PROBE STATION INSTRUCTIONS

The probe station will need to be configured for ICFab measurements. The instructor and TAs will set up the basic configuration.

1. At the rear of the instrument rack, connect triax cables between the large black mounted box and the B1500 SMU ports. Connect to SMU Force port, not Sense.
2. Select the desired measurement program on the B1500A.
3. Connect your device to the desired SMUs using BNC cables on the front panel of the breakout box. For the 10-probe card the connectors used are labeled 1-5 and 11-15.
4. Prepare the probe station for the probe card. Open the black box. Carefully remove (vacuum release button at the base of the probes) the manual probe manipulators without destroying the probe tips and place them in a direction that will ensure against inadvertent destruction.
5. Turn thumbscrews to secure the four (black triangles) probe card clamps onto the probe card. The clamps are stored in the bottom drawer.
6. Raise the top plate using the handle on the left side.
7. Remove the probe card from its case, sliding it into the probe card holder. **Take care not to crash anything into the probe tips.** Tighten the four clamps.
8. Turn on the microscope illumination (knob on small box just inside the door). Move the microscope in X and Y, using the knobs above the microscope, to direct the microscope illumination onto the probe tips.
9. Pull the stage out using the handle. Place your wafer on the stage and turn on the "Master" vacuum switch to turn on the hold-down vacuum. Check to see that the wafer is secured.
10. Push the stage back out using the handle. Be sure that it goes all the way in.
11. Focus the microscope on the wafer. Using the knobs on the right side of the stage, move the wafer so that the desired pattern comes into view. Adjust the wafer rotation using the lever on the front of the round stage.
12. Slowly lower the probe card using the handle on the left, watching the wafer through to microscope at the same time.
13. As the probe tips approach the surface they will come into focus, and as they touch, they will "skate" laterally very slightly on the surface. The diameter of the probe at its widest point is about 30 μm. The probe should skate approximately 60 μm to provide a low resistance contact, 2-4 Ω. Adjust the micrometer on the handle to fine tune the skate distance. **NEVER MOVE THE SUBSTRATE WHEN THE PROBES ARE DOWN!**
14. Microscope illumination can generate electron-hole pairs, photoconductivity in the Si. If you want to do a measurement in the dark, turn off the microscope illumination and carefully close the doors to the probe station box to avoid disturbing the probes.
15. Make measurements on the B1500A. Save your data. Transfer your data using a memory stick.
16. If you want to move to another pattern, raise the tips and move the substrate.
17. **LOOK THROUGH THE MICROSCOPE WHEN RAISING/LOWERING PROBES!**
18. When you have finished, raise the probe card and remove the wafer by pulling the stage out with the front handle. Put the stage back when the wafer has been removed.
19. Remove the probe card by loosening the clamps and pulling out the card without bumping anything. Place the card in its case and place it in the drawer.

20. Remove the 4 probe card clamps and place them in the bottom drawer.
21. The next user will set up their own configuration.

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. RING OSCILLATOR AND SOUNDCHIP TESTING

The ring oscillator requires a power supply VDD to power the inverters, and an oscilloscope to measure the period of the oscillation, along with a small test box that helps with the connections.

Ring Oscillator

1. Connect the power supply to the test box using banana plugs. Start with the power supply at 5 V. Next, using BNC cables, connect between the VDD and GND connectors on the box and the appropriate connectors on the breakout box front panel. Then connect between the external trigger on the test box to the external trigger on the oscilloscope (This establishes a common ground between the power supply and scope). Now connect the ring oscillator output (breakout box) to the oscilloscope input.
2. Lower the pins onto the appropriate chip bond pads. If the circuit is working you should see an oscillation with a frequency in the neighborhood of 5 MHz on the oscilloscope. Measure the period of oscillation and divide this by 122 (two times the number of inverters in the ring). This is the average propagation delay per inverter stage.
3. Slowly vary the voltage, and see how this affects the propagation delay. If you go too high in voltage you will burn out the devices and the ring will stop oscillating. Don’t worry, you have 72 ring oscillators on each wafer!

Sound chip

1. Connect the output of the power supply to the test box using banana plugs. Set the power supply to 5 V and do not change it. Next, using BNC cables, connect between the VDD and GND connectors on the box and the appropriate connectors on the breakout box front panel. Next connect the CLK, RST, and OUT lines between the test box and the breakout panel.
2. Lower the pins onto the chip. If the chip is working you will hear music! Pressing the reset (RST) button sets the song back to the beginning. If you don’t hear music, press the reset button. If there is still no music, then the chip is dead. Move on to the next one. There are lots to test!

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