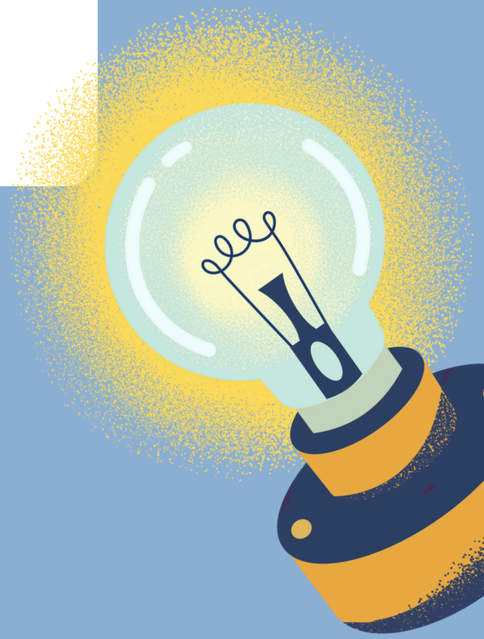
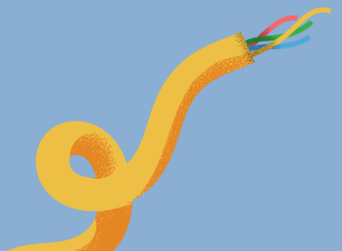
Voltage and Current Smoother for a 9 V battery





Team Spaklers

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Introduction

Even though batteries are a portable and easy power source, they can occasionally provide varying current and voltage because of a number of variables, including ambient influences, load variations, and battery health. In electronic applications, these variations may result in noise, instability, and decreased efficiency. A smoothing circuit is used to reduce voltage fluctuations and steady the voltage in order to solve the problem.

What is a DC Current and Voltage Smoother?

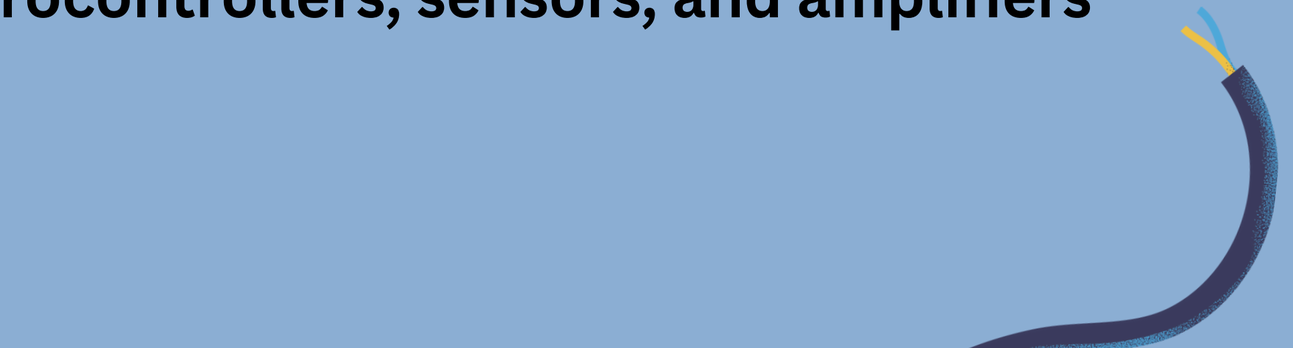
A DC Current and Voltage Smoother is a device designed to stabilize both current and voltage in direct current (DC) circuits. It ensures that the voltage and current delivered to connected components remain constant, even if there are fluctuations in the input power supply.

Why is it Important?

- Ensures stable power delivery to prevent malfunction or damage.
- Reduces noise in systems like audio or analog circuits.

Key Applications:

- Battery-operated devices
- Sensitive electronics like microcontrollers, sensors, and amplifiers



Our Specifications

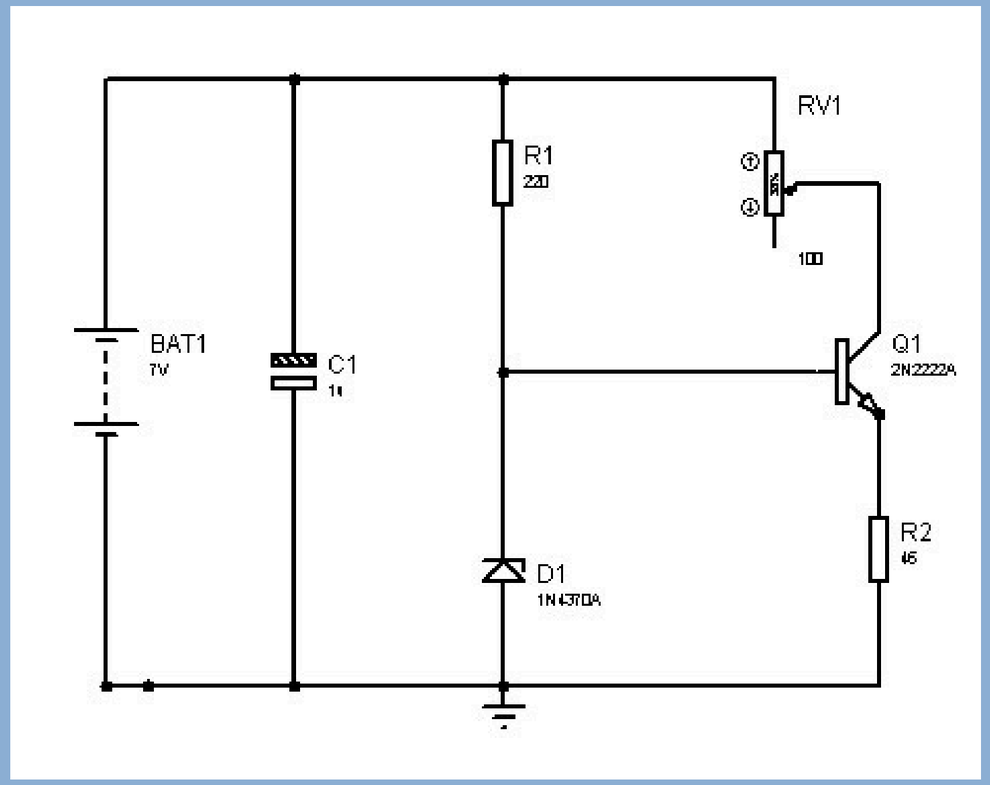
Current Smoother

- Input Voltage : 9v - 7V
- Output Current : 50mA - 53 mA
- Load Resistance : 0-75ohm

Voltage Smoother

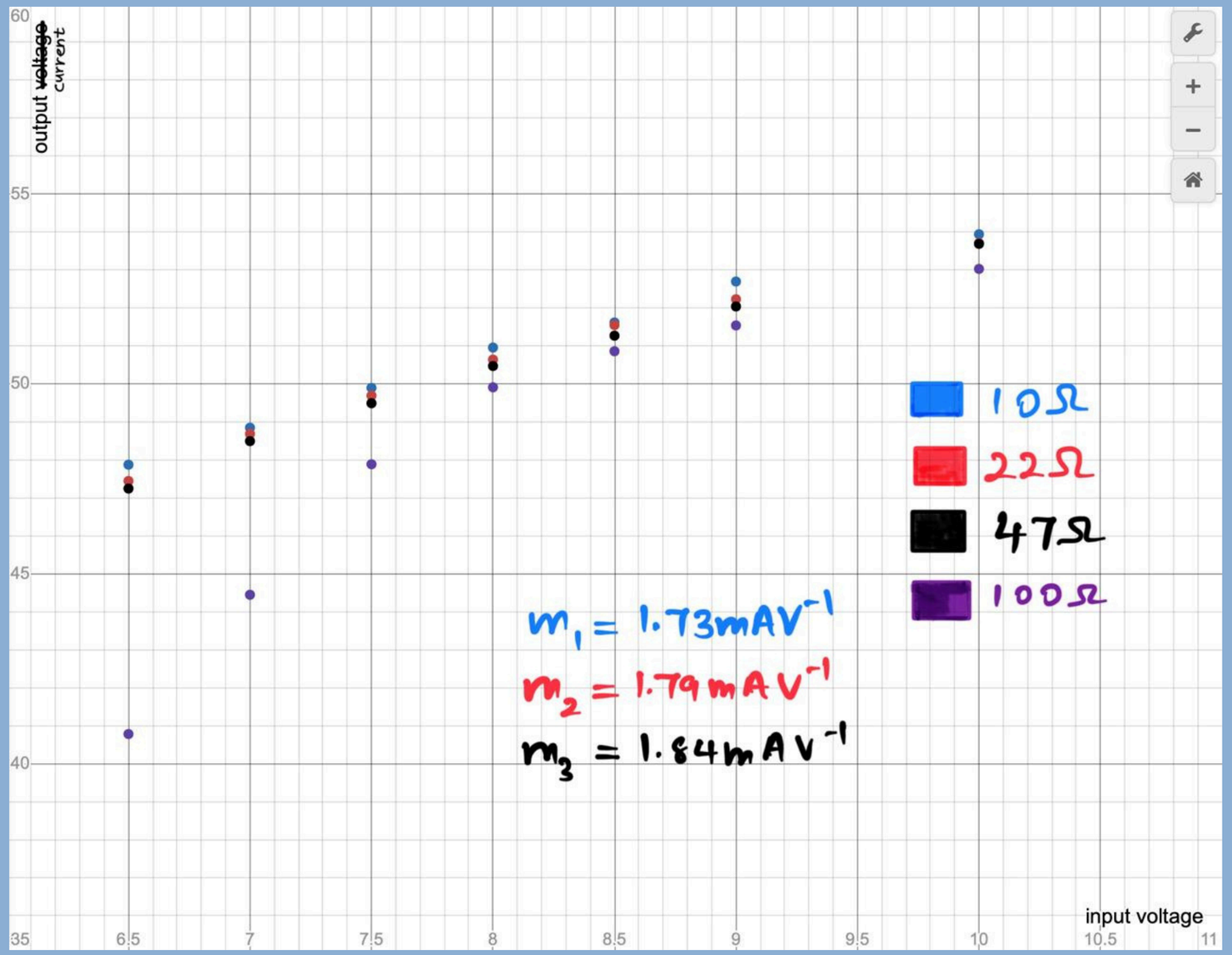
- Input Voltage : 9v - 7V
- Output Voltage : 7V
- Min Load Resistance : 470ohm

Current Smoother

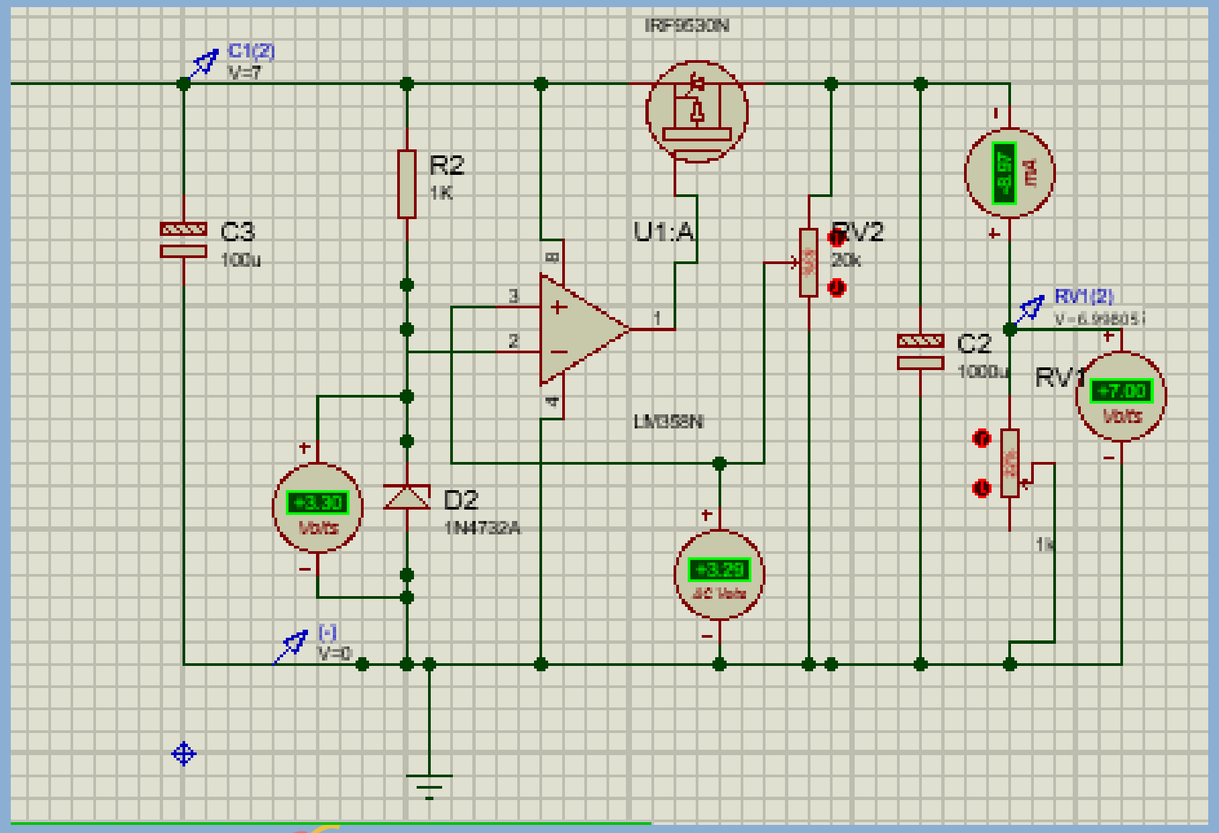


- A constant VE is Given by zenor diode.
- Hence the Ib becomes Constant
- As Ib is constant, the collector current (IC) also remains constant.
- The transistor (Q1) maintains a steady current through the resistor (R2).
- The potentiometer (RV1) is used to demonstrate variable Load Resistance

Testing


output ~~voltage~~ current
60
55
50
45
40
35
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
input voltage
10Ω
22Ω
47Ω
100Ω
$m_1 = 1.73 mAV^{-1}$
$m_2 = 1.79 mAV^{-1}$
$m_3 = 1.84 mAV^{-1}$

Voltage Smoother



Error Amplifier:

- Compares a fraction of the output voltage (via a resistor divider network) to a reference voltage(Zener Voltage).
- Produces an error signal that adjusts the gate voltage of the PMOS to regulate the output voltage.

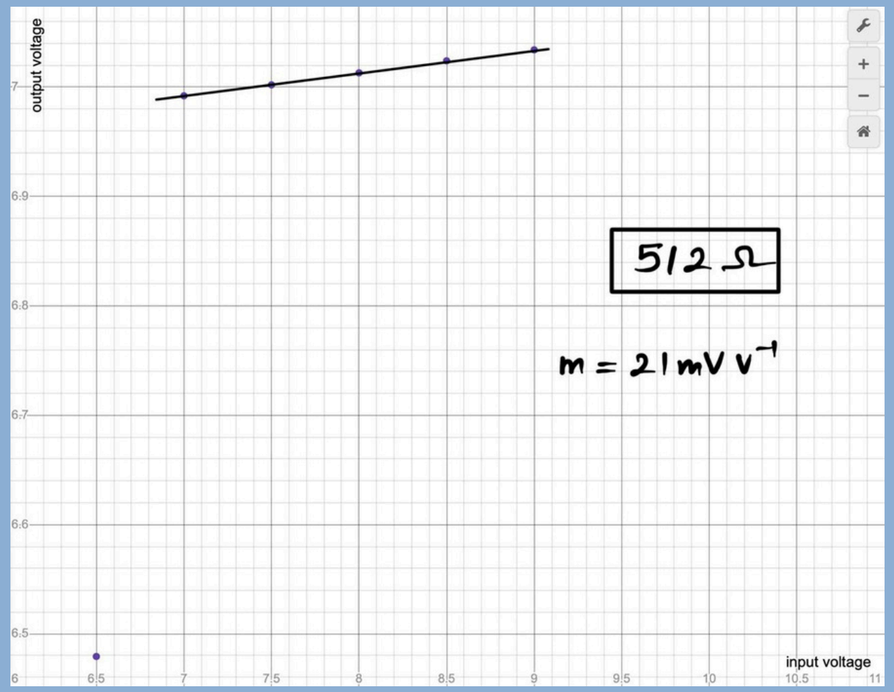
PMOS Pass Element:

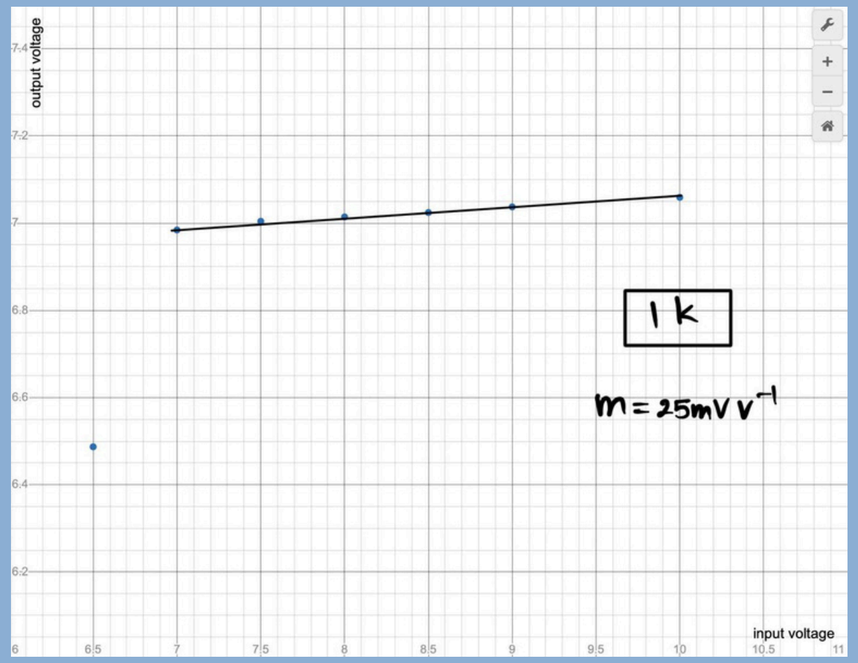
- Acts as the main regulating component, controlling the flow of current from VIN to VOUT.
- The PMOS transistor operates in the linear region to regulate voltage.
- Since a PMOS transistor is used, the dropout voltage (difference between VIN and VOUT)

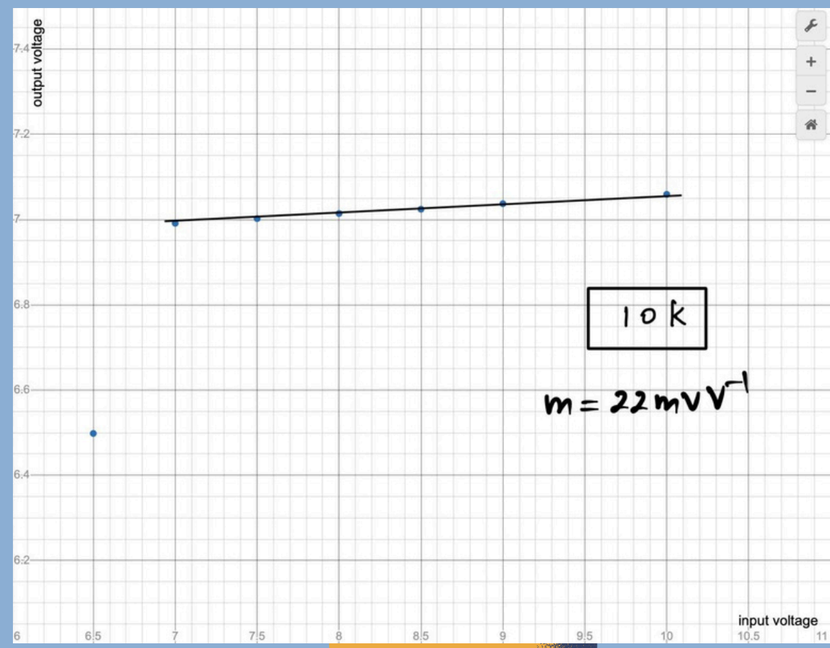
Stability:

- The circuit may include capacitors (not shown in this basic diagram) for stability, ensuring that the output voltage is smooth and free from oscillations.

Testing

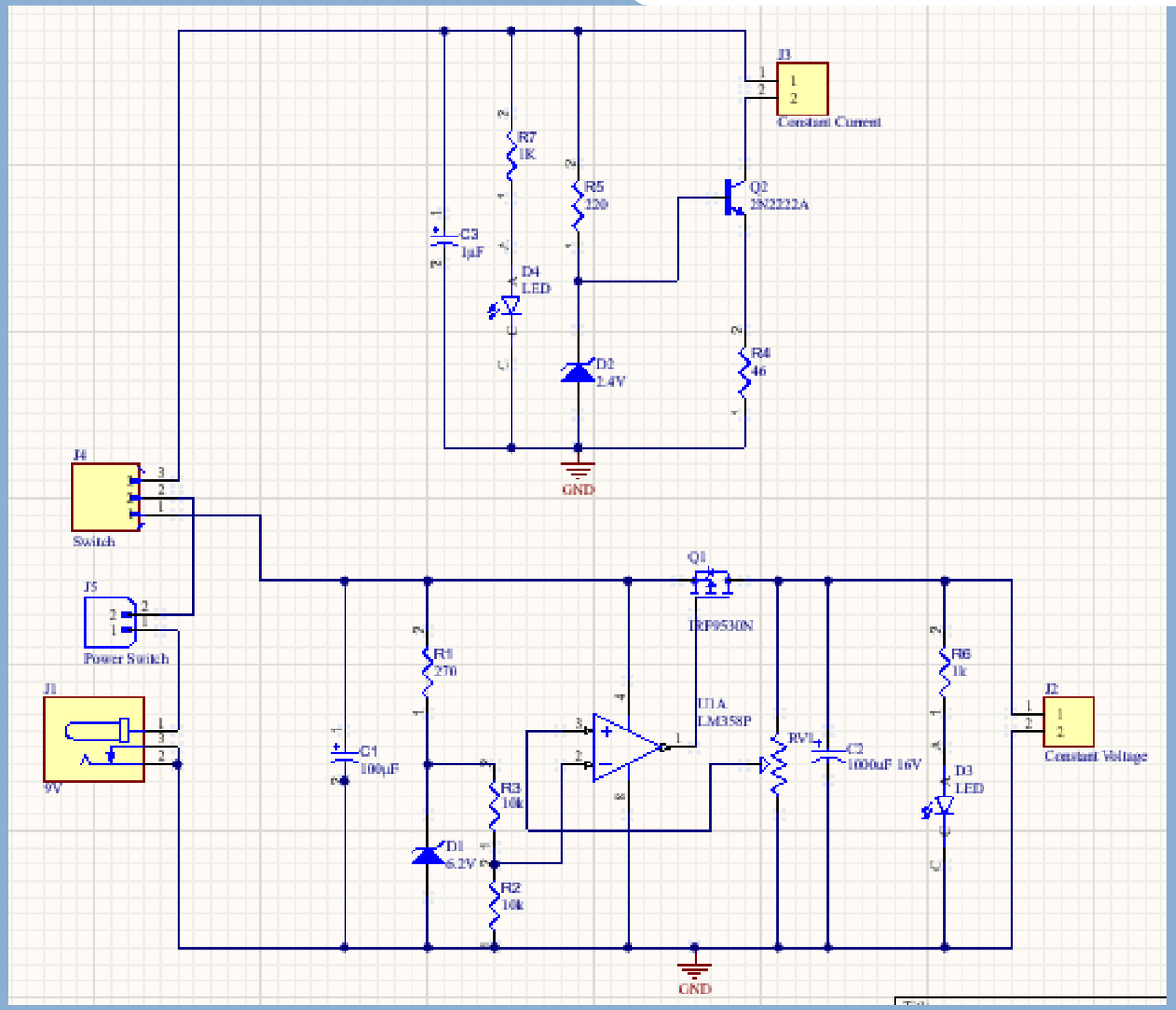

output voltage
input voltage
512 Ω
m = 21mV V⁻¹

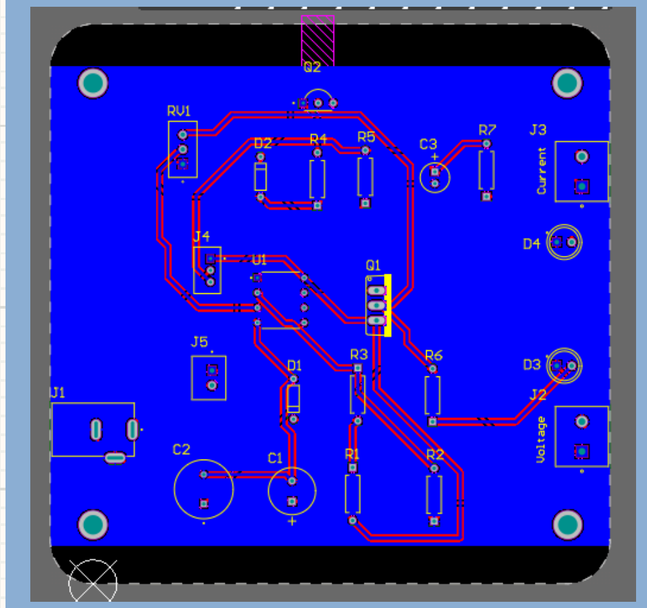

output voltage
input voltage
1k
m = 25mV V⁻¹

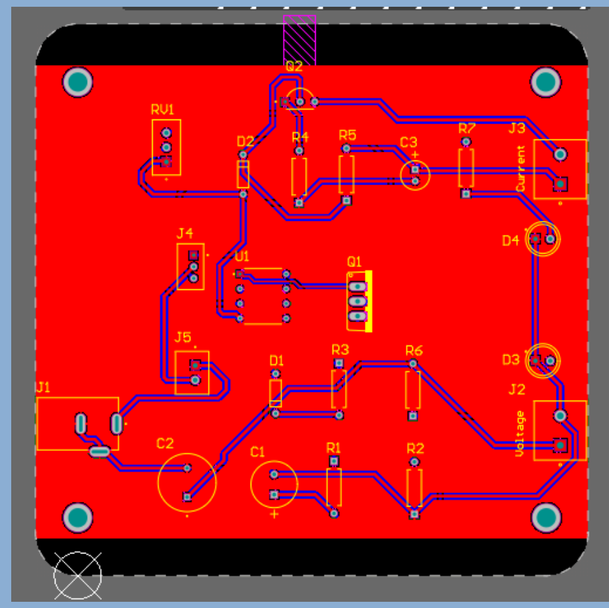

output voltage
input voltage
10k
m = 22mV V⁻¹

- IFN9530N MOSFET - low dropout voltage , Good for low-voltage operation
- LM358N op-amp - Single Supply: 3V to 32V , Draws 0.5 mA per amplifier, which is relatively low. Inexpensive and widely available but noise is relatively high. 50 µV/V - PSRR , 70 dB -CMRR , input offset voltage 2 mV
- 2N2222A Transistor - Can handle up to 800 mA , Vce(sat) is low 2N2222 (NPN) or BC547 (NPN) for low current; TIP31 (NPN) or TIP32 (PNP) for higher current.

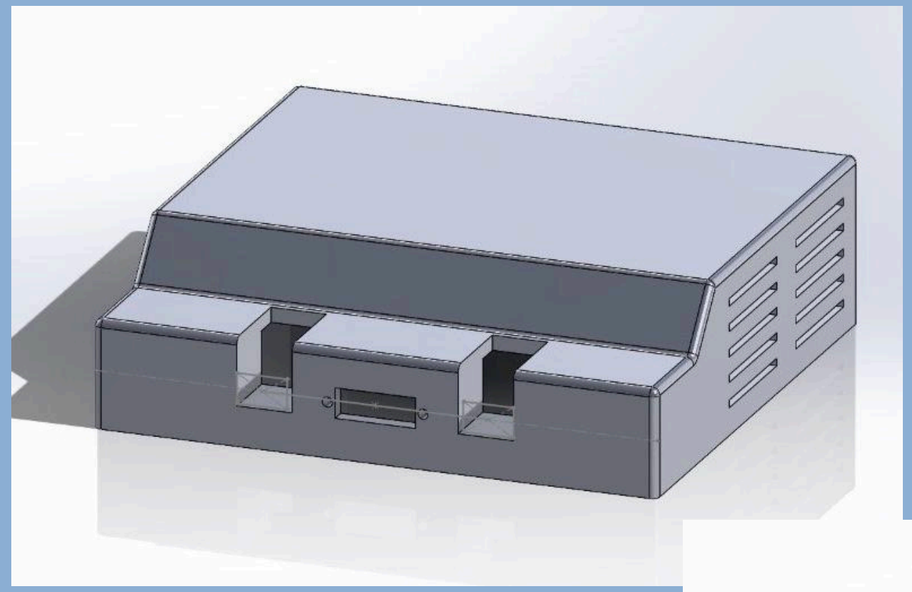
PCB design

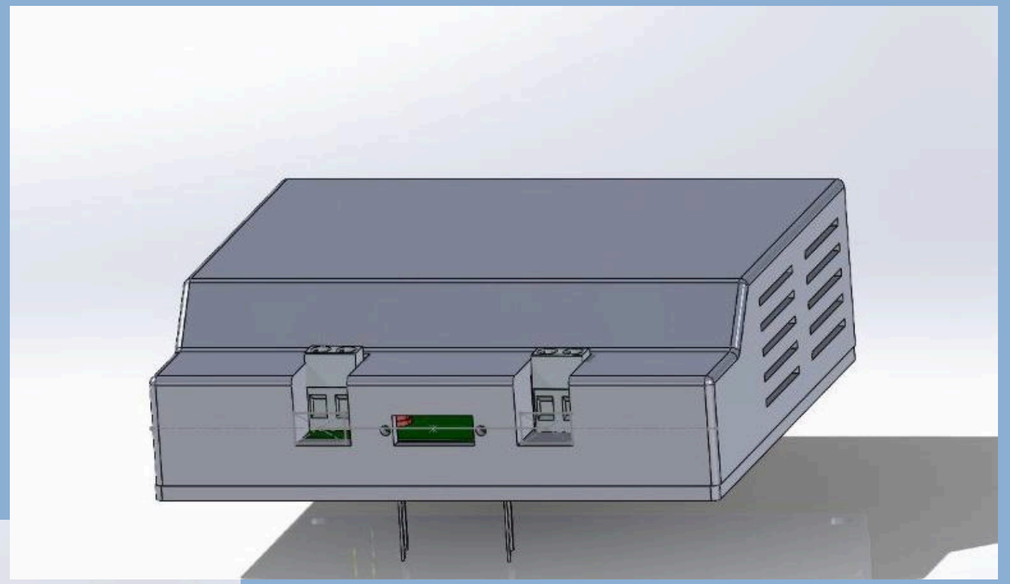

J3
Constant Current
R7
1K
R5
120
Q2
2N2222A
C3
1µF
D4
LED
D2
2.4V
R4
46
GND
J4
Switch
J5
Power Switch
J1
9V
Q1
IRF9530N
R1
270
U1A
LM358P
C1
100µF
R3
10k
D1
5.2V
R2
10k
RV1
C2
1000uF 16V
R6
1k
D3
LED
J2
Constant Voltage
GND

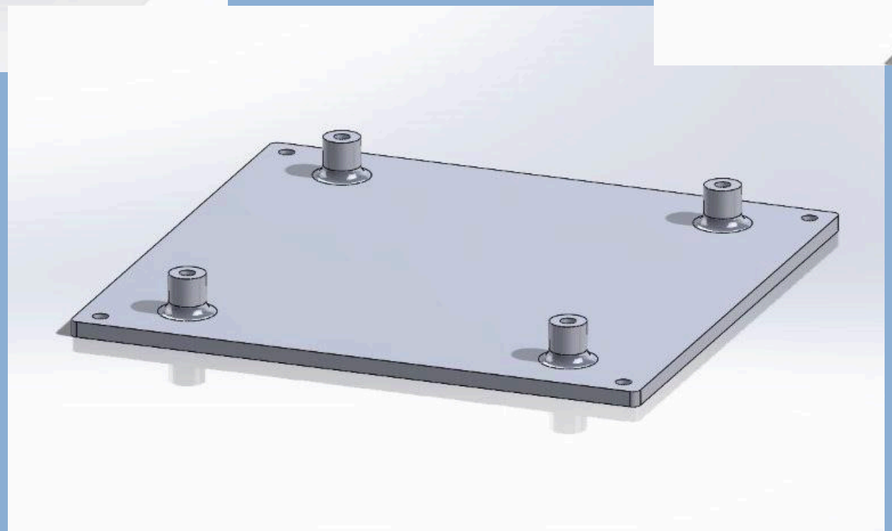

RV1
D2
R4
R5
C3
R7
J3
Current
J4
U1
Q1
D4
J5
D1
R3
R6
D3
J1
J2
C2
C1
R1
R2
Voltage


RV1
D2
R4
R5
C3
R7
J3
Current
J4
U1
Q1
D4
J5
D1
R3
R6
D3
J1
J2
C2
C1
R1
R2
Voltage

Enclosure design







Task Allocation

Ilukkumbura IMEIB - Constant voltage circuit design and simulation.
Priyanjana TPIM - PCB design and circuit testing
Aashir MRM - Constant current circuit design and simulation
Basith MNA - Encloser design and circuit testing

Q and A

Thank You