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Date: November 24, 2023
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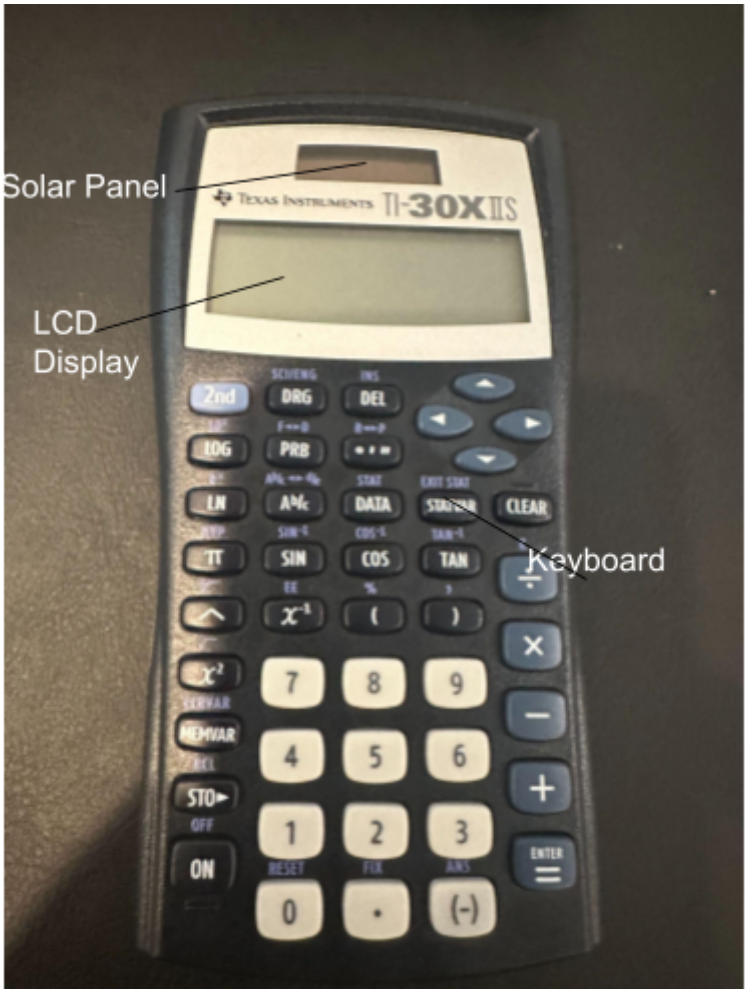
Reverse Engineering the TI-30X-IIS

Product summary:

The TI-30X-IIS, was chosen for this project because of its accessibility to hardware. It is very easy to take it apart and understand the hardware. However, it is nuanced enough for a technical discussion. Moreover, its ubiquity in school makes it very relevant to the lives of many students, making it a very important electronic device to reverse engineer.

Design summary :

Front view:



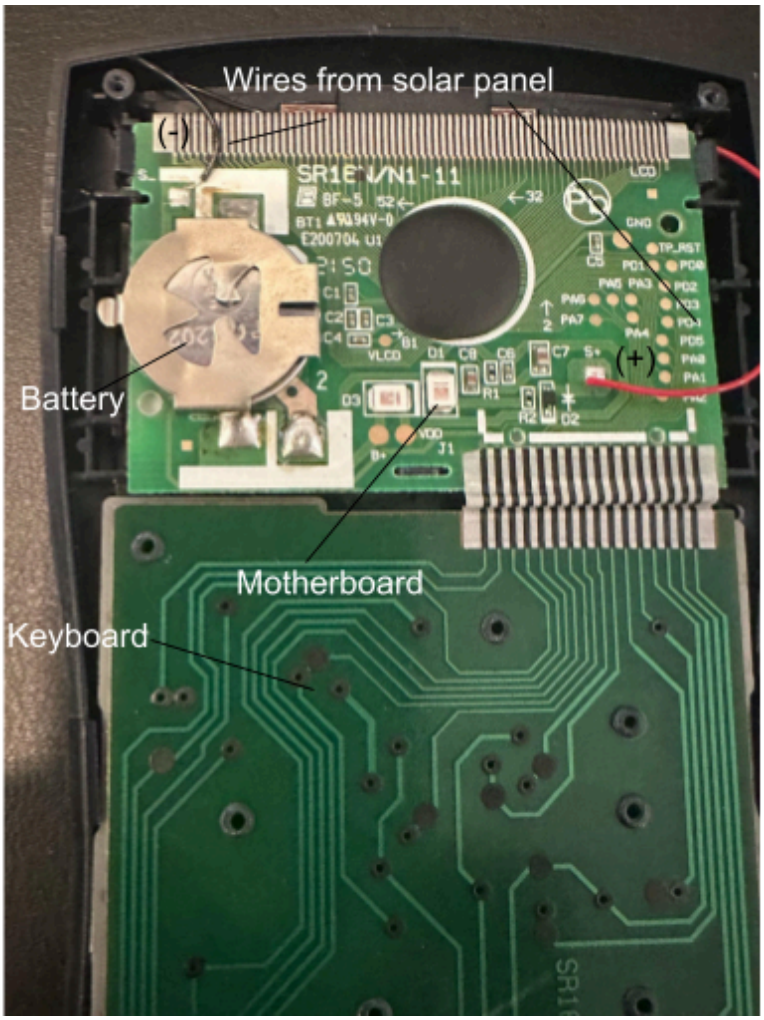
What are the key components seen in the picture above ?

First, at the top of the calculator there is a solar panel which supplies electricity to the battery. Second, there is a LCD display with a transparent glass covering, for protection. Third, there are buttons, which are connected to a keyboard, which allow the user to actually use the calculator.

Back view:

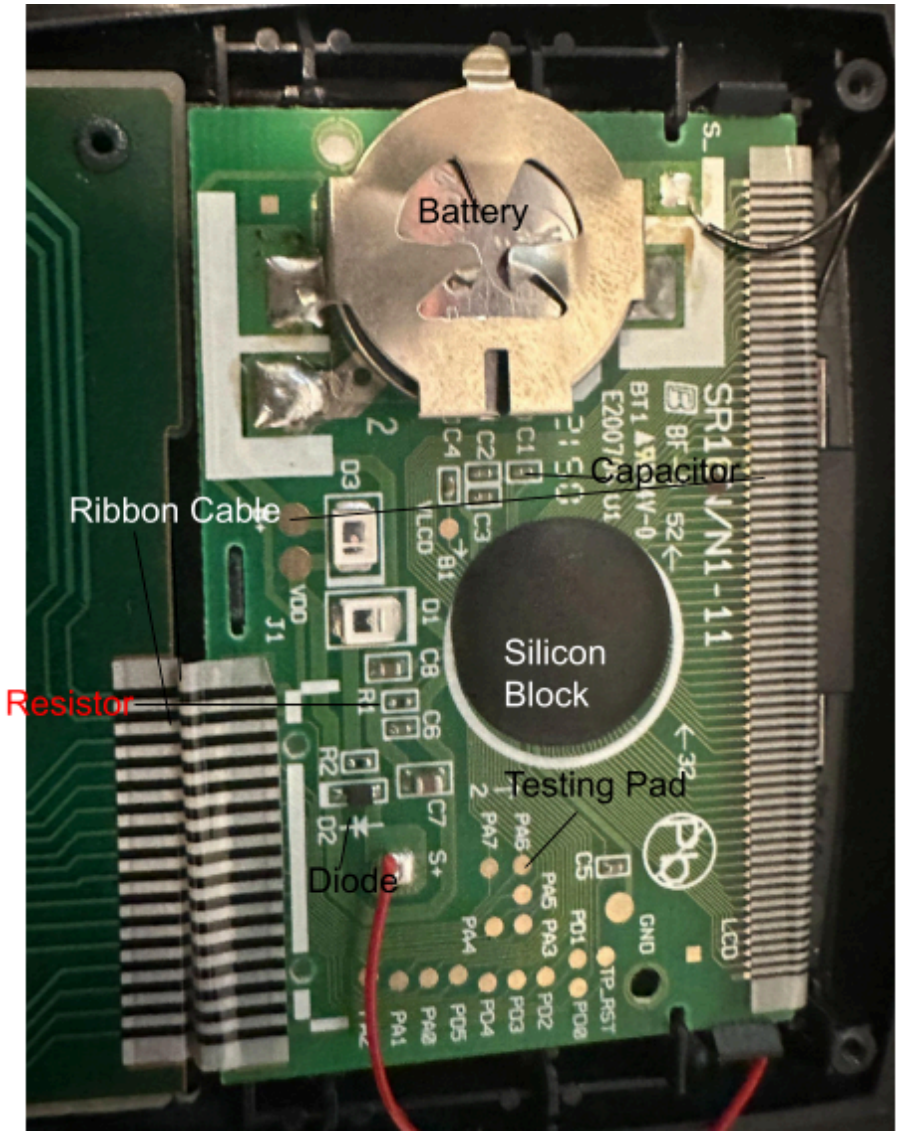
The chassis is made out of plastic, likely because it is cheaper than aluminum. The front is connected to the back through 4 phillips screws, which are used because of their ubiquitous nature in electronics. An interesting design choice is the curve in the center. This curve makes the calculator fix better in a human hand, which improves the general user experience.

Hardware overview:

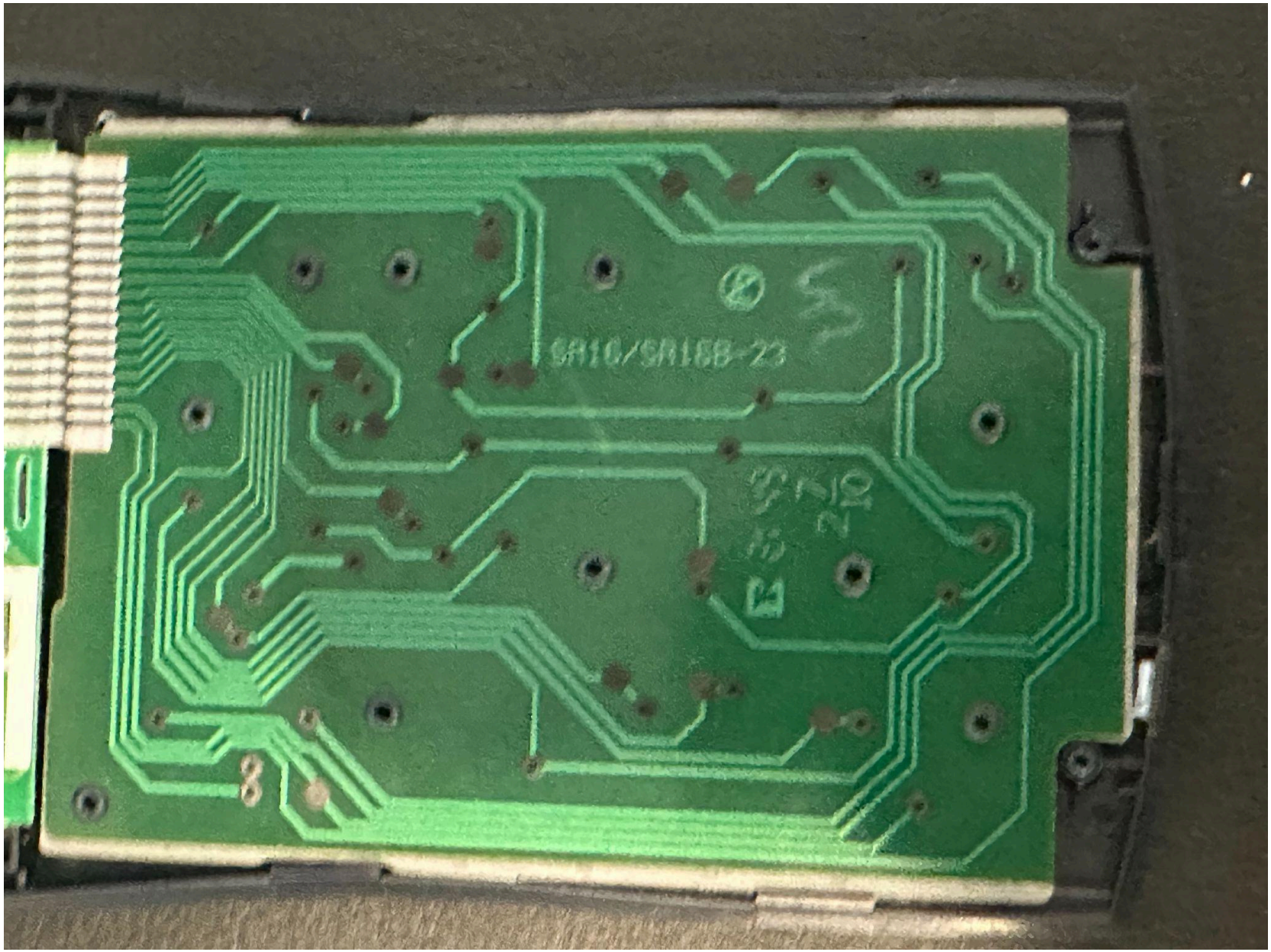


There are five primary parts of the inside of the calculator. First, there is the battery, which powers the calculator. Second, there is a solar panel which connects to the motherboard using the red (+) and black(-) wires. The solar panels allow the battery to recharge, which makes the calculator last longer. Third, there is the motherboard, which holds important hardware components. Fourth, is the keyboard which is at the bottom of the picture. Fifth, the lcd screen is soldered to the back of the motherboard.

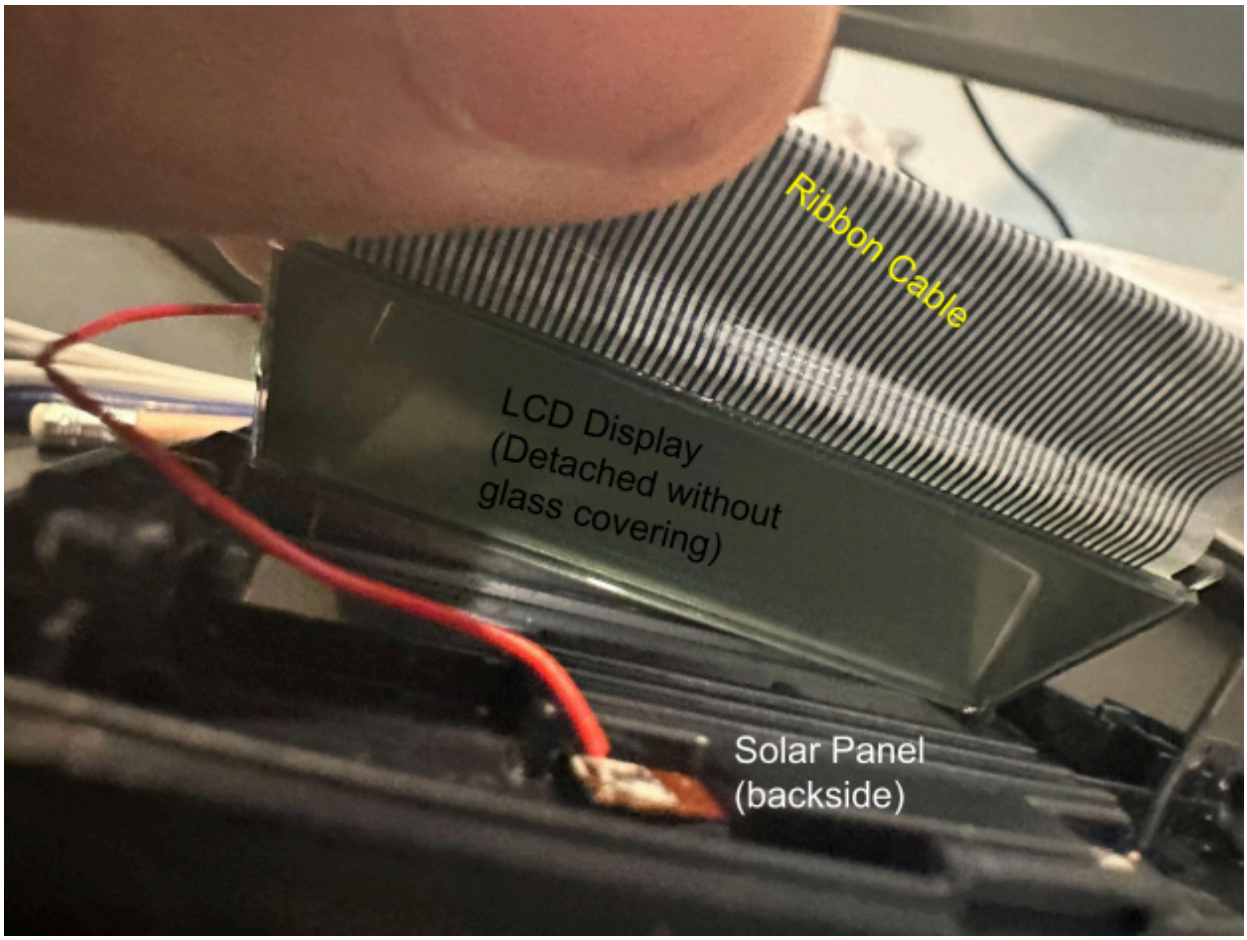
The motherboard:



First the battery powers the motherboard. Second, the silicon block covers the custom made CPU and RAM.RAM and CPU commute and store calculations. Third, testing pads (golden circles) allow the testing of electrical components. Fourth, resistors (indicated with ‘R’) regulate the flow of electricity, which prevents overcharging. Fifth, diodes (indicated with ‘D’) direction of electricity. Sixth, capacitors filter out direct current.


SR1C/SR1CB-23

This is the back of the keyboard, the black circles correspond to membrane switches which are pressed by the user. Using ribbon cables, the keyboard is able to communicate with the motherboard.



This is the lcd screen, when detached from the chassis. It is soldered to the back of the motherboard, which is space efficient, which is important in small devices.

This is a CMOS battery, which is rechargeable.

Key lessons :

First, space efficiency is very important in electronics engineering. Many components are layered. For example, the motherboard is soldered on top of the LCD. Second, hardware is not accessible enough. Many components are soldered to each other, making them inaccessible for one who does not have soldering iron, possibly interfering with the right to repair. Last, all computers share common parts. Even calculators have a CPU and RAM.