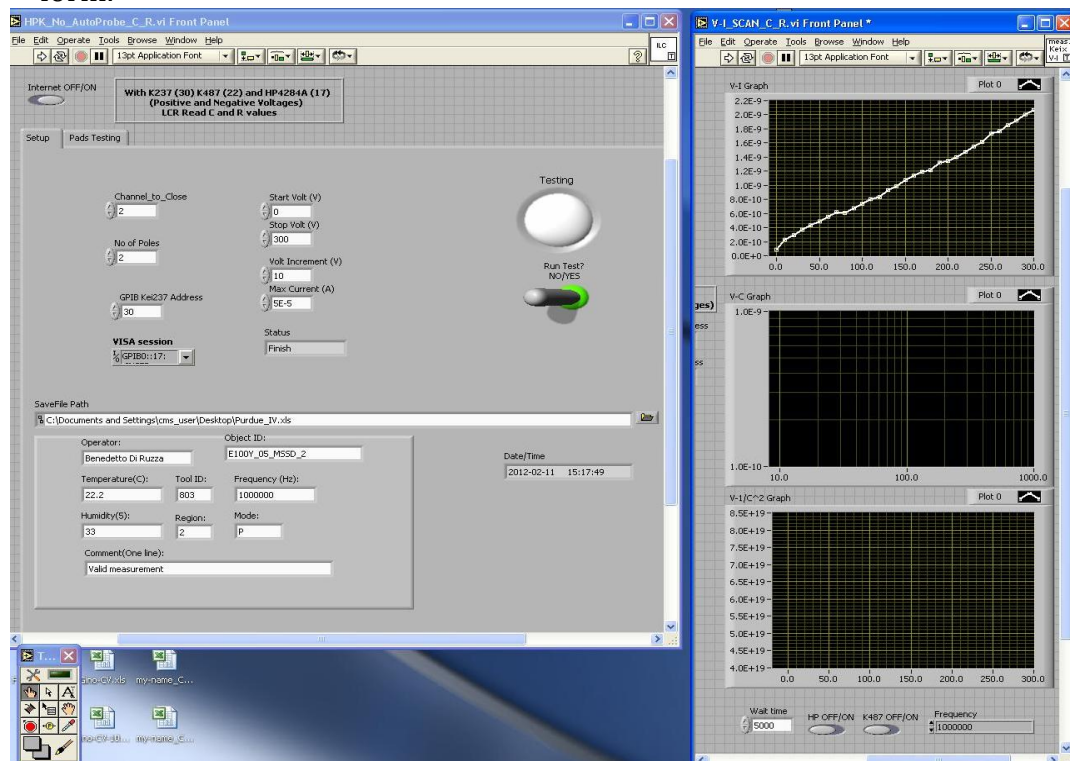
8. Close the Dark Box. Make sure it is light tight.
9. Remove the light (on the left hand side of the dark box) from the microscope:



10. You will do a quick check to make sure we have the proper probe connection by setting the Keithley voltage to -1 Volts (forward biasing). You should see a high current value (most likely the compliance value) displayed on the Keithley. If not, check the circuit connections and press the probe tip down some more (with a screw on the top of the probe holder).

11. Go to the Personal Computer and get familiar with the LabView Program's Front Panels.

You will see two of them. One on the left is defining some parameters and starting the data taking. One on the right will display the data in graph form.



Enter the following information on the left Front Panel (Some parameters can be default):

Your name → Operator

The serial number from the envelope → Object ID

/Desktop/yourname\_IV\_DIODE.xls → filename

0 → Start Volt

500 → Stop Volt

10 → Volt Increment

5E-5 → Max current (try to think about the meaning of this parameter)

12. At this point you are ready to run the program and you should start taking data. On the left panel, click the clear arrow shape on the top-left corner to start the program. Then click on the “switch” under the white circle to start the data taking. The circle will turn red.

Plots are updated only when the measurement is finished.

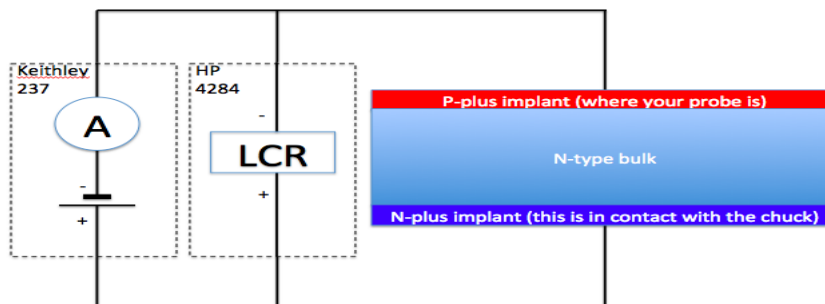
The measurement will take several minutes. You should spend this time looking at the Keithley 237 SMU and try to understand what kind of instrument it is, what accuracy and range of measurements it provides. We will try to make the Manual available. If you are interested and/or familiar with Labview feel free to look at the code used for the measurement.

Once the measurement is finished you will see the results of your IV scan on the top plot of the panel on the right (middle and bottom graphs are irrelevant at this point).

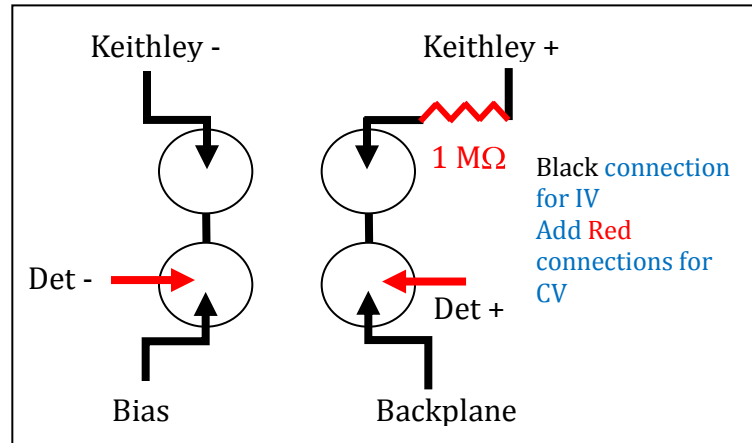
Repeat the measurement with 800V Stop Volt value to see the breakdown voltage where the current shoots up to much higher values than you observed before. Determine the corresponding breakdown voltage.

Your IV-on-DIODE measurement is finished. Make sure the file with the appropriate filename is present on the Desktop.

13. Let's get ready for the CV-on DIODE measurement. You have to do the connections for the CV curve on the DIODE according to the following schematic and instructions. So open the dark-box and get going:



You will connect cables/leads to the grey box inside the dark box, on the left hand side, for CV measurement as shown below schematically:



Make the connections for CV measurement. Make sure that the 1 MΩ resistor is in the circuit this time.

14. Close the Dark Box and go to the left Front Panel on the PC.  
Enter the following information on the GUI:  
Your name → Operator  
The serial number from the envelope → Object ID  
/Desktop/yourname\_CV\_DIODE.xls → filename  
0 → Start-Volt  
500 → Stop Volt  
10 → Volt Increment  
5E-5 → Max current (try to think about the meaning of this parameter)
15. At this point you are ready to run the program and start taking data.  
On the left panel, click the clear arrow shape on the top-left corner to start the program. Then click on the “switch” under the white circle to start the data taking. The circle will turn red.

Plots are updated only when the measurement is finished.  
The measurement will take several minutes. You should spend this time looking at the HP 4284 and try to understand what kind of instrument it is, what accuracy and range of measurements it provides. We will try to make the Manual available. If you are interested and or familiar with Labview feel free to look at the code used for the measurement.

Once the measurement is finished you will see the results of your CV scan on the middle plot of the panel on the right. The bottom plot is for  $1/C^2$ . Determine the depletion voltage value from these plots.

Note how the IV curve in the top plot is different from the previous measurement. Any possible explanation?

Make sure the file with the appropriate filename is present on the Desktop.

NOW THERE ARE THREE OPTIONS:

- You already used up 90 minutes. If this is the case you should
  - Open the box and raise the probes
  - Inspect the other devices available in the piece of silicon. You should be able to identify two long silicon strip detectors. Discuss with the instructor the various features that you see and how they will be used for wire bonding later on.
  - put the device back in the envelope in the same way it was when you arrived by following the initial procedures backward.
- You used up 60 minutes or little more. If this is the case you can consider repeating one of the two measurements maybe by inverting the roles with your partner.
  - Remember to leave some time to put the device back in the envelope in the same way it was when you arrived by following the initial procedures backward.
- You used up less than 60 minutes. If this is a case you should try to perform another measurement. Inspect the other devices available in the piece of silicon. You should be able to identify two long silicon strip detectors. Discuss with the instructor the various features that you see and how they can be used for probing (some of them will be used for wire bonding). Identify an AC PAD (better a central one) and place on it the RIGHT PROBE with the micropositioner.
  - Disconnect the DET- of the LCR from the LEFT PROBE and connect it to the RIGHT PROBE. At this point you can perform another CV measurement with the GUI (remember to add “strip” to the filename). This will be the measurement of the capacitance of a single strip (an important parameter for the noise characteristic of a silicon detector).
  - Remember to leave some time to put the device back in the envelope in the same way it was when you arrived by following the initial procedures backward.

**Collect all your data on the memory stick and move on to the next activity.**

Consider using your data for an offline analysis with whatever software package you prefer.