

Adafruit Macropad RP2040 with Transparent Lego Keycaps and Sounds from The Crystal Maze

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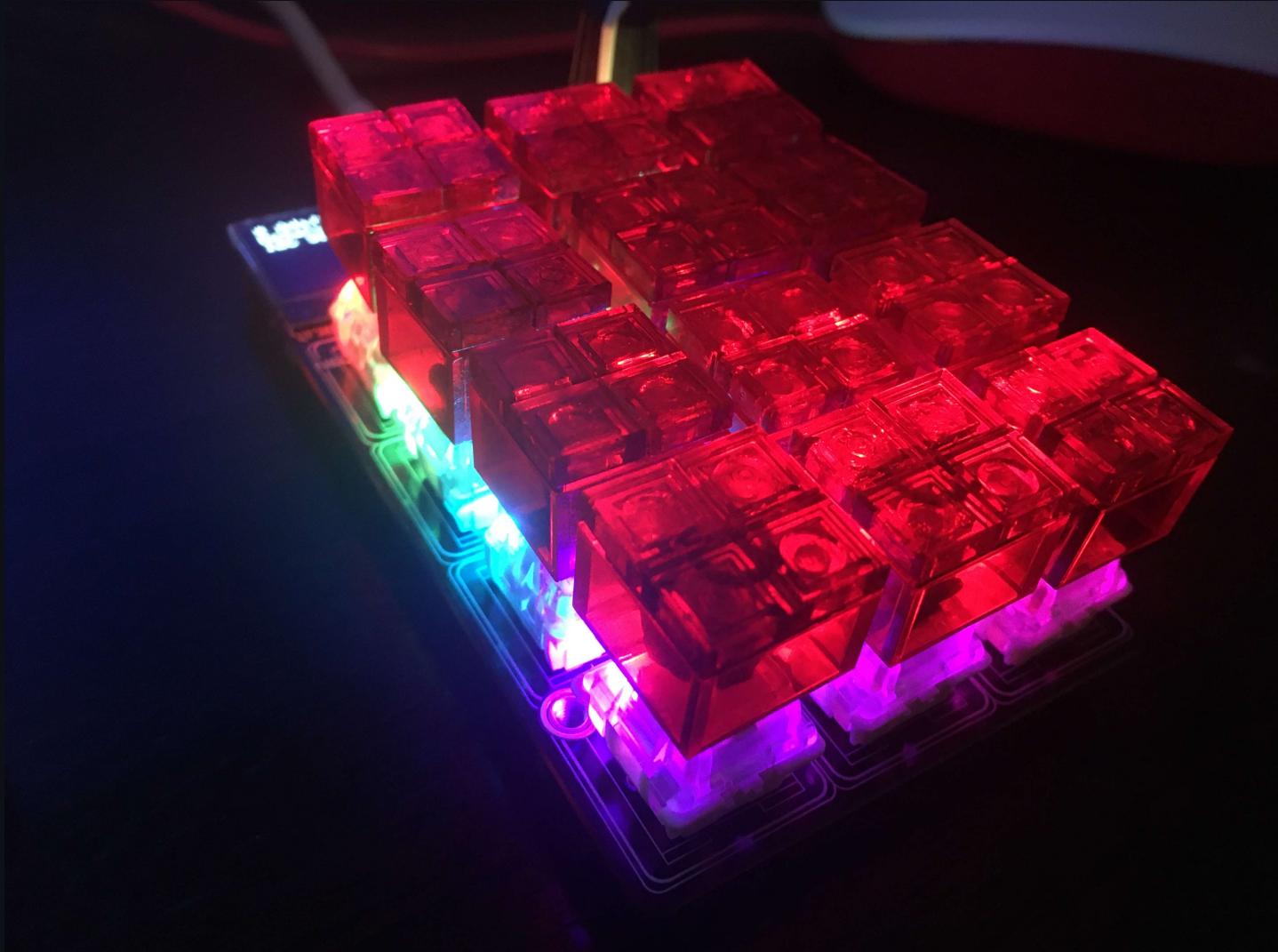
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macropad

Adafruit Macropad RP2040 with Transparent Lego Keycaps and Sounds from The Crystal Maze



Introduction

The Macropad by Adafruit Industries is a Shortcut Keyboard powered by a Raspberry Pi RP2040. The same microcontroller powers the Raspberry Pi Pico RP2040 and the usage is much the same.

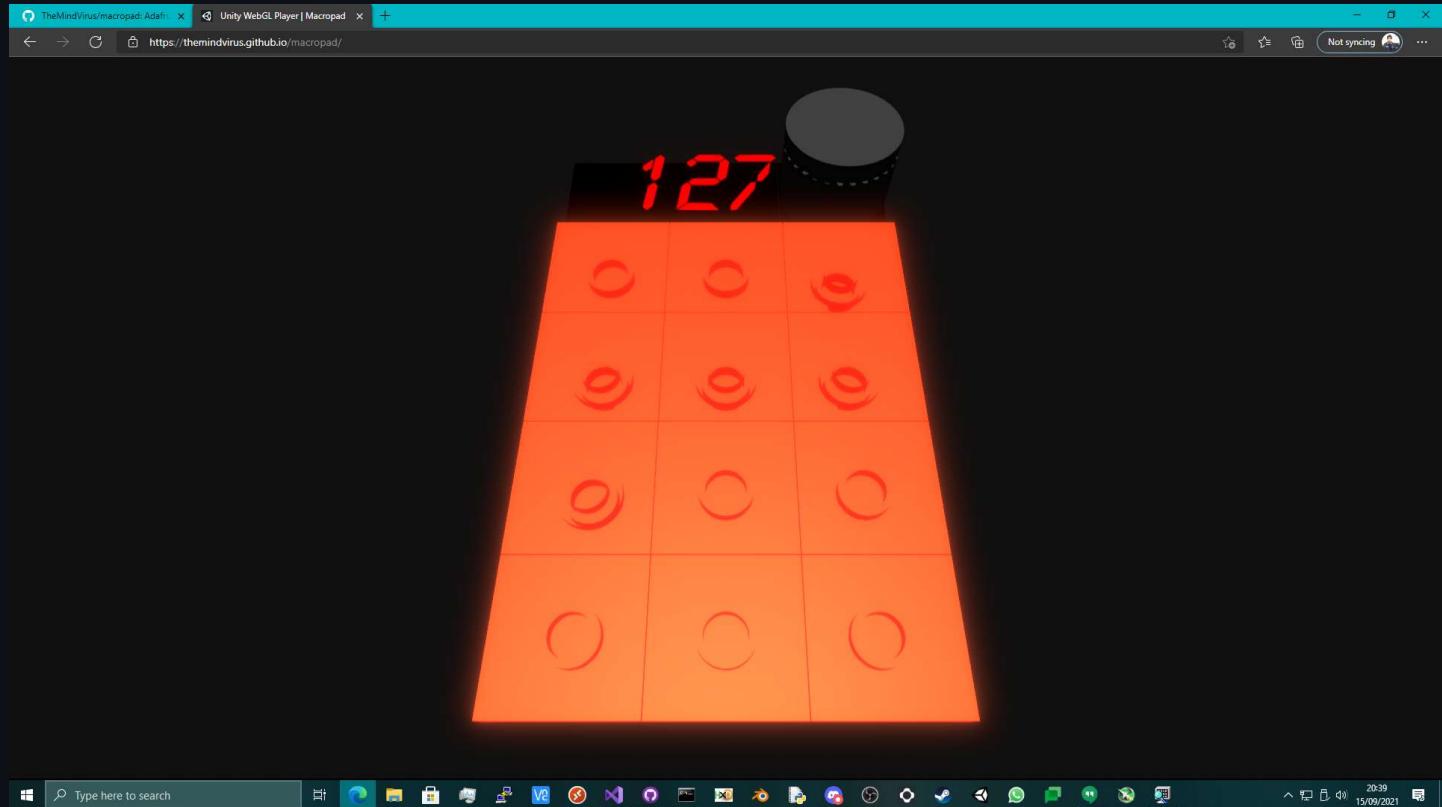
There are a wide range of CherryMX keyboard switches to choose from, each with different tactile feel and clickyness. How do you know which keys you like before buying a whole keyboard?

This project will see you assembling your own Macropad with a selection of different CherryMX keys and keycaps to find what fits your preference and needs.

Prototype

It is a good idea to prototype in any way you like before you receive the budget for your project. It's also useful for showing people what you want to create so that they know how to help you. I decided to create my prototype in Unity3D using Unity WebGL Player so it can run on a phone.

Demo: <https://themindvirus.github.io/macropad/>



Parts

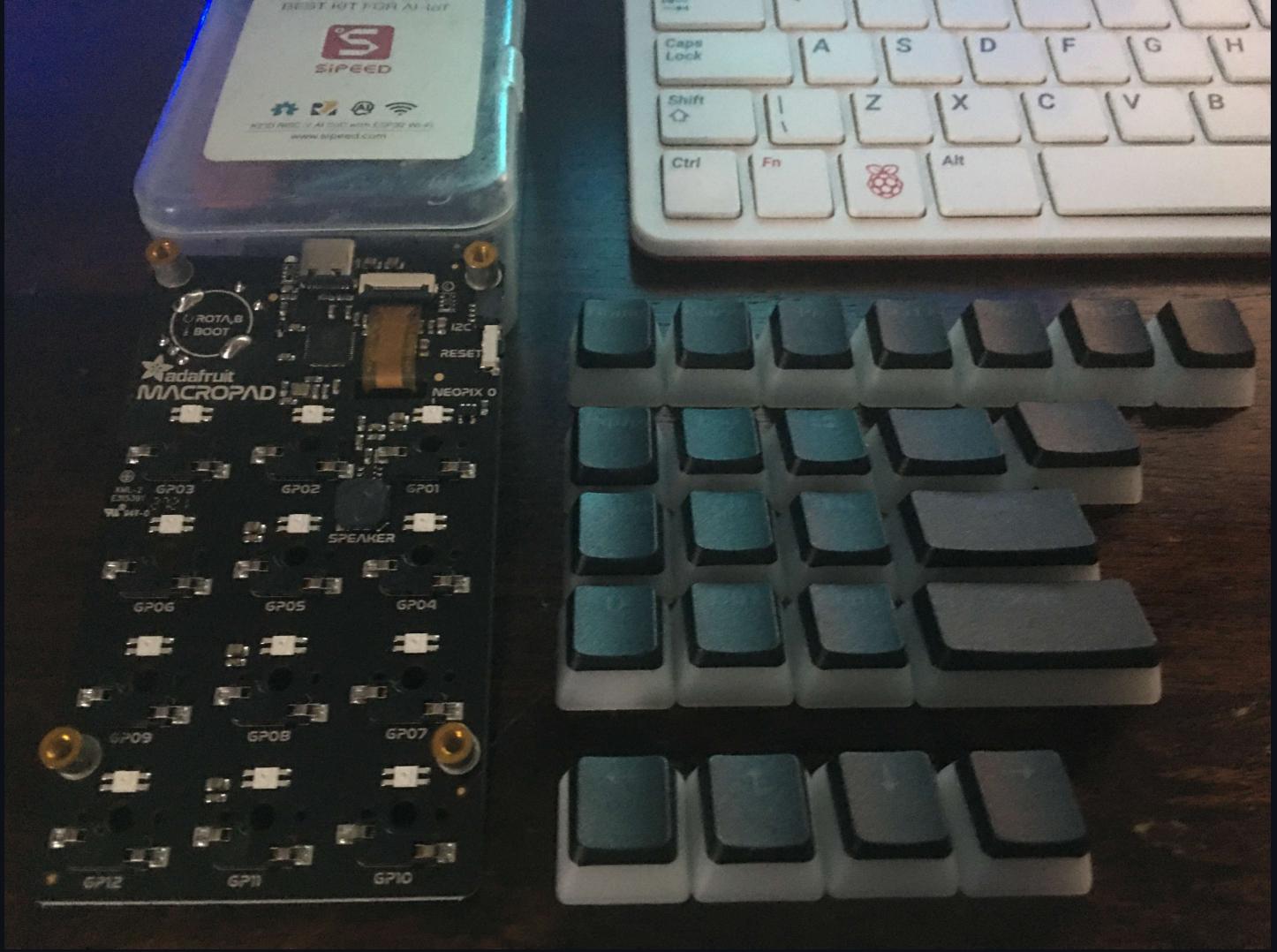
To start with, I purchased a fine selection of Glorious CherryMX Switches from OverclockersUK. Every key switch in the sample pack is a different flavour of tactile feel and clickyness. You will need at least 12 of them to complete your Macropad. (More info in [./costings.txt](#))



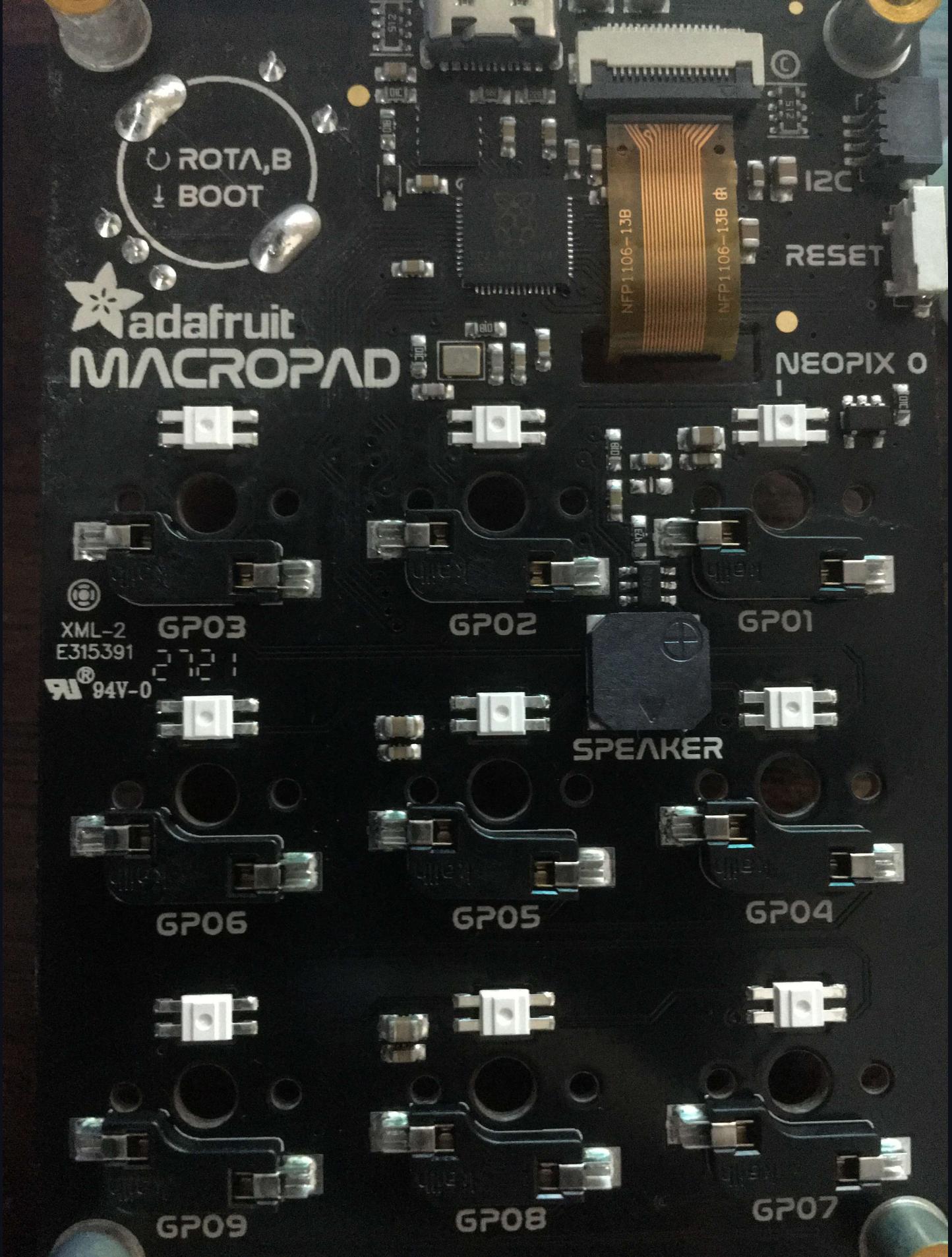
To source the custom Lego pieces and also to create the original prototype, I turned to BrickLink Studio. The Studio 2.0 Software is much like Lego Digital Designer before it and allows you to freely make design choices. The prototype uses 2x2 Tiles whereas I ended up using 2x2 Bricks and 1x1 Tiles for the final build.



This wouldn't be a project about the Adafruit Macropad RP2040 without an Adafruit Macropad RP2040. I chose the one which doesn't come with any keys or backplate because I wanted to customise it and still be able to see the RP2040 that's powering the board on the underside.



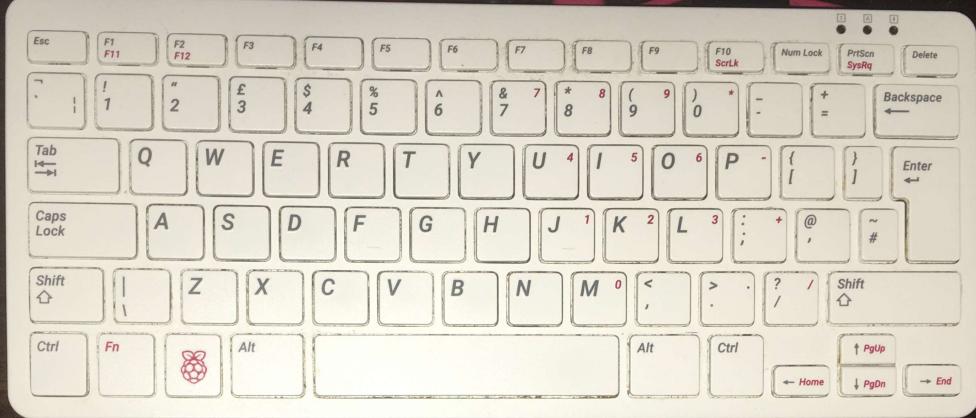
Here is a close-up of the back of the printed circuit board (PCB). The central chip with the Raspberry logo is the RP2040 that runs your custom programs. Beside it is some flash memory and a ribbon cable for the display. A small speaker plays tones of a frequency you specify in either Arduino or CircuitPython.



The CherryMX keys are colour-coded to help identify their characteristics. The footprint of the Macropad allows you to choose between Cherry, Kailh and Gateron. Some switches are weighted differently from others and some emit a specific texture of sound when typed on repeatedly. There are also many more switch manufacturers.



The key switches are modular and so are the keycaps, allowing for a huge range of possible combinations. Along with the Lego keycaps, I also purchased an assortment of Black Pudding keycaps from Adafruit. The underside of the keys will be lit with GRB NeoPixel Light Emitting Diodes (LEDs) so choose wisely.



A single lead is all that is required to power the device, upload firmware to it and receive key data from it. The back of the Macropad has a USB Type-C connector for all of these purposes. The same reversible cable is used by chargers for mobile phones and a growing ecosystem of accessories, making it somewhat ubiquitous.



If however your PC doesn't have a USB Type-C port available or within a cable's length, you may instead opt for a shorter USB Type-A to Type-C adapter cable, such as the one pictured below. This is ideal if you have a USB Hub on your desk. I will be using this cable with the USB Hub on the back of the Raspberry Pi Official Keyboard.



While attempting to attach the Lego keycaps to the CherryMX switches, I realised that this was not enough to hold the keycaps sturdily in place. The key switches came with a set of rubber inserts that fit around the axle on the top of each switch (some of which have square boundaries around them). I instead opted for some Blu Tack!



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Assembly

Carefully, without applying too much pressure, align and attach each CherryMX switch to its slot on the Macropad. The pins are quite fragile and are prone to bending. They need to connect to the board's conductive contacts. No soldering is required; the switches should click into place. I also found a knob cap from an old defunct mixer.



If you're using keycaps that are designed to fit on top of CherryMX switches then you may skip this step. For Lego keycaps you will need to apply a small blob of Blu Tack to the top of each switch axle before gently aligning and attaching each keycap. You're looking for it to hold strongly but not be too obtrusive.



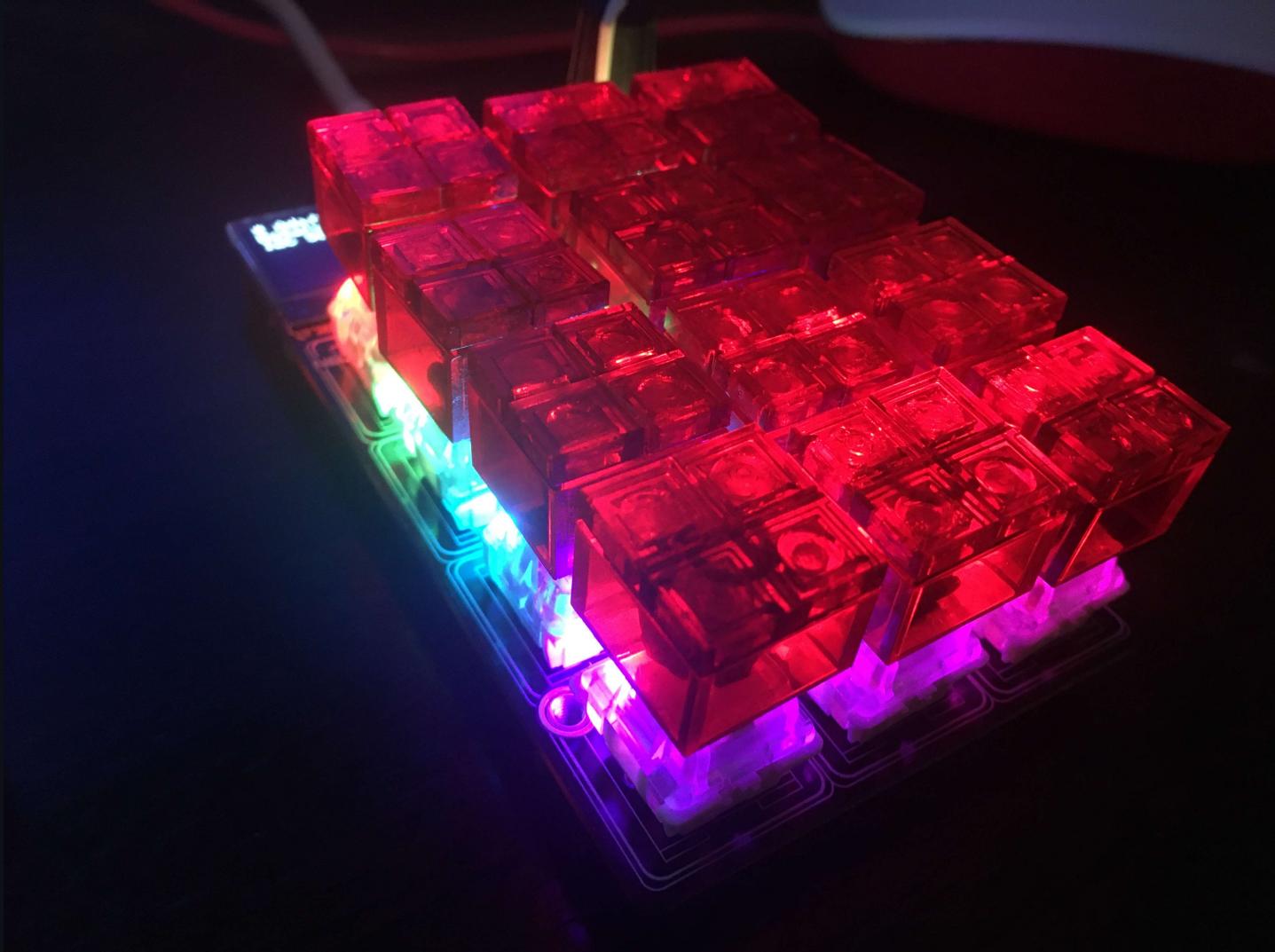
When you have attached your keycaps your Macropad should look something like this. The studs on top of the Lego bricks can give a unique feel to your shortcut keyboard, but some may prefer flatter keycaps. In this case, it is ideal to attach tiles on top of the studs before attaching the keycaps to their switches.



This is what the finished Macropad should look like after attaching all the keycaps each with 4 tiles.
You may have spare key switches and keycaps which can be swapped in and out as and when you wish.
The next stage is to connect the Macropad to your PC and upload your own custom programs to it.



As soon as you plug in your Adafruit Macropad produced by DigiKey Electronics, you will see their logos flash briefly on the display and all your keys will illuminate with a sequence of breathing light colours. This is the demo program and it gets overwritten by your code. (See [./Factory Firmware/](#) for similar code)



You can use either Arduino IDE or CircuitPython to program your Macropad. The versions used in this project were Arduino IDE 1.8.13 and CircuitPython7-rc1. You will also need to install the relevant Macropad Libraries. Uploading firmware is the same process as for the Raspberry Pi Pico. Press in the Rotary Encoder for BOOTSEL.



When you hold down BOOTSEL while powering on your Macropad, it will appear as a USB Flash Drive, but it is only for storing temporary programs (not for important documents which may be lost). Dragging `./CircuitPython7.uf2` to this drive will cause it to disappear as "RPI-RP2" and reappear as "CIRCUITPY".



The Macropad requires no extra driver installation to work because it uses the USB Mass Storage Standard Class which is built into many operating systems. My sketch turns the keys into the hidden F13-F24 keys on Windows and makes a sound on each key press. If however you want to do something different then feel free to experiment.



I hope you enjoyed following my project and maybe even have your own Macropad designs and sketches as a result. If you like what you see, please consider clicking the sponsor button at the top of this page while perusing. More content is being created every day by a diverse group of people who are sometimes unappreciated for their work.

Sound Byte: <https://github.com/TheMindVirus/macropad/blob/main/soundbyte.wav>

Clickyness: <https://github.com/TheMindVirus/macropad/blob/main/clickyness.wav>

Useful Links

Home: <https://github.com/TheMindVirus/macropad/>
Demo: <https://themindvirus.github.io/macropad/>
RP2040: <https://www.raspberrypi.org/products/raspberry-pi-pico/>
Macropad: <https://learn.adafruit.com/adafruit-macropad-rp2040?view=all>
CircuitPython: <https://circuitpython.org/>
CherryMX: <https://www.cherrymx.de/en>
BrickLink: <https://www.bricklink.com/v3/studio/download.page>
Lego Digital Designer: <https://www.lego.com/en-us/ldd>
Unity: <https://unity.com/>

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