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HEART ECG MONITOR

BY GROUP 27

**Department of Electronic and Telecommunication
Engineering**

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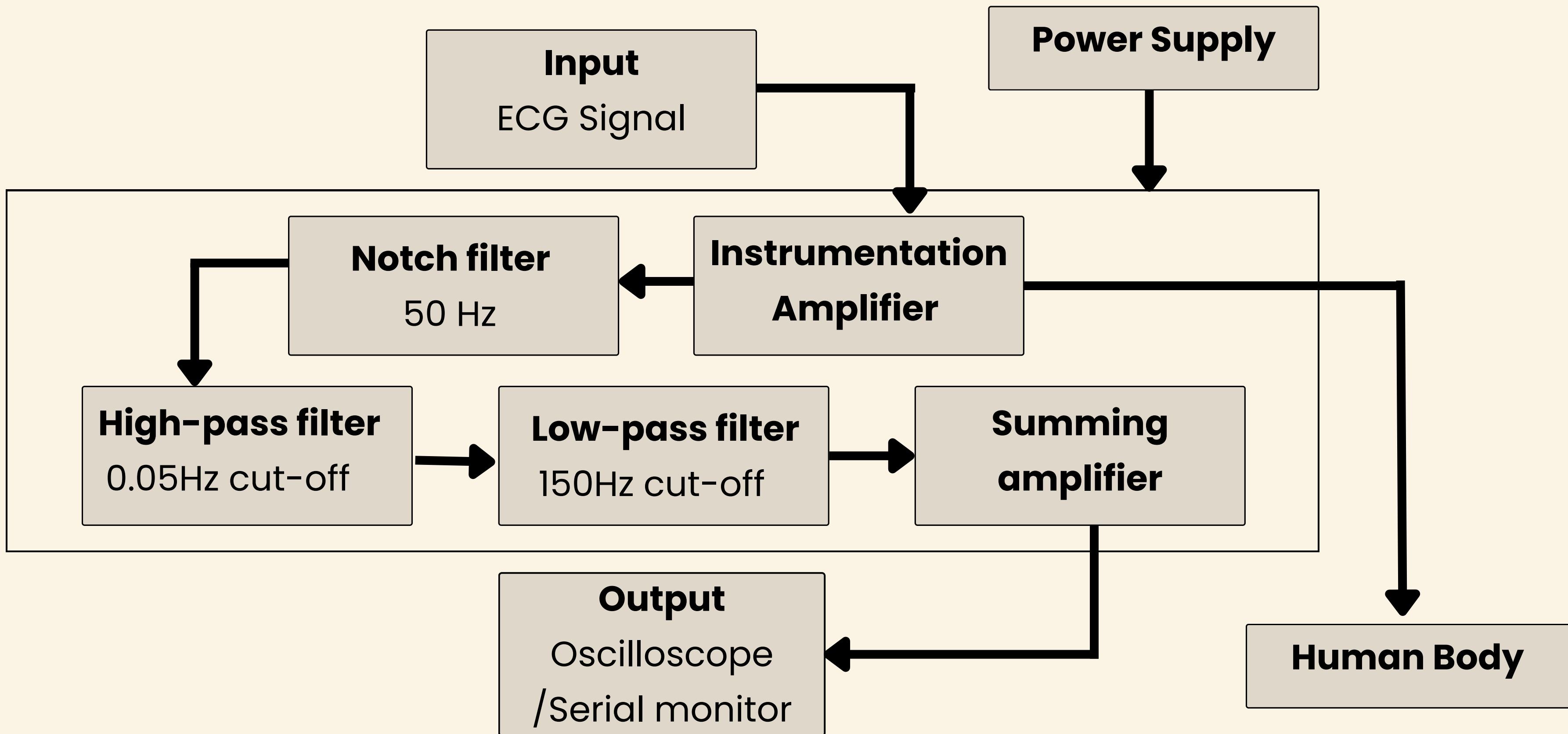
PRODUCT SPECIFICATIONS

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- 3-lead ECG signal as input using any ECG electrodes available in the market
- Noise filtration using high-pass, low-pass, and notch filters to obtain a signal in the range of 0.05Hz to 150Hz
- Amplification of the ECG signal using multiple (3) stages
- Displays the ECG signal on Oscilloscope or Arduino Serial Monitor
- Powered by rechargeable batteries

SYSTEM BLOCK DIAGRAM

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INSTRUMENTATION AMPLIFIER

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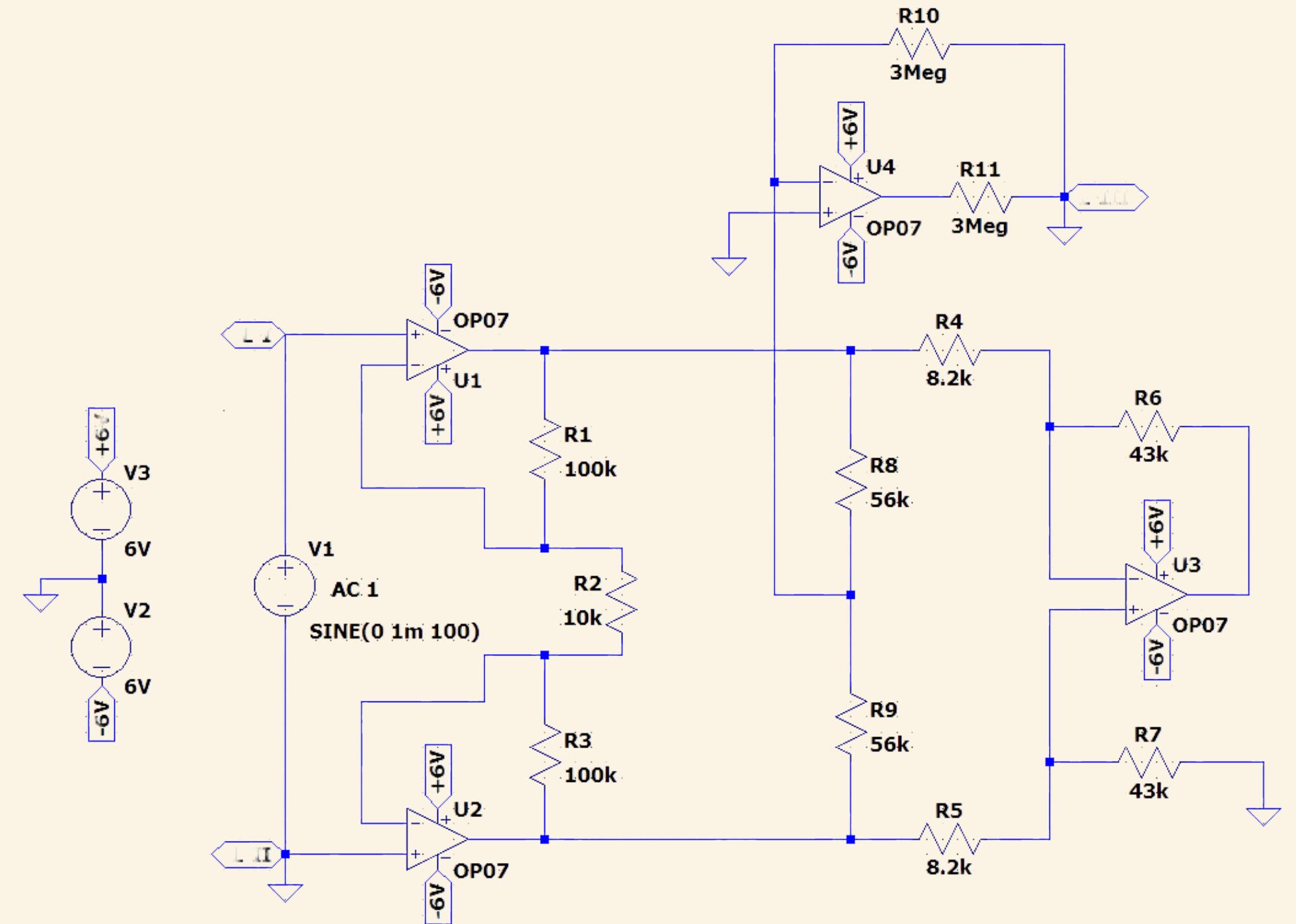
This consists of 2 stages

- Buffering Amplifier
- Differential Amplifier

Differential Mode Gain - 110

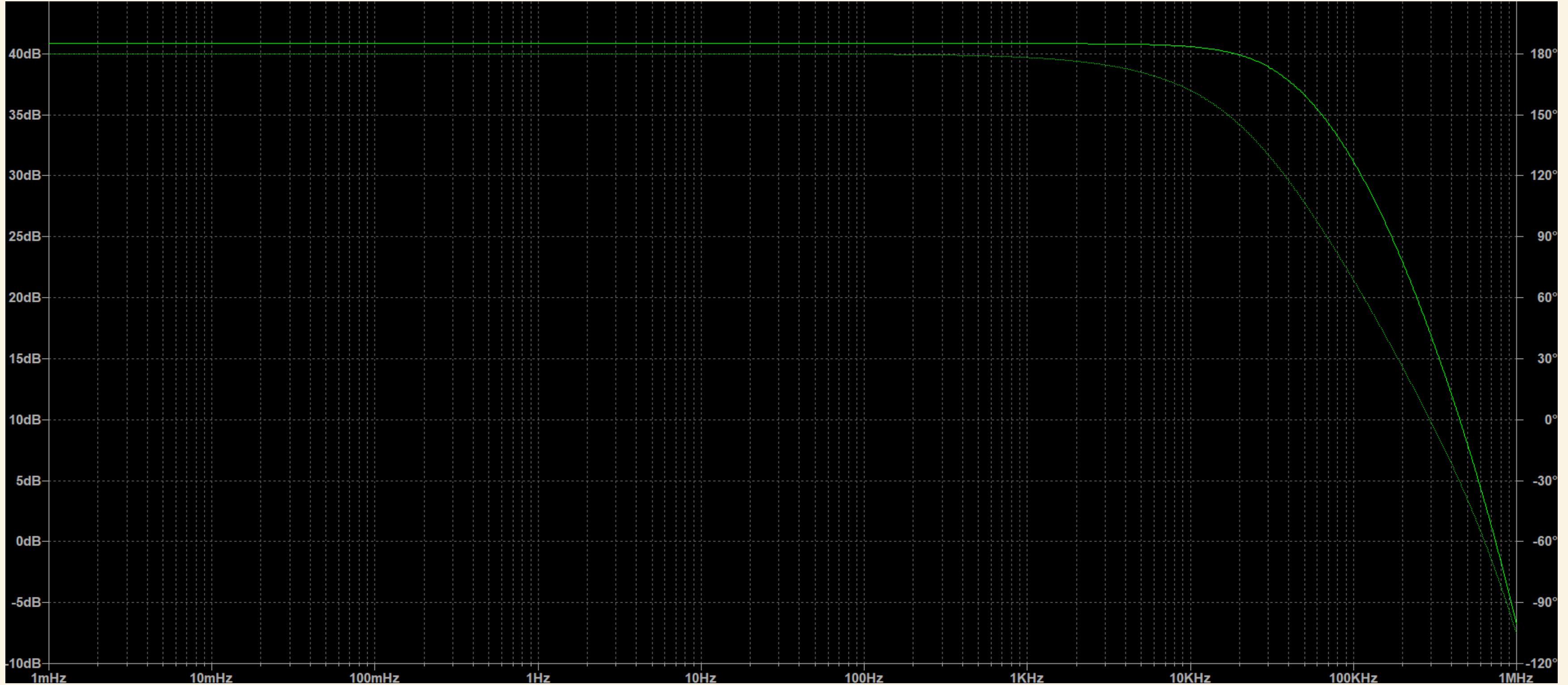
Common Mode Gain - 2.4e-6

Additional Right Leg Drive circuit
to further increase the CMRR
(Common Mode signal is inverted
and fed back to the right leg)



INSTRUMENTATION AMPLIFIER

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Frequency Response of the Instrumentation Amplifier in Differential Mode

INSTRUMENTATION AMPLIFIER

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Frequency Response of the Instrumentation Amplifier in Common Mode

50HZ NOTCH FILTER

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Active Wien-Robinson filter was used

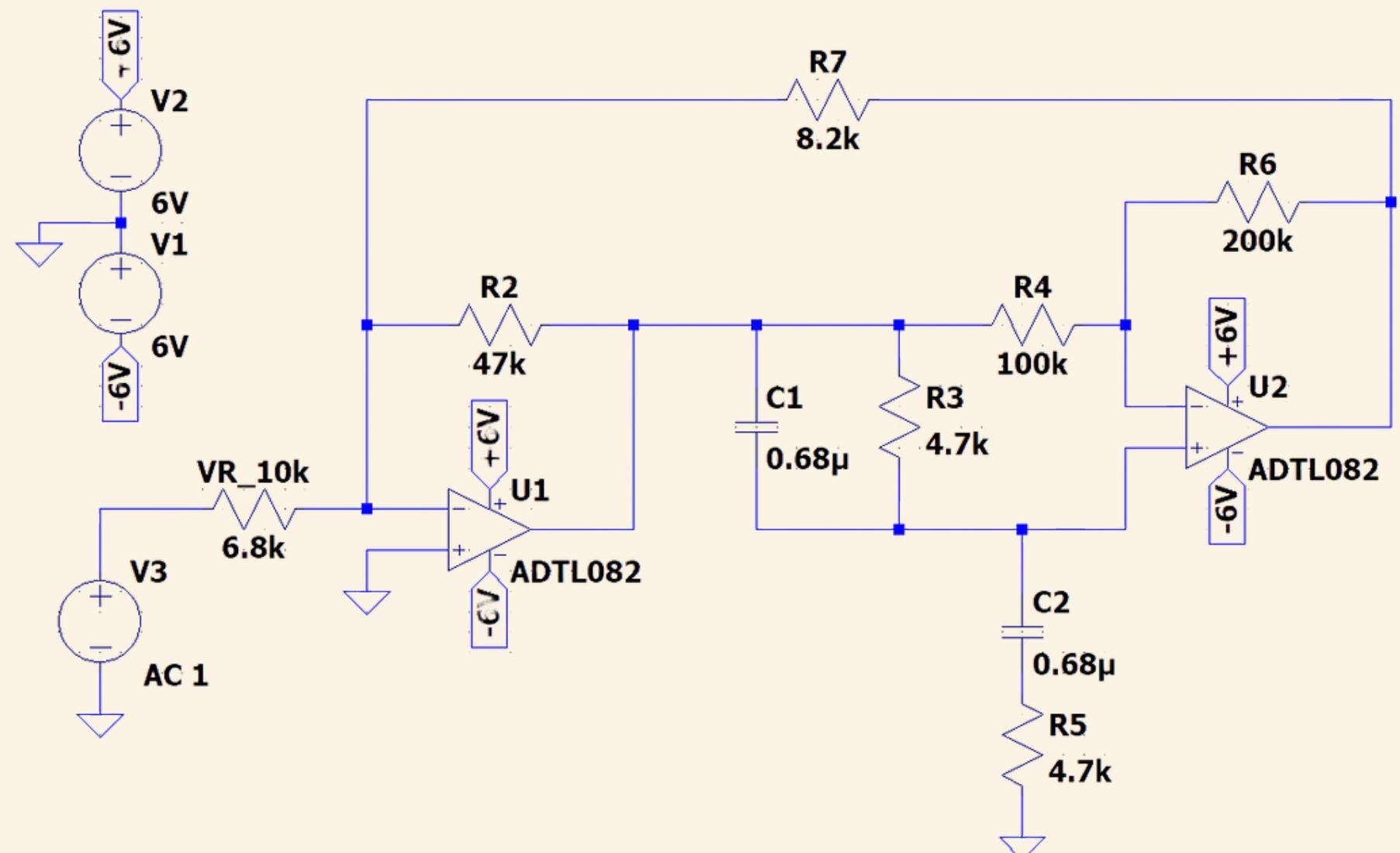
Upper Cut-off frequency - 39.9 Hz

Lower Cut-off frequency - 62.1 Hz

Mid Cut-off frequency - 51 Hz

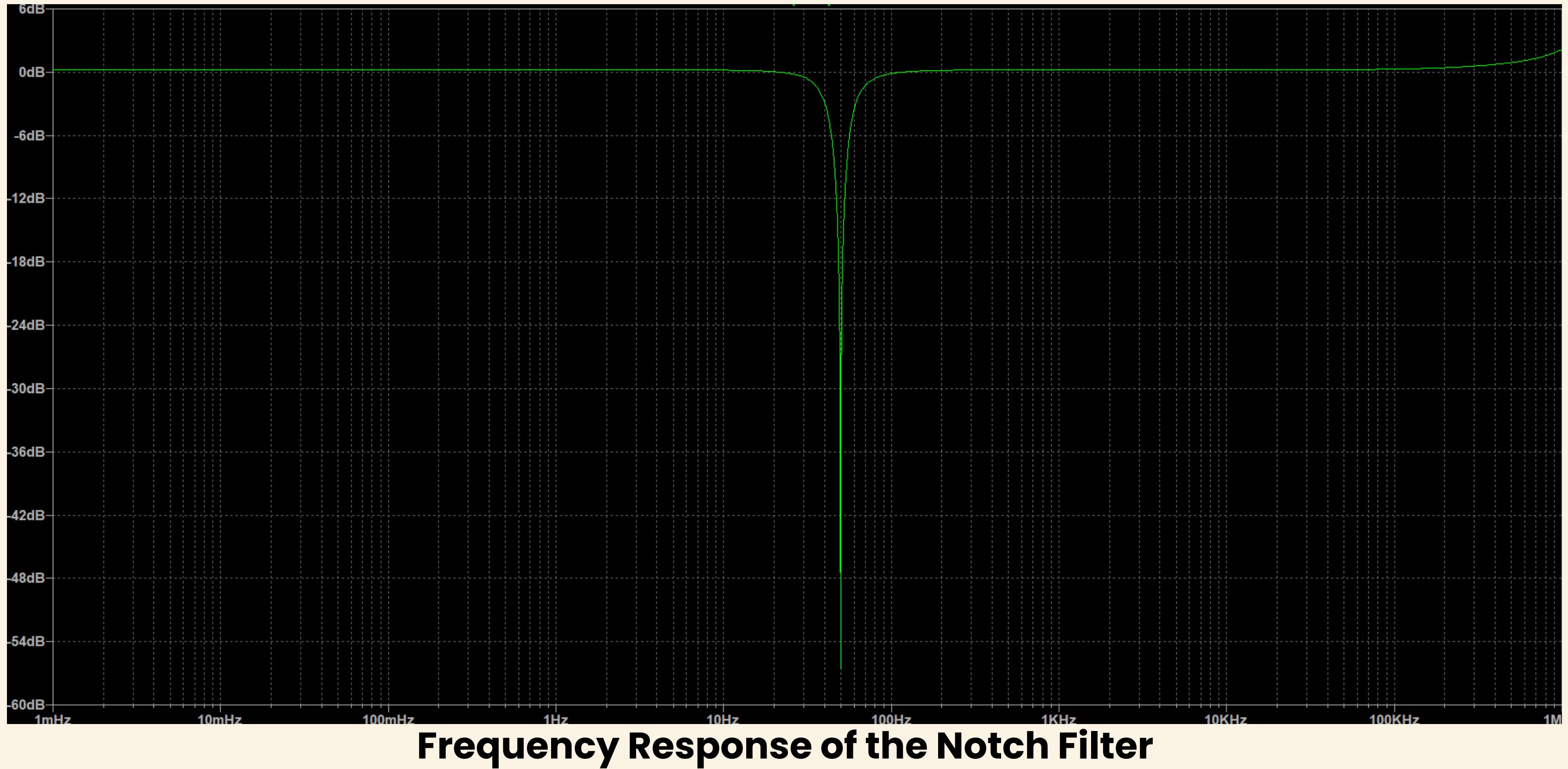
Order - 2

Gain - 1



50HZ NOTCH FILTER

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0.05Hz HIGH-PASS FILTER

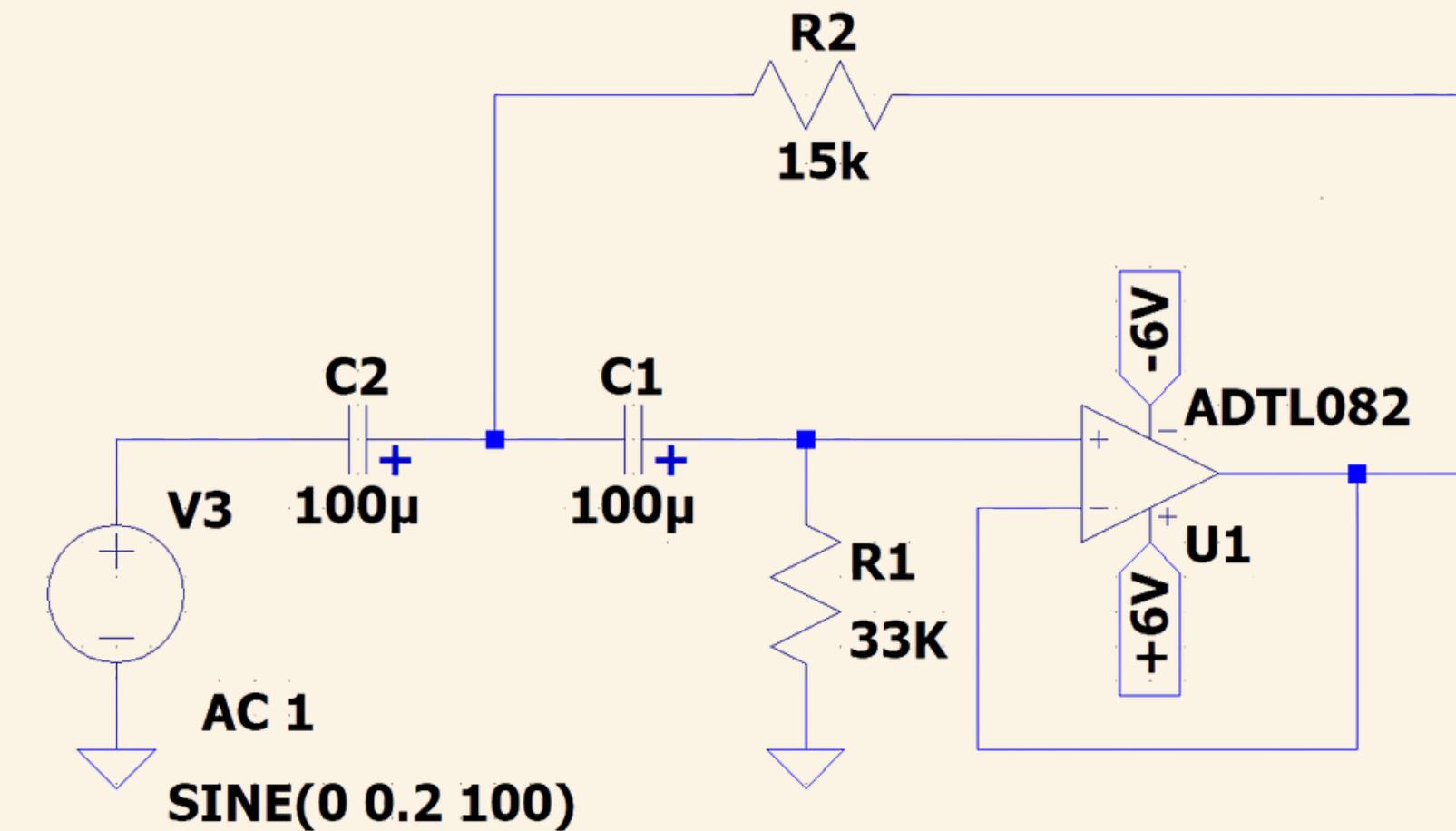
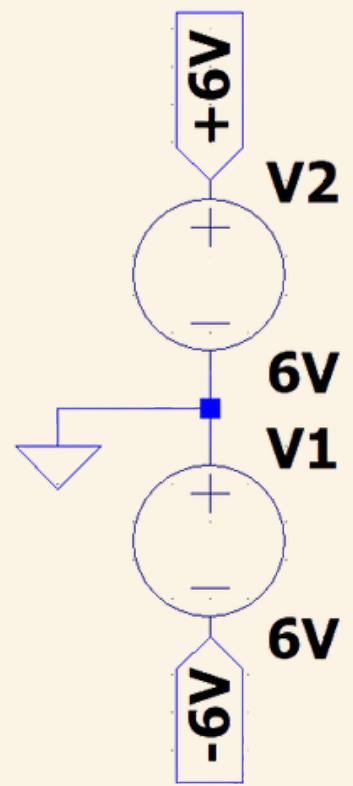
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Sallen Key Topology

Cut-off frequency - 68.4 mHz

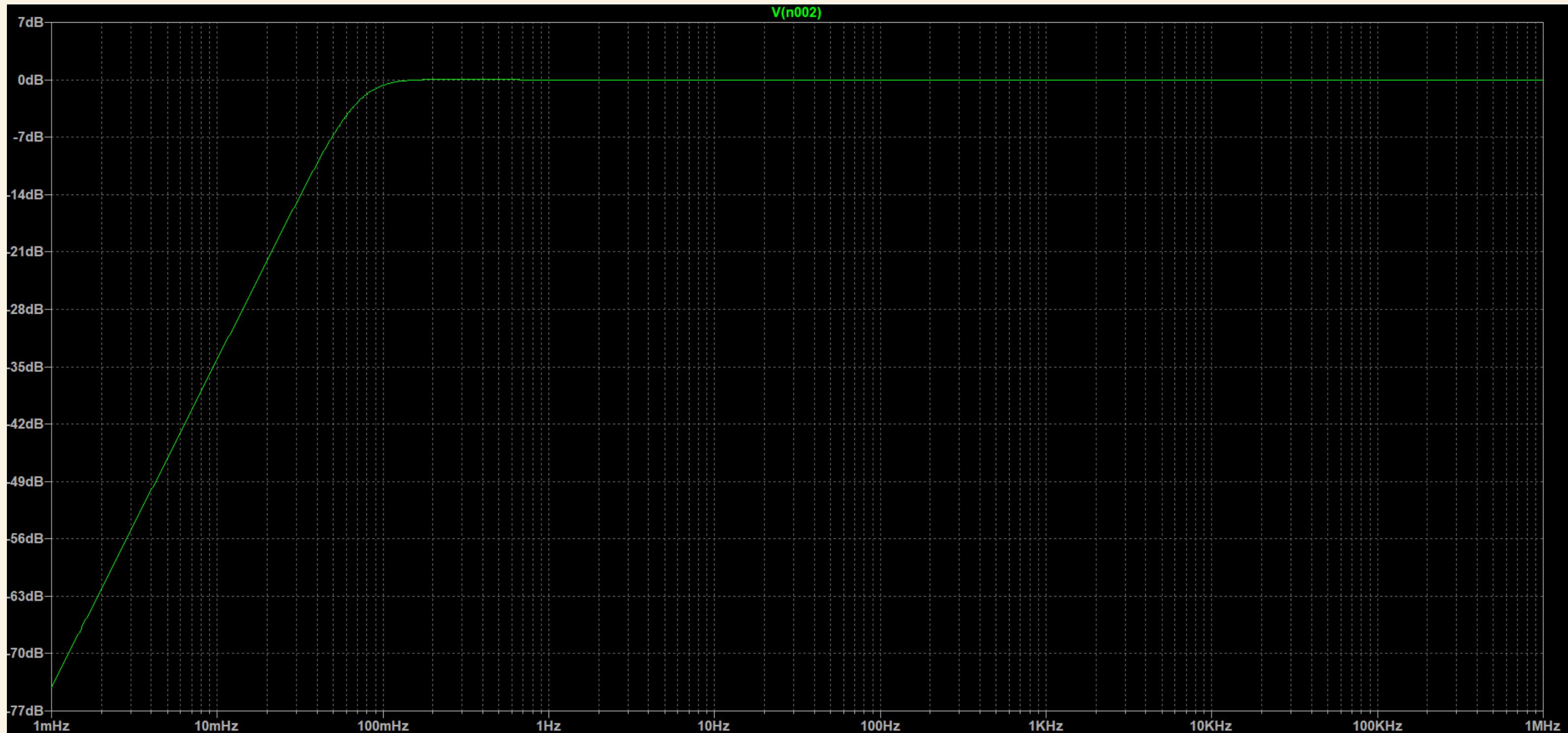
Order - 2

Gain - 1



0.05Hz HIGH-PASS FILTER

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Frequency Response of the High-Pass Filter

150HZ LOW-PASS FILTER

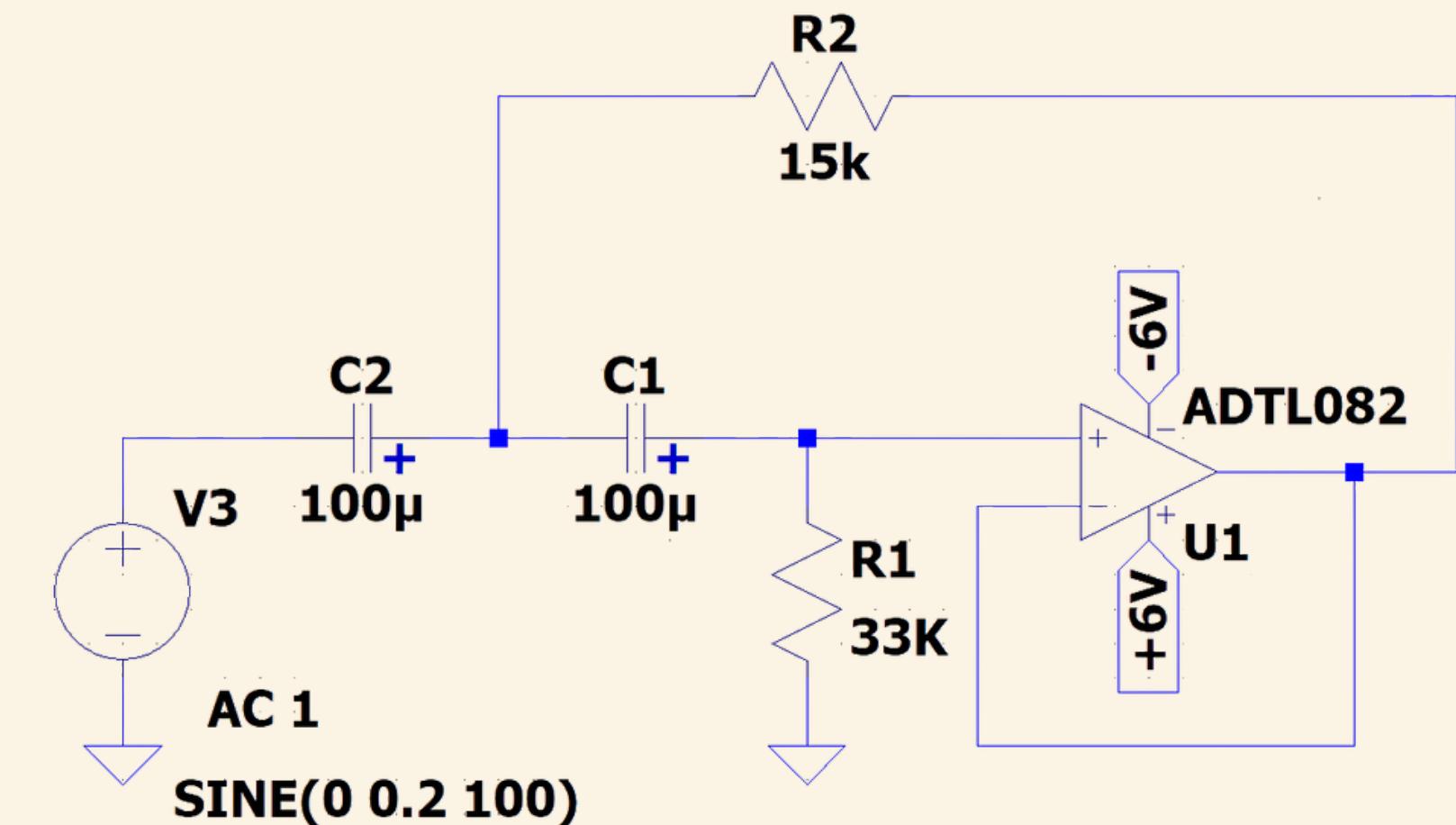
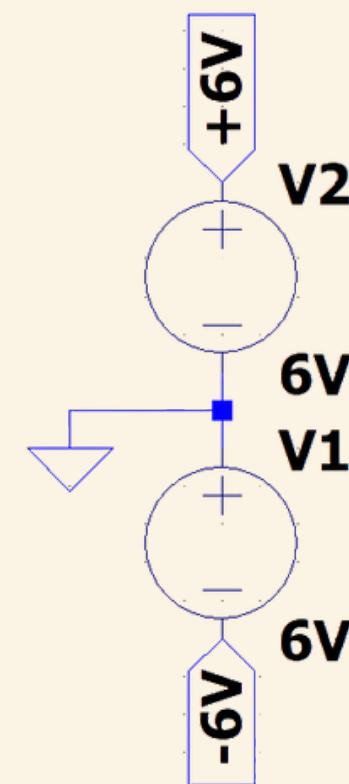
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Sallen Key Topology

Cut-off frequency - 147.7 Hz

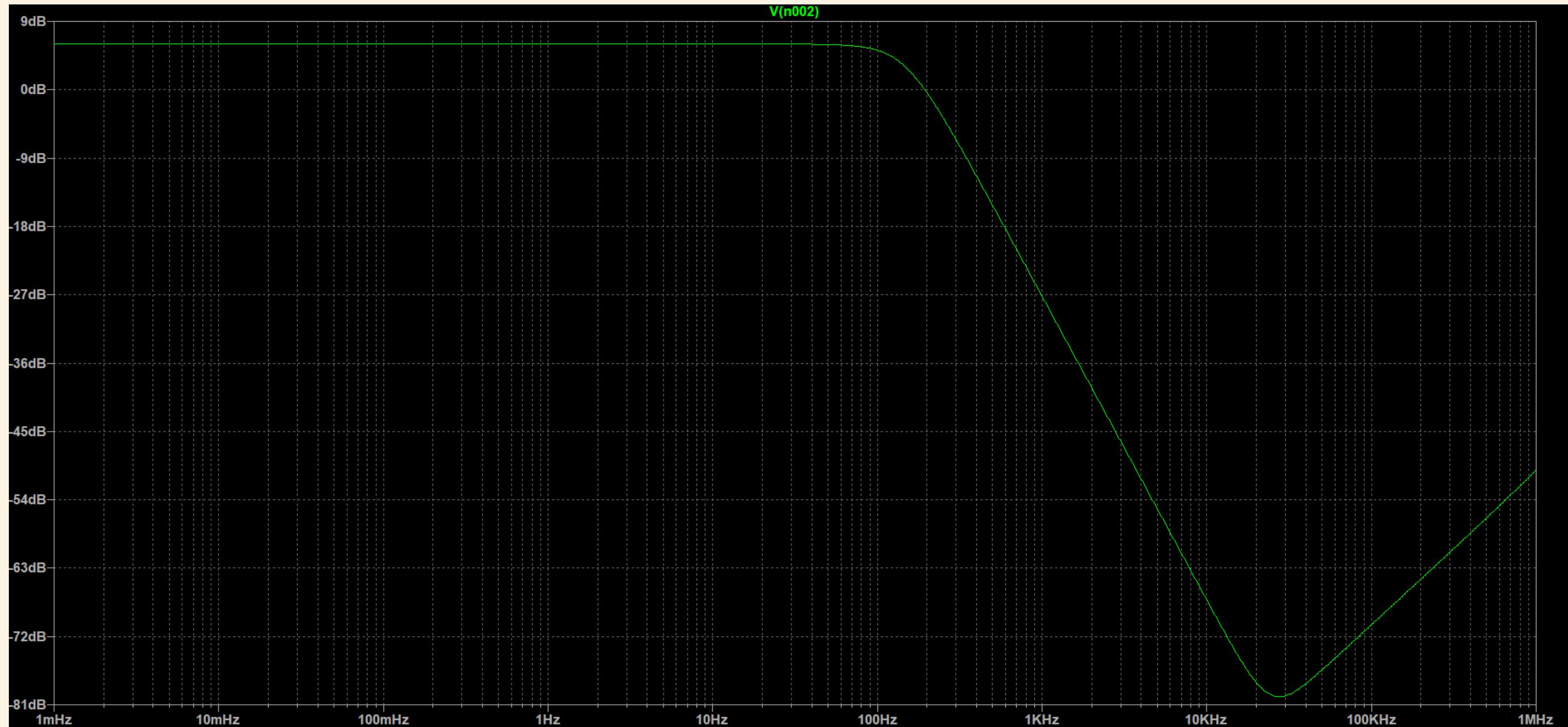
Order - 2

Gain - 2



150HZ LOW-PASS FILTER

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Frequency Response of the Low-Pass Filter

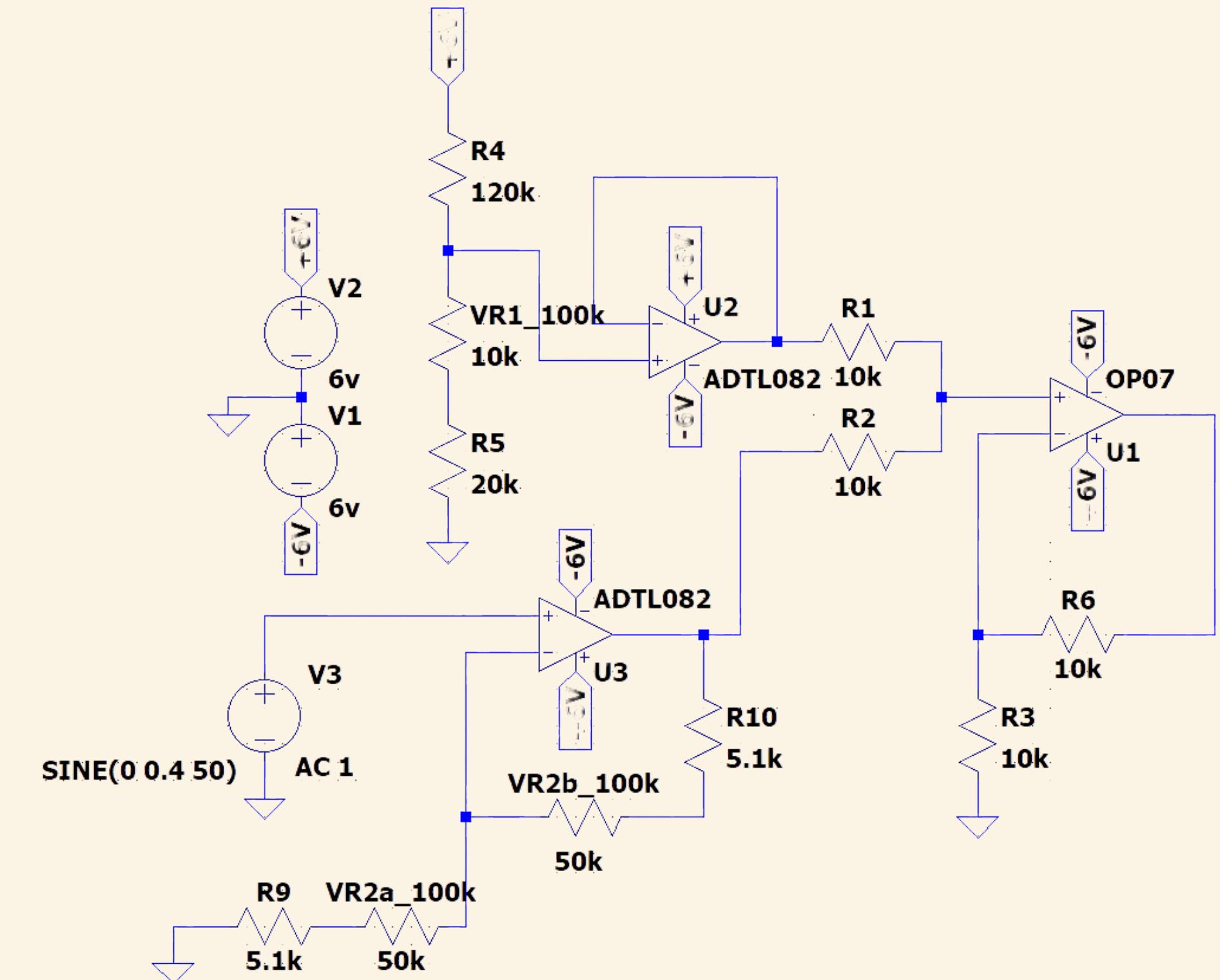
SUMMING AMPLIFIER

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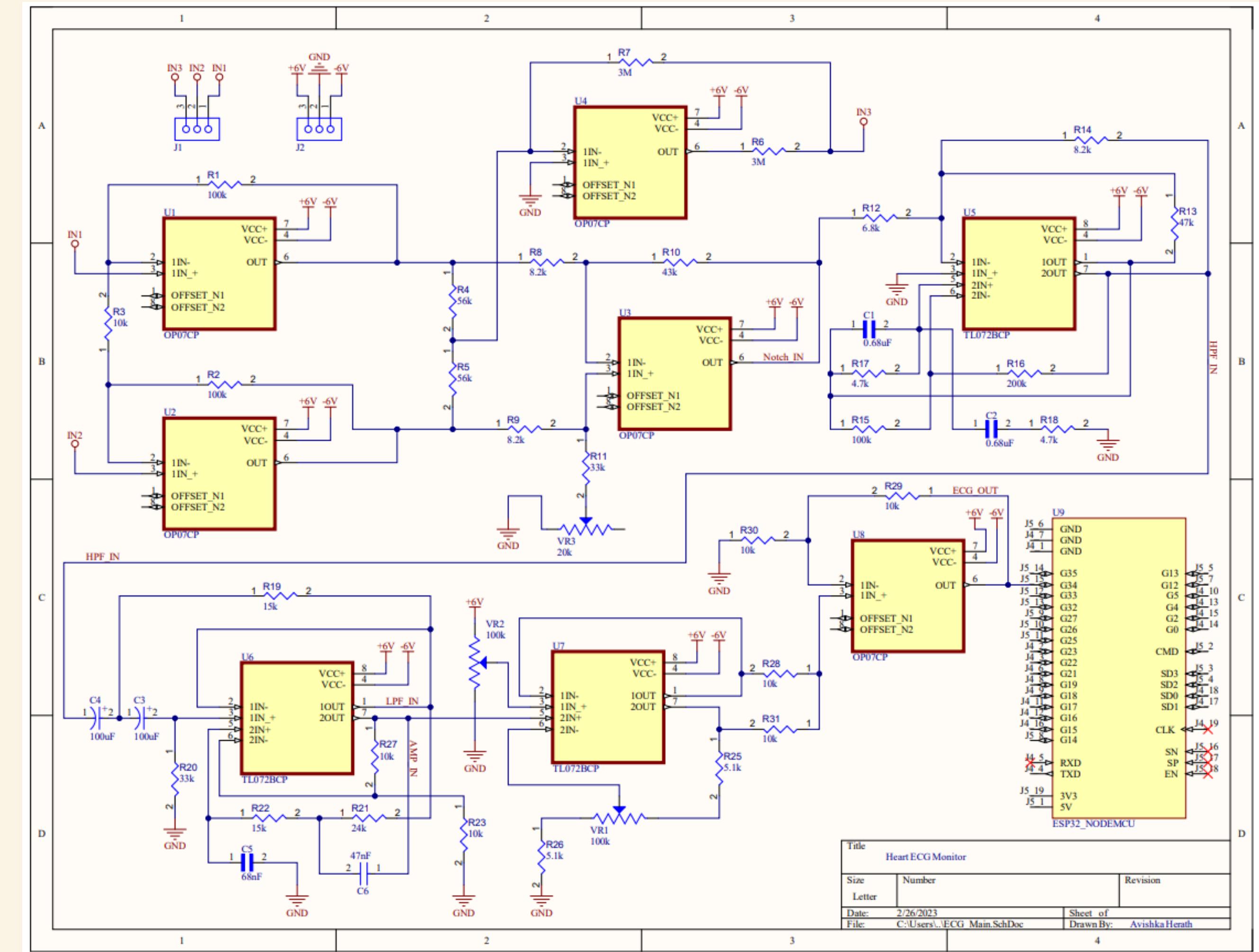
This stage adds up **Amplified Signal** from previous stages and a **Constant DC Voltage**

Minimum Gain - 1.05

Maximum Gain - 21.6



MAIN PCB SCHEMATIC



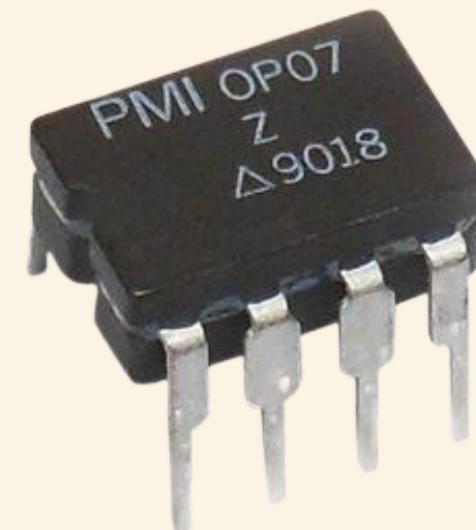
COMPONENT SELECTION

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- **OP07CP Precision OpAmp**

Typical Parameters of the OpAmp

- Common Mode Rejection Ratio (CMRR) of 120 dB
- Power Supply Rejection Ratio (PSRR) of 108 dB
- Unity Gain Bandwidth of 0.6 MHz
- Input Offset Voltage of 60 μ V
- Slew rate 0.3 V/ μ s



Used for Instrumentation Amplifiers

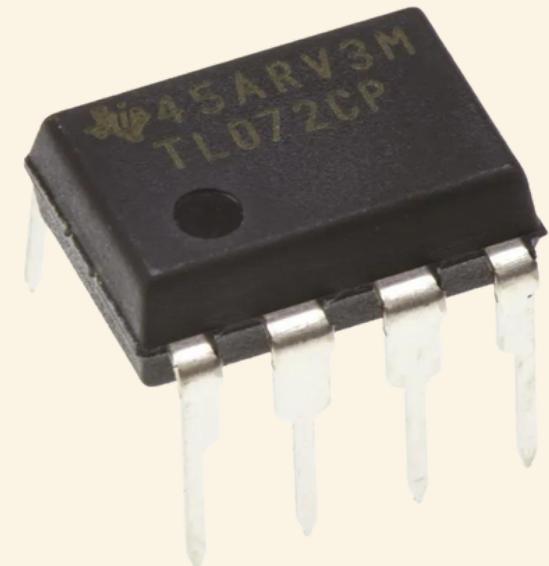
COMPONENT SELECTION

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- **TL072CP Dual OpAmp**

Typical Parameters of the OpAmp

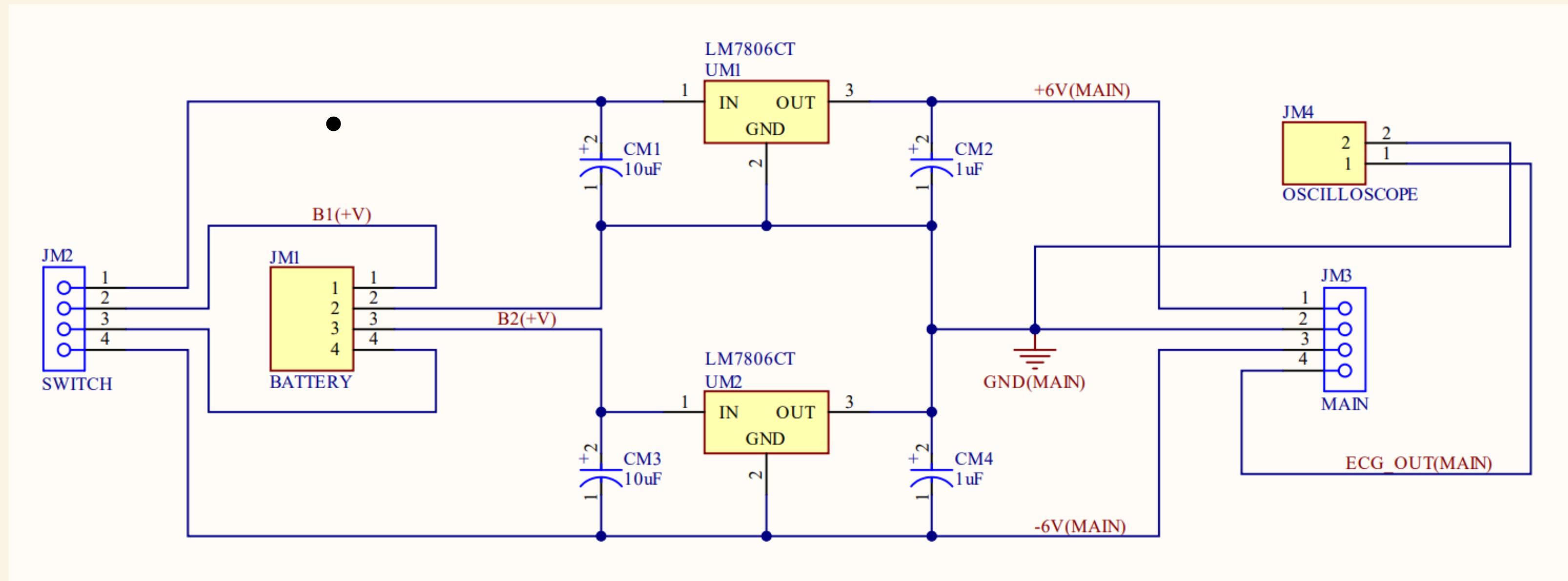
- Common Mode Rejection Ratio (CMRR) of 105 dB
- Power Supply Rejection Ratio (PSRR) of 100 dB
- Unity Gain Bandwidth of 5.25MHz
- Input Offset Voltage of 1 mV
- Slew rate 20 V/ μ s



Used for Filters and Other stages

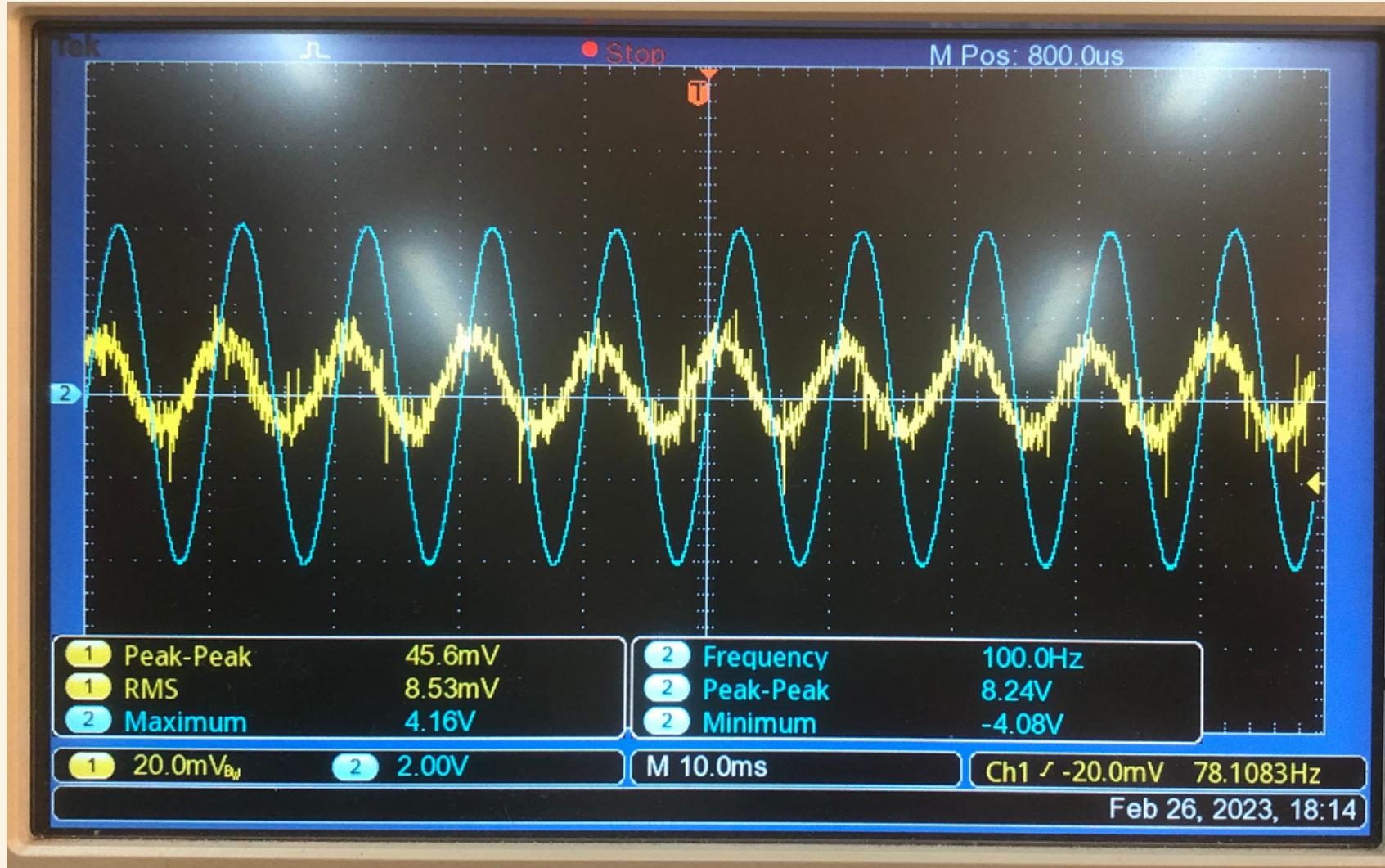
REGULATOR PCB SCHEMATIC

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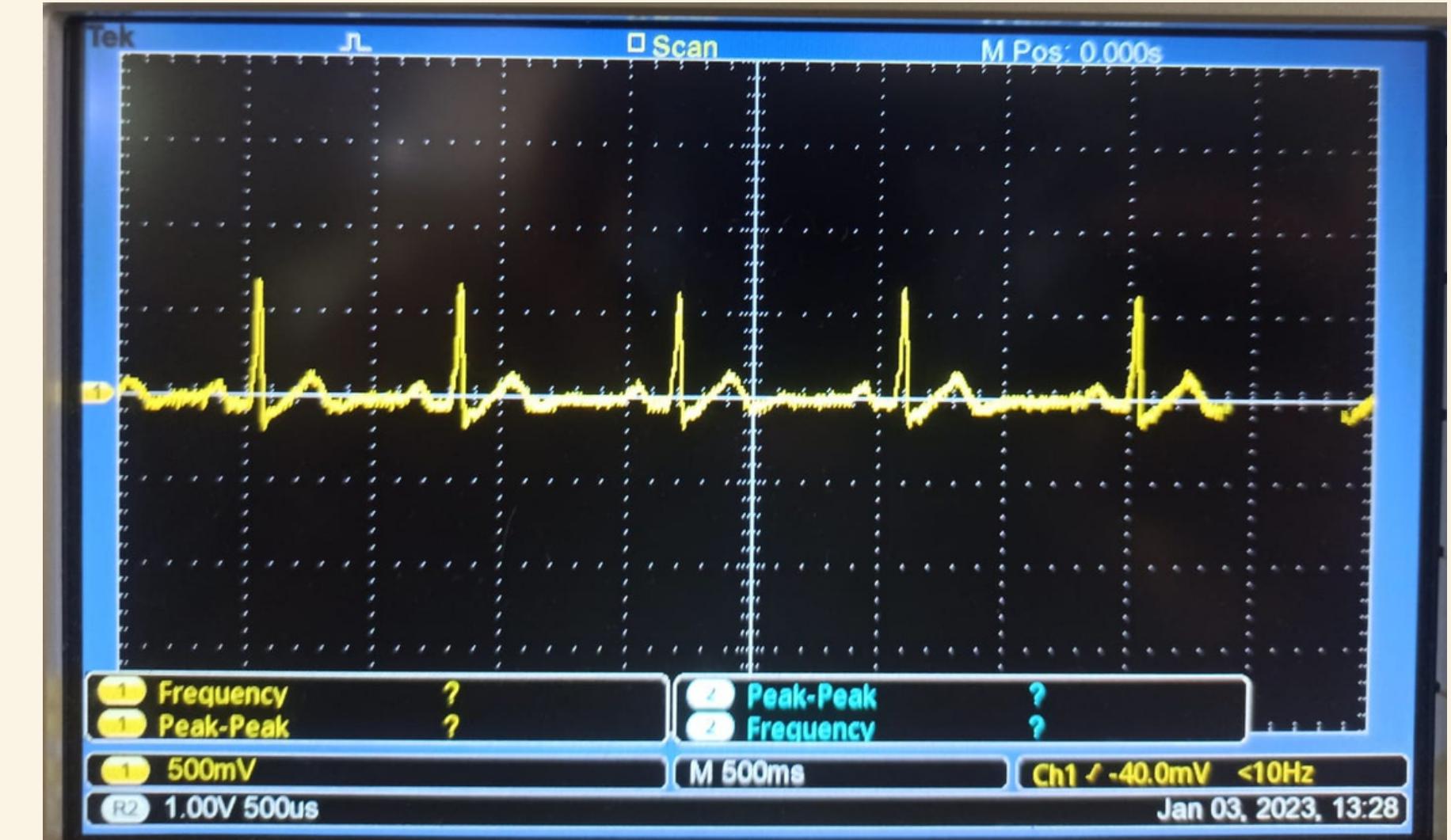


RESULTS

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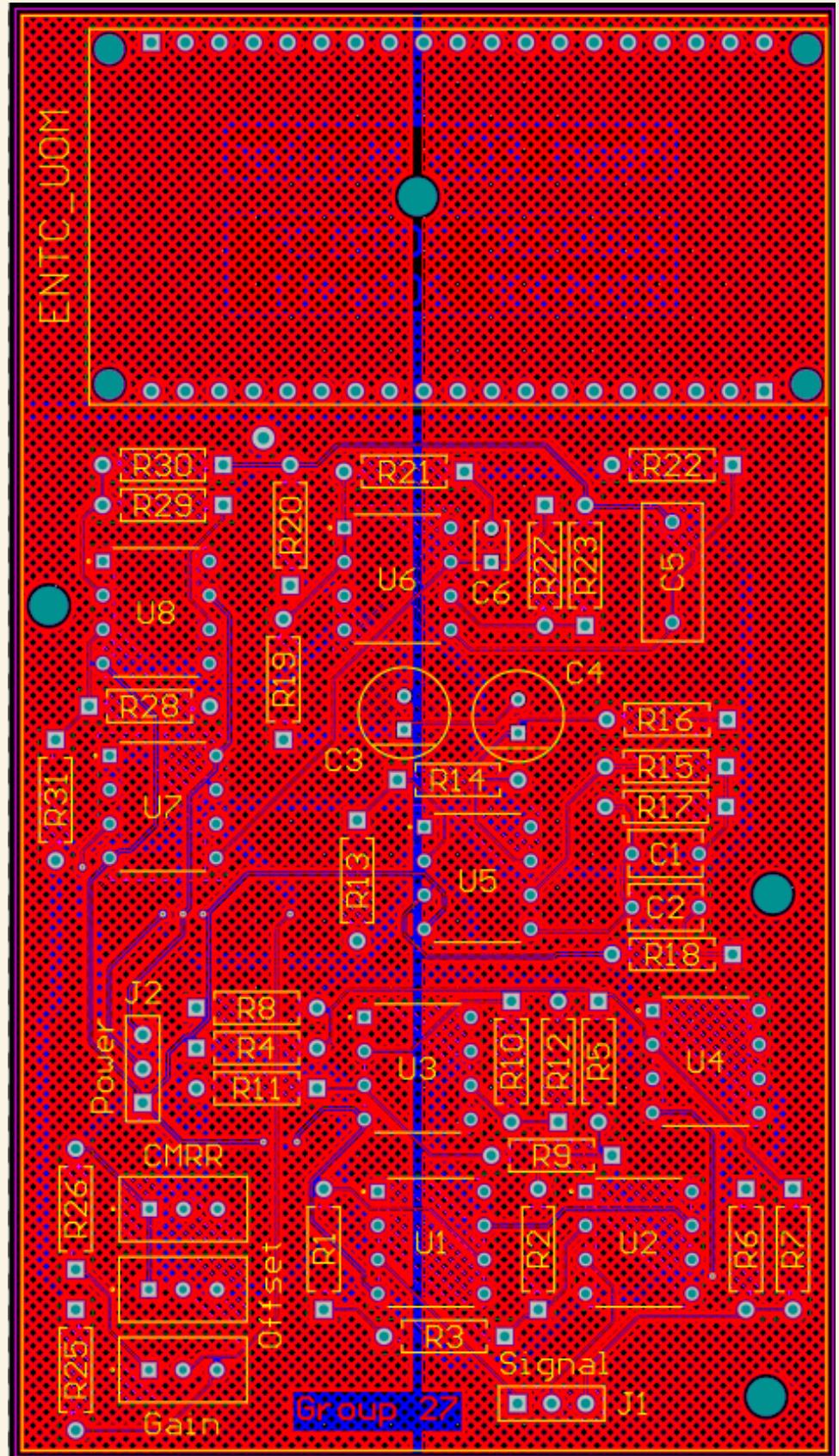


Input Sine wave of Peak-Peak
20mV and frequency 100Hz is
filtered and amplified up to a Sine
wave of 8Vpp

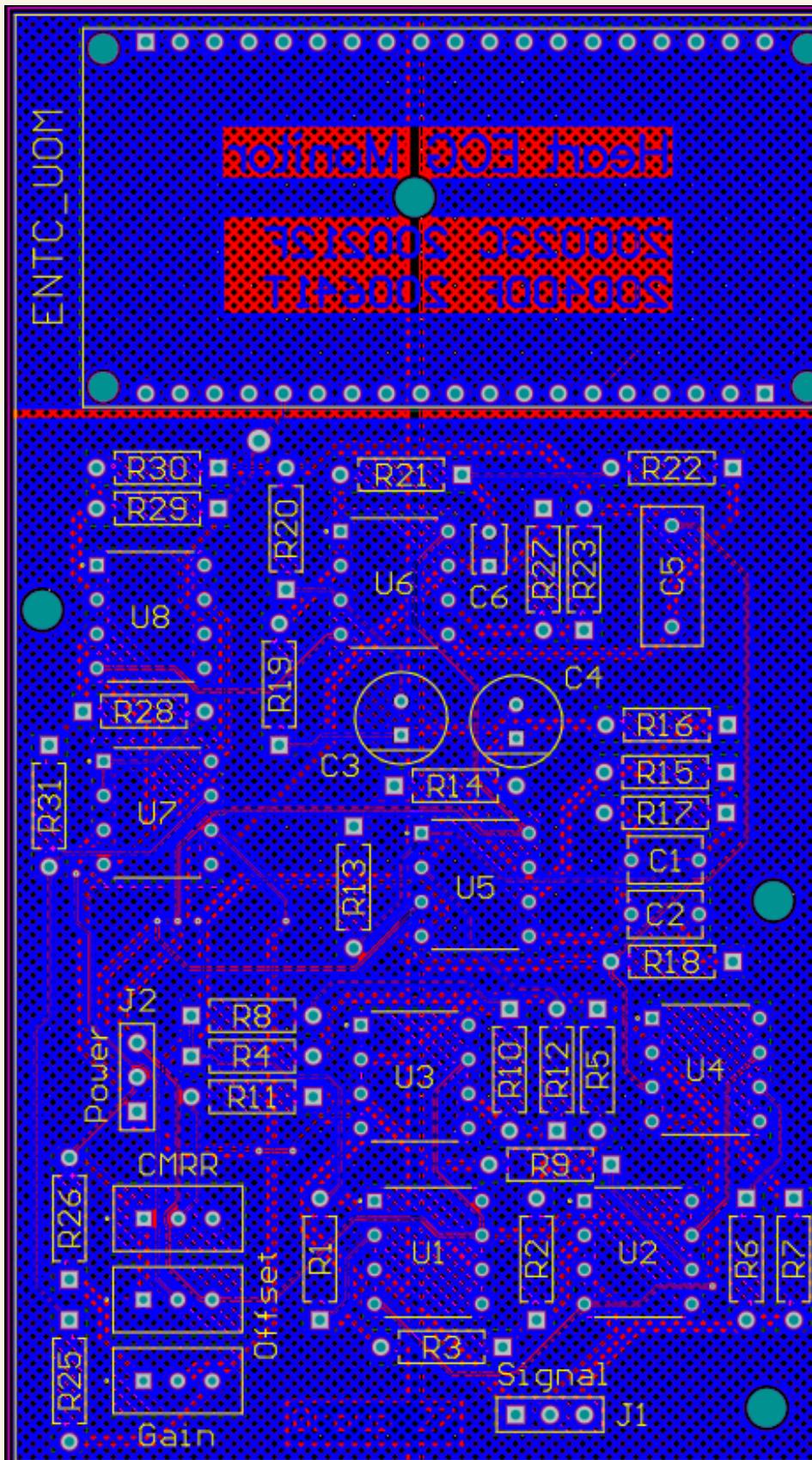


Filtered and Amplified ECG signal

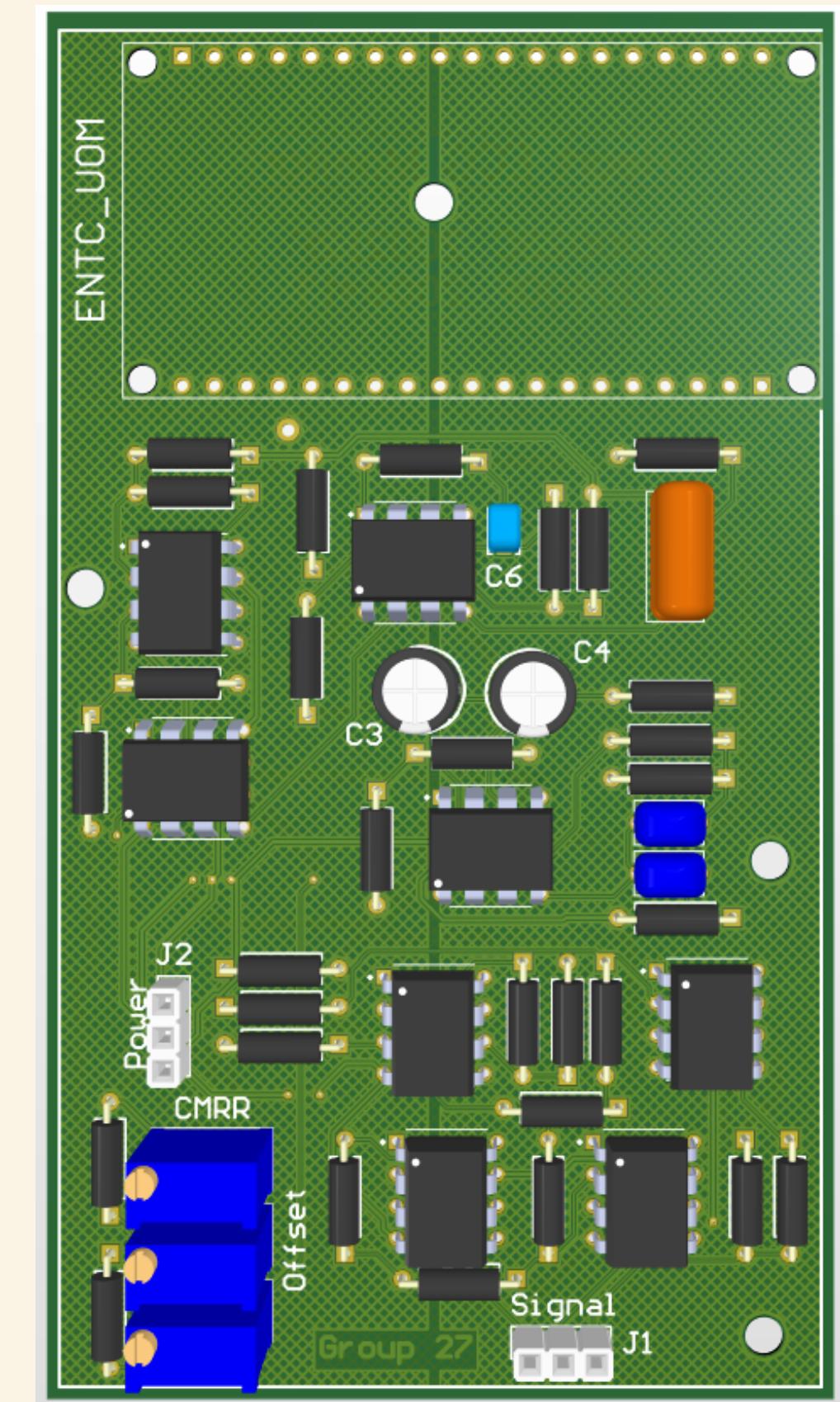
MAIN PCB DESIGN



TOP VIEW



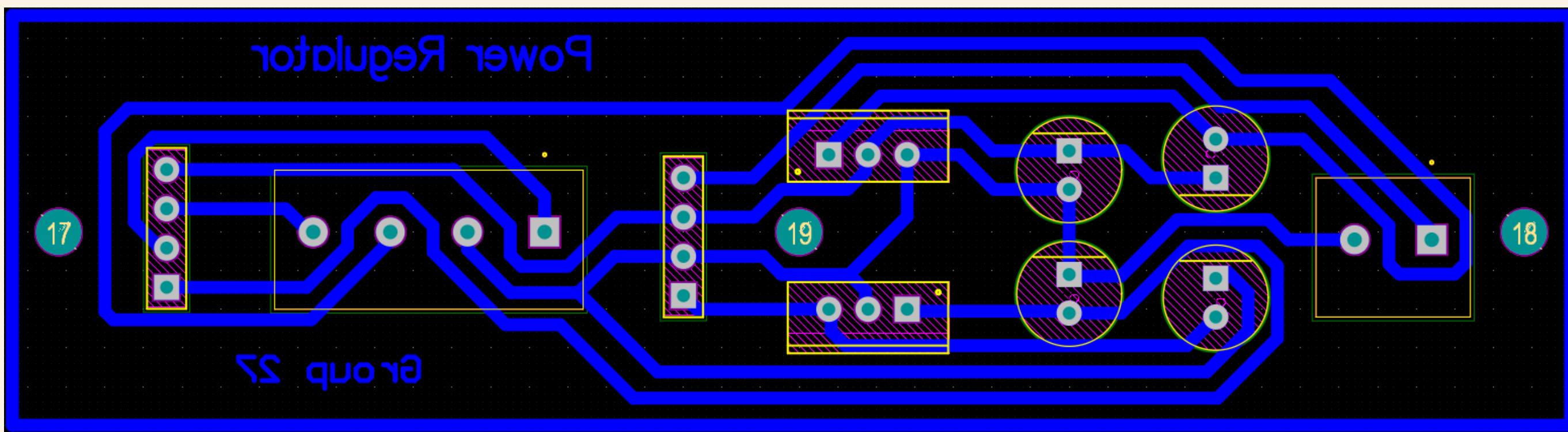
BOTTOM VIEW



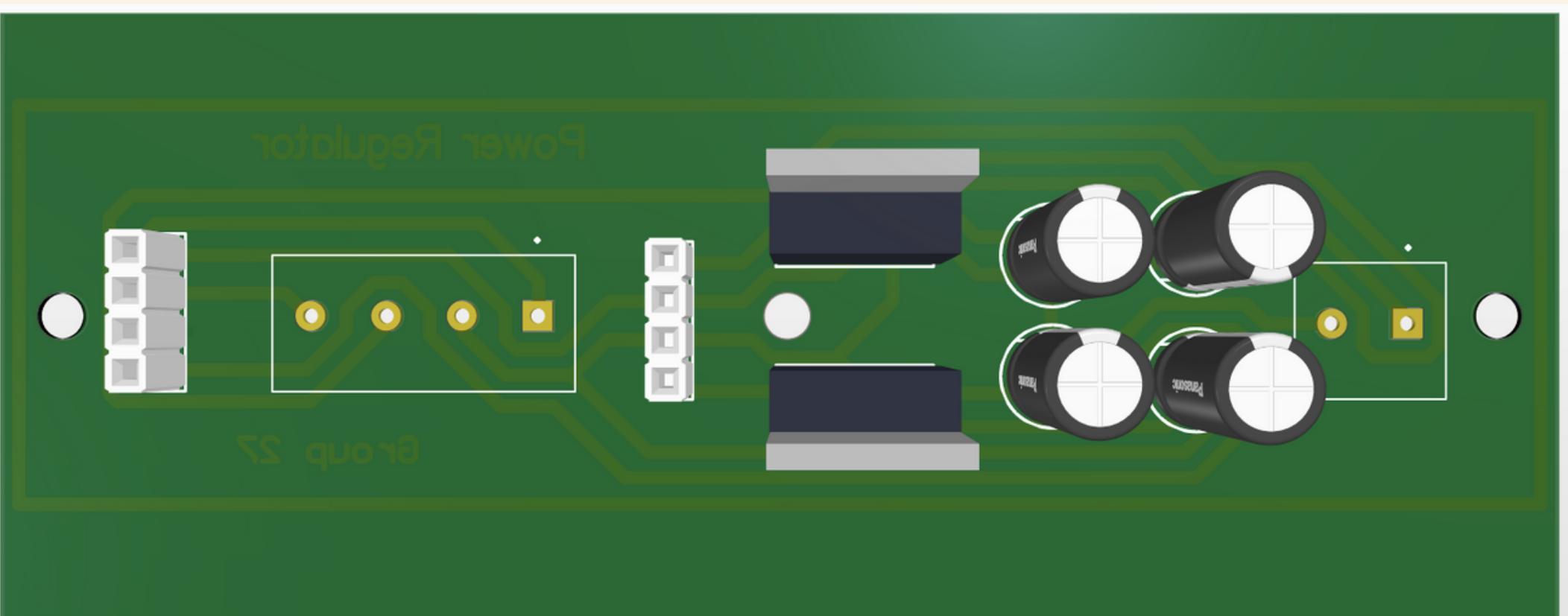
3D VIEW

REGULATOR PCB DESIGN

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BOTTOM VIEW

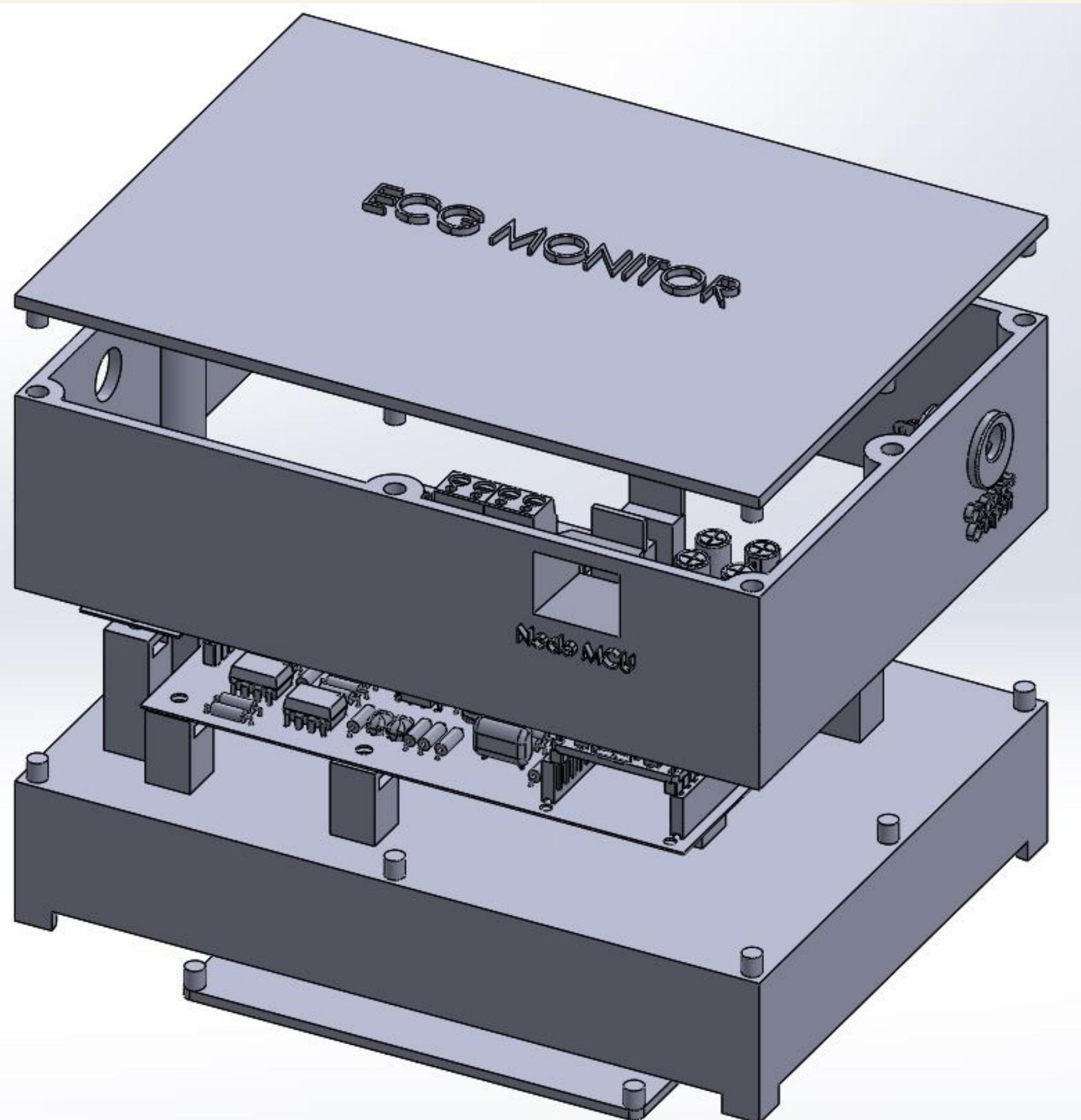


3D VIEW

ENCLOSURE DESIGN

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- MTS-1 series On/Off Toggle Switch
- 3.5mm connector for signal input from the electrodes
- Micro USB output for displaying ECG signal on Serial Monitor
- Output port for Oscilloscope connection
- Battery compartment
- Ventilation holes



FUTURE IMPROVEMENTS

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- Addition of an in-built display
- Reduction of PCB size by the usage of SMD Components
- Developing into an IOT device
- Recharging the device without removal of batteries

THANK YOU

