wonkystuff

WonkyStuff Core1 (Rev.C) Assembly Instructions

Thanks for buying the WonkyStuff **core1** board. The **core1** is designed as a simple audio generation device which can be reprogrammed. There are four controls (the function of which will depend on the programming) and a pair of mono audio outputs. One of the outputs is a simple square wave - usually a sub-oscillator, whilst the other can be a selection of waveshapes. The **core1** is designed to run from approximately 5v (three AA batteries give 4.5v which is close enough) – applying any more is likely to cause damage to the chips (the other components will be fine unless you plug it into a *very* high voltage. **Don't plug it into a very high voltage.**).

These instructions are a work in progress. If they are unclear, or there are any mistakes, or you just want to say 'hello', please email us at `info@wonkystuff.net`*, or message us via facebook or twitter. Our website is http://wonkystuff.net/.*

There is a basic requirement that your soldering skills are up to scratch (I'm sure they are). If you need a reminder, you could do worse than to take a look at this soldering tutorial over at adafruit.com: https://learn.adafruit.com/adafruit-guide-excellent-soldering/

Parts List

Before starting, make sure that you have all of the parts listed below. The chips are not big fans of static electricity, so take care when handling them (they're quite robust in our experience, but take care nonetheless).

Label	Part	Description
`B1`	Battery pack	Takes 3 AA batteries (not included)
`C1`, `C2`	1nF	Capacitor (marked 102)
`C3`, `C4`	100nF	Capacitor (marked 104)
`C5`, `C6`	1uF/2.2uF	Electrolytic Capacitor (red or purple)
`J1`, `J2`	3.5mm jack	Audio Outputs

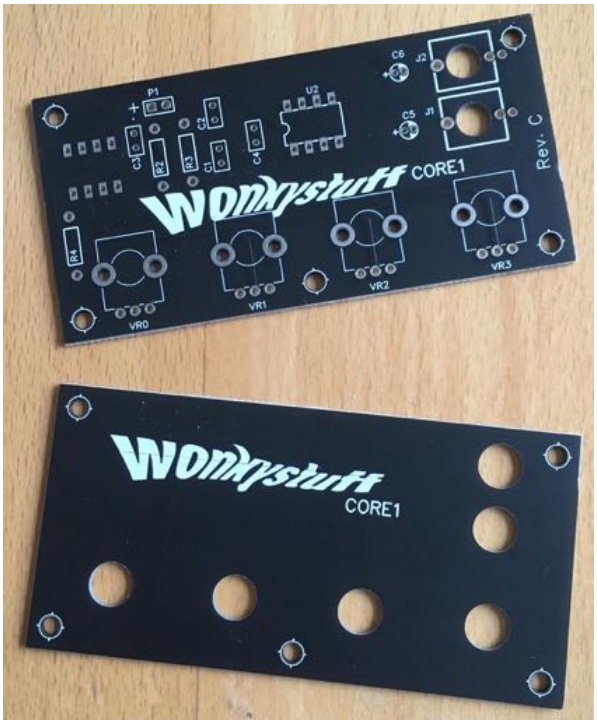
Label	Part	Description
P1	Power connector	Connect the battery pack, or 5v
R1, R2 , R3	10k	Resistor (brown/black/black/red/brown stripes)
U1	ATTiny85-20	Main processor (pre-programmed as *dr1c*)
U2	MCP6002	Dual Op-Amp
VR0, VR1, VR2, VR3	10k Potentiometer	Interaction!
–	IC socket	Used to house the ATTiny85
–	PCB	A double-sided Printed Circuit Board and panel
–	15mm standoffs	Legs for the completed kit (4)
–	10mm spacers	Between the PCB and the panel (5)
–	M3 screws	Fix the panel down (6)

You'll also need a soldering iron, some solder, a pair of wire cutters, a Philips screwdriver and a space to work in.

Assembly

Although most of the components are soldered to the top of the board, the ATTINY85 (**U1**) and the power connector (**P1**) are placed on the bottom of the board for easy access.

During construction. the component bodies should more-or-less fit within the white outlines on the PCB. Some components (resistors and capacitors) will need their legs clipping once they have been soldered.



If it is not already split, snap the PCB into the two parts - circuit board and panel. Put the panel somewhere safe for now.

Top Side

Position the PCB so that *VR0*-*VR3* markings are visible. The general procedure with the assembly is to work in component-height order, so, let's start with the shortest compnents - the resistors.

Step 1

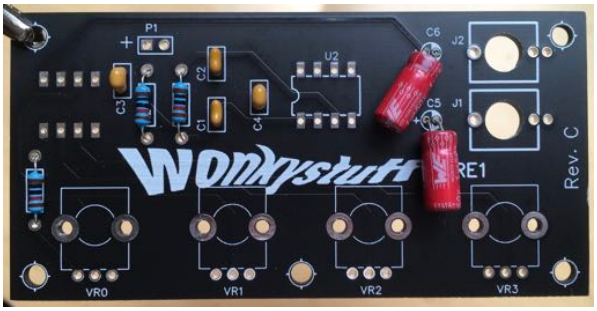
Start with the resistors (`R1`, `R2` and `R3`) taking care that they are placed correctly on the board. The legs of these should be bent at 90 degrees such that they line up with the holes in the PCB (the orientation of the resistors is not important).

Step 2

Next add the small capacitors (C1, C2, C3 and C4) taking care that they are positioned correctly on the PCB. Check the writing on the capacitor bodies to make sure they're put in the correct place. The legs should line up easily with the holes in the PCB (again, the orientation of these components is not important).

Step 3

Now solder the larger capacitors (C5 and C6). If your kit contains the red capacitors, you need to make sure that they lie flat (see the picture) otherwise the panel will not fit. If your kit contains the purple capacitors then these can be mounted 'standing up'. These capacitors have a 'right' and a 'wrong' way to be connected. The side of the component with a white stripe on it is the negative terminal; the PCB is marked with a + for the positive terminal[1].



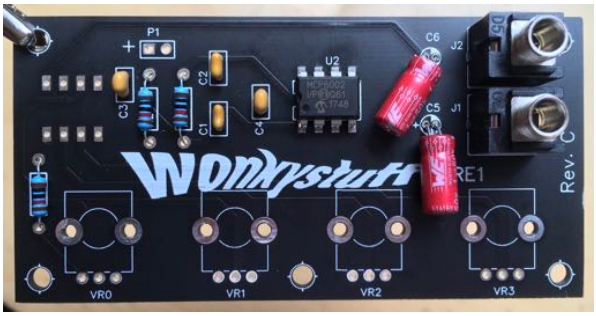
Step 4

Now solder in the IC U2, **Make sure that the indicator for pin 1 (either a *notch*, or an *indented dot*) matches the orientation of the PCB.**

[1] I don't know why it's done like this!

Step 5

Solder the audio jacks `J1` & `J2` onto the PCB.



Step 6

In turn, insert the four potentiometers into place (the large tabs may need a slight squeeze for them to go into the holes correctly). The big tabs are there for mechanical support, so don't forget to solder them later (wait until you're sure that the pots line up with the panel holes before fixing these tabs).

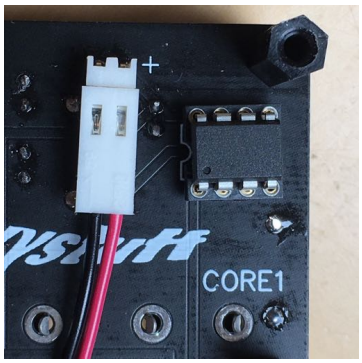
Bottom Side

Turn the PCB over…

Step 7

Now solder the IC socket for U1, taking care to match the notch in the socket with the symbol on the PCB (for the socket, it doesn't *actually* matter, but it makes things easier to remember when you get around to inserting the IC later).

Solder the power connector so that it overlaps the PCB. If in doubt, attach the battery pack to the connector before soldering and make sure that the red wire matches the + symbol on the PCB (see the picture). It is possible to attach the power connector on either side of the PCB, it is up to you whether you want the power pins to extend out of the back of the board or not. In each case, make sure that the red wire will connect to the pin marked with +

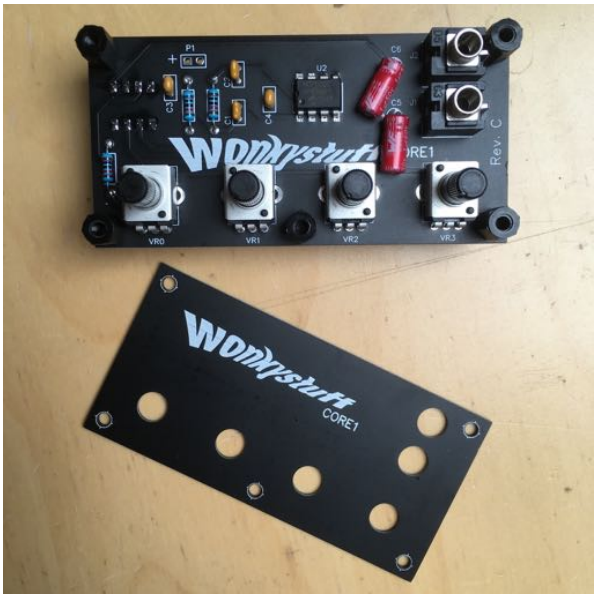


That's it for electronic assembly – give the soldering a look over to check for bad connections, short circuits etc. then insert U1 into the socket (the legs may need a little squeeze to make them line up).

Make sure that the indicator for pin 1 (either a *notch*, or an *indented dot*) matches the orientation of the PCB.

At this point you can actually connect it up, although you might want to put the panel on first as it gives some support to the audio output jacks.

Final Assembly



The final part of assembly is mounting the panel and legs. The 15mm spacers should be inserted underneath the main PCB and the 10mm spacers screwed onto them – do this at each corner. For the centre-front pillar, fix the 10mm spacer to the main PCB using one of the M3 screws.

If you haven't done so already, remove the nuts and washers from the jack sockets. The top panel can now be put in place and the remaining M3 screws used to fix it in place. Finally fasten the washers and nuts to the audio jacks so that they are nicely supported.

Figure 1: Finished!

Sound!

The ATTiny85 comes pre-programmed a modified version of the original **dr1.a** firmware (https://github.com/minimism/dr1a), a fairly simple drone synth capable of generating some quite nice sounds.

1. Insert 3 AA batteries into the battery holder;
2. Connect the audio outputs to your audio device (e.g. a mixer);
3. Rotate all of the controls fully counter-clockwise;
4. Attach the battery pack to the board.

Now there should be a low-frequency square wave coming from the coming from the `J2` output and a sine wave coming from the `J1` output an octave above the square wave. Altering `VR1` will change the waveform (there are 8 different shapes). `VR2` changes the fundamental frequency, and `VR3` changes the slave frequency - play about and see what sounds good. `VR0` causes the waveform to change randomly - the frequency of change depends on how far clockwise `VR0` is turned.

Sound Engine Description

`VR2` affects the frequency of oscillator 1, whilst `VR3` affects the frequency of oscillator 2. Oscillator 2 is a wavetable oscillator whilst Oscillator 1 resets the phase of Oscillator 2 to zero every time that it cycles (this is basically what used to be called *hard sync*). If the frequencies are integer multiples then the output sound can be quite smooth, but richer sounds are heard when the oscillator frequencies are not harmonically related at all!

The sampling rate of the (8 bit PWM) output is 50kHz.

In the dr1.a firmware there are four basic wavetables available to oscillator 1, as well as four intermediate positions:

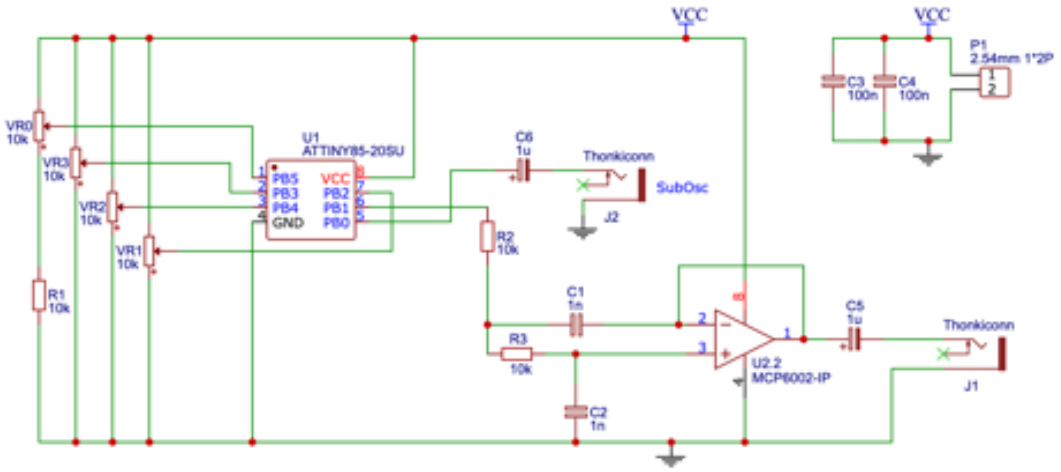
1. Sine
2. Sine + triangle
3. Triangle
4. Triangle + square
5. Square
6. Square + sawtooth
7. Sawtooth
8. Sawtooth + sine

Hacking

Each of the potentiometers is simply responsible for sending a control voltage to the processor – it is possible to modifiy the circuit so that any voltage source (within the range 0-5 volts) can be used to drive VR1-3. *VR0 is a special case, if a voltage less than 2 volts is applied here, then the processor will be reset; therefore it is not advisable to apply external control voltages to this input.*

It goes without saying that it is possible to damage the chips by injecting too much voltage/current into the pins - proceed with caution!

Schematic


VCC
VCC
P1
2.54mm 1*2P
C3
100n
C4
100n
VR0
10k
VR3
10k
VR2
10k
VR1
10k
R1
10k
U1
ATTINY85-20SU
PB5
PB3
PB4
GND
VCC
PB2
PB1
PB0
C6
1u
Thonkiconn
SubOsc
J2
R2
10k
C1
1n
R3
10k
C2
1n
U2.2
MCP6002-IP
C5
1u
Thonkiconn
J1