



Session 4: amplification

Applied Electronics for Sound and Music
Aubery Lis



Outline

- Brief theoretical basics
- Building a dual amplifier

Voltage amplification

- Any signal (e.g. an oscillation in a synthesizer circuit) has an amplitude – how “big” is the signal voltage-wise
- Amplifying voltage by N (e.g. 2) means that the amplitude will become N times (e.g. twice as) big
- This usually means that the volume of such signal will increase if you put it to active speakers
- Can we amplify using passive components?

Voltage amplification

- Can be only done with active components – passive components can never amplify a signal
- In olden times, single discrete transistors were used to amplify (both voltage and current)
- Nowadays, we use operational amplifiers (op-amps) to amplify voltage-wise
- Bonus: op-amps barely draw current from the signal source, but can output significant current to the load => can drive small speakers, headphones, etc

Why use op-amps

- Some sound sources, such as dynamic and piezo microphones, coils and guitar pickups, output electric signals of tiny voltage amplitude and can drive no significant load (speakers etc)
- They have to be amplified by 100 to 1000 times and buffered current-wise
- Op-amps can amplify by that much without a lot of noise and are current buffers

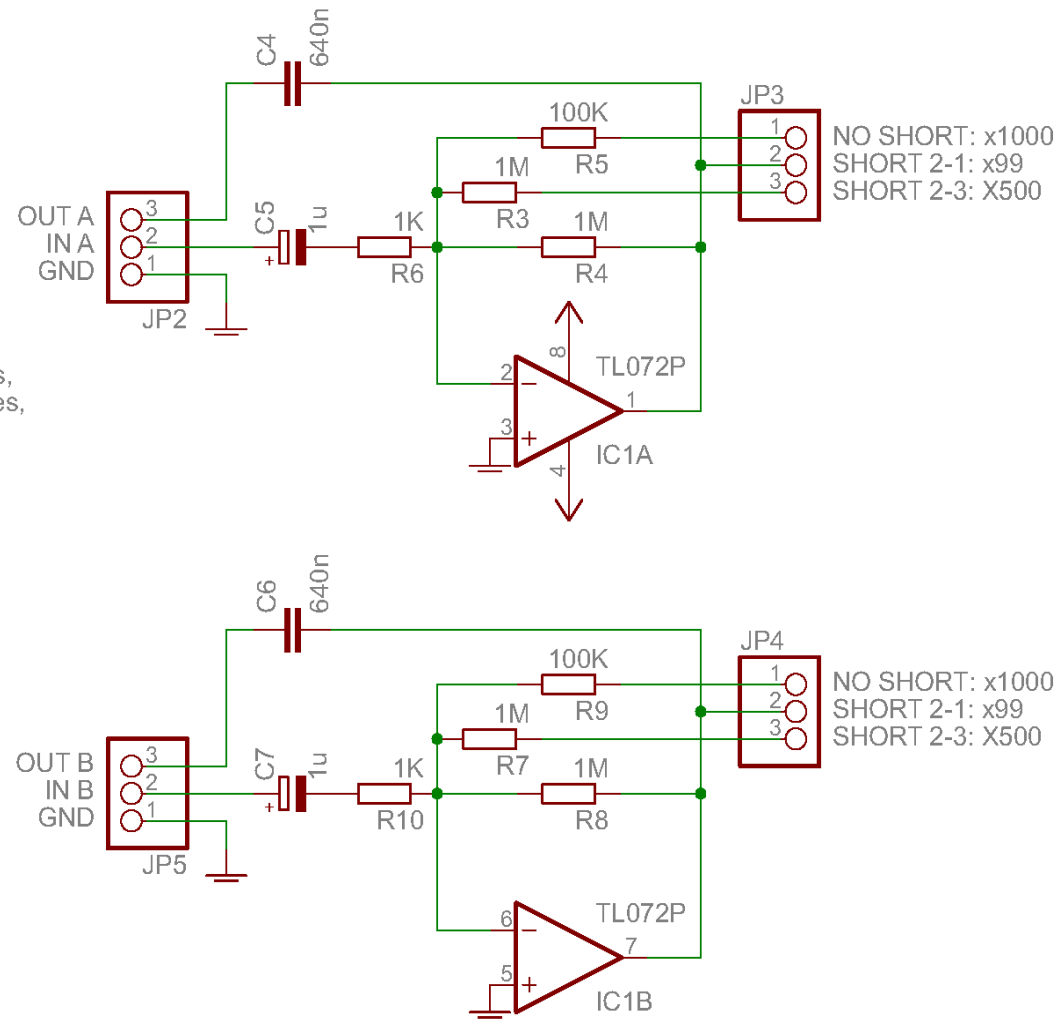
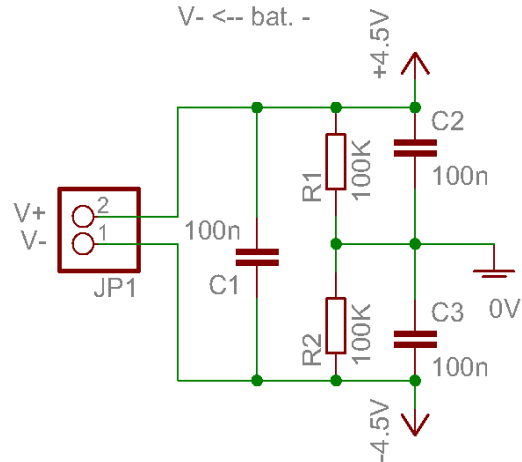
Schematic

DUAL AMPLIFIER MINIMODULE

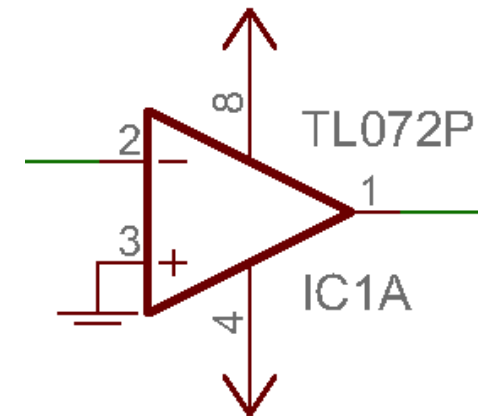
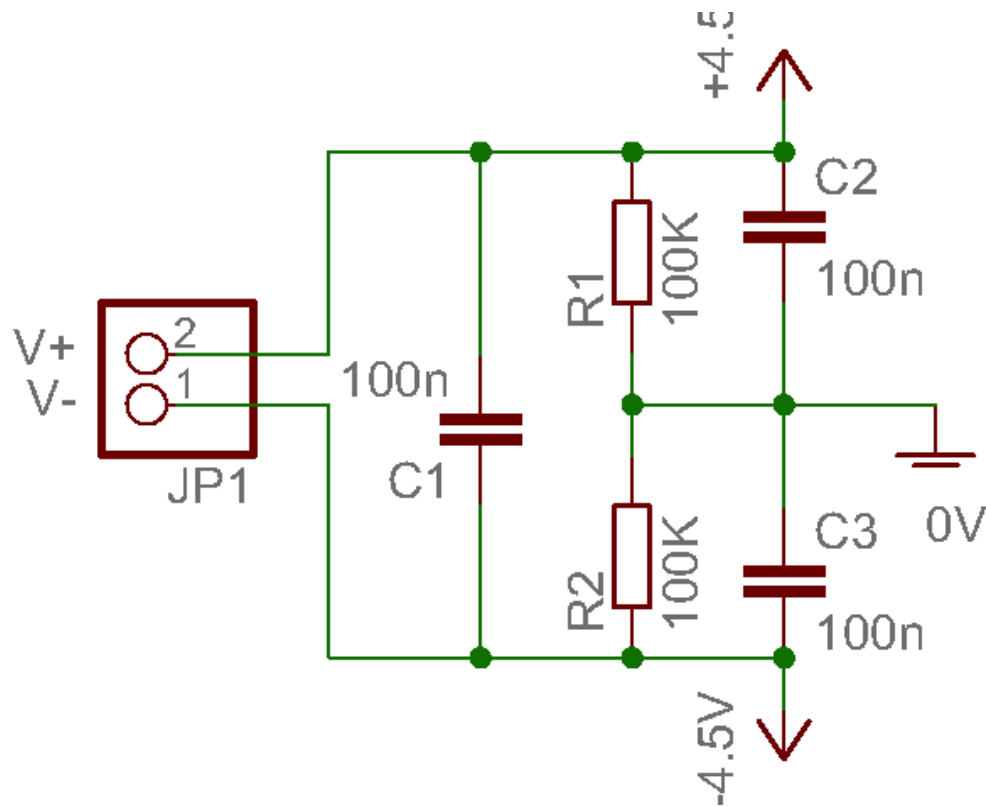
Dual Amplifier minimodule
Design by Aubery Lis, 2022
Educational purpose only

Used to pick up sounds from piezos,
coils and other "microsound" devices,
as well as amplifying line audio
to more "processable" levels
probably can be a distortion :D

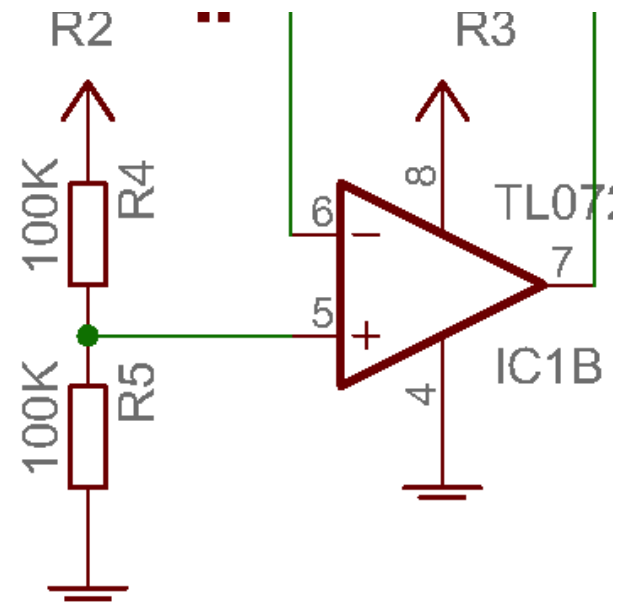
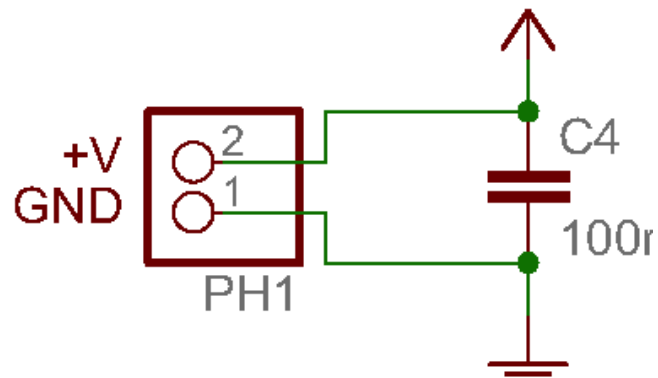
runs off a 9v battery
V+ <-- bat. +
V- <-- bat. -



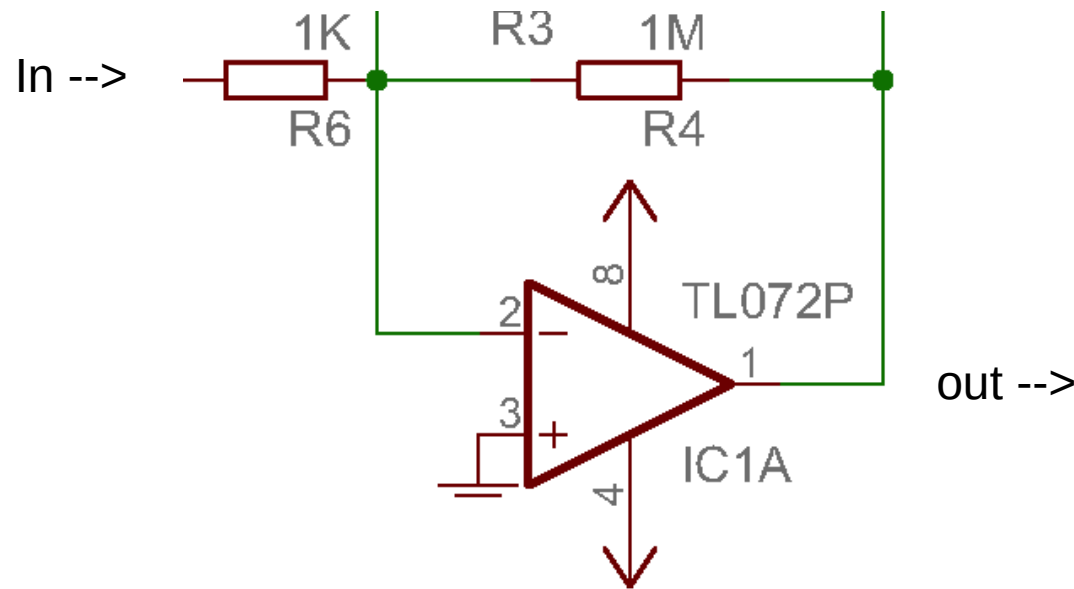
Schematic overview



Noise minimodule throwback?



Inverting amplifier configuration

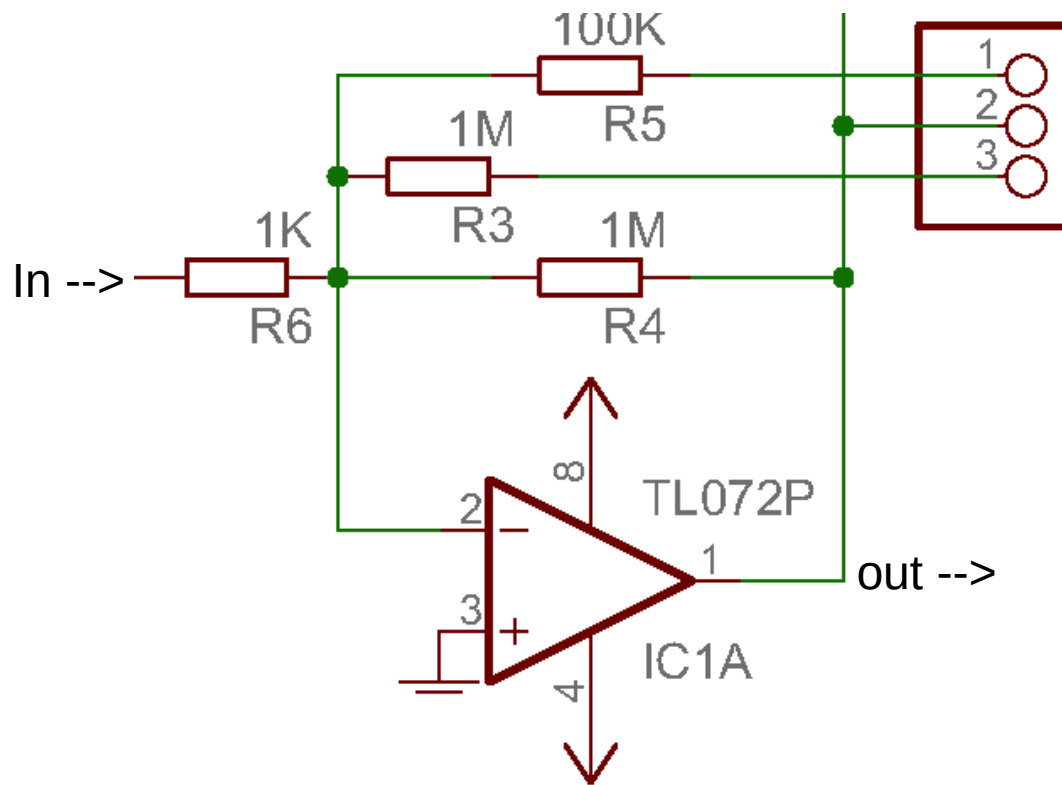


Inverting op-amp gain is calculated as $(R_{in} / R_{feedback})$
Here, gain is $R4/R6 = 1M/1K = 1000K/1K = 1000$

This amplifier outputs the INVERTED version of the input, that is also amplified by 1000 voltage-wise

How do we make the voltage gain variable?

"Programmable" gain

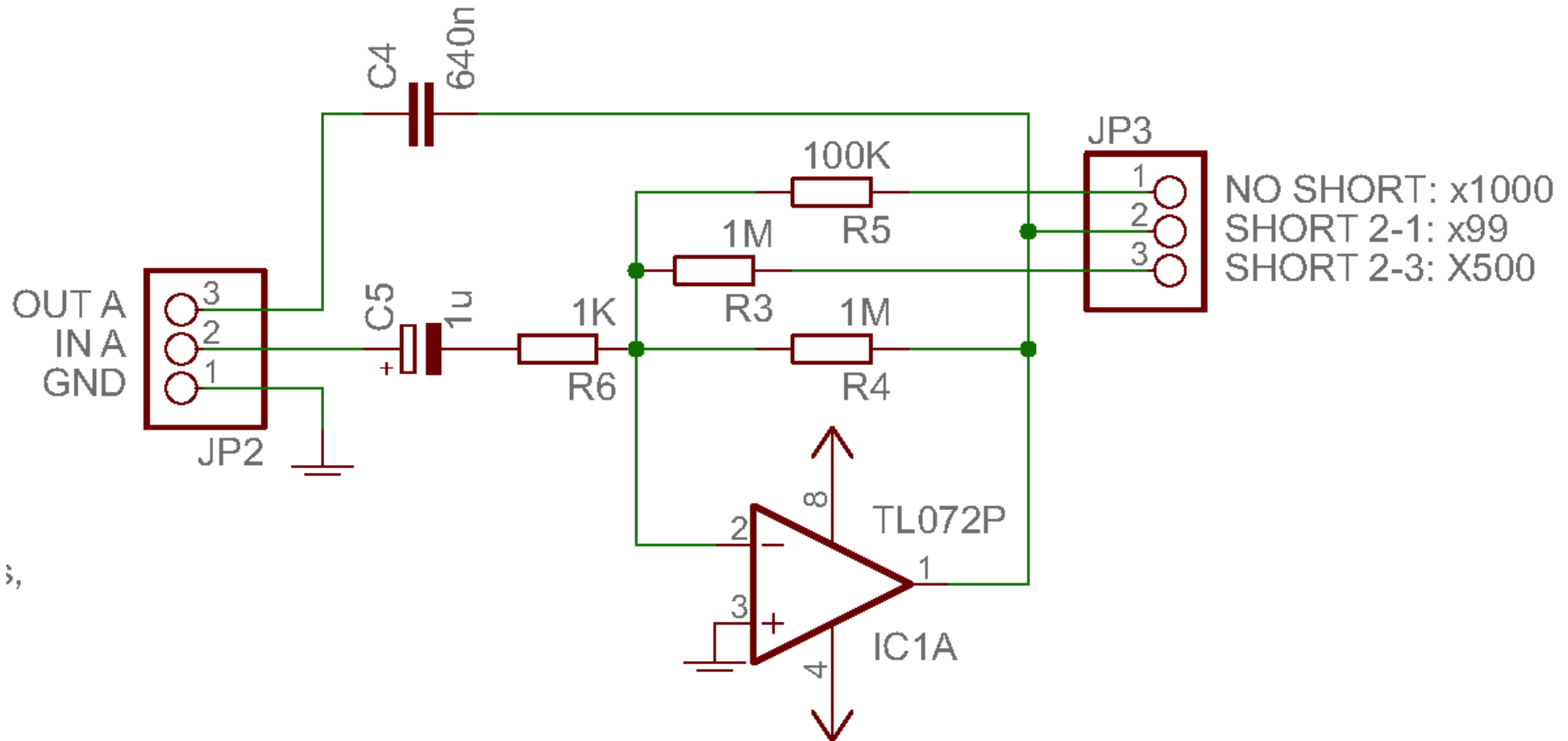


R4 is always connected across IC1A output and inverting input

Jumper can select if R3, R5 or nothing gets connected **in parallel** to R4, changing the **overall resistance** around the op-amp, thus changing the gain

How will enabling R3 affect the gain?

Final amplifier schematic



Layout

