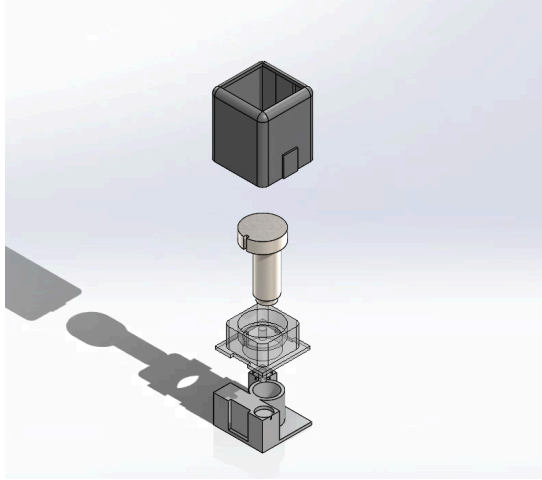
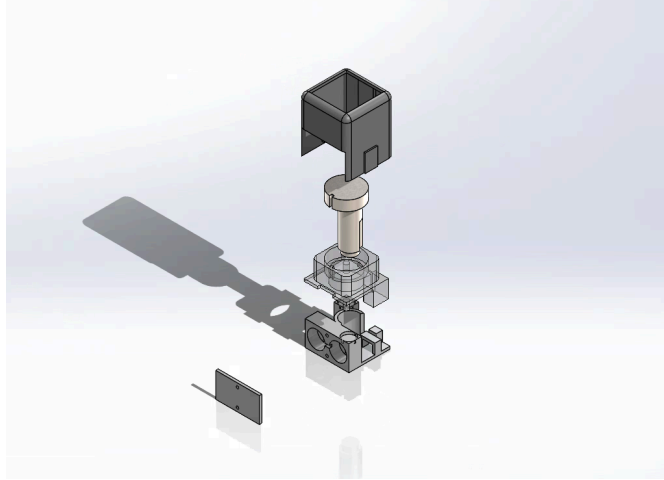


Button Mk.8S and Mk.8E User Manual

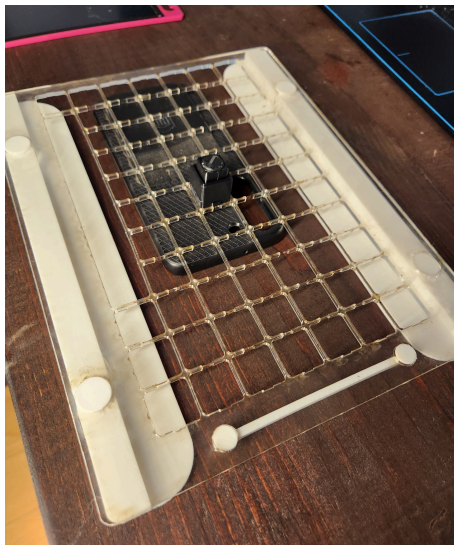
Made by group 4.5: KeyKreators



Mk.8S



Mk.8E



Keyguard with button

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Acronyms:

- PLA: Polylactic Acid, a commonly used 3D-printing filament
- CPLA: Crystalized Polylactic Acid, a more durable PLA filament
- PDF: Portable Document Format

Introduction:

This product was purpose built for the 10th generation iPad that our user uses to teach students with learning disorders to form simple sentences, using the TD snap app with the Motor plan 66 setting configuration. The user needed upgraded tools to improve their students' user experience. The basic idea was to have pressable physical buttons along with a fitted keyguard for the tablet. The buttons should be different colors and easily made as per the client's request.

The prototypes we made are able to adhere to the clients requirement of having multiple colors, besides the conductive core which can only be the color black. The remaining parts of the button can be any color that is loaded into the 3D printer. The ease of assembly of button MK.8S is perfect for standard use, and is assembled very quickly as it telescopes inside itself. The second button, the MK.8E, is a bit more complex, but it contains an LED for additional visual feedback as per one of the clients requests.

The Keyguard is the only part the client cannot fully 3D print as it is laser cut from acrylic, however there are services which will laser cut and send parts to clients. The keyguard being made from acrylic is important as it is fairly scratch resistant and very clear, which makes it very well suited for the tablet, also it's fairly inexpensive which increases its appeal for standard usage and replaceability.

Materials:

Important: different printers use different diameter filaments, do research before buying, the common size is 1.75mm diameter for most common printers

Button MK.8S:

- Yellow PLA
- Green PLA
- Orange PLA
- Conductive PLA
- Springs with 5mm OD and 12-15mm in length (cut in half pen springs work)

Button MK.8E:

- Yellow PLA
- Green PLA
- Orange PLA
- Conductive PLA
- Springs with 5mm OD and 12-15mm in length (cut in half pen springs work)
- 1000 OHM resistor
- 6mm square 2 terminal push button
- 22 Gauge solid core wire (breadboard hobby wire works as well)
- 5mm LED (ones that work: red, yellow, orange, green)
- 2 x LR626/377 cell batteries (dollar stores have them)

KeyGuard:

- 1/8" clear (or colored) acrylic
- Color of choice PLA

Required Tools and Equipment:

- 3D printer (all steps)
- Laser cutter (Keyguard)
- Needle nose pliers (both buttons)
- Wire strippers (MK.8E)
- Soldering iron (MK.8E)
- Lead free solder (MK.8E)
- Soldering stand (MK.8E)
- Super glue (everything)

Equipment Use:

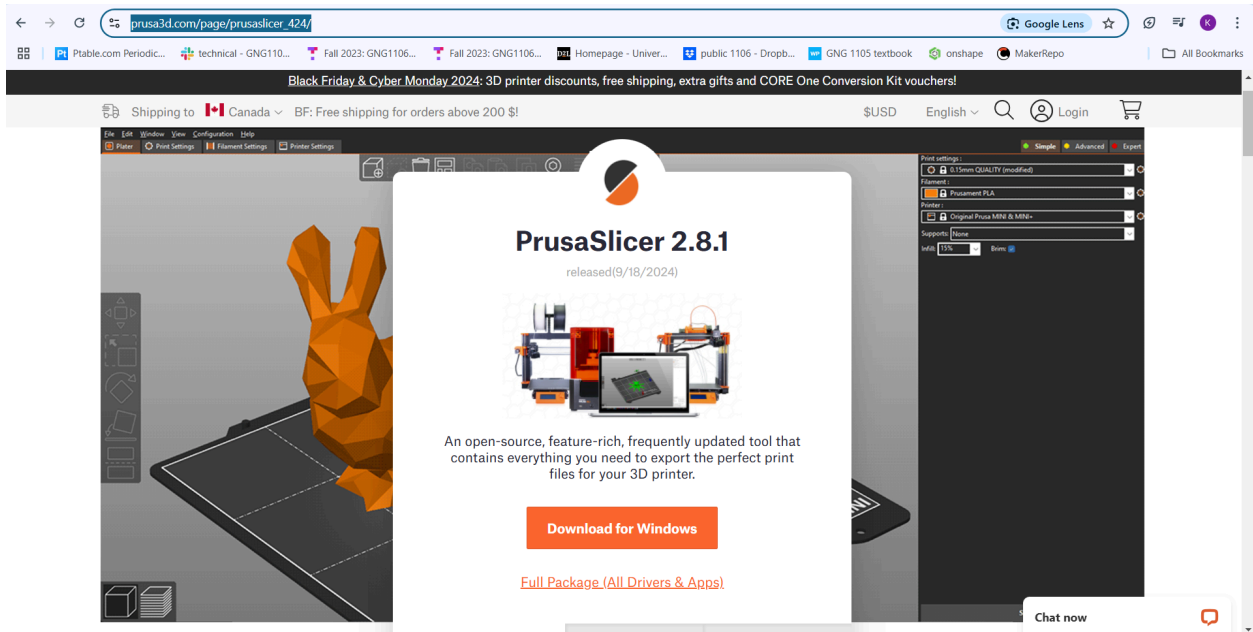
3D printers:

Slicers are the brain of the 3d printers, they work by converting .stl files into the specific type of file that different printers require (ex: .gcode, .3mf, ...). These printer specific files are what control how the printer moves along with deciding where to print.

NOTE: some printers will have their own slicers which WILL always work better than using a compatible slicer, but most slicers are the same and very user friendly.

Pt. 1: Downloading a Slicer:

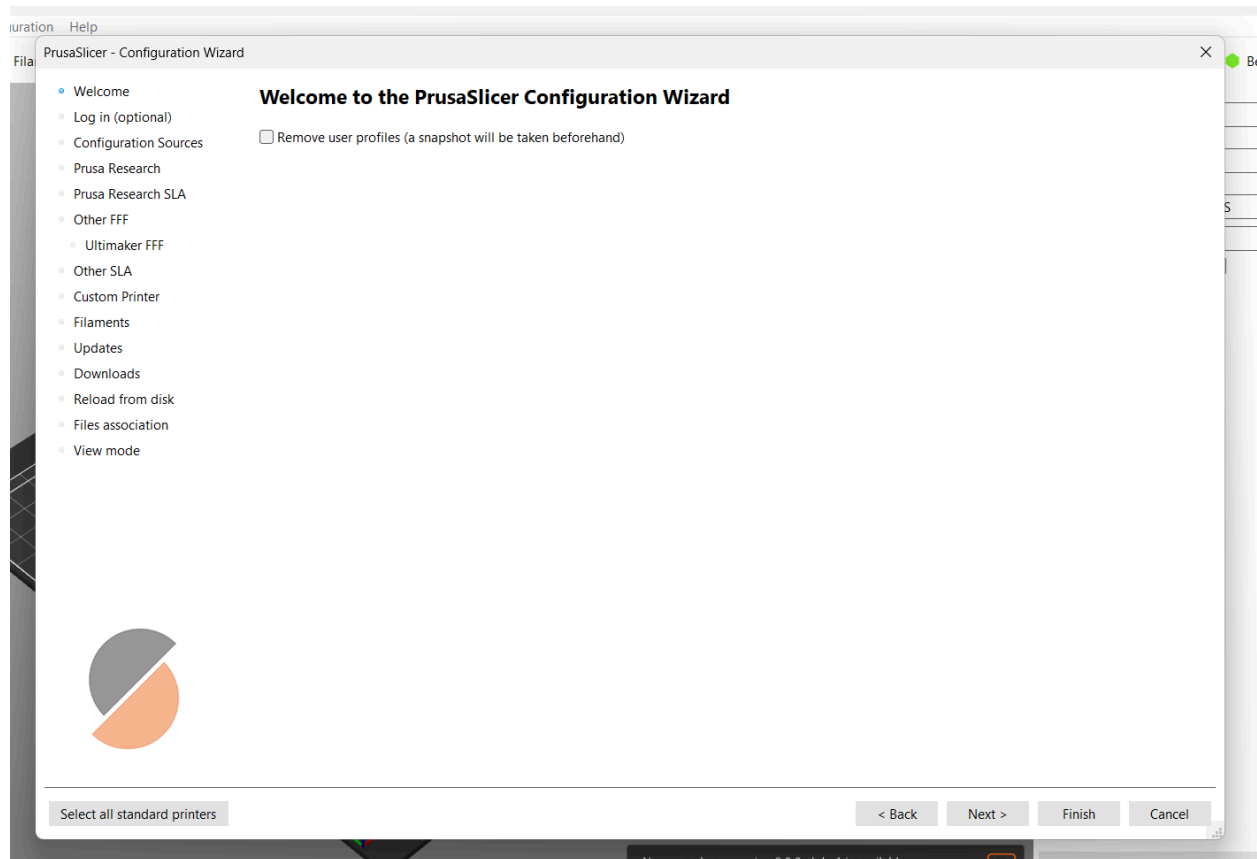
-Please follow this link: https://www.prusa3d.com/page/prusaslicer_424/. From here you can install the Prusa slicer and Gcode viewer.



-Just click agree on everything until you see a screen like in pt. 2.

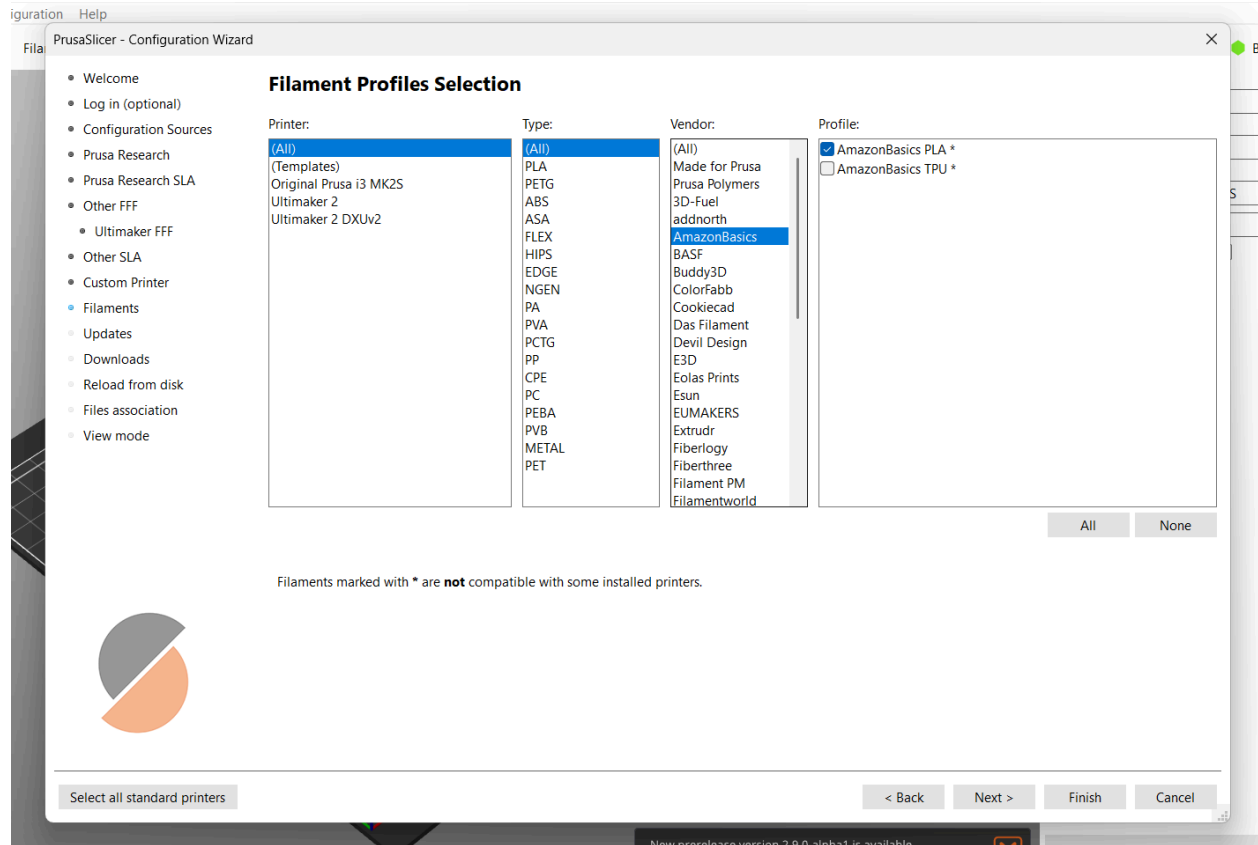
Pt. 2: Printer specifications:

-If you clicked agree the whole way and didn't choose a printer or filaments then you can go back by hitting the **configuration** tab in the top left then selecting **configuration wizard**. Your page should be like the following picture.



-From here you're gonna want to go to **Other FFF**, you'll see a list of printer company names, from here you need to find the printer you'll be using and select it as your default.

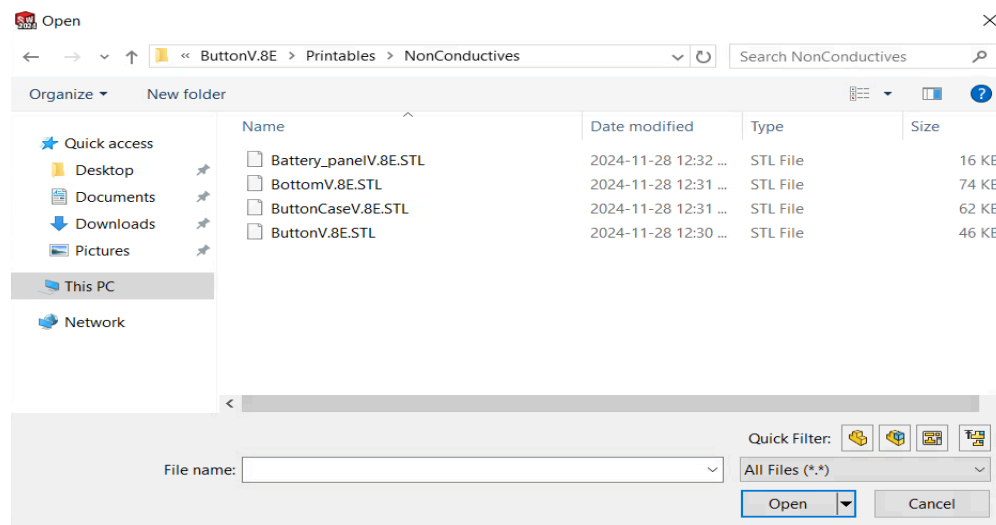
-After that, head to the Filaments page, select **AmazonBasics** under the **vendor list**, **select PLA**, then go to **generic** under the **vendor list** and select **PLA**. Similar to the next picture.



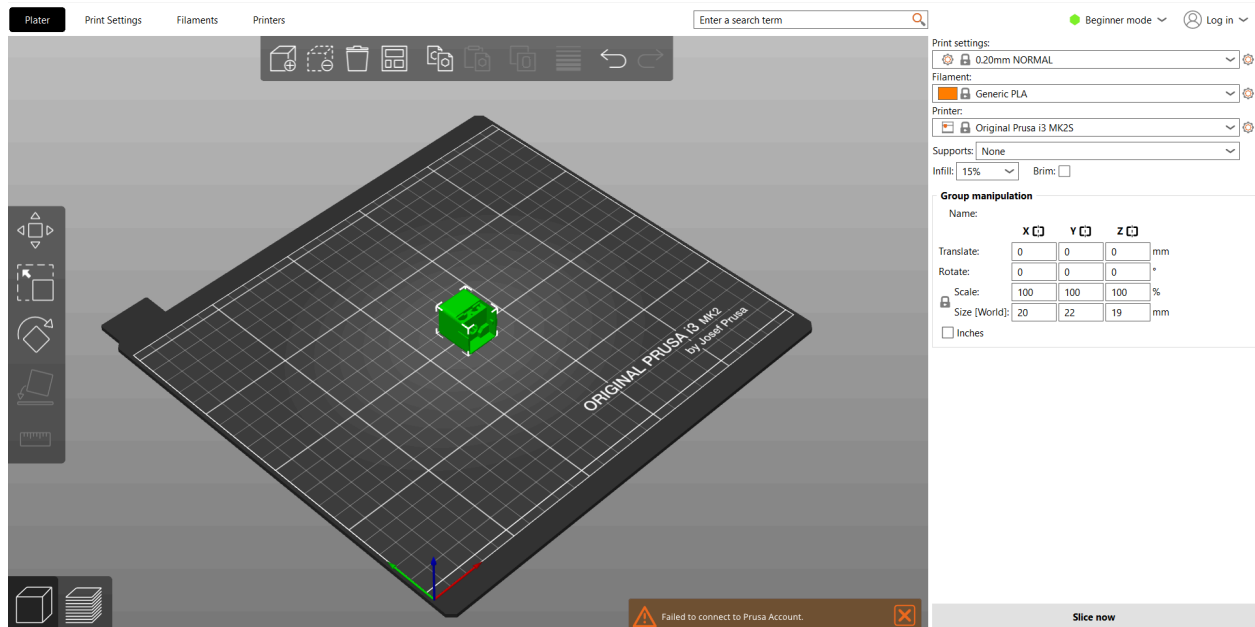
-When you get to the **view mode** section, just ensure it's on the **basic/beginner** mode.

Pt. 3: Completion

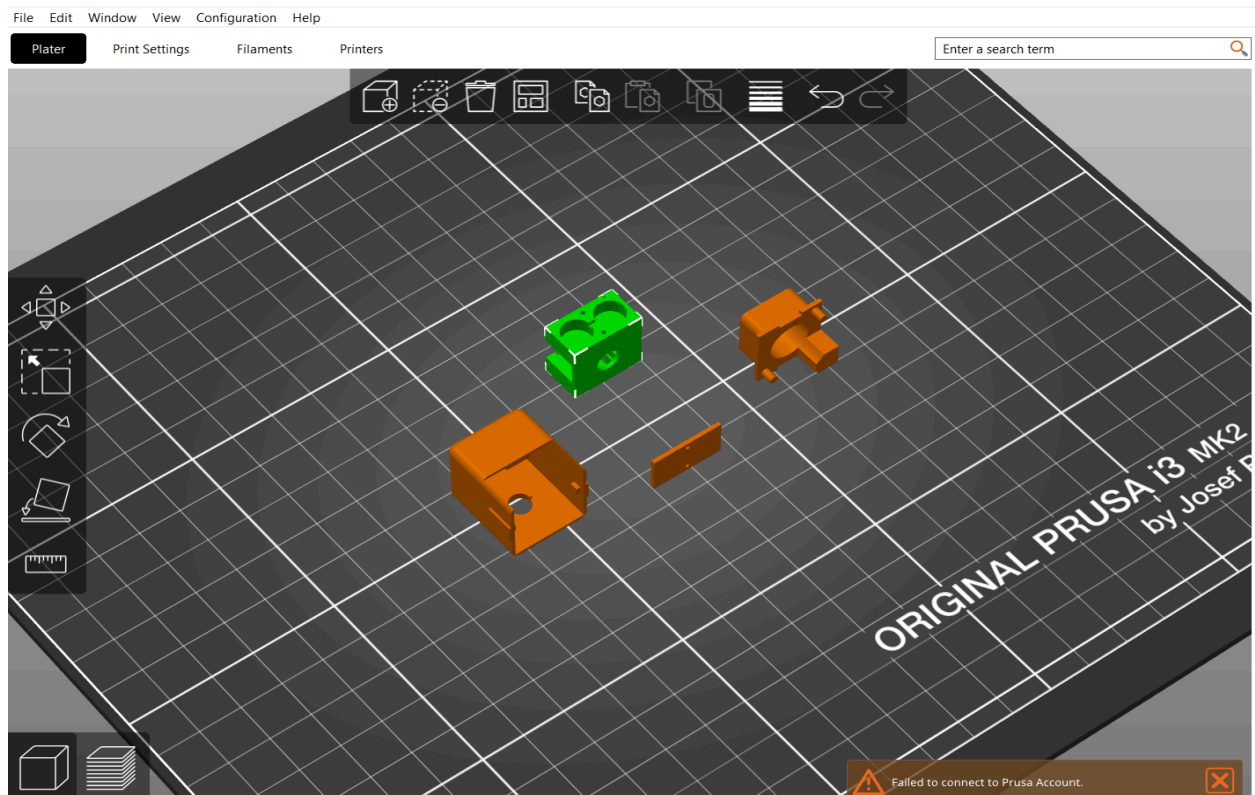
-After the above is complete you can drag and drop the .stl files into the open prusa app directly from their location (**only showing the nonconductive file from MK.8E**).



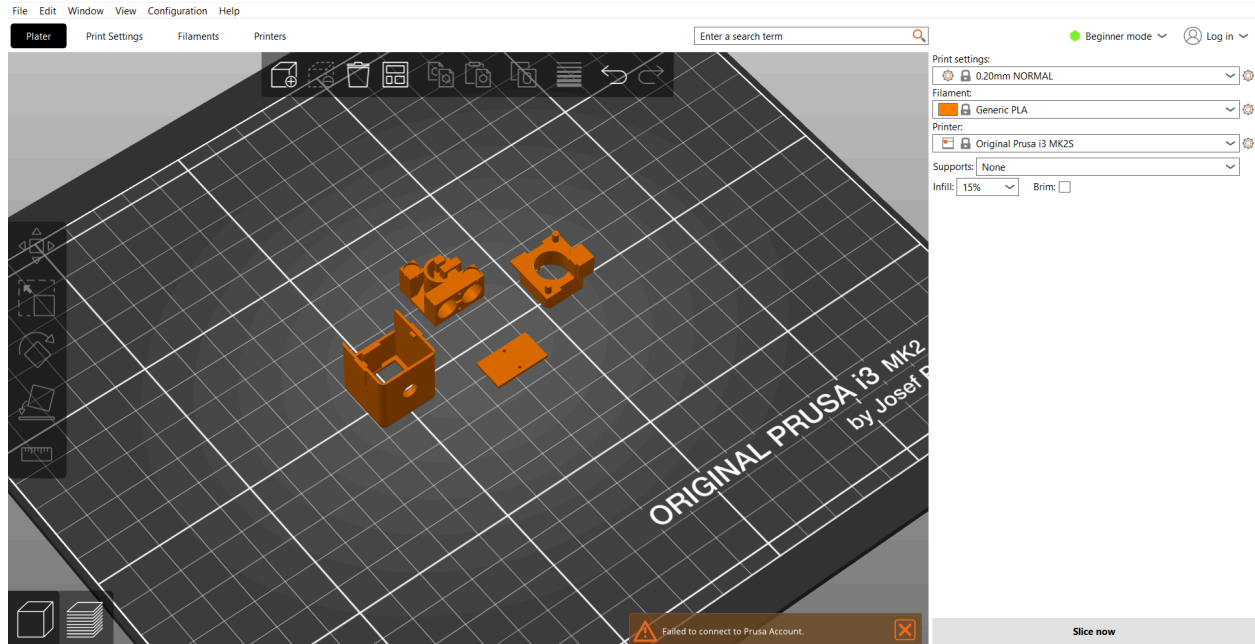
-After all files are in it should look like below.



-From here you need to move the parts as well as put them on their proper faces for printing. Click and spread out the parts on the grid on the screen (which represents the print bed).

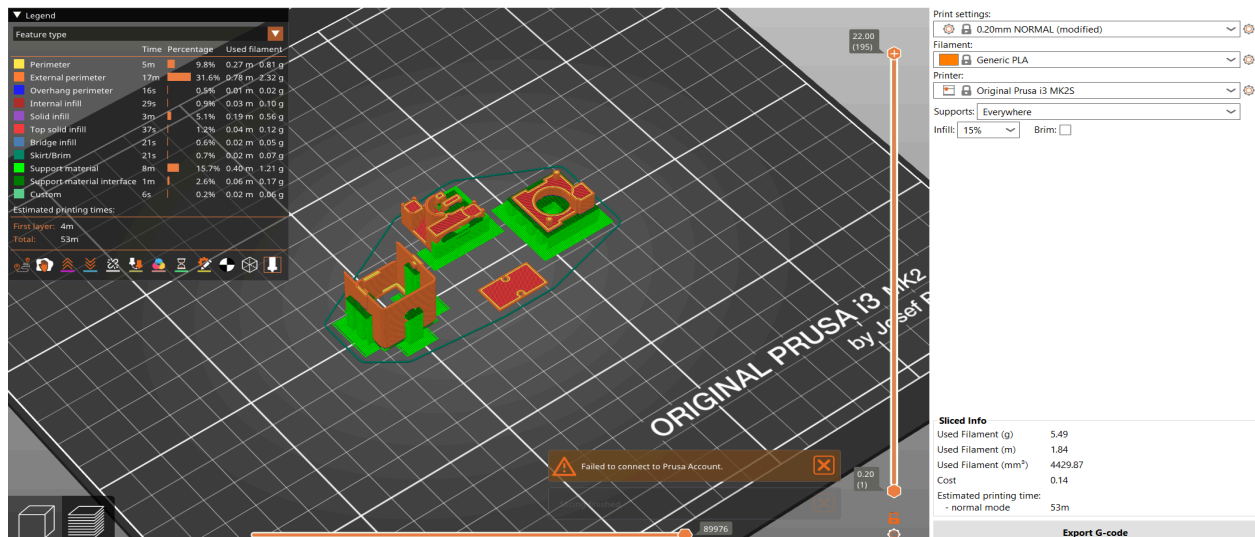


-The next step is to use the **flip on face** feature on the left side of the screen, right above the ruler symbol, arrange your parts like below (all buttons should be similar).



-In the above picture on the right side you'll notice the print settings, set it to whatever your printer says is **normal**, typically either amazonbasics PLA or Generic PLA. Below is the printer which is specific to your case. In the support section hit **everywhere**, leave the infill at 15% for anything button related, then hit **slice now**.

NOTE: If you print the guard rails for the keyguard you should set the print setting to the highest number (fast setting), and decrease the infill to 5%, this will make the print faster, you **CANNOT** do this for smaller parts as it will result in incompatible tolerancing.



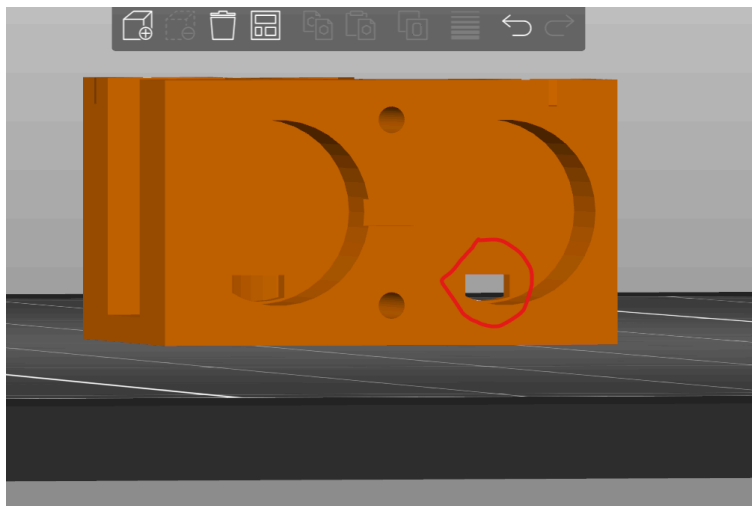
-Hit export and put the file onto either a usb or an SD card which you then put into the printer to print. Every printer is different but I put a checklist below of things to look for to start the print.

Checklist:

1. Load proper filament for the part you're printing.
2. Find the SD or USB slot for the printer, and put your files onto the device from your computer.
3. Next is to look at the printer interface and try to find a section related to the word **print**.
4. Find the name of your file, then hit okay or whatever button the printer uses.
5. Now you just have to wait until it prints.
6. Clean the printer, and your part (more on that later).
7. If you are unsure of any steps, please refer to online guides for your printer.

Cleaning up prints:

Best way to clean the supports off of the prints was just to use a carpentry knife, as well as the leg of an LED for the holes in the battery box (Circled in red below). The rest of the support comes off easily, needle nose pliers help a lot.



Laser Cutting:

The files needed to laser cut vary by company however companies should all be able to be cut from PDF file format, you may have to confirm with a call.

We will provide an inkscape file as well as a pdf, using inkscape you can edit the keyguard in case we improperly dimensioned your prototype.

To download inkscape go here <https://inkscape.org/>. From this you can open the .svg file we provided. I highly recommend **NOT** editing the original file as this way you can go back.

To use inkscape the main thing is the pathing (joining and separating pieces) which you can get info through here <https://www.youtube.com/watch?v=PDFsLwSPAil>. And use the alignment (<https://www.youtube.com/watch?v=MNgjZDkQW1w>) and translation (<https://www.youtube.com/watch?v=BMg29D9uhDI>) functions to move parts around. You also

need to keep the lines at 0.001 inches, this lets the laser cutter know that that line is to be cut, you can change line thickness like this (<https://www.youtube.com/watch?v=OF1qgEEI2-4>).

Assembly:

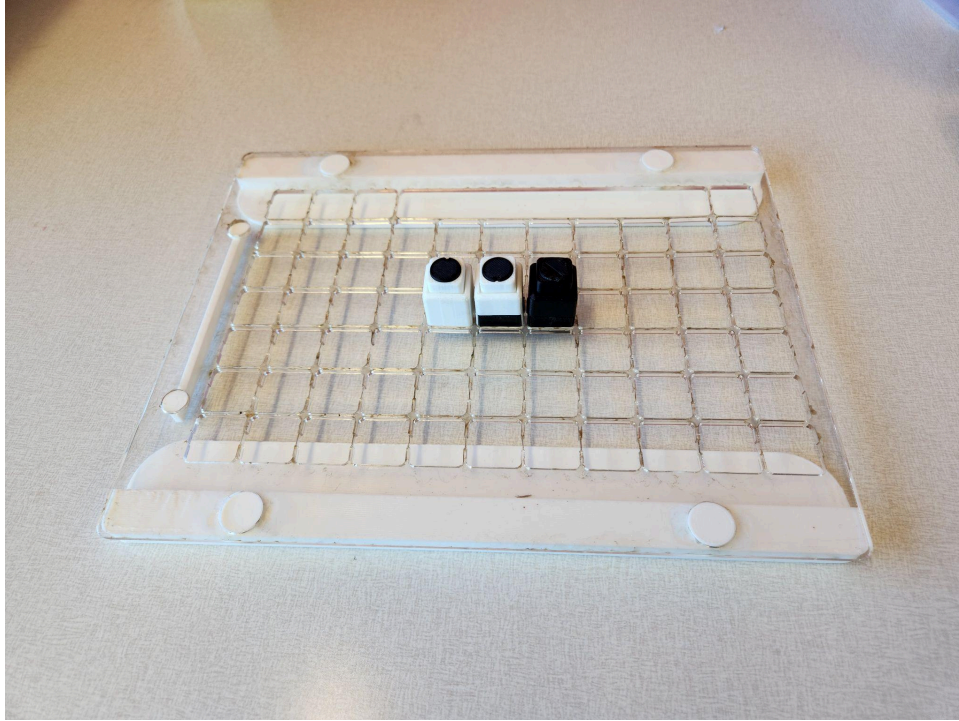
KeyGuard:

With the cut acrylic grid, and the printed rail guides and stopper piece, glue all dowels into their respective holes as shown below.



Step 1: assembly

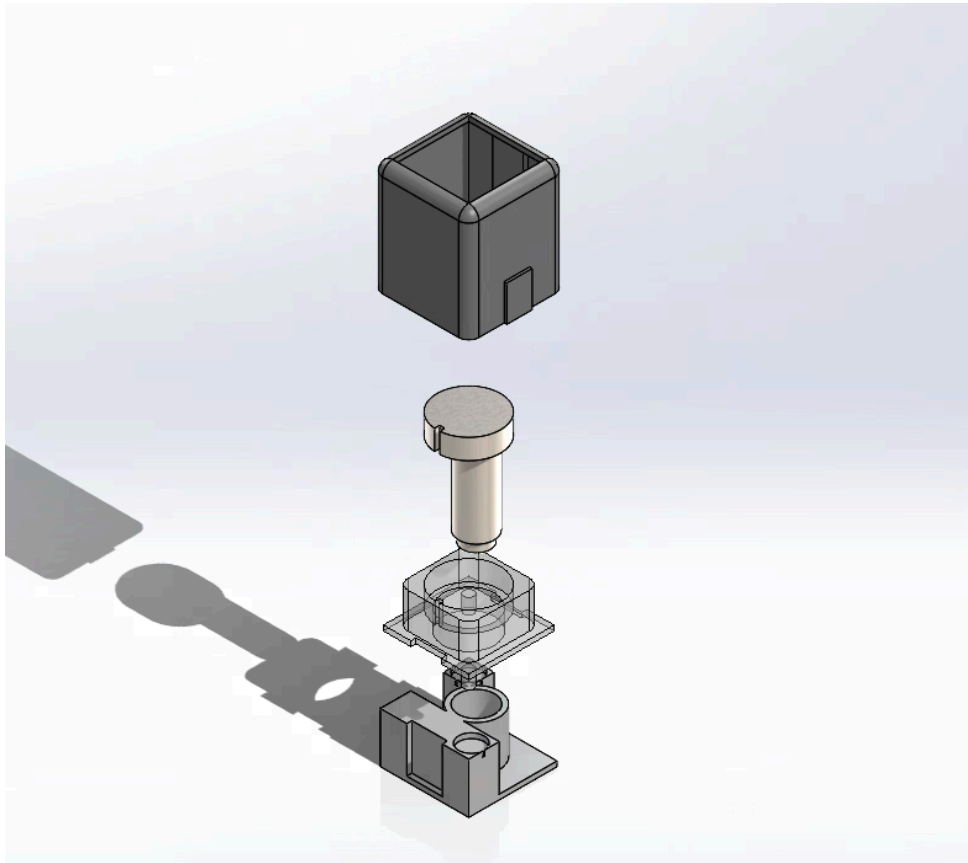
Step 2: Fasten



Step 3: Glue up and finish

Note: the tablet should be able to slide on the rails below the acrylic.

Button MK.8S:



Step 1. Press the core into the button, gluing it is recommended.

Step 2. Glue the springs into the holes in the corners of the bottom piece.

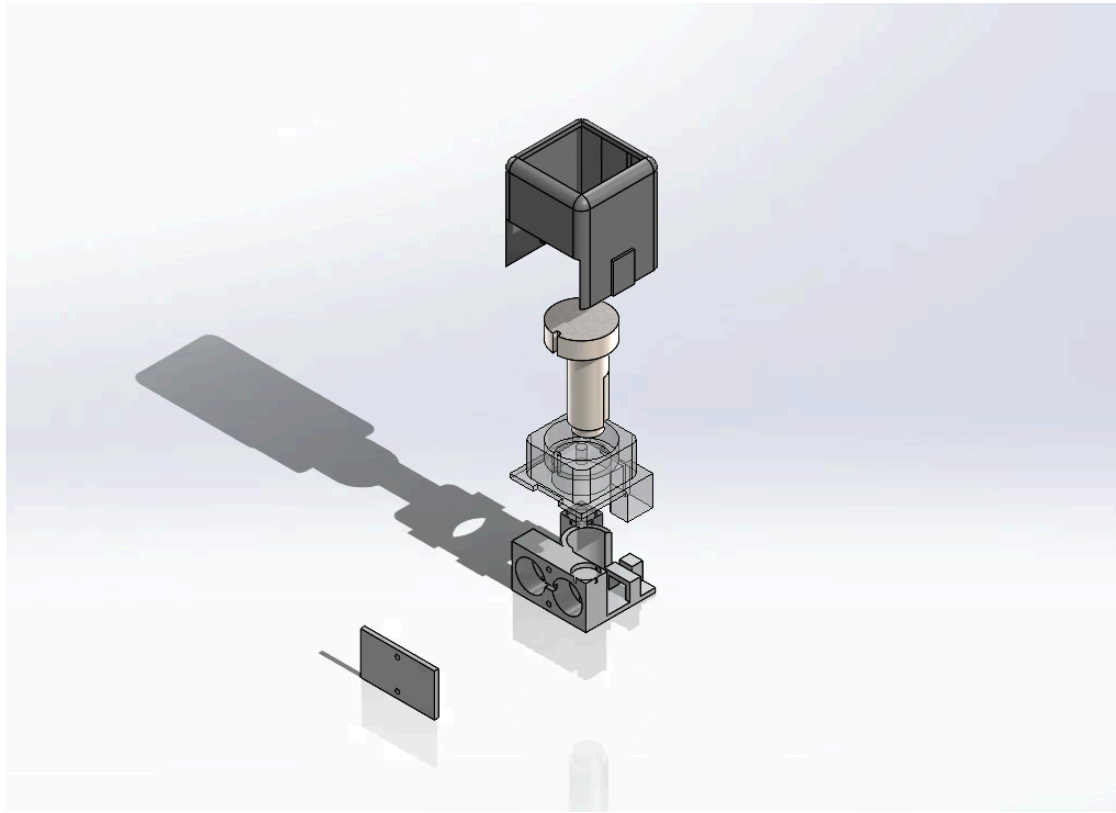
Step 3. Put the button and core into the button casing.

Step 4. Carefully make sure the bottom springs align with the dowels in the corner of the buttons, then insert the bottom slowly; the parts will hold together by compression, but the use of glue is recommended.



A complete Mk.8S button

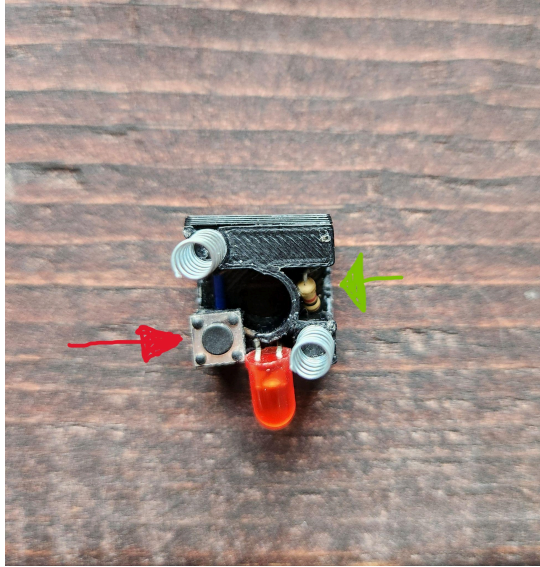
Button MK.8E:



Step 1: press the conductive core into the button

Step 2: Press the core and button top into the casing.

Step 3: Next you need to solder the following parts: **LED, 1k ohm resistor, 2 inch section single strand wire.**



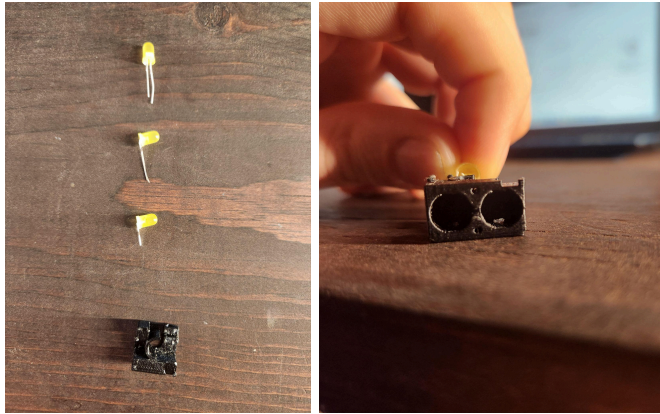
Run as much of the resistor (**green arrow**) through the holes going to the battery and to the LED position as possible (It won't sit flat), then run a **minimum** 2 inch piece of wire from the opposite battery hole to the corner across from it (**Red arrow**) under the button position. Next, grab the push button and solder one button terminal to the extra wire sticking out.

3b.



Now gently pull the extra wire (copper strand on the left) through the battery hole until the button is sitting on its dedicated corner, you can measure this using the groove on the conductive core as shown at the beginning (it matches with the square corner for easy installation). At this point you should apply a little glue to the button seat, but ensure the clearance is somewhat loose for the core by moving it up and down. Bend the unsoldered button terminal toward the center, and cut some of the resistor wire off on the LED side (keep this for later). It should look identical to above without the LED, and springs.

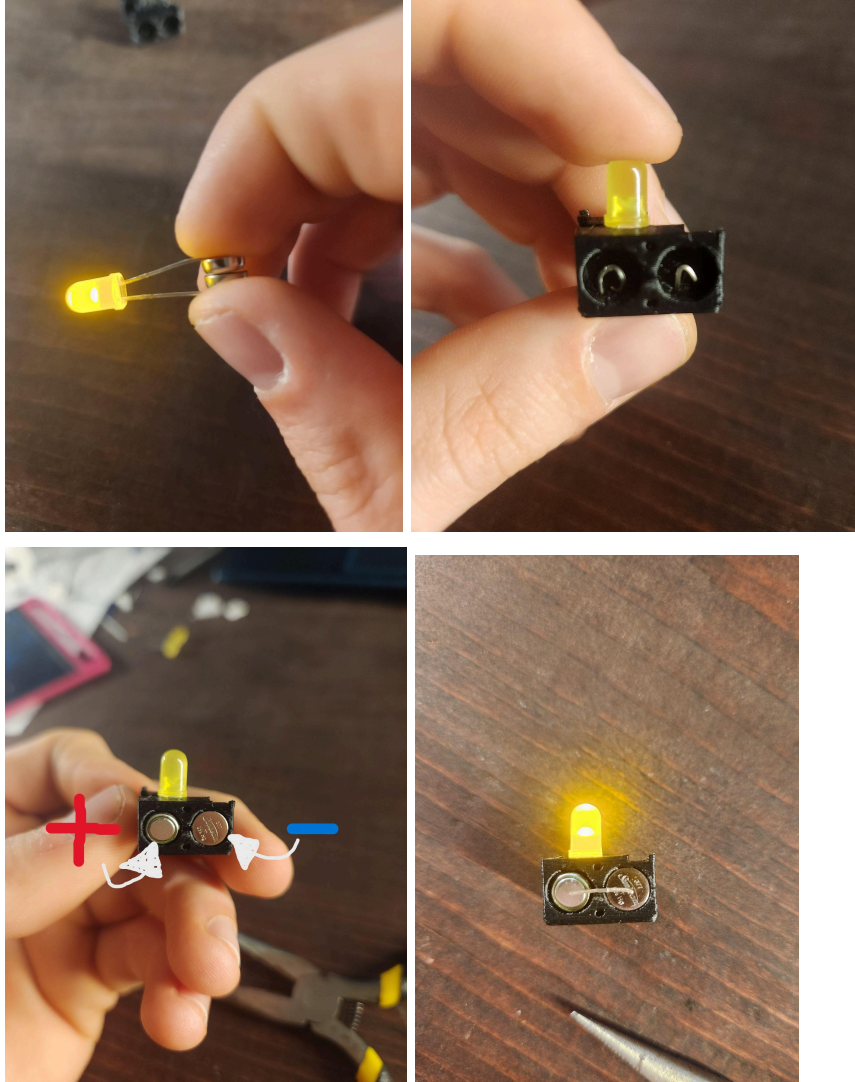
3c.



The next step is to use cutters to cut the LED to length and the spring. To do this, bend the LED legs to 90 degrees, then compare it to the battery box, there must be $\frac{1}{2}$ the base of the LED above the battery box. And either use the proper springs, or cut a pen spring in half. Now you need to solder the LED to the button and resistor that were bent toward the center earlier. Followed by gluing the springs into their respective slots. (it should look identical to the image in 3b).

3d.

Now pinch the two cell batteries in your fingers, and put the wires sticking out of the battery holes of the fully soldered bottom piece on either side while pressing the button, find which way powers the LED and note where the positive side is (similar example below). From here you can use needle nose pliers to make flat coils out of the extra wire in the battery holes (similar example, second picture below). Next you want to insert the positive side of the battery in the **previously recorded positive** side of the wiring, the other battery is the opposite orientation (third picture below). From here adding a wire between the two batteries puts them into series, and the circuit is complete (no button example below).



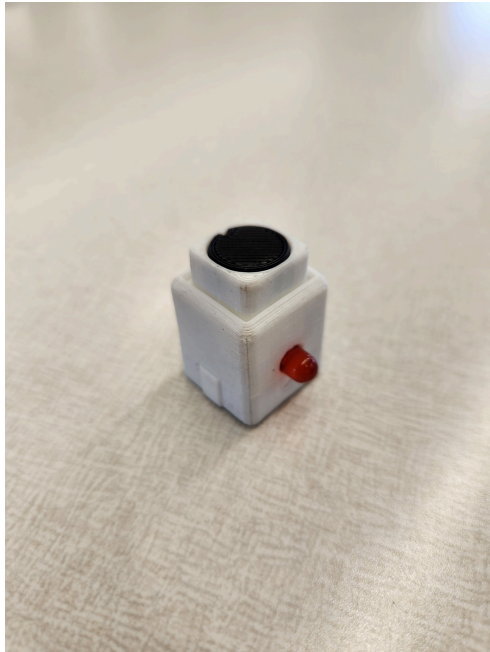
3e.

From here the circuitry is finished, and resembles the image in 3b. Next we add the battery cover which will press the wire on the batteries keeping them in series, we actually glued our cover shut however if you wanted to replace them, i would use M1x3 metric screws on the top hole of the battery cover.


Step 4:

Now the core and button are in the case, the next step is adding the soldered bottom into the case. Before trying, press the core out of the button, then install the soldered bottom into the case. We recommend testing if the light is turning on when the button is pressed before putting the core in permanently. Finally, squeeze the top button with pliers and press the core

back in. now test it on a screen. If all is well, glue the bottom to the button casing, and the button is complete and should resemble the button below.



Assets:

 Project Files