Assembling The Quirkey

Overview

The basic Quirkey chord keyboard consists of 6 microswitches fitted with keycaps held within a two-part shell, powered by a single micro controller board and connected via a USB cable. The default firmware emulates a full standard US USB keyboard, but the code can be reconfigured to other languages. No driver is needed on the PC, laptop, tablet etc.

Supported controllers are currently an Arduino-compatible that uses the AT32U4 chip (such as the Leonardo Mini), and Raspberry Pi Pico variants.

Components List

The following items are needed for assembly:

AT32U4-based Arduino
OR
Raspberry Pi Pico with USB
USB Lead to suit the above, 1m+
6 miniature lever microswitches
6 keycaps, shell, base (3D printed)
Two-part “5 minute” epoxy
Thin PVC insulated stranded wire
Solder
20mm of heatshrink to fit 6 wires (3.5-5mm∅)
4 countersunk woodscrews 6g x 12-16mm
4 Stick-on non-slip pads or foam tape
Small cable tie

Suggested Tools

Sidecutters
Wire stripping tool of choice
Needle nosed pliers
Fine sandpaper
Sharp knife
Soldering iron and sponge
Lighter or hot air gun
Epoxy mixing tray and stick
Things to clean up epoxy drips
Screwdriver to fit screws
Wooden clothes peg (clothespin)

Fit The Keycaps

As the epoxy takes a while to set hard, we’ll fit the keycaps first. Now is a good time to test the fit of a keycap onto the microswitch lever so you know how it feels to do that. The tip of the lever fits in the shallow keycap notch.

Scrub an area at the free end of each microswitch lever with sandpaper to clean and roughen the surface. Don´t scrub the lever off the switch! Push a switch into each switch cavity from the top of the shell. All the free ends of the levers should point to the front (rounded) end of the Quirkey shell. The top surface of the microswitch should be level with the bottom of the keycap cavity. They have to go in perfectly straight, or they will stick to the sides (needle nosed pliers come in handy here).

If using multi-coloured keycaps, lay them out in the following order so that they match the Quirkey tutorials, and you can locate them before the epoxy you are about to use sets:

Switch	Inner	Pinkie	Ring	Middle	1st	Thumb
Colour	Black	Blue	Green	Yellow	Orange	Red

Mix a minimal amount of the epoxy. Put an **extremely light** film of epoxy approximately 6mm long on the roughened end of the microswitch lever to ensure good adhesion. Put a dab **about the size of a match head** in the shallow end of the channel on the underside of the keycap where the tip of the microswitch lever will contact it. Place another dab next to the first but in the deeper channel (these epoxy dabs can be run together). It is OK if a small amount of extra epoxy enters the deep channel down the centre of the keycap. Carefully scrape off any epoxy that ends up anywhere else.

Slip the keycap onto a microswitch lever, sliding it on from the back towards the front – this avoids getting epoxy on the front face of the keycap. The rear of the keycap should rest on the bottom at the rear of the keycap's shell cavity. If you fluff it up, remove the keycap and clear away any surplus epoxy before trying again, even if it means partly or fully removing the microswitch to do so (poke it from underneath with a thin screwdriver or convenient stick).

As you add each keycap, make sure that it moves freely within its cavity before the epoxy sets solid. You can make it click but do not fully depress the microswitch. Put the leftover epoxy to one side.

Program The Controller Firmware

You will find the code on https://github.com/VikOlliver with the Arduino code under 'Microwriter' and the CircuitPython code under 'Quirkey'. The controllers are programmed with their respective standard environments using the USB lead, so rather than reproduce the fine details here, refer if necessary to the README on GitHub and either http://arduino.cc or http://circuitpython.org

Note: When plugging in and unplugging the controller **always** hold the USB socket between finger and thumb. Do not hold the board itself, otherwise you will snap the USB socket off! (Ask us how we know)

Wire The Microswitches

Do not handle the switches until the epoxy has set. Test this by poking the epoxy you mixed earlier, rather than tugging on the keycap! If it is not quite set, amuse yourself by learning some Quirkey chords while you wait.

Cut 6 lengths of wire 120mm long, 6 lengths 90mm long, and one 50mm long. Strip about 8mm off each end, and twist the ends to prevent fraying. Tin all the

stripped ends well with solder. Trim all the ends of the 120mm wires and 50mm wire to 4mm. Trim **ONE** end of the 90mm wires to 4mm.

Pop the microswitches out of the shell from underneath with a thin screwdriver or convenient stick. Shave off any excess glue on the switch body, the bottom surface of the keycap, and in the keycap cavities in the shell with a sharp knife. If it appears necessary you may add additional epoxy to reinforce the joins.

Identify the “NO” and “C” contacts on the microswitch (these are the two that join together when the switch is depressed). Tin these terminals of the microswitches. Solder a 120mm lead to every “NO” pin. Solder the 4mm trimmed end of a 90mm lead to each “C” switch pin. You may find a clothes peg handy for holding the microswitch upright while soldering.

Your microswitches should now all have one short lead, and one long lead.

Prep Cavity For Controller

It is recommended that the controller is placed as far forward as possible in the shell, on the left edge under the thumb keys, with the USB socket pointing in the general direction of the cable notch on the opposite side of the shell.

Mark the cut points on infill in the shell cavity to fit your controller, and snip the infill with the wire cutters far enough to allow the controller and USB cable to fit flush and snug – allow extra room to route wires under and over the controller and USB plug.

Only cut through 1mm of infill at a time unless you have particularly tough sidecutters. Then use pliers to break away the bits between the cuts. Test the fit of the controller, and follow the same process to allow the USB cable to exit from the cable notch.

Note: If possible, orient the controller so you can see the labels on the controller’s pins. Ensure that any reboot switch on the controller is clear of the shell and wiring!

Fit Microswitches

Push a switch into each switch cavity from the top of the shell, threading its pair of wires through the hole below. All the free ends of the levers should point to the front (rounded) end of the Quirkey shell. If using coloured keycaps, follow the ordering described under “**Fit The Keycaps**”.

Take all the short switch leads, lay them into the wiring cavities, twist the ends firmly together, and solder into a smooth lump (this is why you leave the ends 10mm long). A clothes peg is handy for holding the twisted mass together while you solder.

Solder the 50mm lead onto the free end of the lump, cover the join with heatshrink, and shrink wrap with a heat source (e.g. soldering iron or lighter), ensuring no solder is directly exposed. Try not to melt the Quirkey shell.

Trim the free end of the 50mm wire to 4mm and solder it to GND on the controller. Solder the remaining microswitch wires to controller IO pads as follows for both Arduino and a standard Pi Pico:

Switch	Inner	Pinkie	Ring	Middle	1st	Thumb
Pin D/GP	8	7	6	5	4	9
Character	SHIFT	u	s	o	e	SPACE

Trim excess wire from joints. You can now connect the controller with a computer using the USB lead and test the function of the switches.

Note: If the microswitches are not a tight fit, they can be popped out, padded on the side with a little adhesive tape or weak glue taking care not to obstruct the top surface of the switch, and pushed back in again. Do not use epoxy as this might make repair and replacement a trifle difficult.

Adding The Base

With the USB cable plugged in to the micro controller and routed through the hole at the side of the Quirkey, apply a small cable tie to the USB lead inside the case cavity to prevent the lead being pulled out. Tighten well, and trim off excess cable tie.

Put the base on with the countersunk holes exposed. Check that this does not compress any wires or the controller. If necessary, snip away more of the cavity infill to make room for routing the wires. Misbehaving wires can be held down in their cavities with packing, tape, hot glue, etc.

When all is well, drive a screw into each of the countersunk holes. Barely tighten them all at first, then tighten more firmly. As this is 3D printed plastic it is best to just tighten the screws enough to stop the base moving. **Do not** crank on them until they squeak and add a quarter turn.

Stick the 4 non-slip pads (or foam tape strips) to the base of the Quirkey, spacing things out for maximum stability – the exact position may vary between users. If you’re going to fiddle with the internals later it is best not to cover the screw heads.

You’re Finished!

Congratulations, you can now start typing with your Quirkey. Share and enjoy.

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