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adafruit learning system

DIY Pocket LED Gamer - Tiny Tetris!

Created by Jianan Li

Last updated on 2014-12-11 11:00:38 AM EST

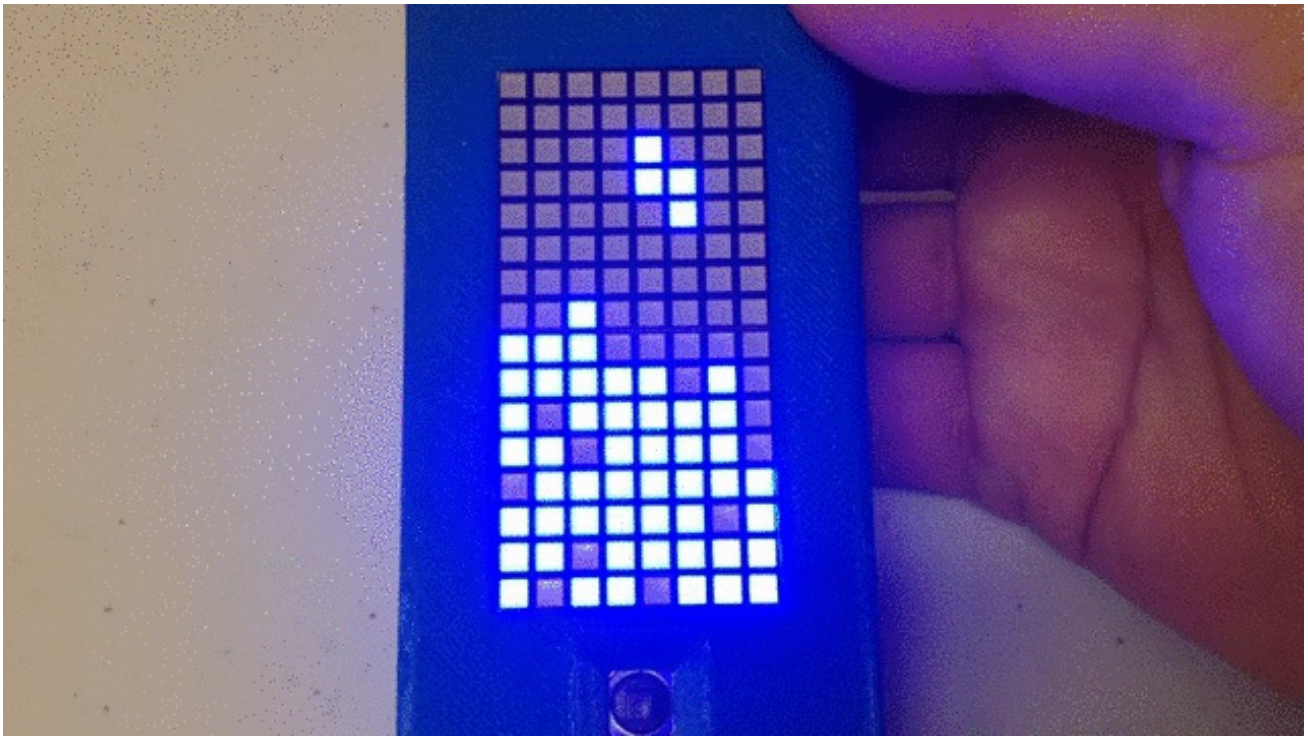
Guide Contents

Overview

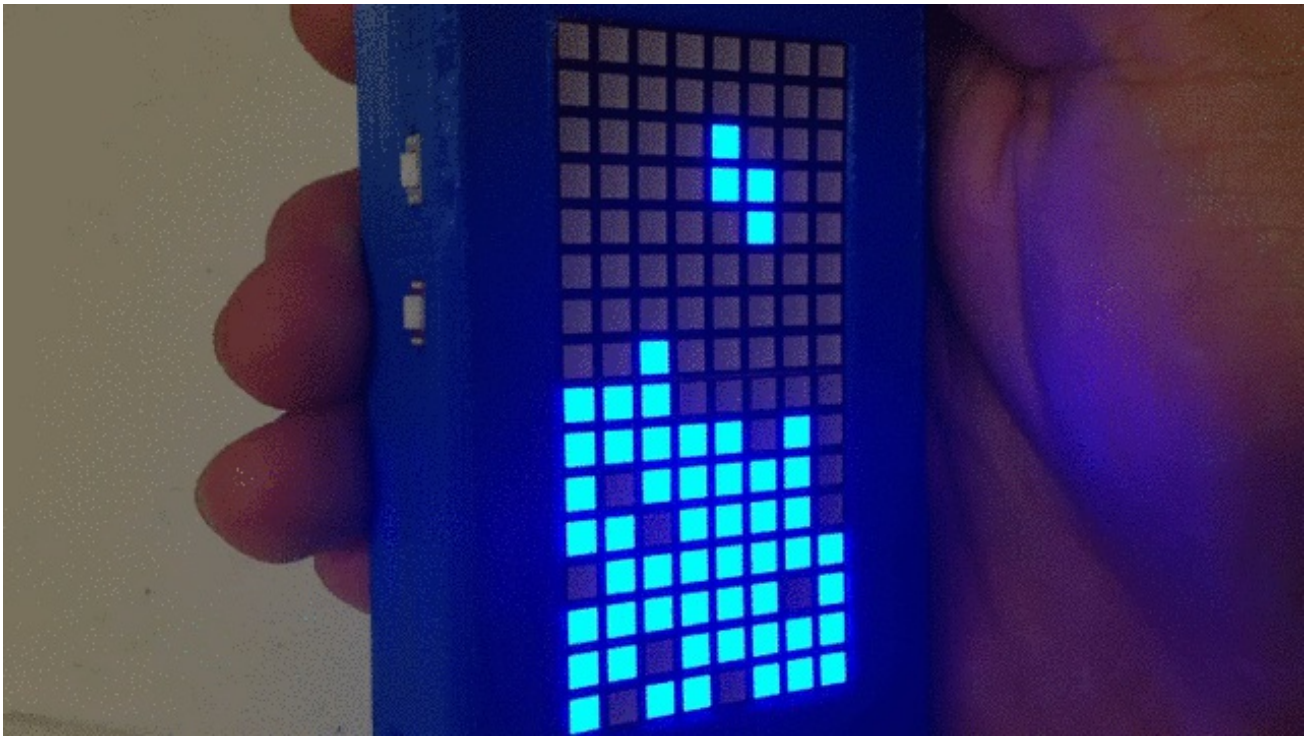
I love Tetris! Nothing could compare with the satisfaction I get from clearing a line after another. So in this guide, we are going to build a handheld game that plays not only Tetris, but Snake and more!

Menu

When the Tiny Tetris is first turned on, you can use the left/right buttons to select between Tetris, Snake, and the Paint program, then press the center button to enter the program. Once you're inside a program, you can switch to the previous/next one by holding down the center button and press the brightness adjustment buttons on the left side.

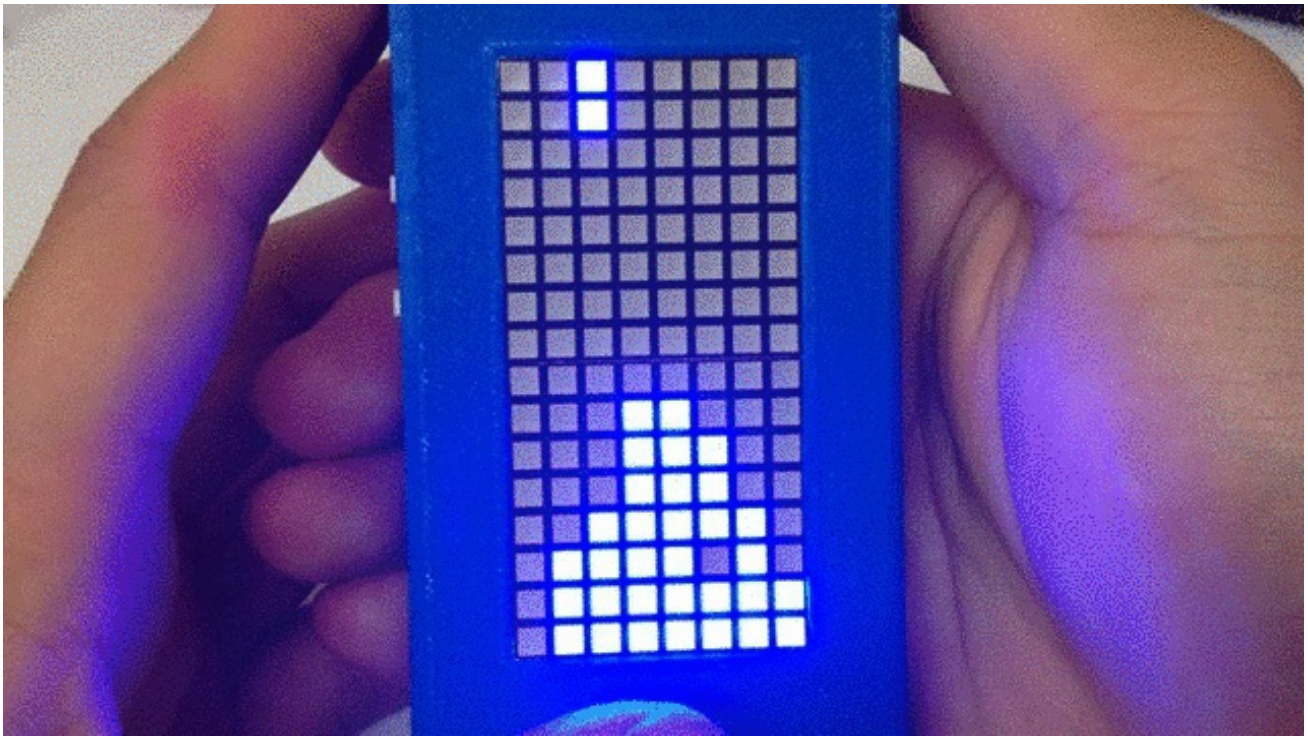


Brightness Adjust



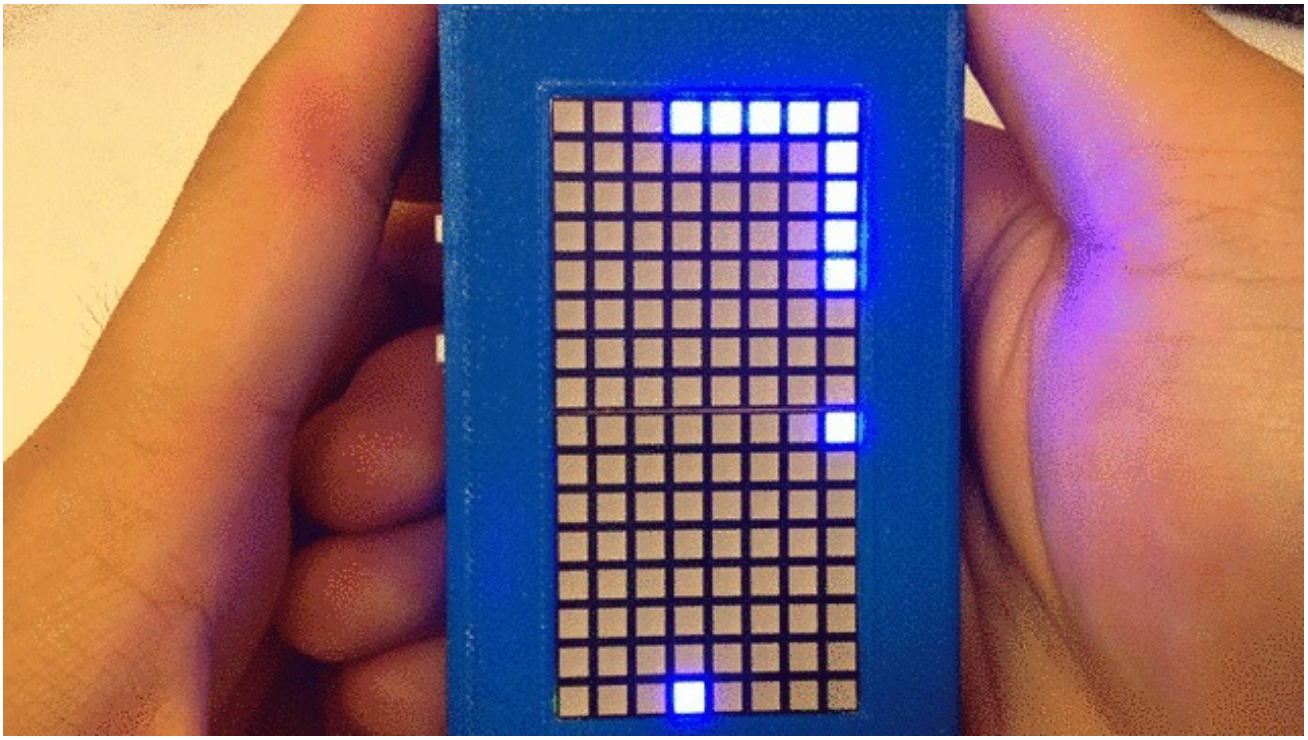
Tetris

- Up - Rotate
- Left/Right/Down - Move to left/right/down
- Center - Drop



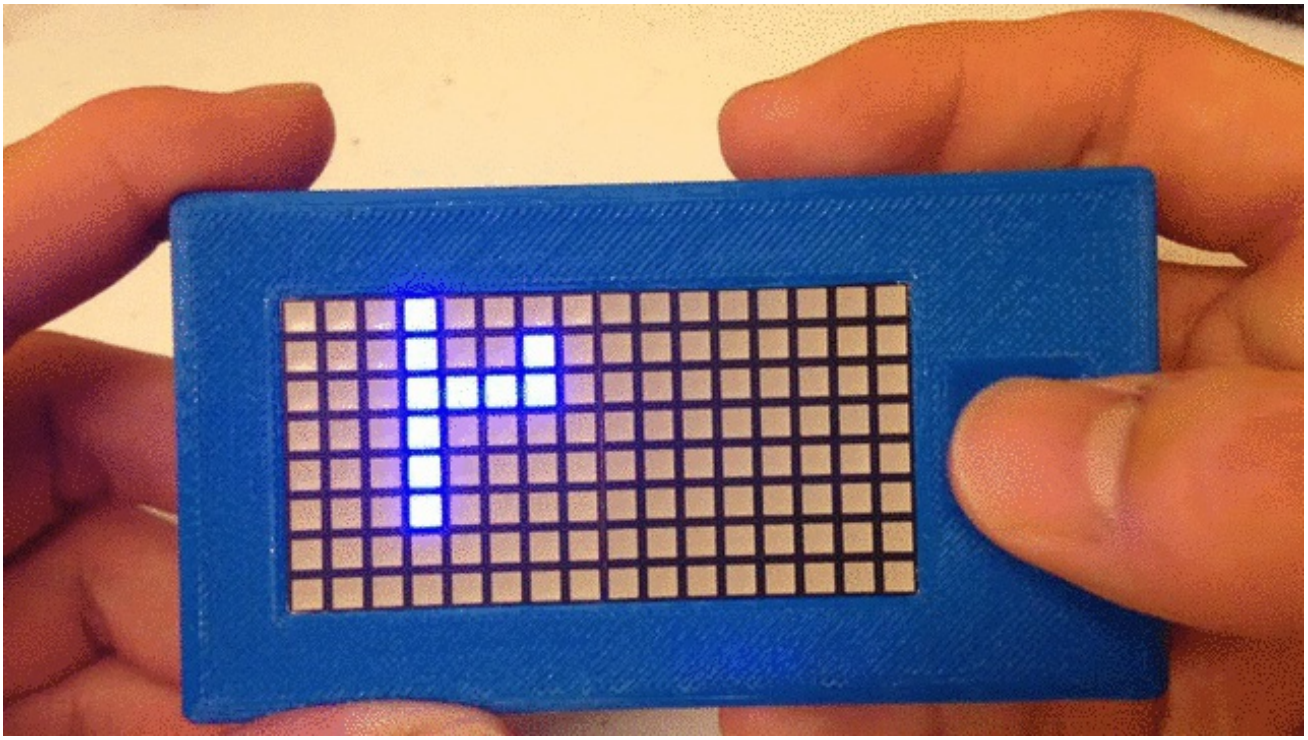
Snake

- Left/Right/Up/Down - Change direction
- Center - N/A

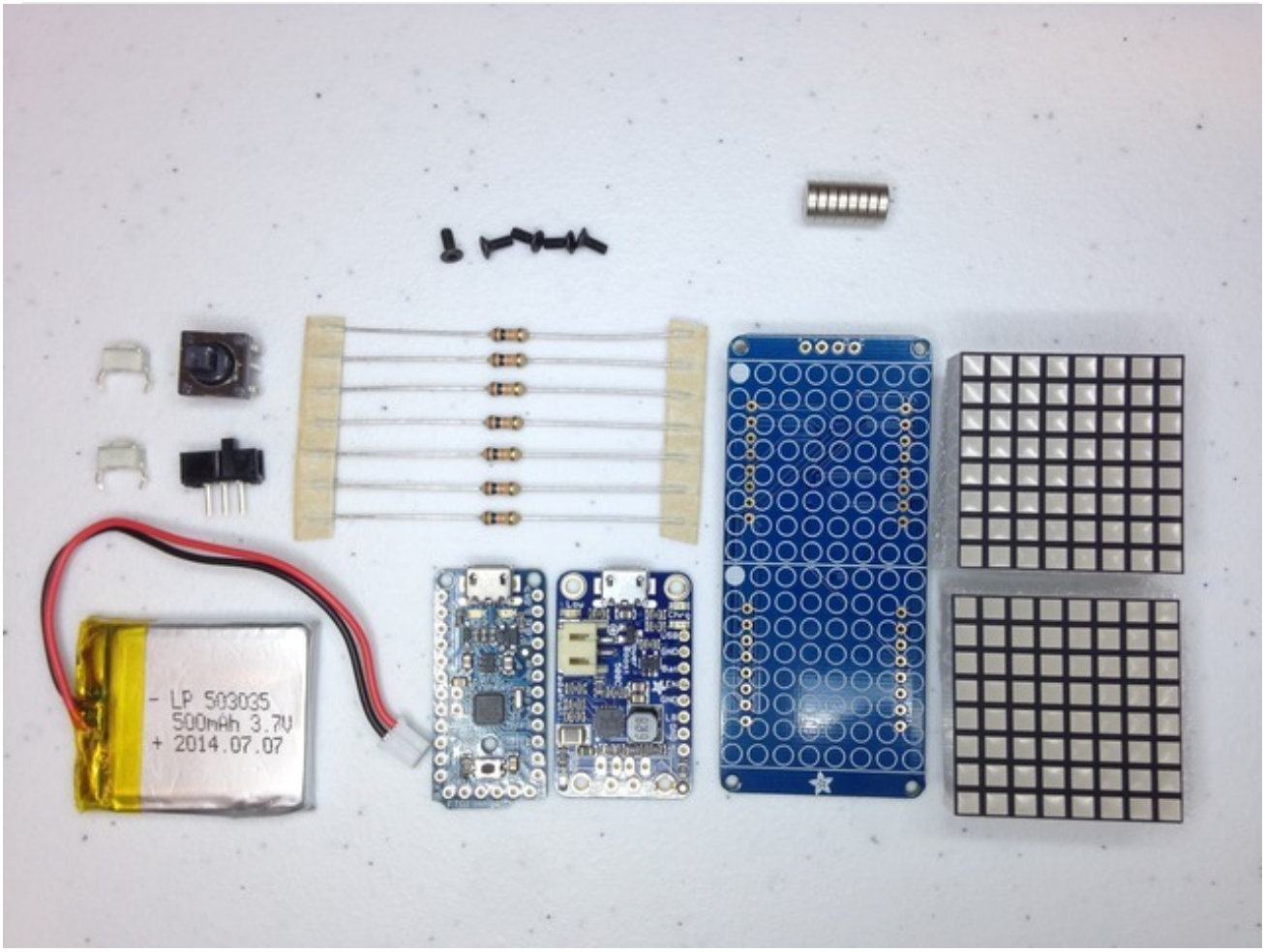


Paint

- Left/Right/Up/Down - Move cursor
- Center - Draw/Clear dot
- Hold center for 3s - Clear canvas



Parts & Tools



Parts

- 1 x Adafruit Pro Trinket (http://adafru.it/2000) - this is the brains of the game
- 1 x PowerBoost 500 Charger (http://adafru.it/1944) - this is the power supply, which manages the battery recharging and conversion
- 1 x 16x8 1.2" LED Matrix + Backpack (http://adafru.it/2040) - pick any color and style, I personally like the square pixels best
- 1 x Lithium Ion Polymer Battery (http://adafru.it/1578) - 500mAh is perfect
- 1 x Thru-hole 5-way Navigation Switch (http://adafru.it/504) - this little joystick works well for gaming
- 1 x SPDT Slide Switch (http://adafru.it/805) - on off switch
- 3 x Tactile Switch Buttons (http://adafru.it/1489) (one missing from the picture above)
- 30AWG Stranded-Core Wire (http://adafru.it/2001) (in various colors) - or any ribbon wire you have around the workbench!
- 7 x 10kΩ Through Hole Resistors
- 5 x M2x5/6mm Flat Socket Head Cap Screw
- 8 x Neodymium Magnets 1/4 x 1/16 Inch

Tools and Misc

- Soldering Iron (http://adafru.it/1204)
- Helping Third Hand (http://adafru.it/291)
- Wire Stripper (http://adafru.it/527)
- Flush Cutter (http://adafru.it/152)
- Pliers (http://adafru.it/1368)
- Screwdriver (http://adafru.it/822)
- Super Glue

3D Printing

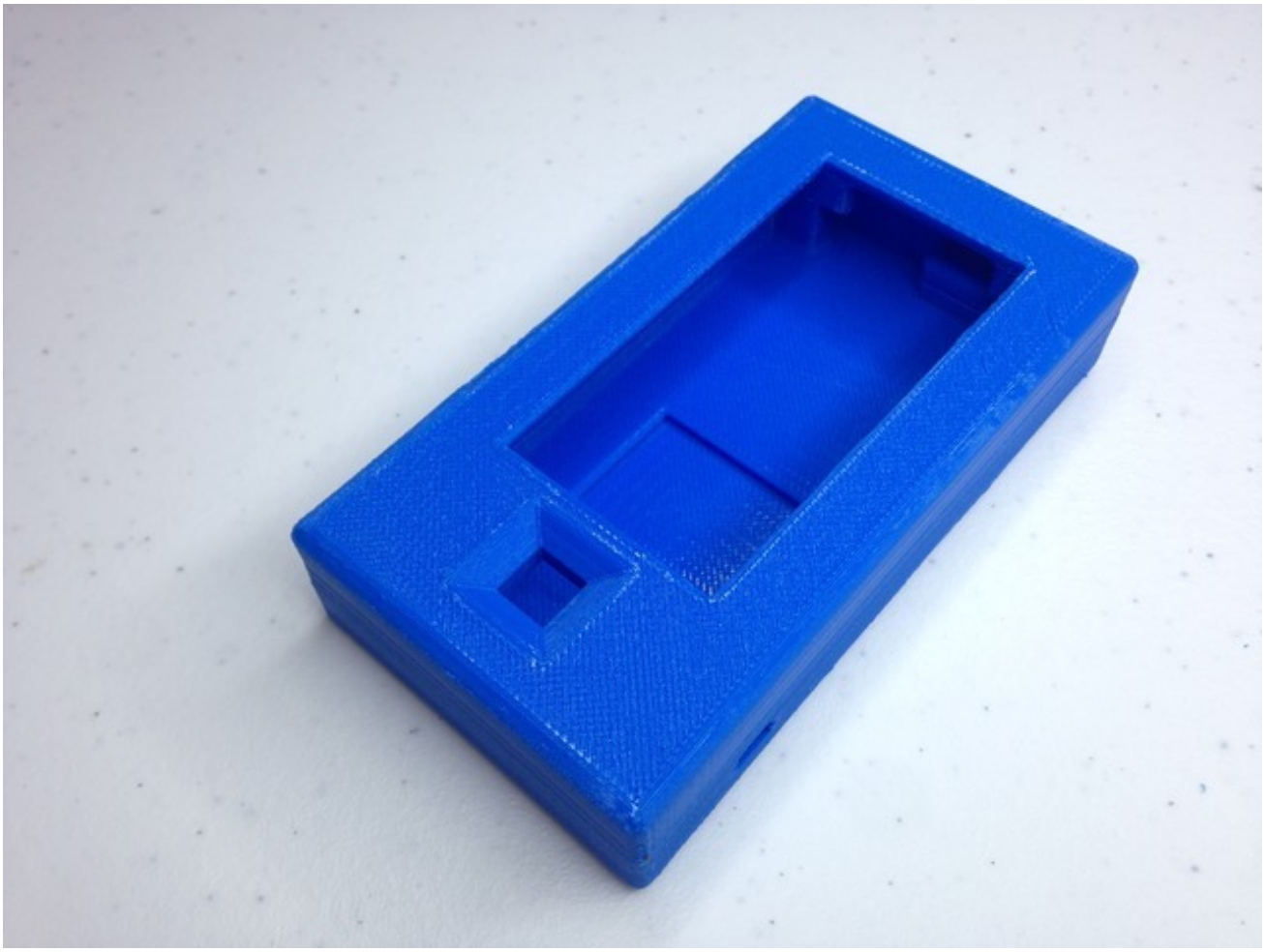
Download STLs on Thingiverse

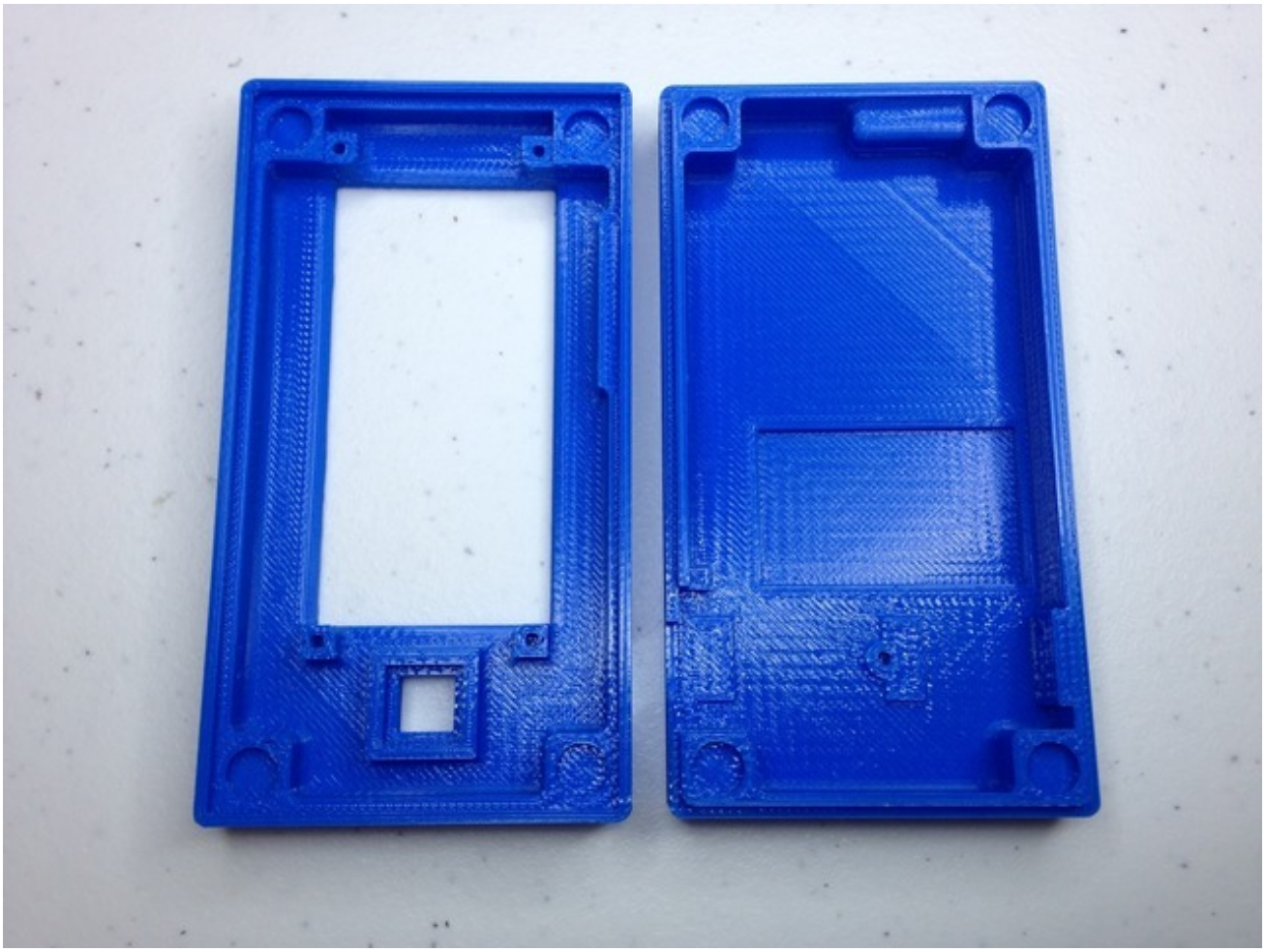
http://adafru.it/dWH

The enclosure is designed in SolidWorks, and printed on a Makerbot Replicator 2 but will fit in nearly any small 3D printer bed. Customize it with your favorite logo!

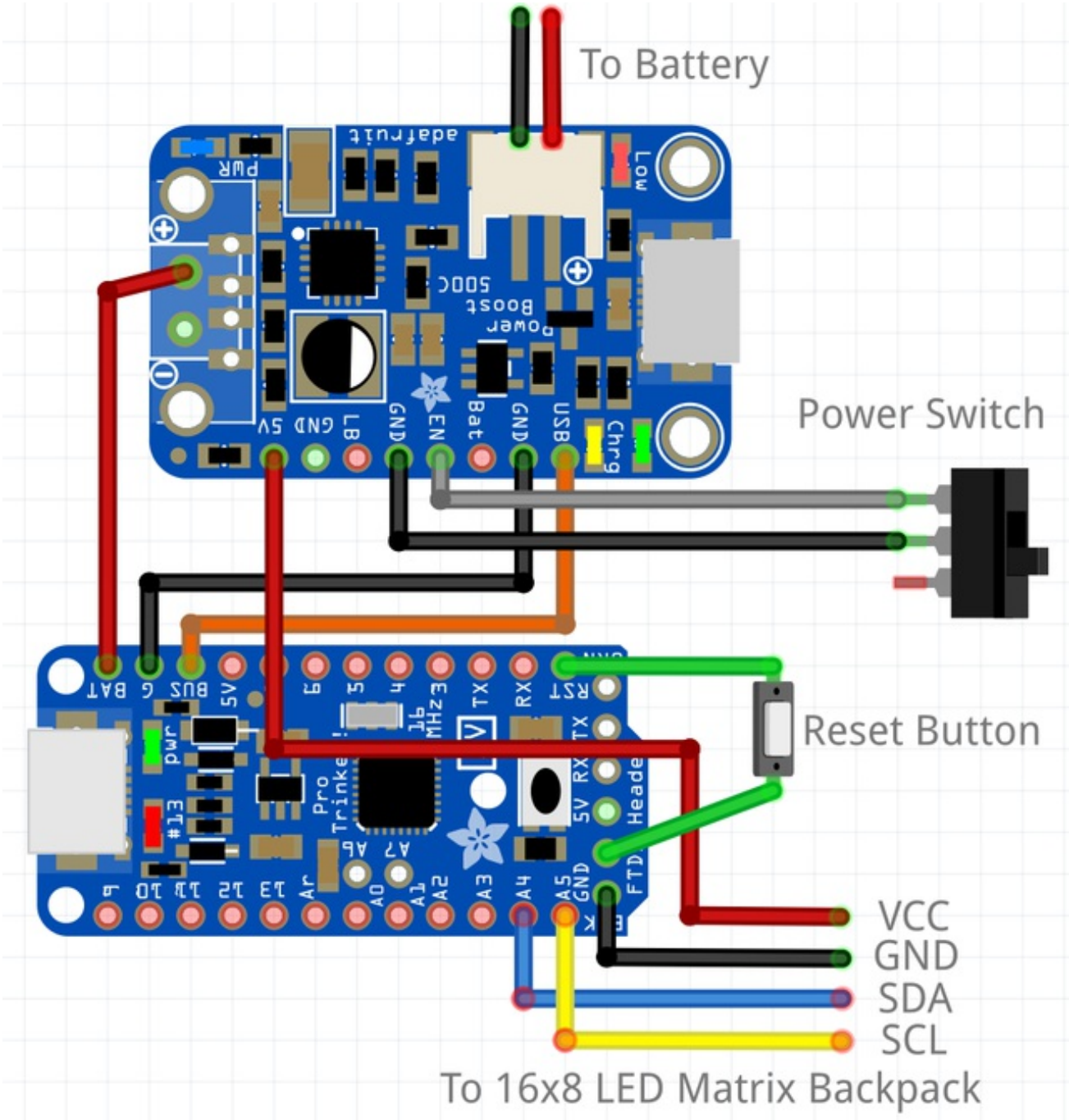
Makerbot Desktop Print Settings:

- Infill: 15%
- Shells: 2
- Layer Height: 0.10mm
- Extruder Temperature: 230°C
- Speed while Extruding: 90 mm/s
- Speed while Traveling: 150mm/s
- With raft but no support



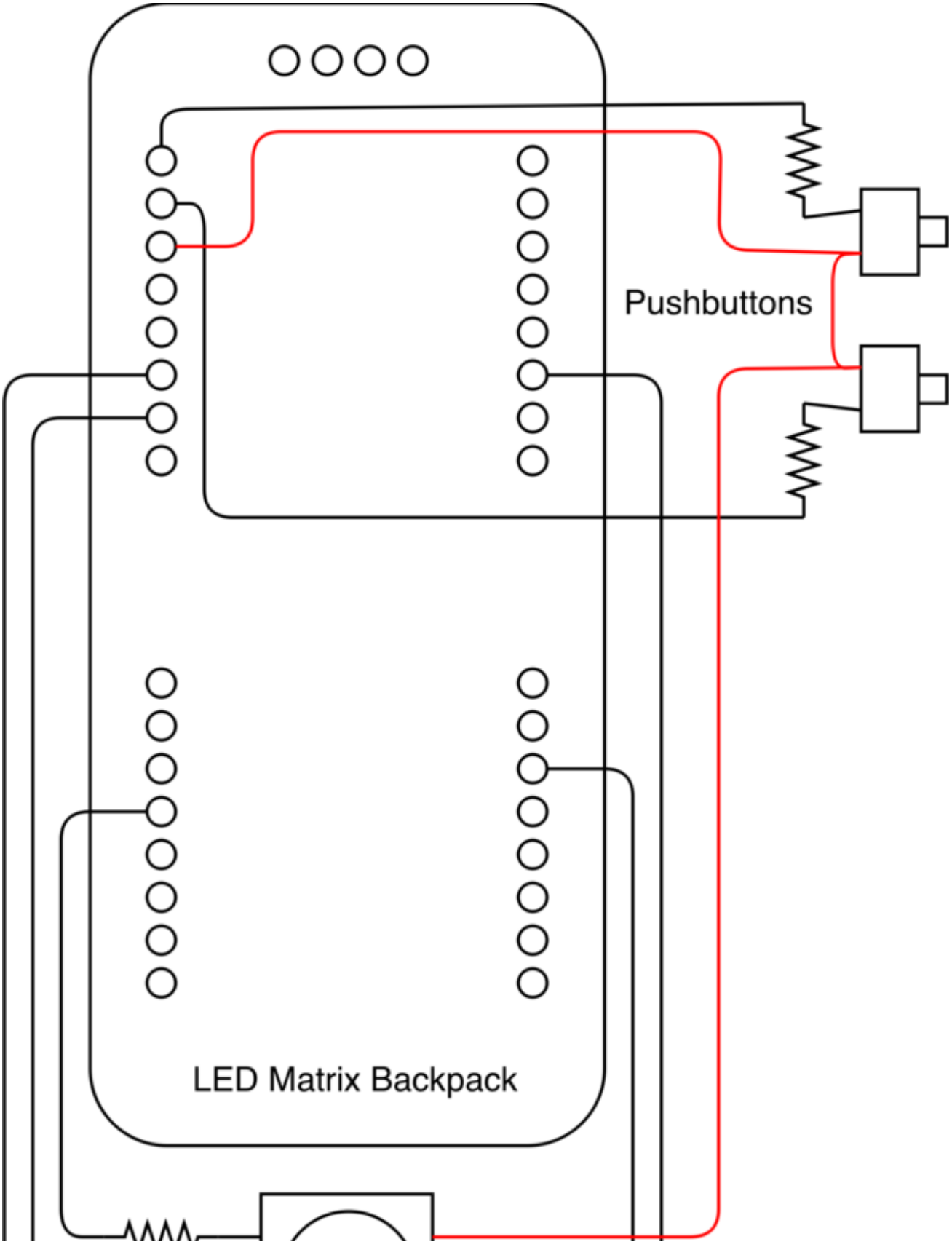


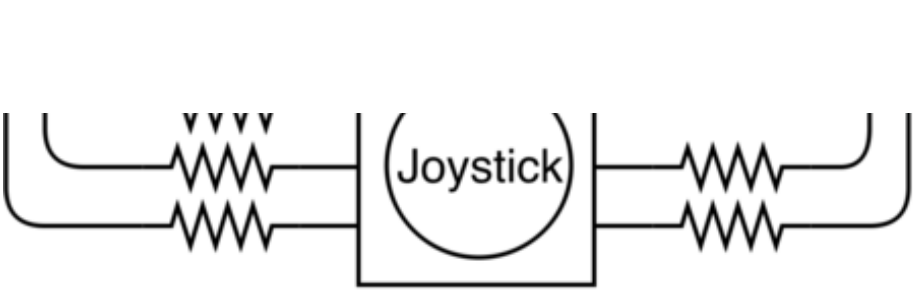
Circuit Diagram
Bottom



This first circuit diagram contains all parts mounted on the bottom half of enclosure. The JST connector on the PowerBoost 500 Charger goes to the LiPo battery, which is not shown in the picture. The four wires that connect to the 16x8 LED Matrix Backpack are the only ones that connect between the bottom and top half of the enclosure.

Top



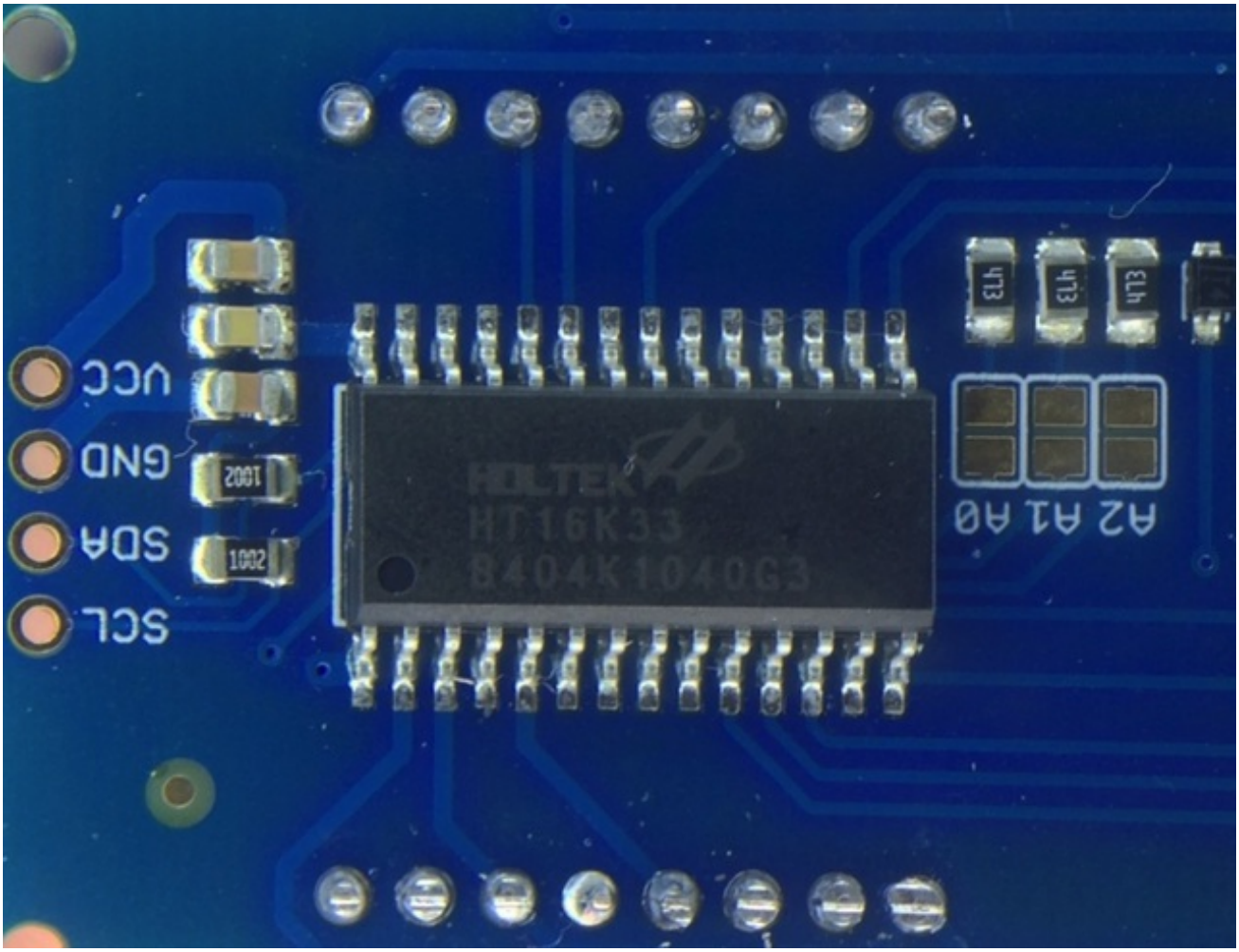


The second circuit diagram contains everything mounted on the top half of the enclosure. This is a view from the inside of the enclosure, which means that both the LED Matrix Backpack and the joystick are facing away from us. If it seems confusing, the assembly guide on the next page will definitely help you understand better. All seven resistors shown in this circuit diagram have a value of 10kΩ.

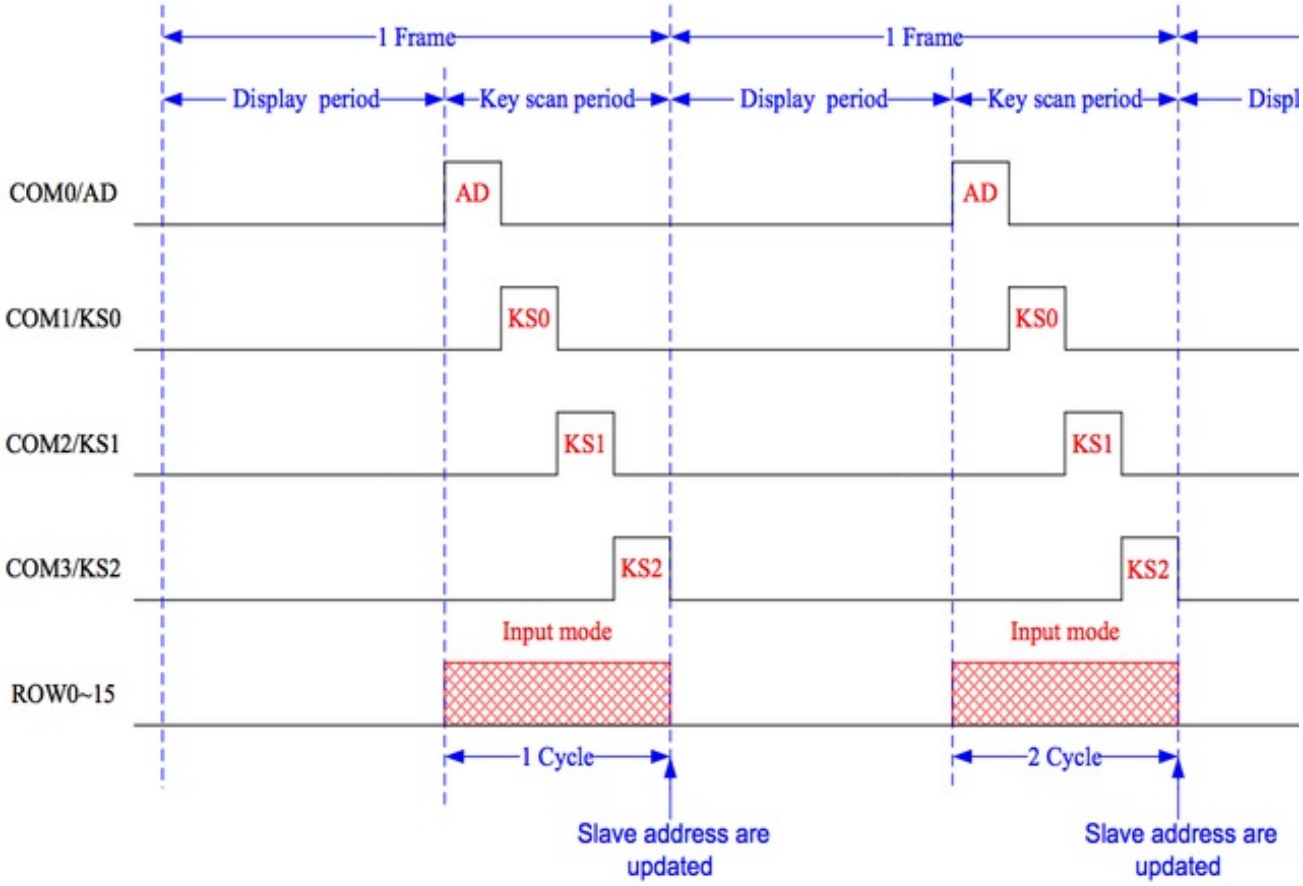
At this point, you might be asking why we're wiring the buttons to the LED Matrix Backpack instead of the Pro Trinket. There are a couple good reasons why we're doing this. One is that we don't need to connect so many wires between the top and bottom half of the enclosure, which makes the assembly much easier. But the underlying reason has to do with the HT16K33 chip located on the LED Matrix Backpack. Let me explain more on the next page.

HT16K33 Explained

So what is the HT16K33 (http://adafru.it/aMy)? It's the name of the chip on the LED Matrix Backpack.

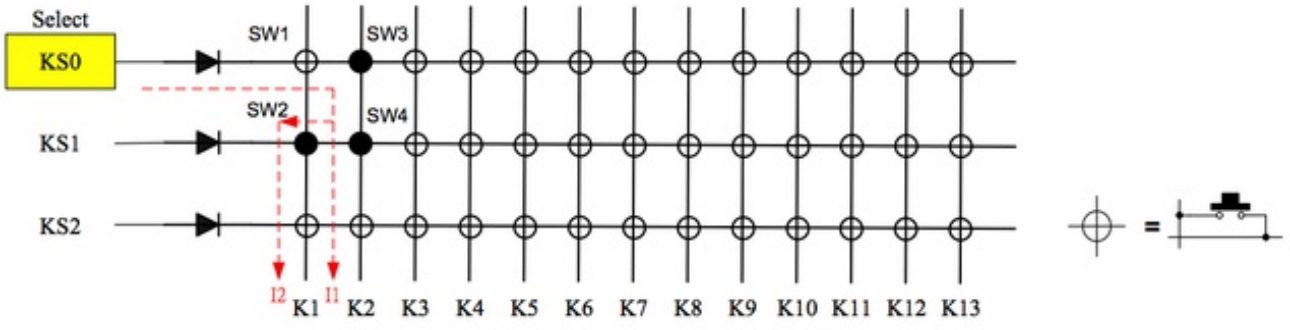


It's a wonderful chip! Not only is it capable of driving a 16x8 LED Matrix, but reading a pushbutton matrix with a maximum size of 13x3. In fact, this is how HT16K33 is used on the Adafruit Trellis (http://adafru.it/1616) to read the 16 pushbuttons.



The HT16K33 refreshes the LED matrix with a frequency of about 100Hz. In each of the 10ms frame, it first refreshes the display, and then scans the button matrix for the state of every single one of those 13x3=39 buttons. But it's gets more interesting! The HT16K33 does not immediately tell you when any of the buttons is pressed. Instead, it waits for one additional cycle, which is a total of 20ms, to confirm the reading on all the buttons, and store the confirmed readings in its internal registers.

It debounces the buttons for you! How cool is that?



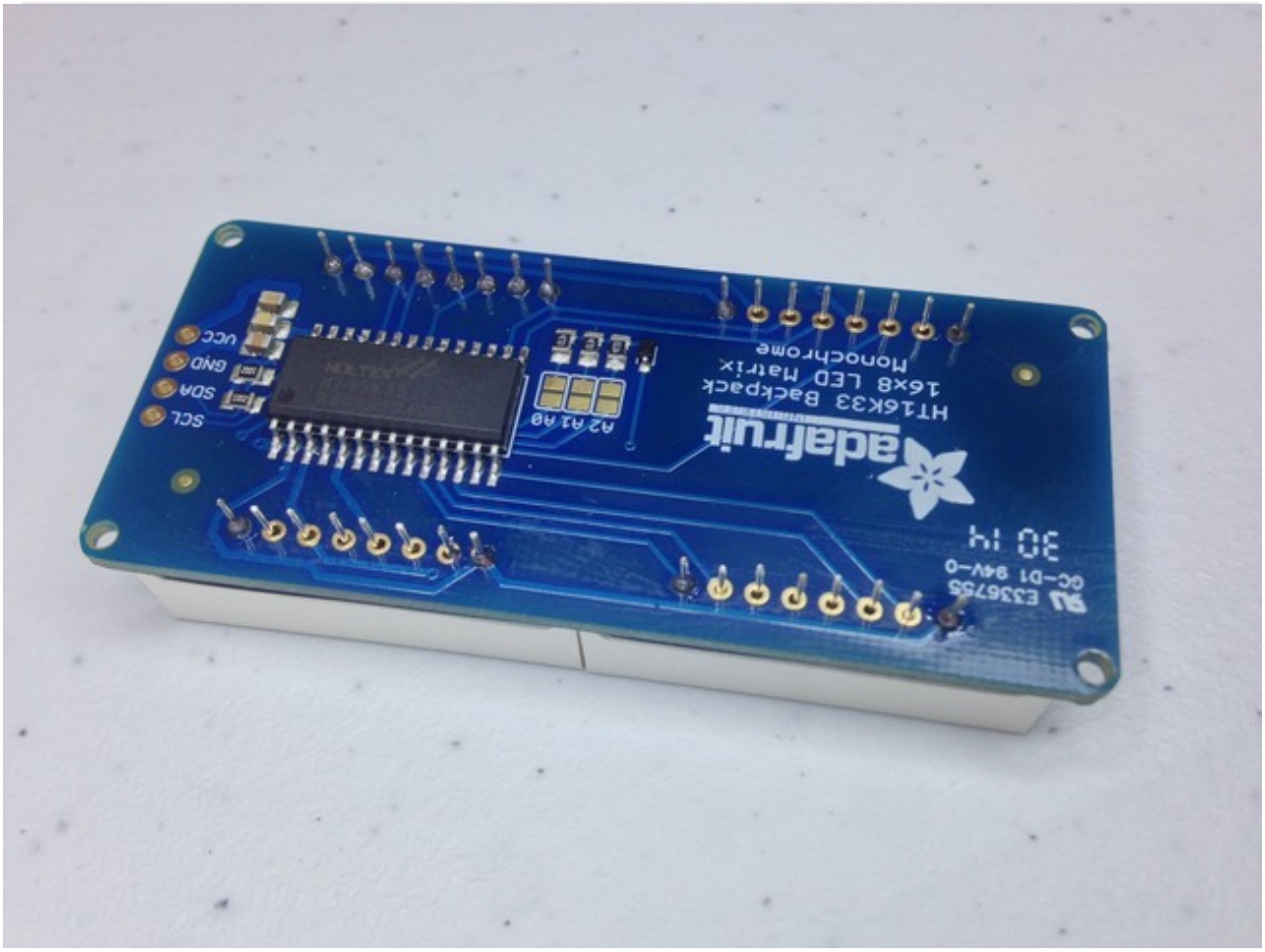
So instead of writing code for debouncing the buttons on the Pro Trinket, we can ask the HT16K33 over I2C about the state of all buttons once every 20ms (50Hz). That's exactly

what we are doing in this tutorial!

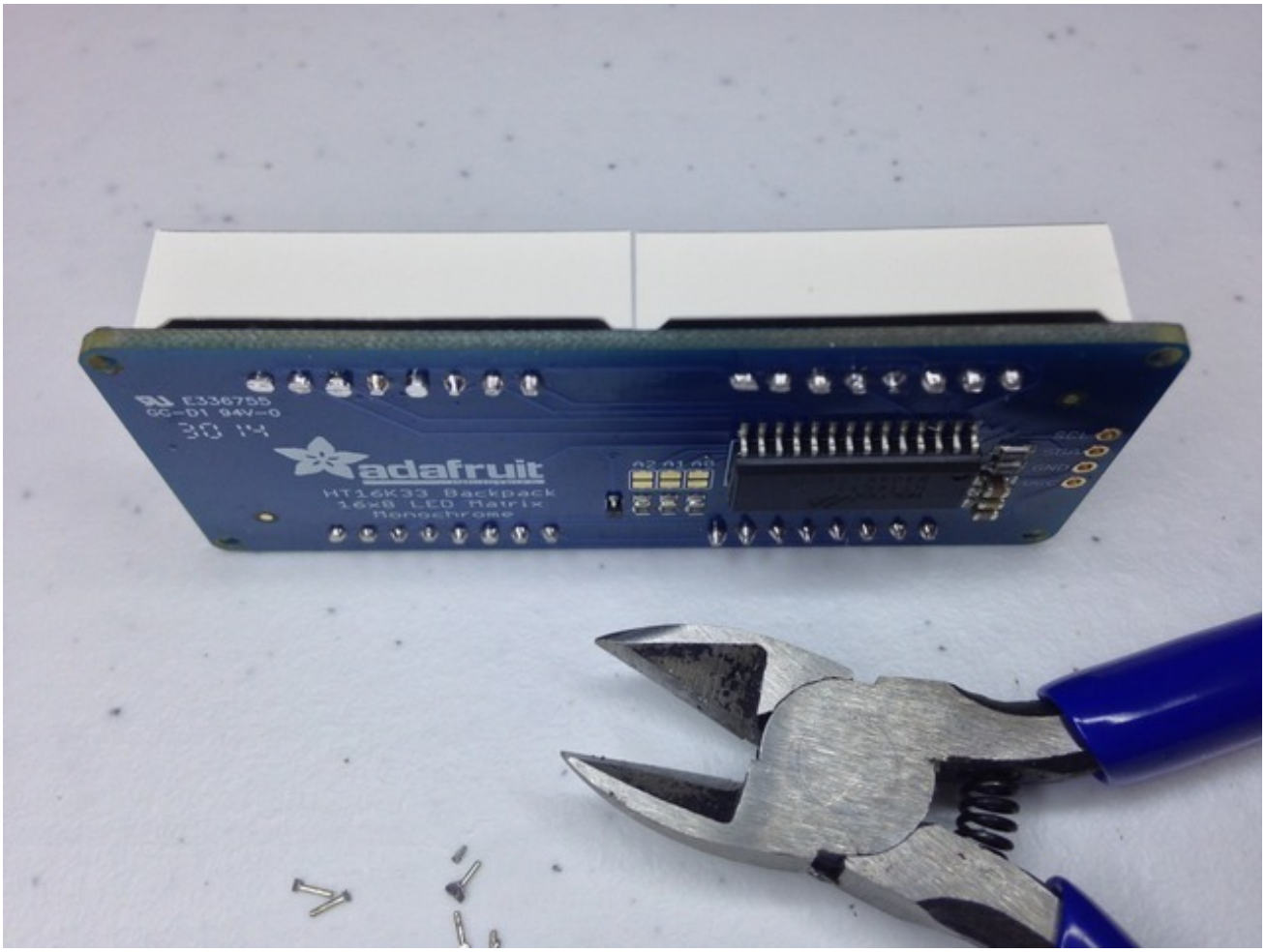
Assembly

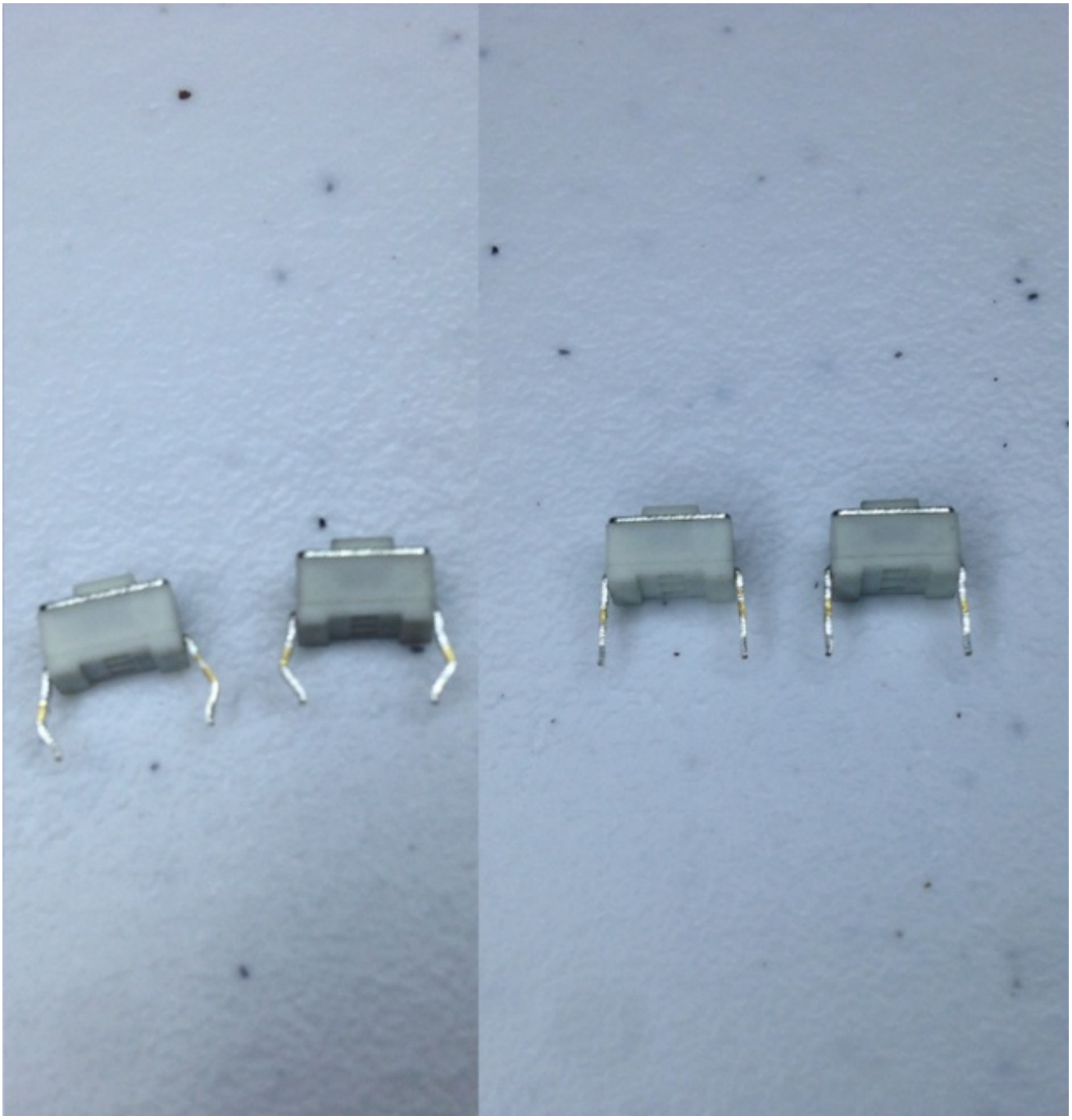
Now let's start to put these components together to build our Tiny Tetris! The entire assembly process consists of three parts: the top half of the enclosure, the bottom half, and the interconnection.

Top

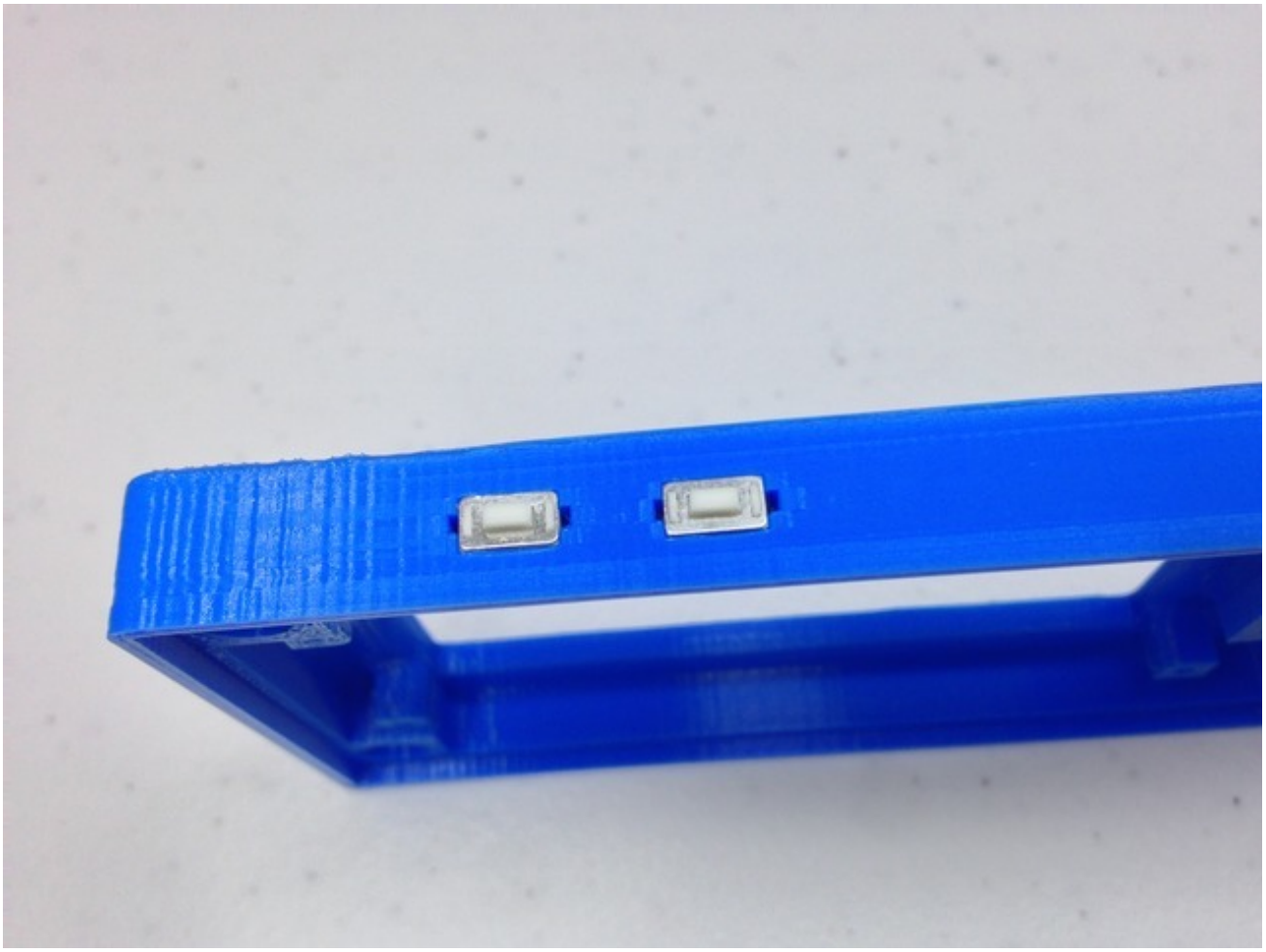


Let's start with the soldering the LED matrices to the Backpack. After all 32 pins have been soldered, carefully trim the pins with a flush cutter.

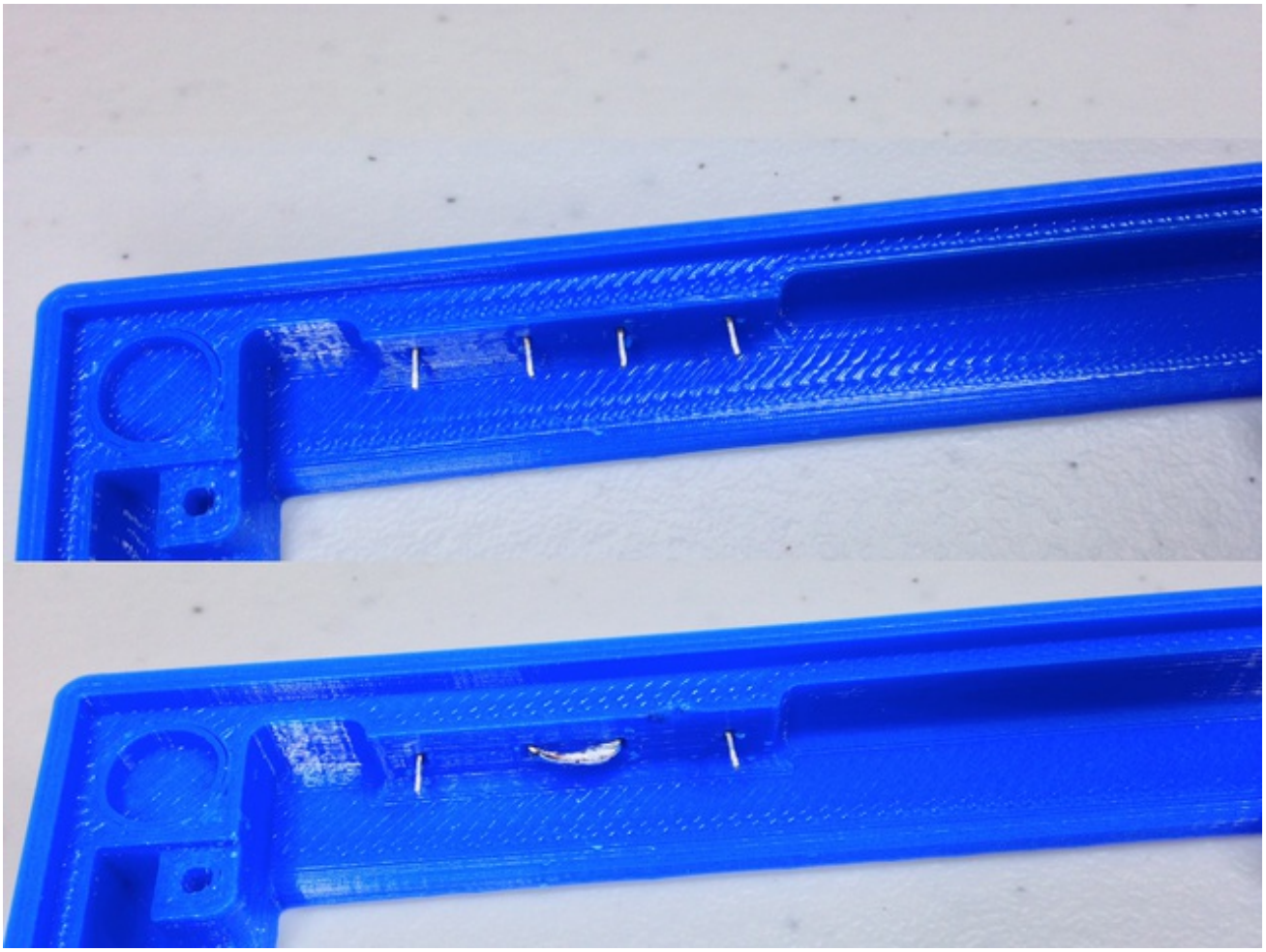

E336755
adafruit
HT16K33 Backpack
16x8 LED Matrix



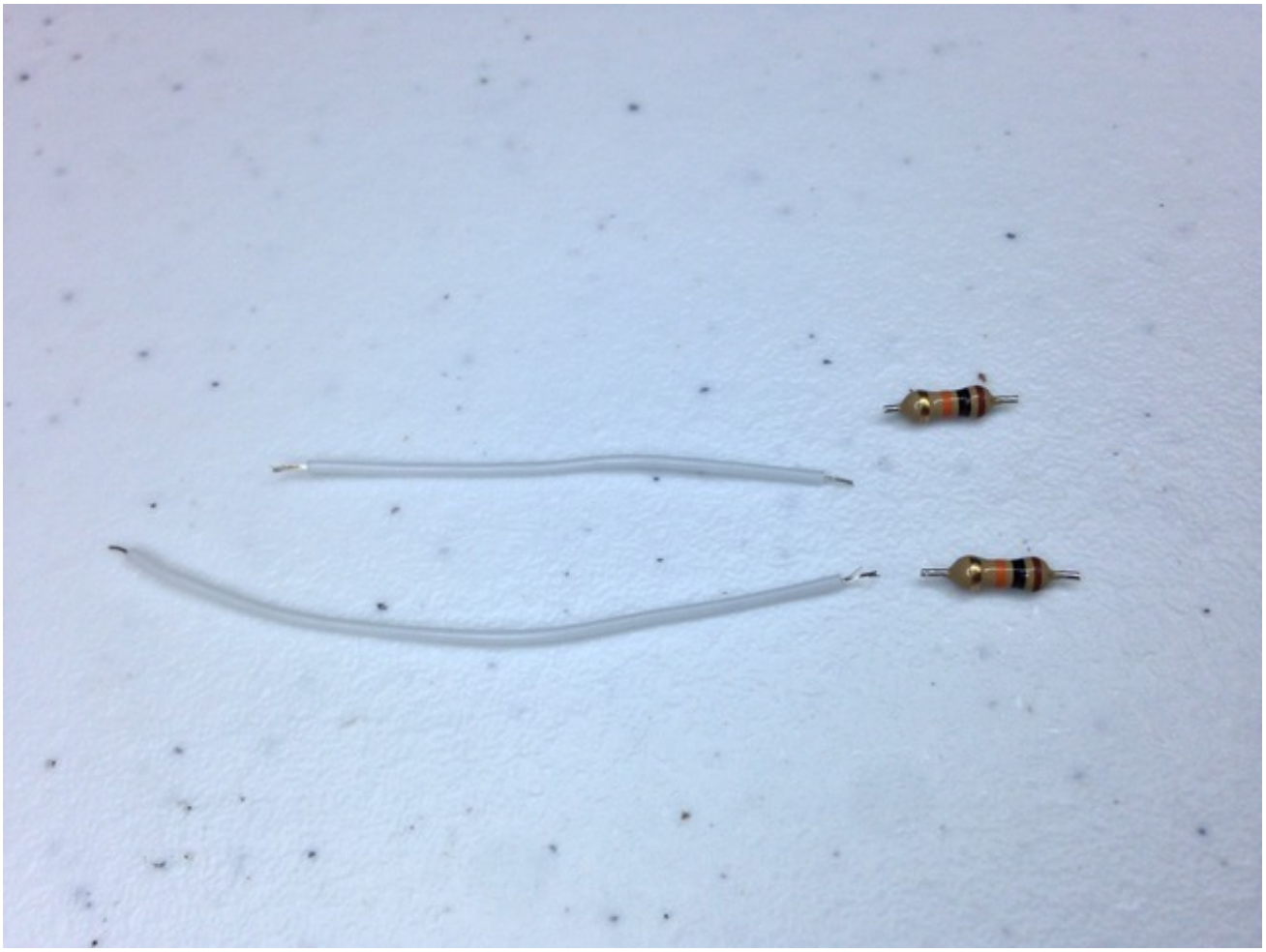
Use a pair of pliers to straighten the legs of the two pushbuttons and then insert them into the cavities on the left side of the enclosure.



Be careful when soldering inside the enclosure. Your soldering iron will deform the PLA plastic if they come in contact with each other (see the burn mark in the picture below.)



On the inside, you should be able to see all four pins of the pushbuttons. Bend the inner two and join them together with some solder.



Now prepare two resistors and two short piece of wires - approximately 4cm and 5cm respectively - and solder each wire to a resistor.