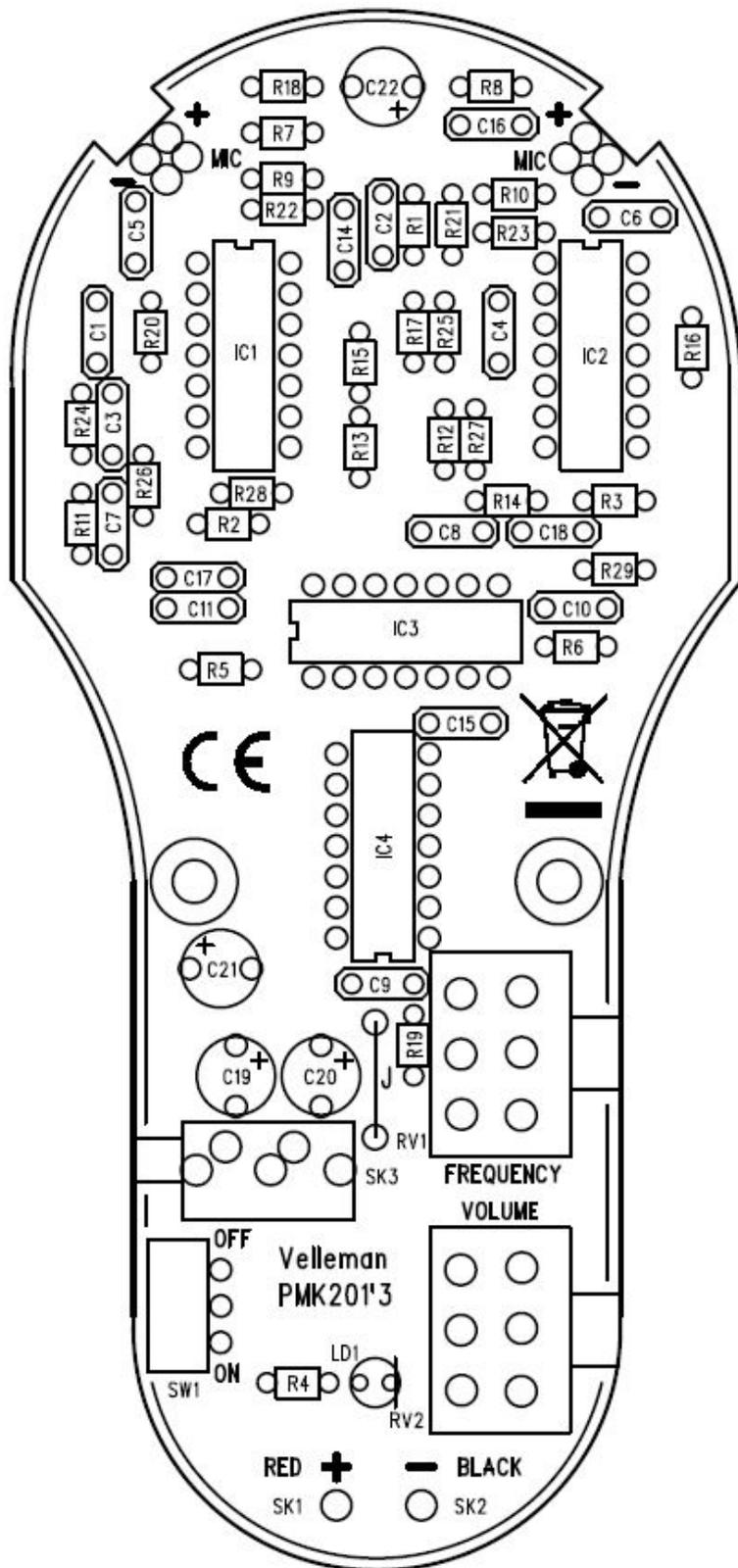
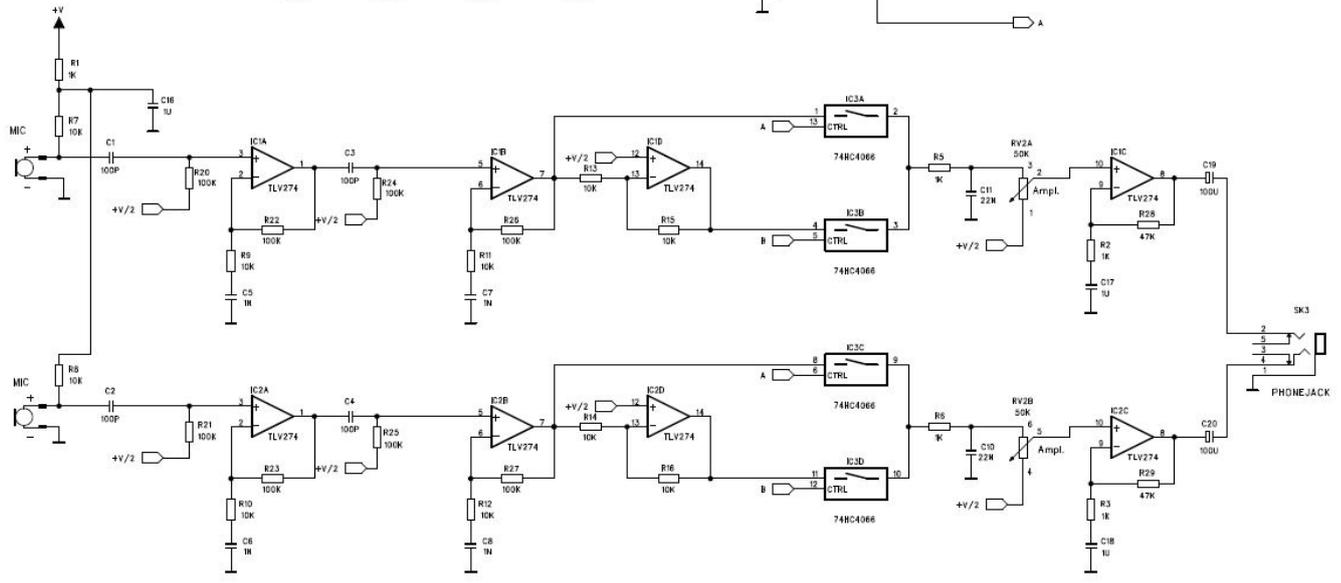
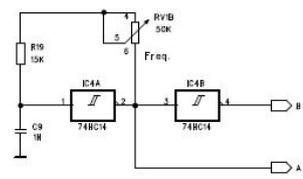
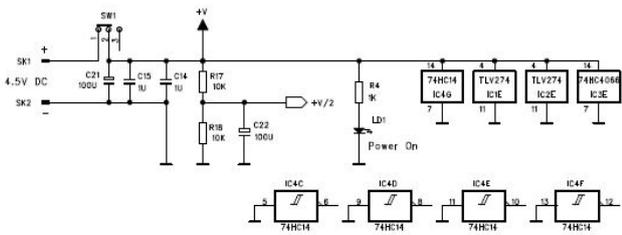


# 1. PCB and schematic





## 2. Assembly manual

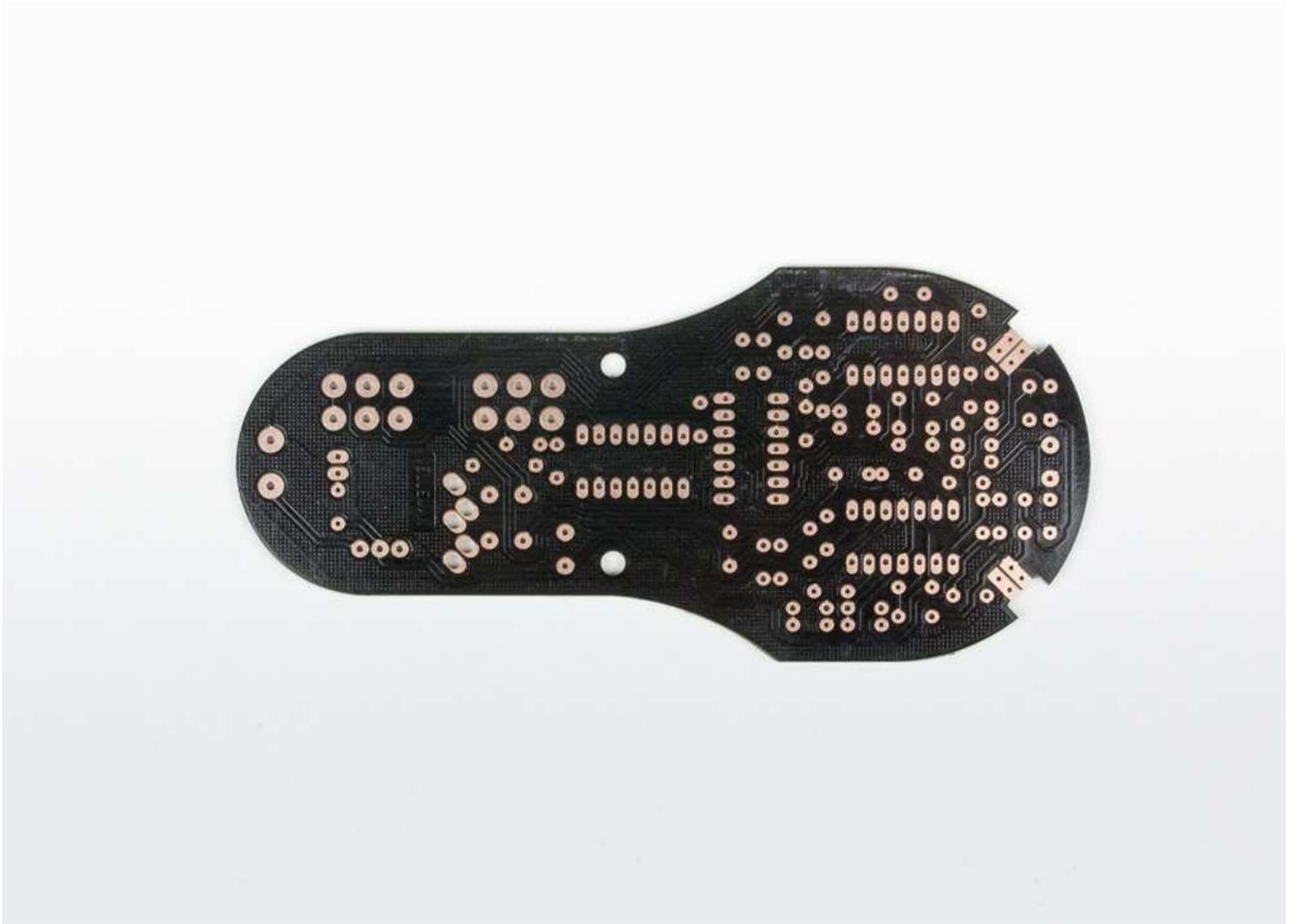
## WHAT'S IN THE BOX

- 1 x PCB
- tape:
  - 5 x jumper
  - 6 x resistor 1K
  - 12 x resistor 10K
  - 1 x resistor 15K
  - 8 x resistor 100K
  - 2 x resistor 47K
- 4 x 14p IC socket
- 4 x ceramic capacitor 100pF
- 5 x ceramic capacitor 1nF
- 2 x ceramic capacitor 22nF
- 5 x ceramic multilayer capacitor 1 $\mu$ F
- 1 x slide switch
- 1 x red LED
- 1 x stereo phone jack 3,5mm
- 2 x potmeter 50K
- 4 x capacitor 100 $\mu$ F/25V
- 2 x electret microcel
- 4 x IC
- 2 x plastic knob
- 1 x battery holder
- 2 x plastic spacer
- 2 x *M3 nut*
- 2 x M3 bolt





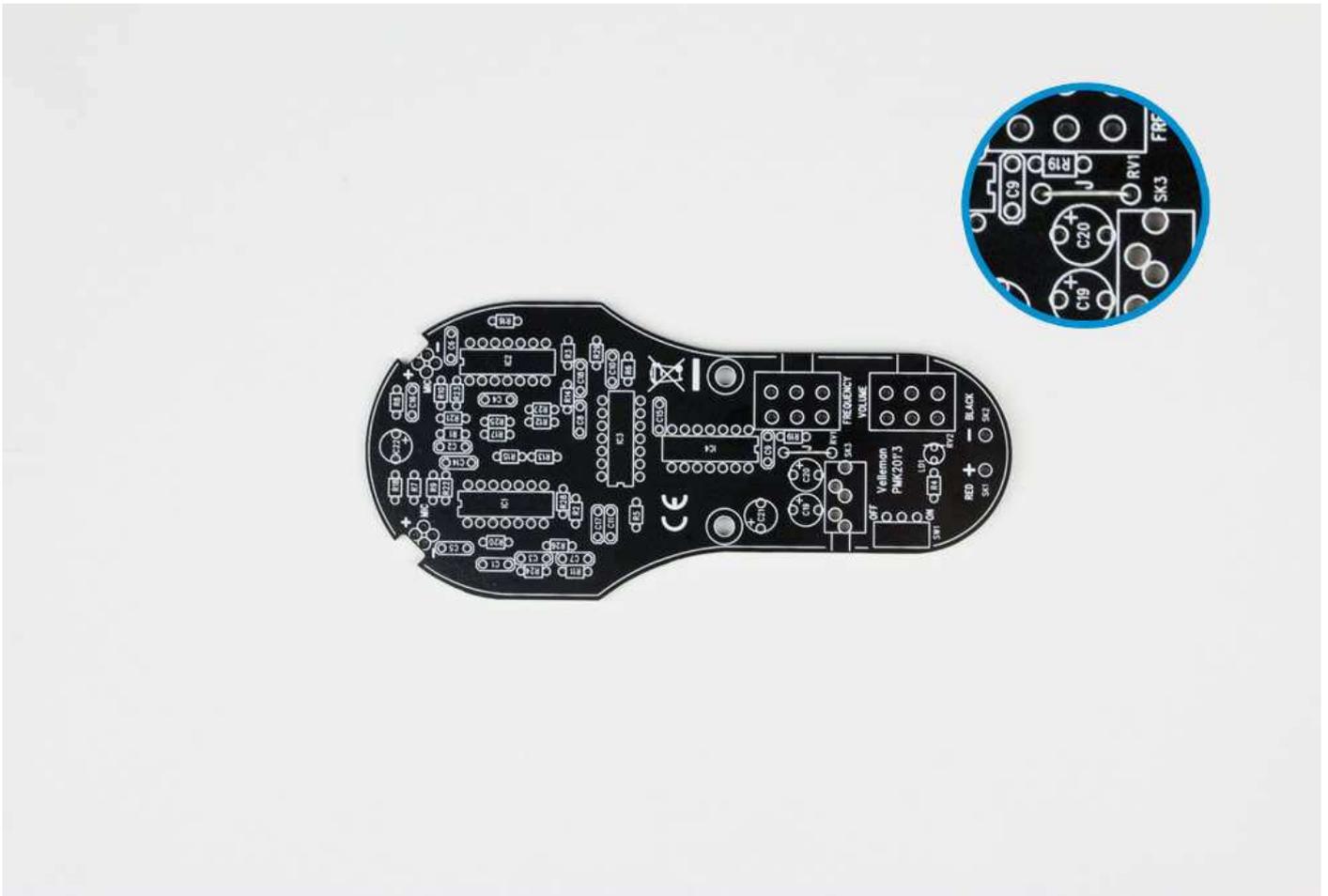
Solder side:



Now follow the steps below in order to solder your kit properly. Good luck!

### 1. Jumper

- J

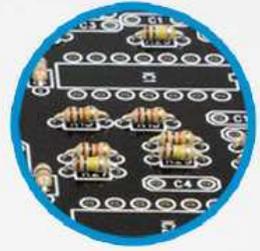
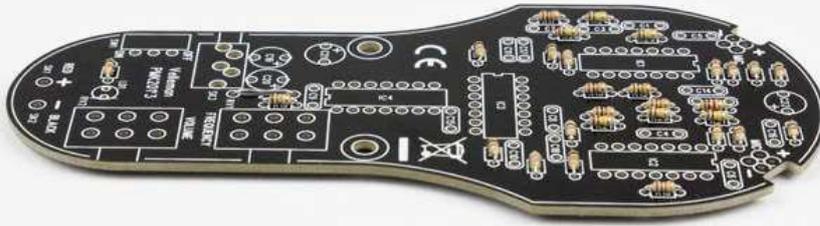
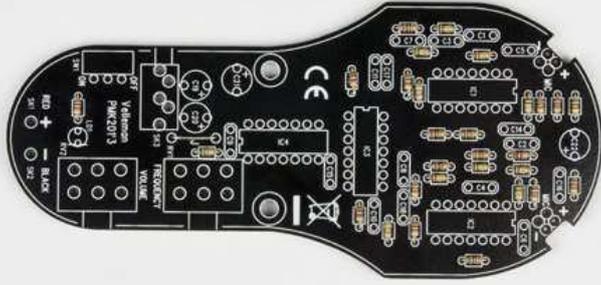


## 2. Resistors

Note: all resistors are placed in the correct order of usage on the supplied tape.



- **R1 ... R6:** 1K (brown, black, red)
- **R7 ... R18:** 10K (brown, black, orange)
- **R19:** 15K (brown, green, orange)
- **R20 ... R27:** 100K (brown, black, yellow)
- **R28 ... R29:** 47K (yellow, violet, orange)



### 3. IC socket

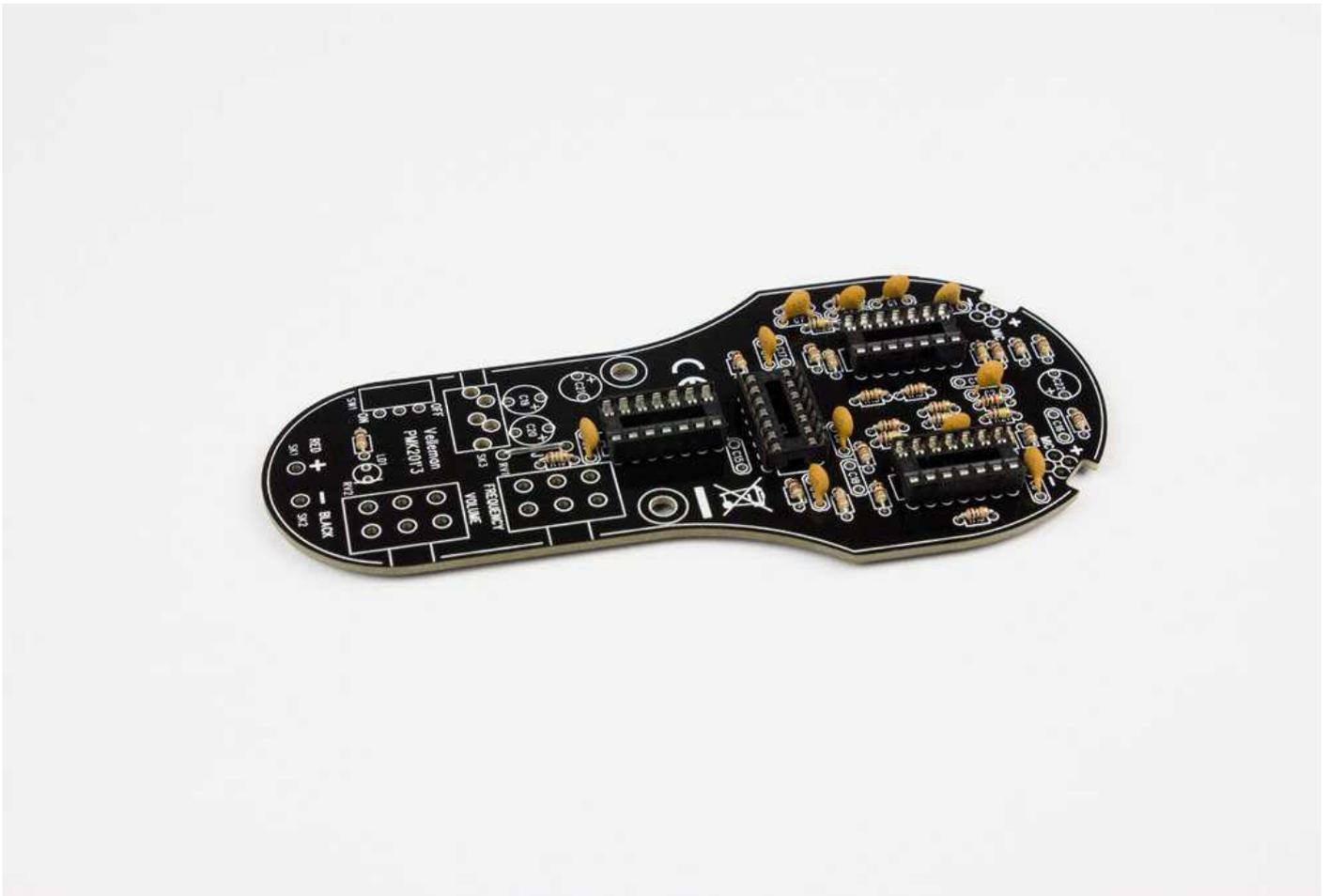
- IC1 ... IC4: 14p IC socket

**Note the position of the notch!**



### 4. Ceramic capacitors

- C1 ... C4: 100pF (101)
- C5 ... C9: 1nF (102)
- C10 ... C11: 22nF (223)



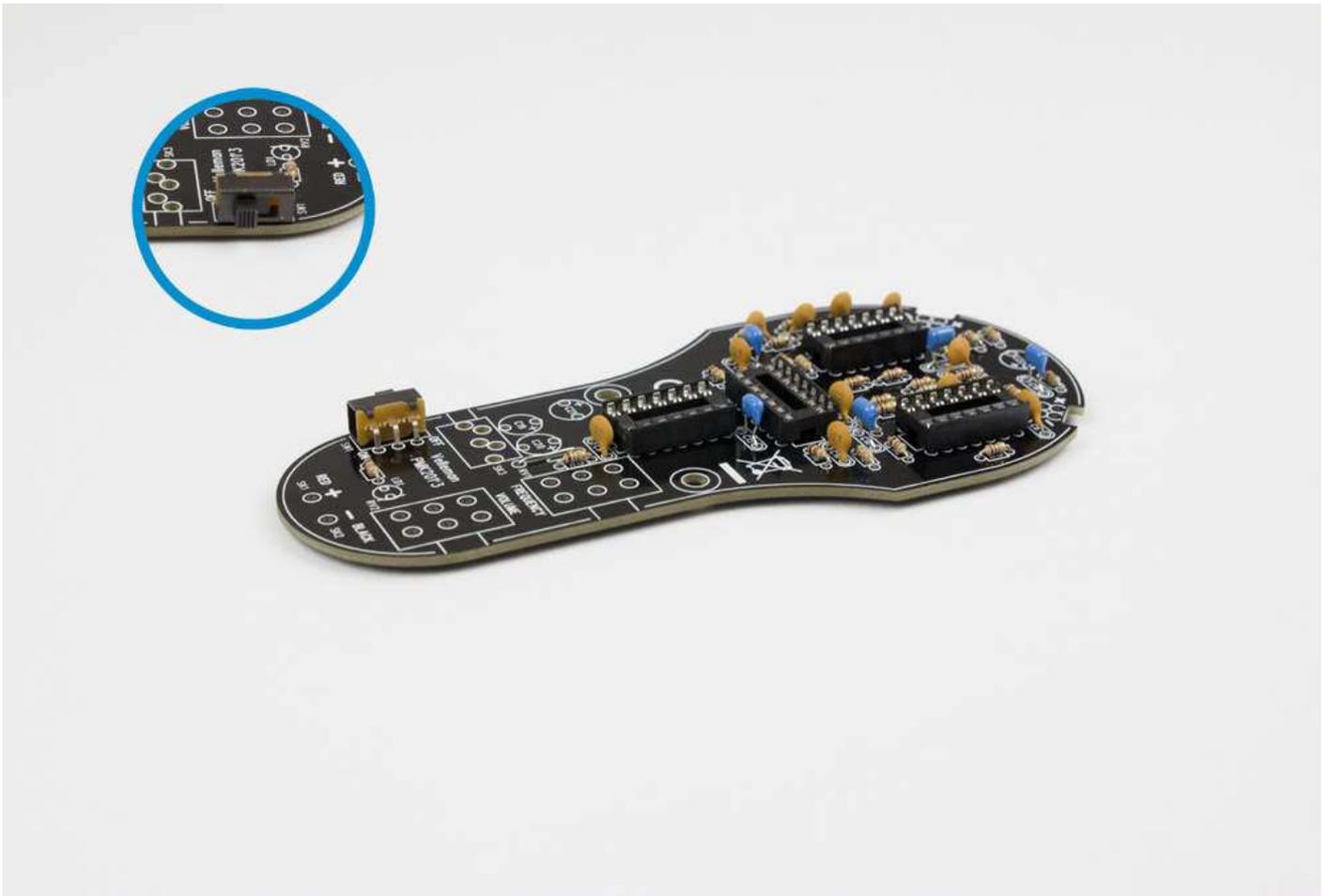
## 5. Ceramic multilayer capacitor

- C14 ... C18: 1 $\mu$ F (105)



## 6. Slide switch

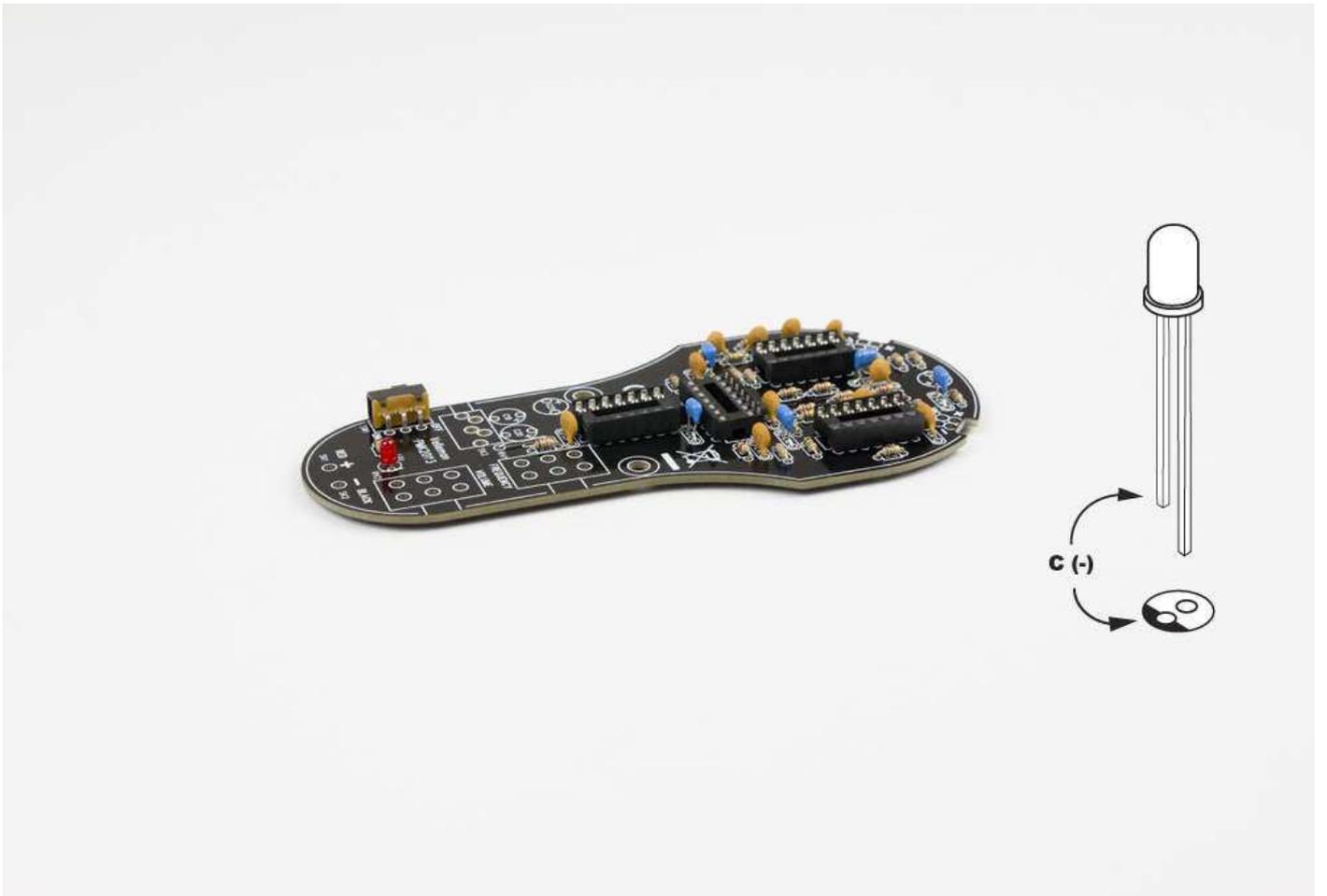
- SW1



## 7. LED

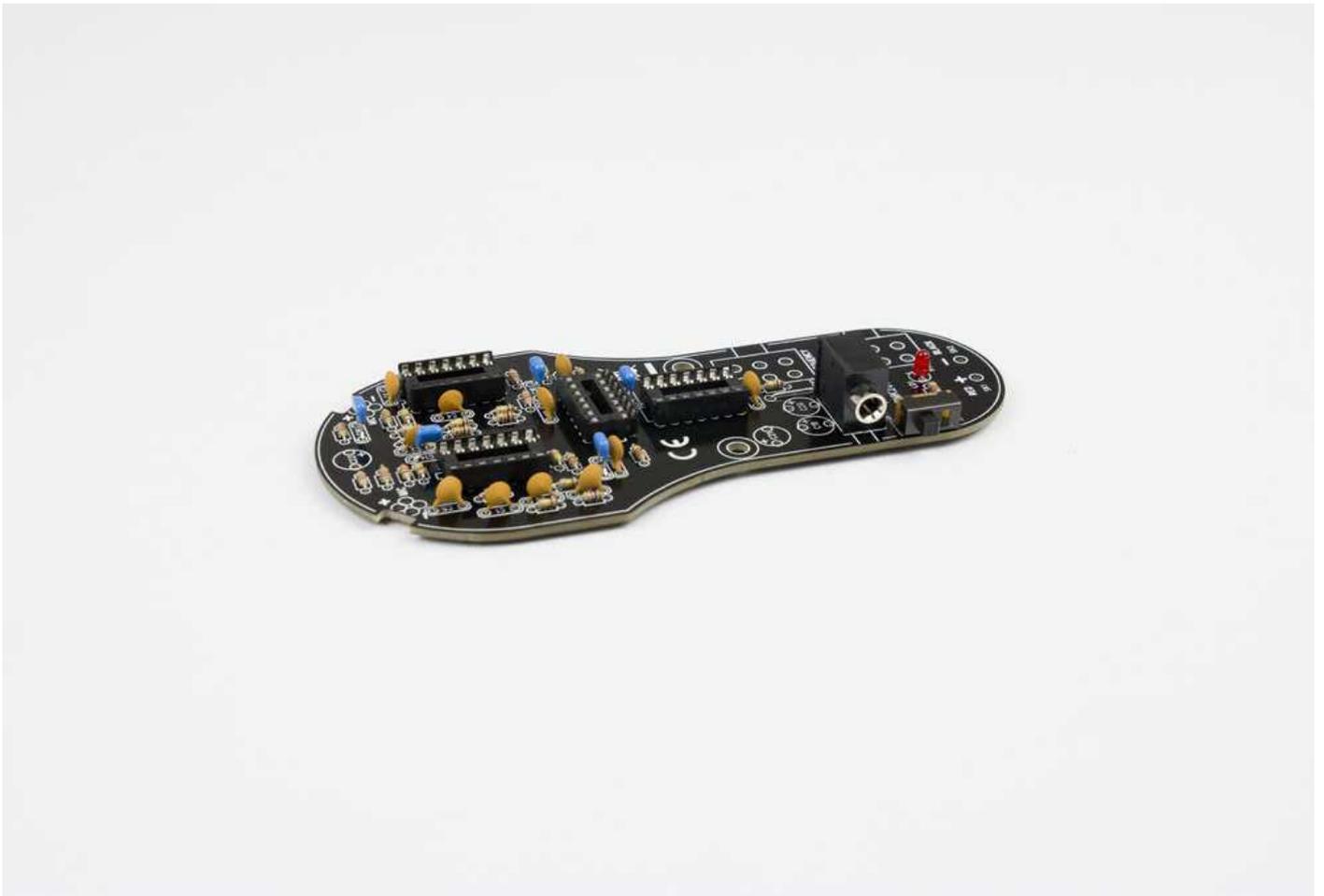
- **LD1:** red led

**Note the polarity!**



## 8. Stereo phone jack

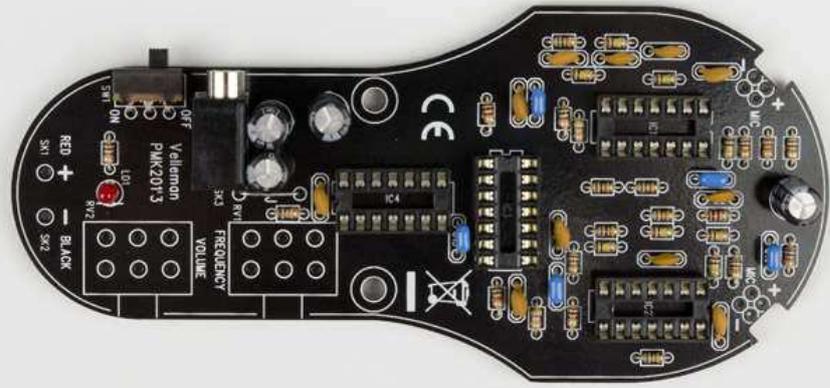
- SK3



## 9. Capacitor

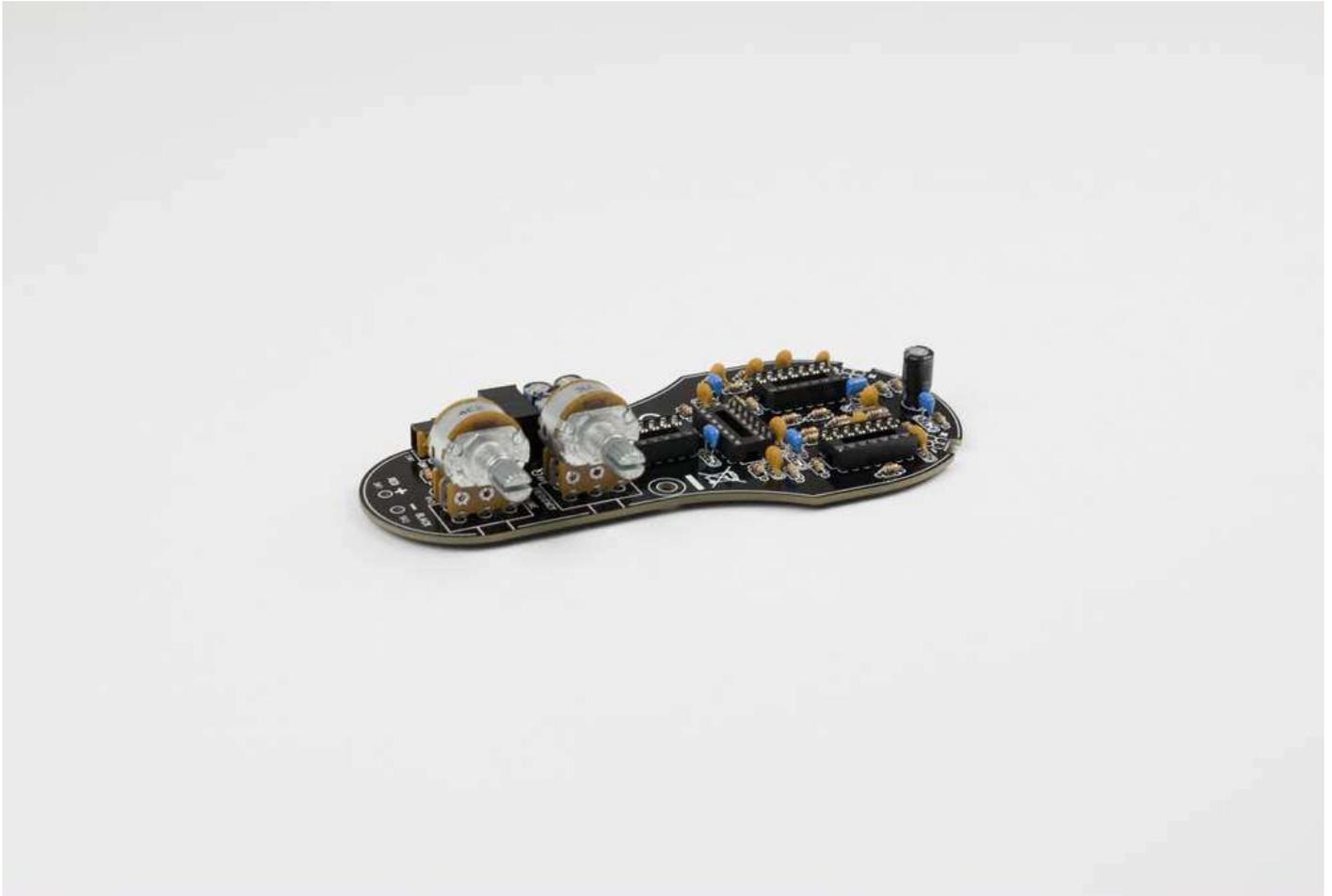
- C19 ... C22: 100 $\mu$ F/25V

**Note the polarity!**



## 10. Potmeter

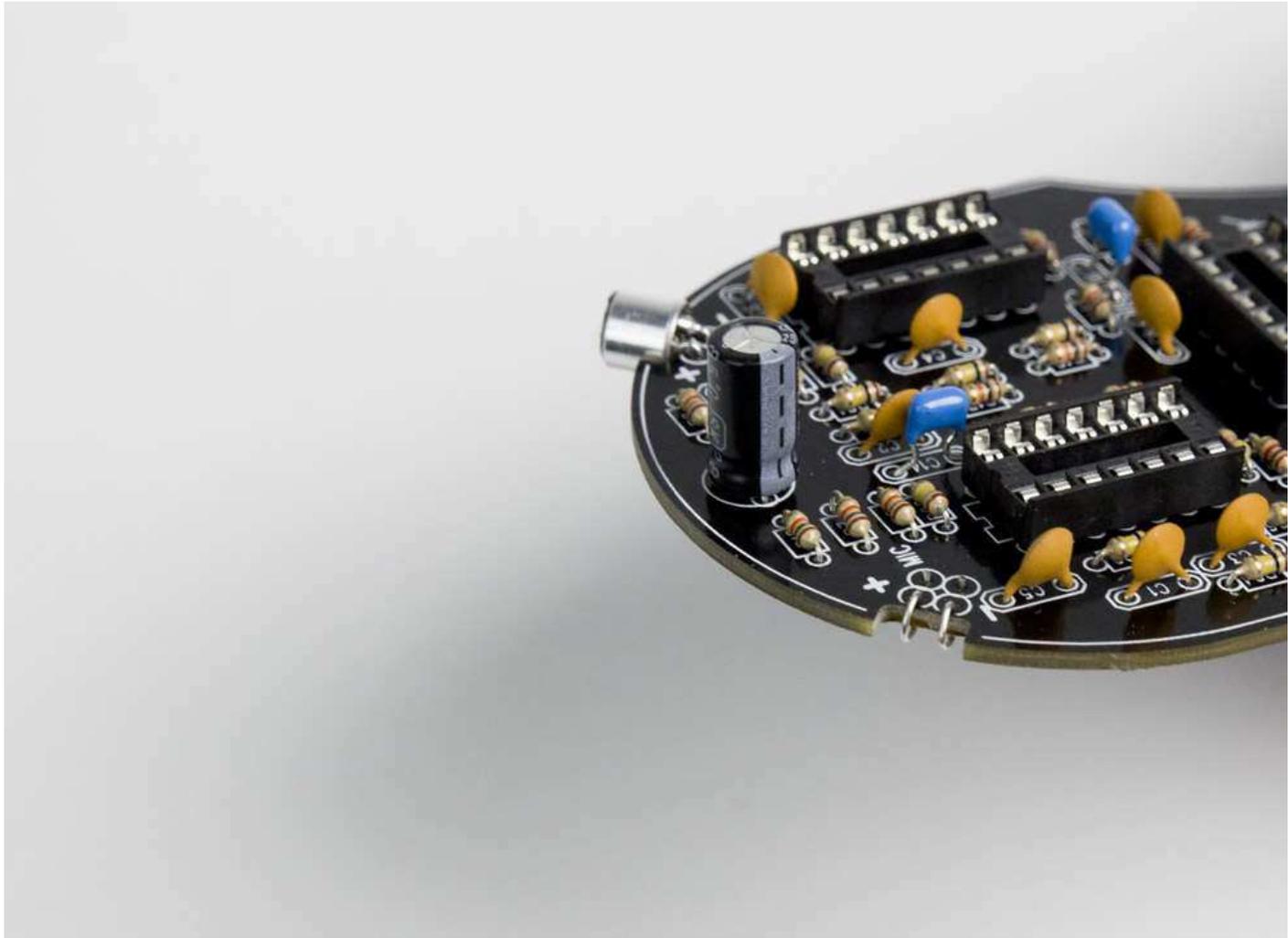
- RV1, RV2: 50K

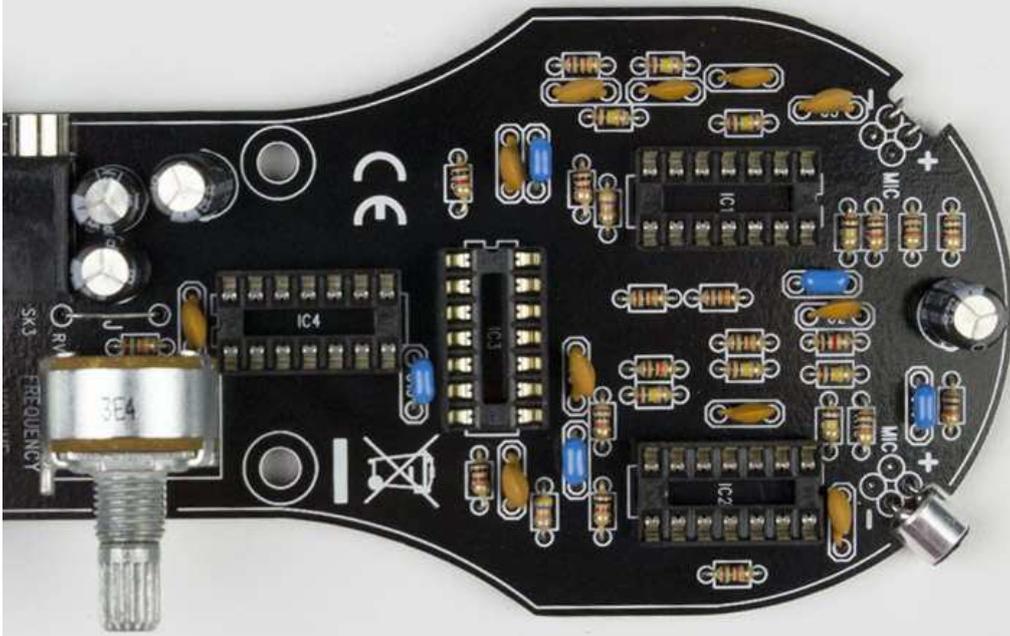


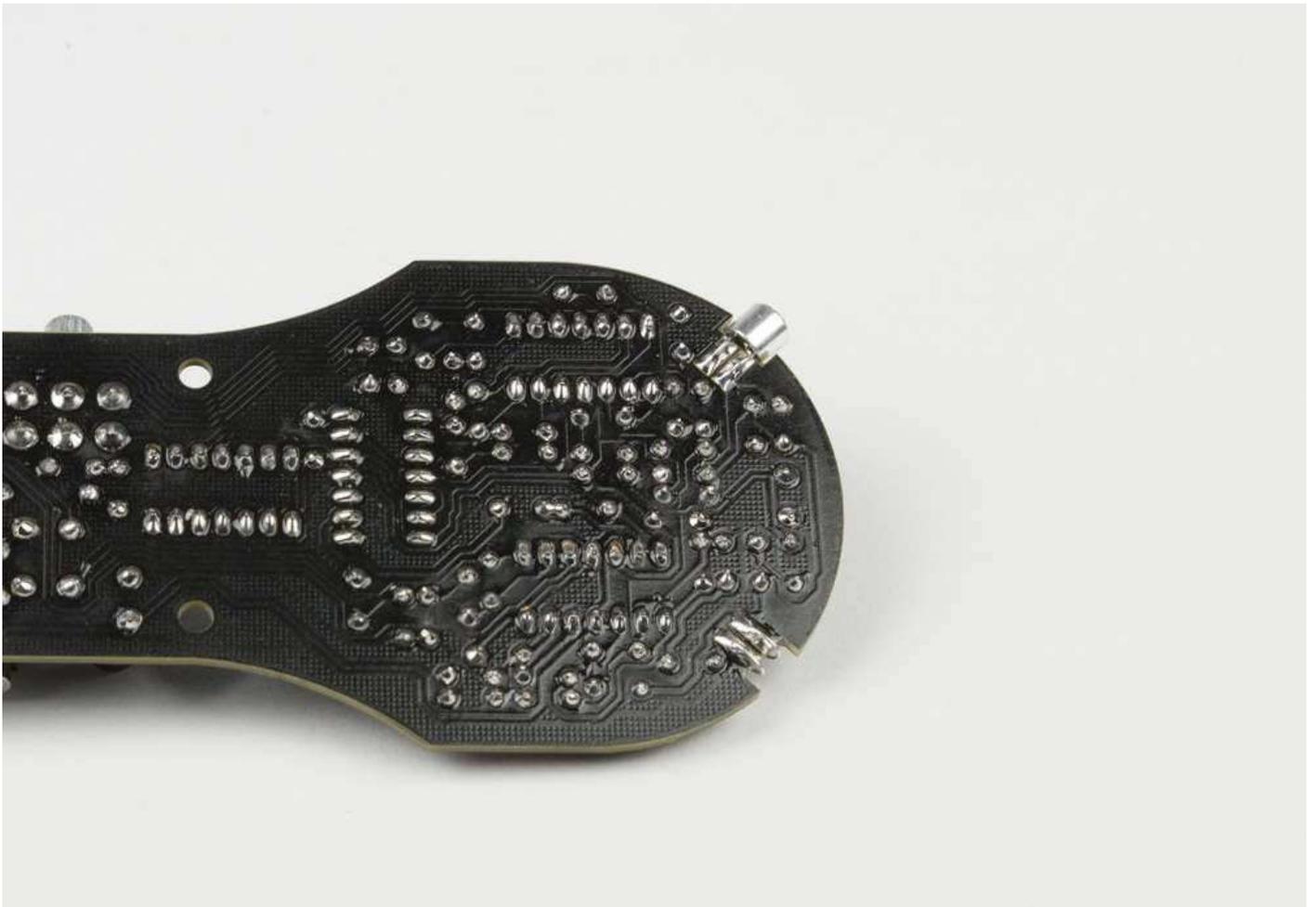
## 11. Electret microcell

- 2 x MIC

a. wind a jumper through both holes on the same side with the same polarity as shown in the picture. Then solder them together on the solder side of the PCB.







b. solder the microcell onto the loops of the jumpers **but note the polarity!**



## 12. ICs

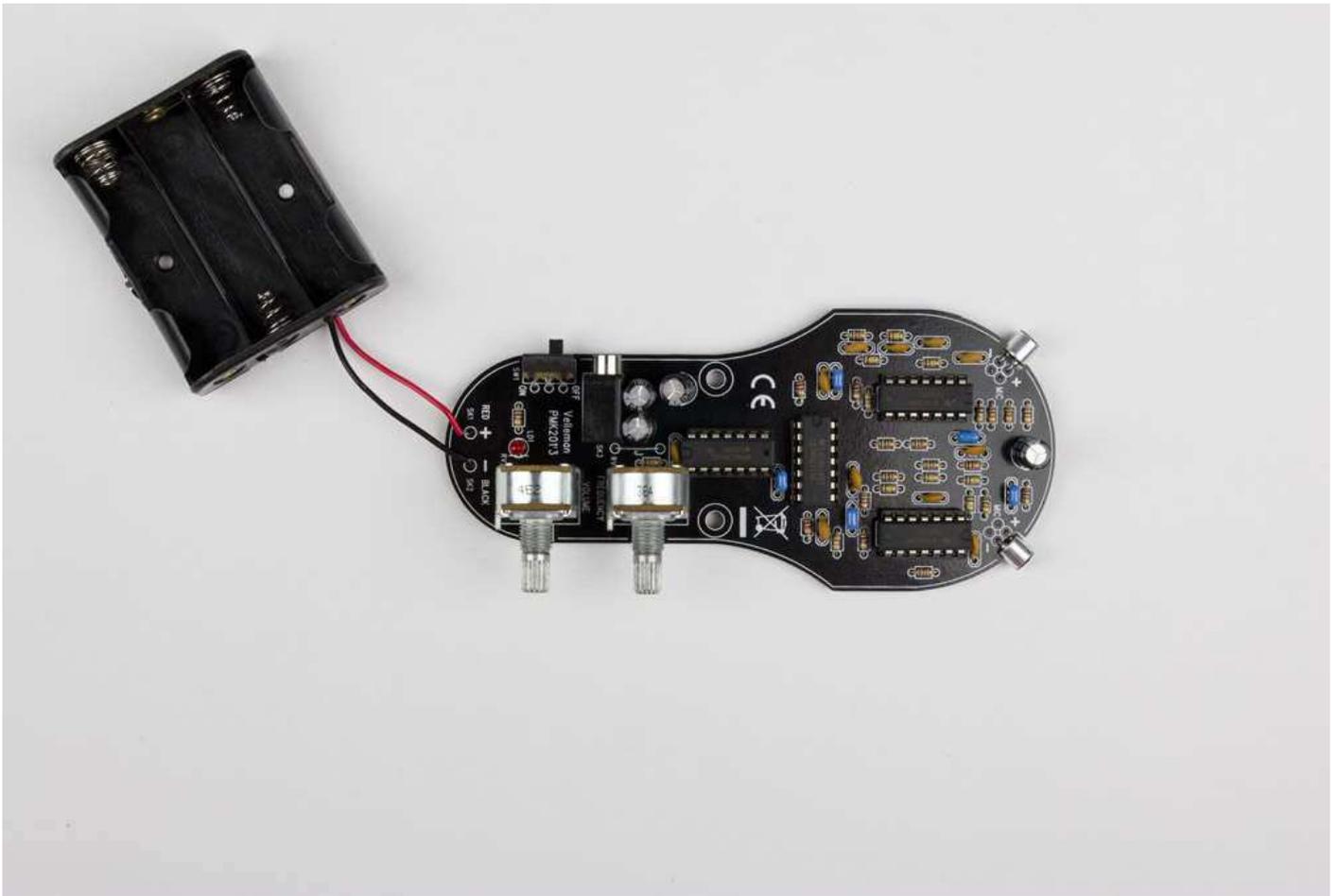
- **IC1 ... IC2:** TLV274
- **IC3:** 74HC4066
- **IC4:** 74HC14

**Note the position of the notch!**

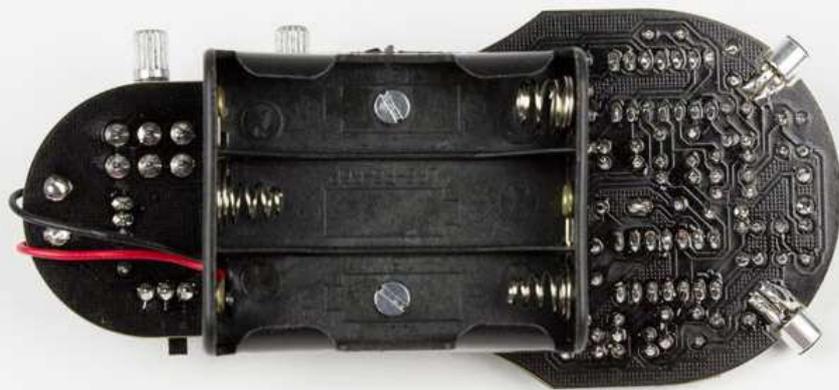


## 13. Battery holder

a. Connect the red wire of the battery holder to RED SK1 and the black wire to BLACK SK2 as shown in the picture.



b. Use the **2 x plastic spacers** and the **2 x M3 nut** and **2 x M3 bolt** to install the battery holder onto the PCB as shown in the picture.

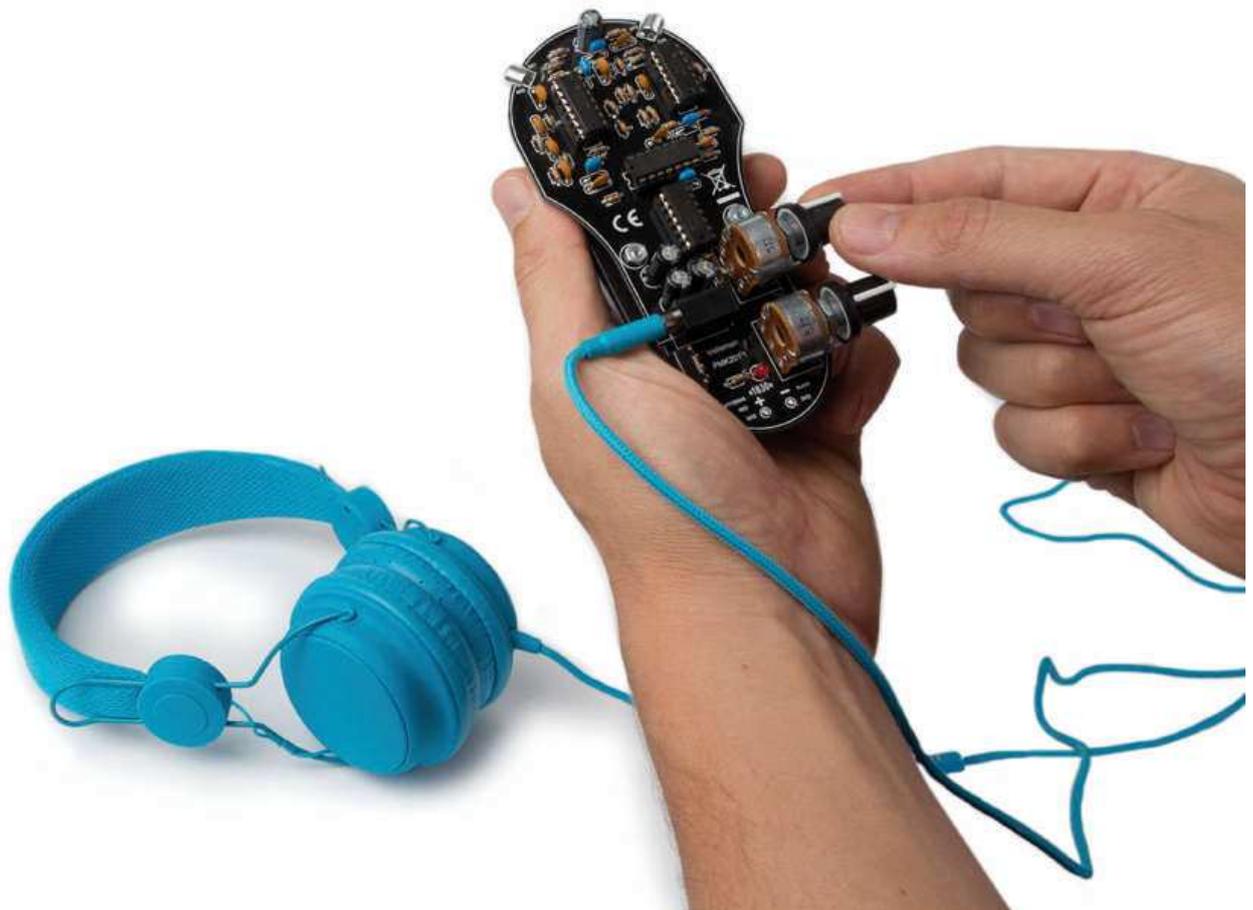


## 14. Knob

Place both knobs onto the potentiometers.



Congrats, your kit is finished!



### 3. User manual

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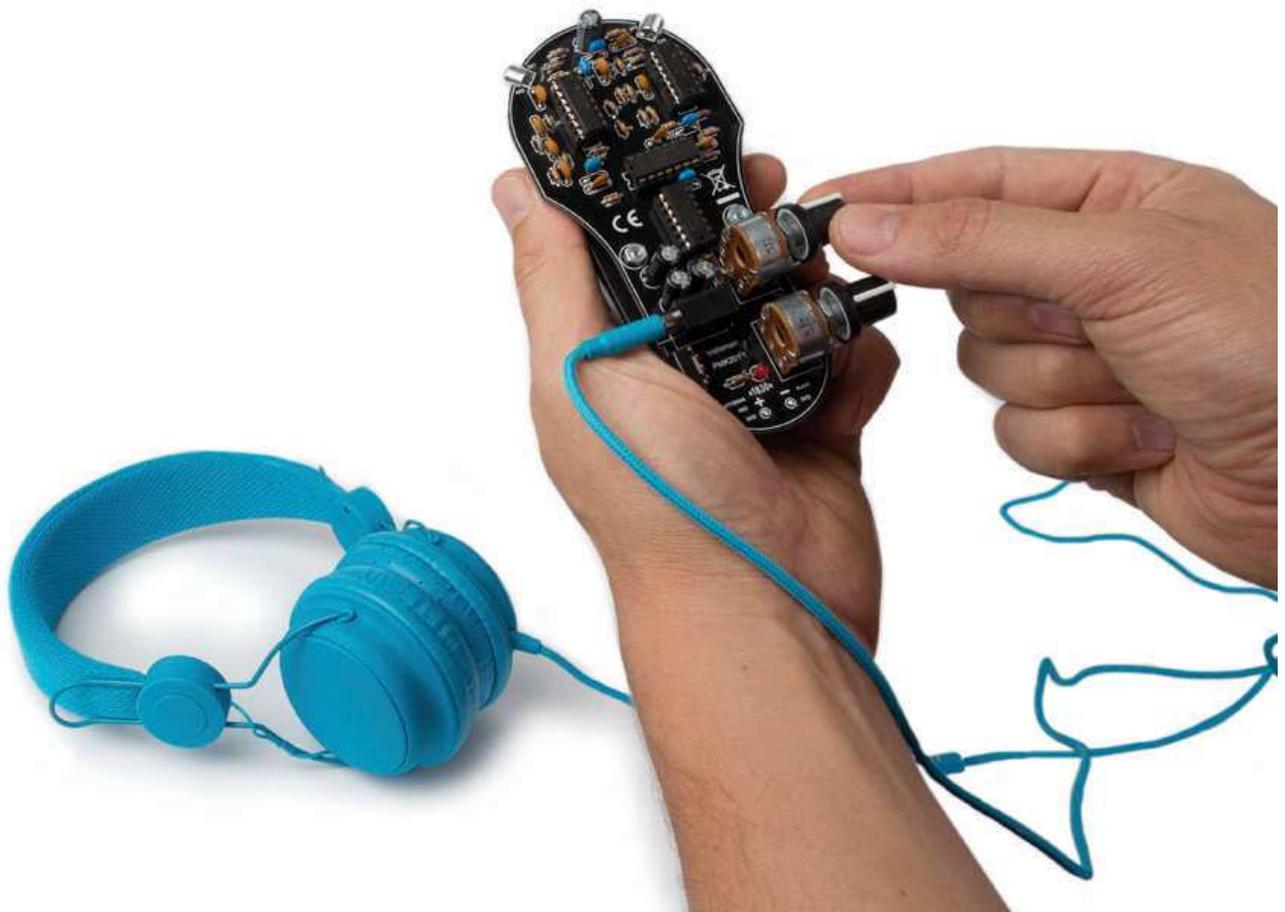
#### INTRODUCTION

The ultrasonic detector (K8118) is an easy-to-use instrument that converts ultrasound into audible sound for humans. Therefore it can be used for studying bats and other animals that emit ultrasound.

The detector uses the heterodyne conversion principle; this means that realistic sounding voices are heard, but their frequency has been shifted and are representative artifacts of the original sounds. Nevertheless, the sounds heard with this detector are highly informative. It is perfectly possible to identify bat species by careful observation in combination with this detector as their call patterns are species-specific and can be quite distinctive.

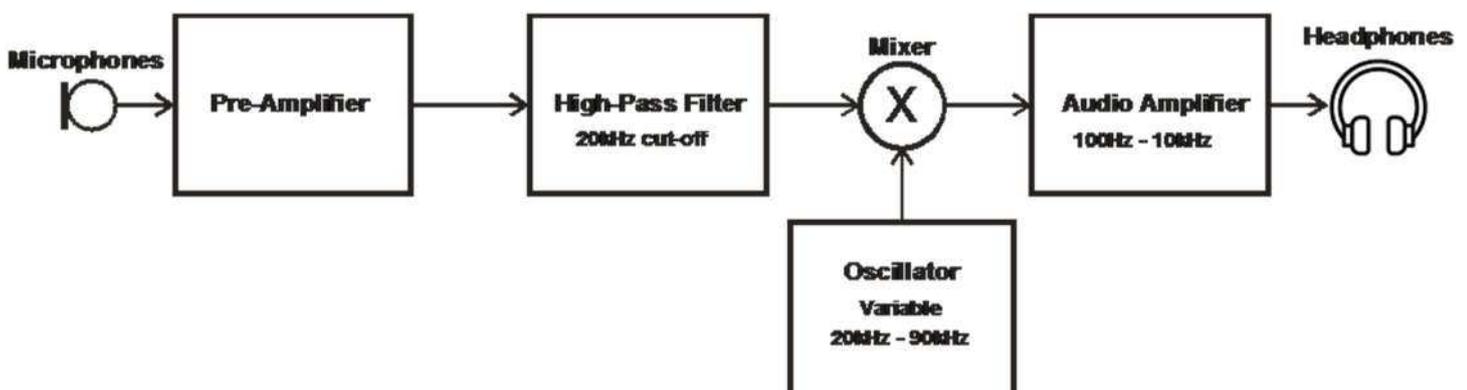
The detector can be used in many other situations where detection of ultrasound is involved, such as:

- bearing test (early warning of bearing failure, detecting lack of lubrication)
- leak detection in pressurized systems (e.g. localize exhaust system leaks)
- electrical inspection (localize arcing, corona discharge)



## SOME TECHNICAL INFO

As mentioned above, the detector works according to the heterodyne principle. This technique means that a limited frequency range is selected for conversion into the audible range. If the frequency control is set to the middle position, the oscillator frequency is approximately 35 kHz. In this case the range about 30 to 40 kHz will be transformed. The incoming ultrasonic signal is mixed with a locally generated signal. The mixer output contains a signal which is the difference between these two frequencies. So for example, if the incoming sound is circa 33 kHz and the local oscillator is running at 35 kHz, the output will be about 2 kHz. Interestingly, the same output would also be produced if the local oscillator is set to 31 kHz as the mixer produces different signals in both positive- and negative senses.



The amplified input signal is combined with the local oscillator output in the mixer. The local oscillator is adjusted so that its tone is close to the ultrasonic frequencies of interest. The mixer effectively multiplies the ultrasonic signal with the local oscillator tone and produces audio-band signals representing their difference. The audio band amplifier buffers the mixer output and drives the headphones.

## INITIAL TESTING

Insert the **3 x 1,5V AA batteries** , connect the headphones and turn switch SW1 to the ON position.

To test the detector, perform the following steps:

1. Set the VOLUME control to about middle position so that some noise is heard in the headphones.
2. Then turn the FREQUENCY control to the middle position to get the oscillator frequency to about 35 kHz.
3. Now gently rub two fingers together near the microphones or slide a fingertip over a sheet of paper held near to the microphones. A scraping sound should then be heard in the headphones. Another good ultrasound source is a jingling bunch of keys.

## USING THE BAT DETECTOR

Once the detector has been tested positively, it's time to venture out at dusk. Hearing your first bat is a very nice experience. Start by setting the frequency control a little above the middle position to get about 45 kHz oscillator frequency. When bats are seen flying close by, point the microphones directly at them. When a bat-like call is heard from the headphones, adjust the frequency up and down until the clearest sound is heard. The device is sensitive enough to produce good results from about 10 meters away. You are listening for a series of click or plop sounds as the bat passes by. Some species actually synchronize the clicks with wing motion, giving the illusion that its wing beats are heard, when it is actually their echolocation pulses.