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DATA PRIVACY

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CAR BATTERY CHARGER

UNDER SUPERVISION OF:

DR / ELTAIB ABDEEN

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PROJECT OVERVIEW

Making a device using the Boost converter to charge the car battery

PROJECT GOAL

GOALS

Using the Boost converter to raise the voltage from 5V input source,
i.e. DC Adapter
to a voltage suitable for charging a car battery

CAR BATTERY

First of all, we need to know some information about the car battery

1.

Voltage of the battery

We found that the batteries needs from 12V to 14.4V for recharging

2.

The current of the battery

Most of car battery chargers provide from 8A to 10A output current to the battery, as shown.

SO WE CAN SAY THAT

Vin =5 V **Vo =14.4 V** **Io=10 A**

→ **Rl = Vo/Io = 1.44 Ω**

Notice that, we assume that the voltage is 14.4V and the current is 10A to take the losses in consideration.

Some important assumptions:

$\Delta I_L = 30\% I_L$ **$\Delta Vo = 1\% Vo$**

→ **Switching frequency = 100KHz**

Which is suitable for most of the components

CALCULATIONS

- **For boost converter**

$V_o/V_{in} = 1/(1-D)$ → $D = 0.653$ (in percentage = 65.3 %)

$\Delta V_o = (V_o * D)/R_o * C * F_s$ → $C = 453\ uF$

take the standard value = 470uF

$\Delta I_L = (V_{in} * D)/(L * F_s)$ → $L = 3.77\ uH$

take the standard value = 3.3 uH

COMPENENTS USED

Element	Value
Inductor	3.3 uH
Capacitor	470 uF
Resistor	1.44 Ω

- **MOSFET**

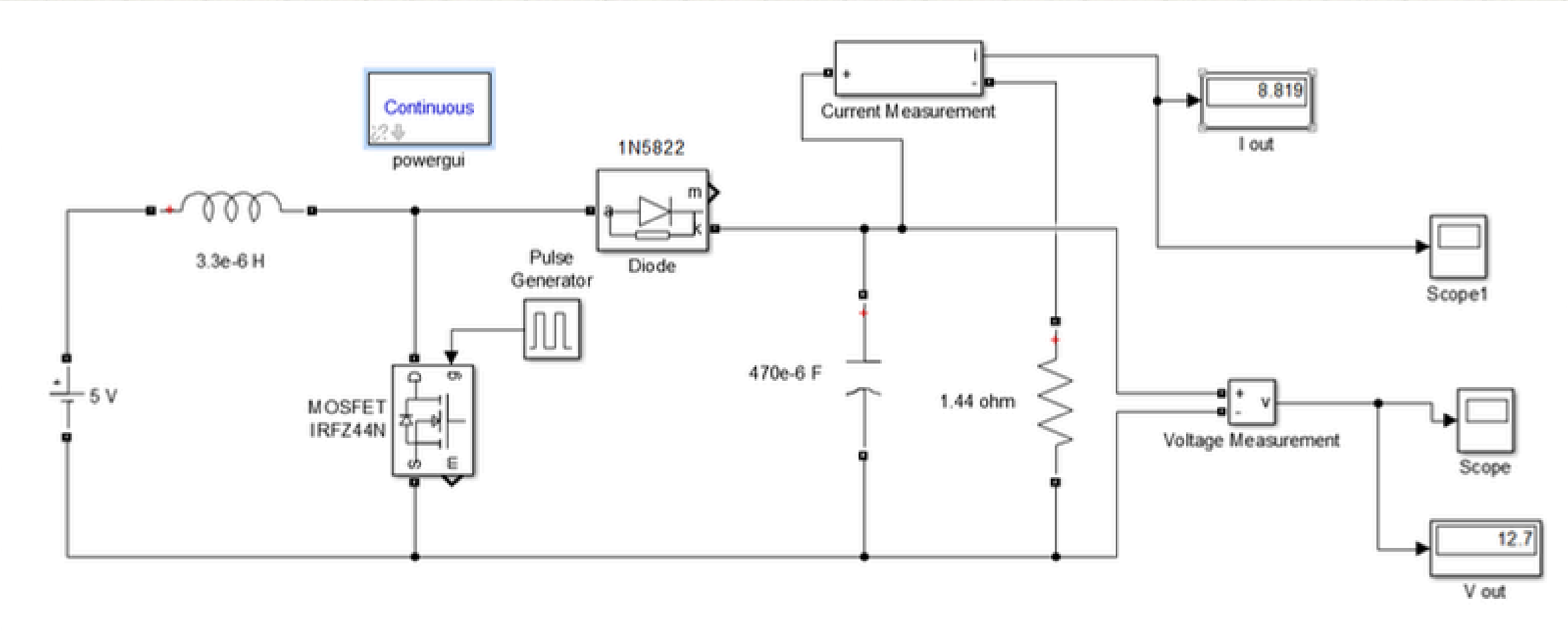
We used the IRFZAAN MOSFET for:
(1) It`s maximum drain current Id = 50 A
(2) It has Rds(on) = 0.0175 Ω

- **Diode**

We used the IN5822 Diode Bec, its I_{fsm} = 80 A, in duration = 8.3 ms

$$\rightarrow \frac{1}{Fs} = \frac{1}{100KHz} = 10^{-5}s < 8.3ms$$

SIMULATION RESULT

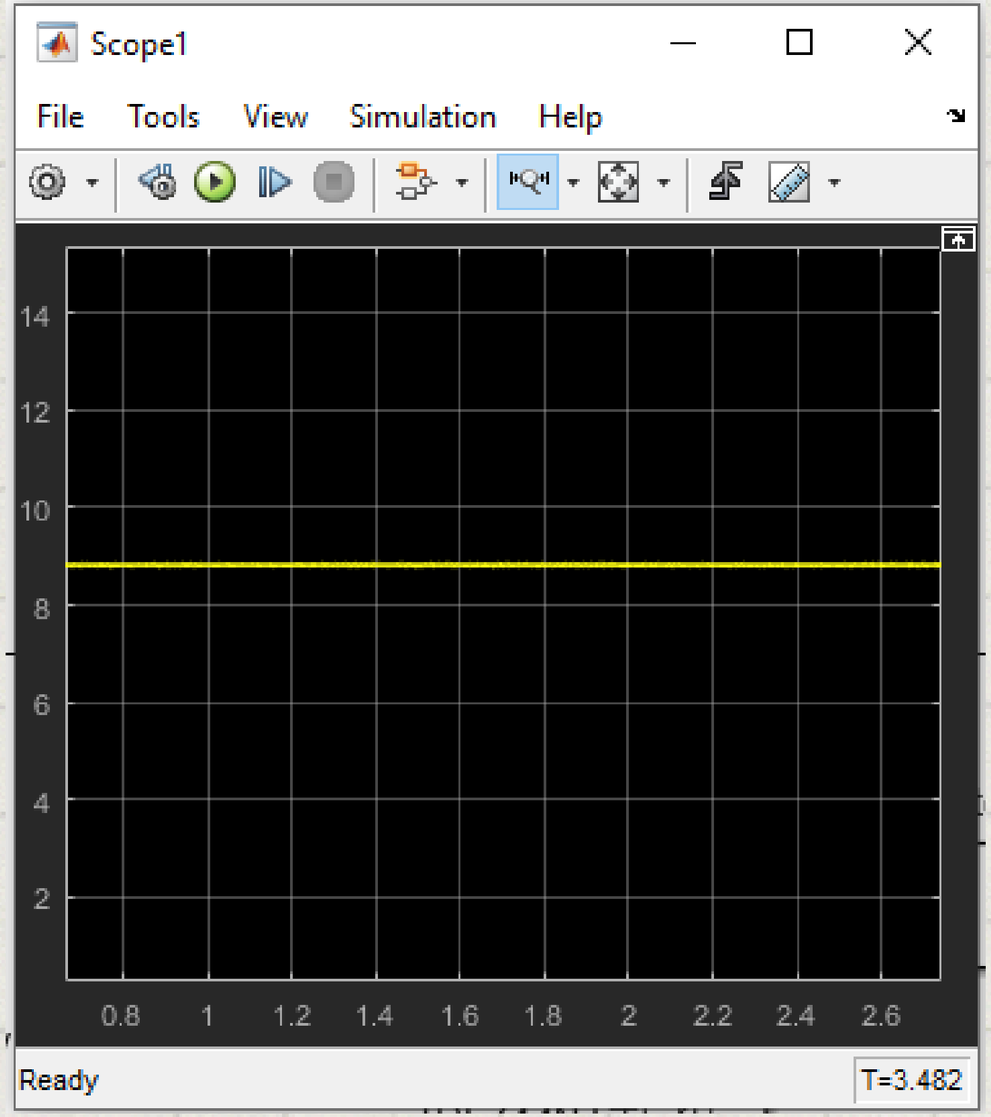


Vo = 12.7 V ✓

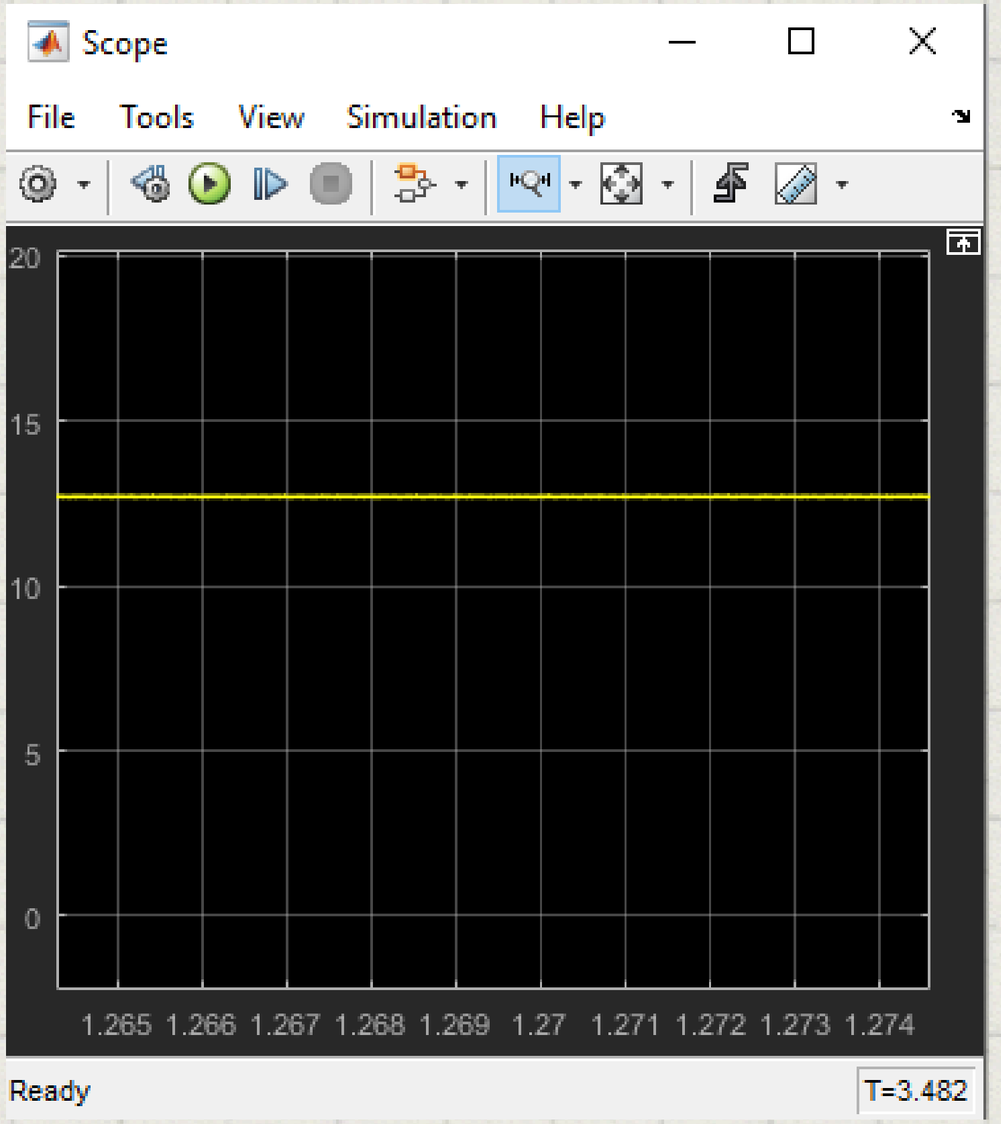
Io = 8.819 A ✓

} ***Acceptable values***

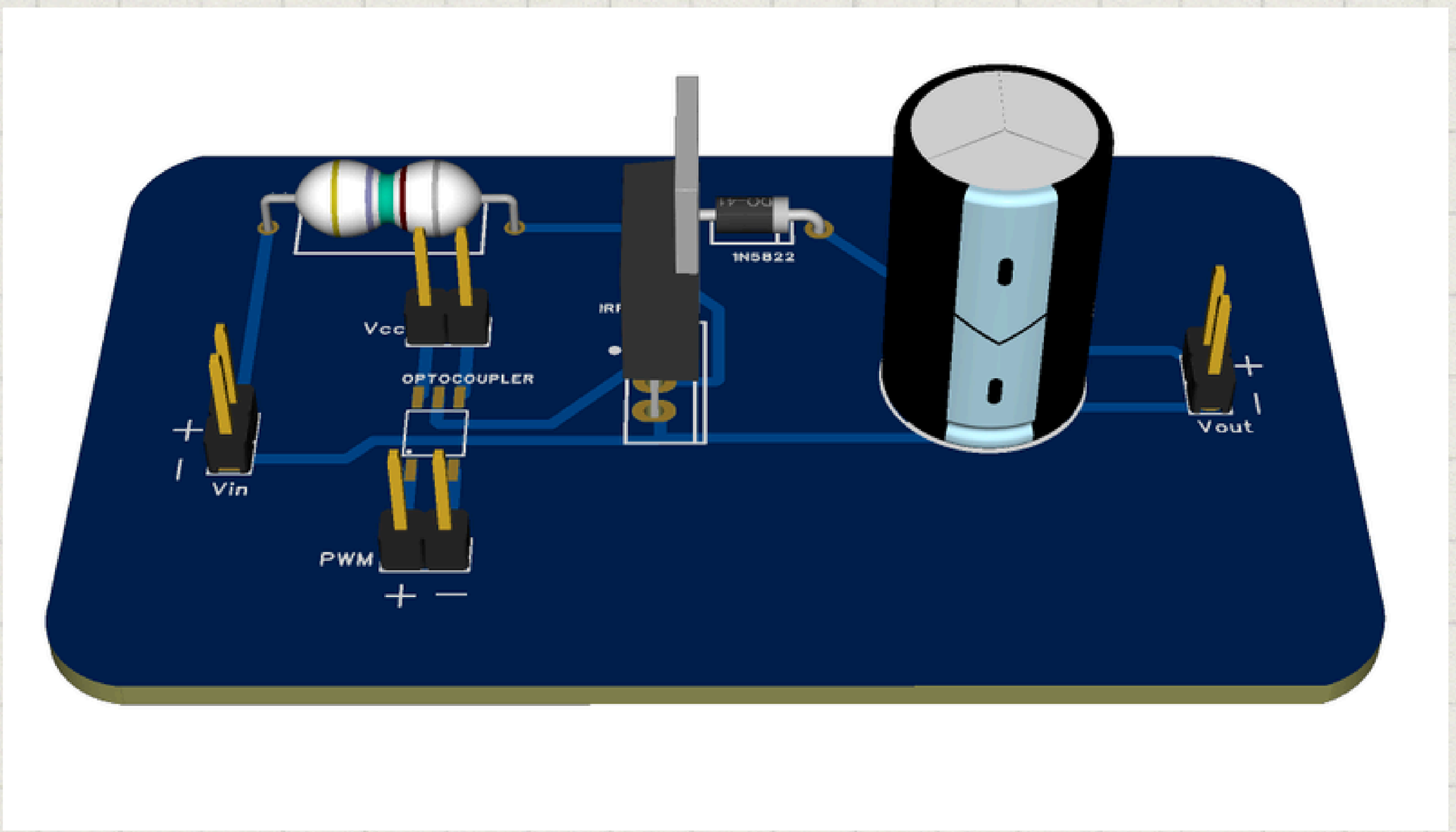
OUTPUT CURRENT WAVEFORM



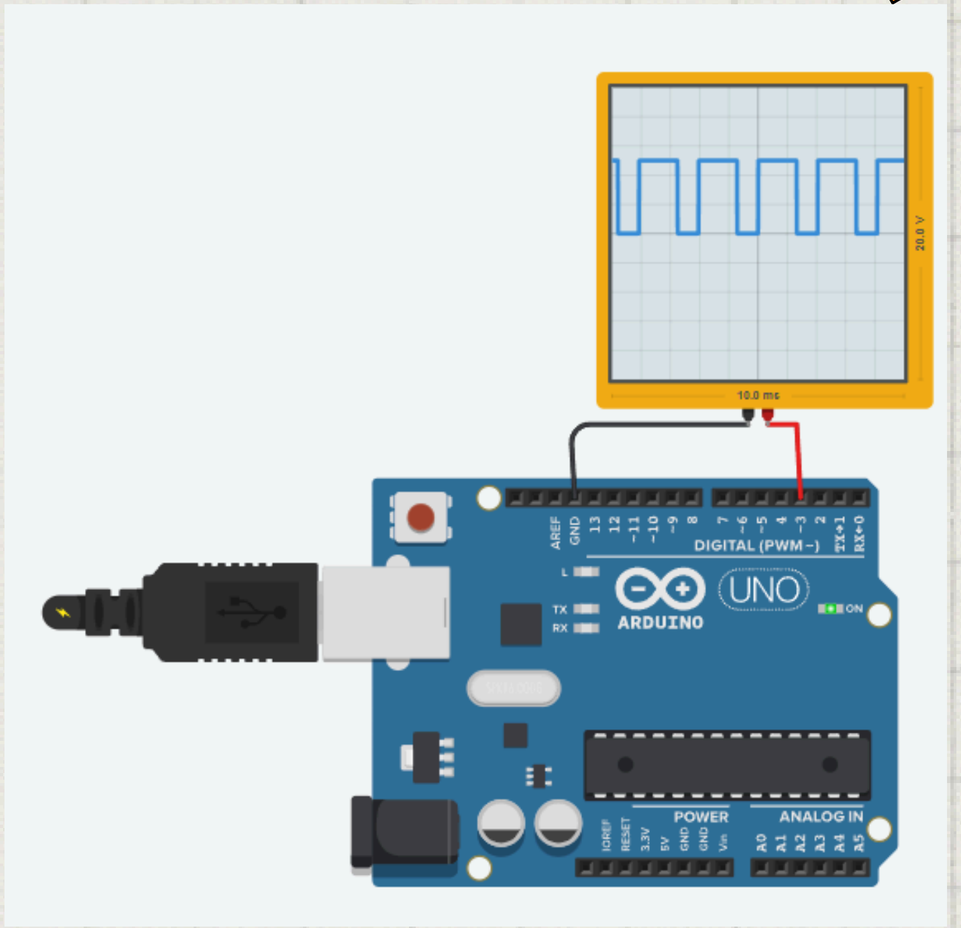
OUTPUT VOLTAGE WAVEFORM



PCB DESIGN



ARDUINO CODE




```
3  void setup()
4  {
5    pinMode(3, OUTPUT);
6  }
7
8  void loop()
9  {
10  analogWrite(3,0.653*255);
11   while (true);
12 }
```

OBTAINING A POWER SUPPLY BY USING THE SAME CIRCUIT

- We can obtain a power supply by using the output voltage of the previous as an input to another circuit.
- The new circuit provides me two output ports
  one of them is a constant DC voltage equals to the input voltage “12.7 V” and the other is a DC voltage can be adjusted by a variable resistance from 1.2 V to approximately equal the input voltage “12.7 in this case”.

CALCULATIONS

$Vo = 12.5(1+(R` / R2))$

$Vo=12.7\ V$

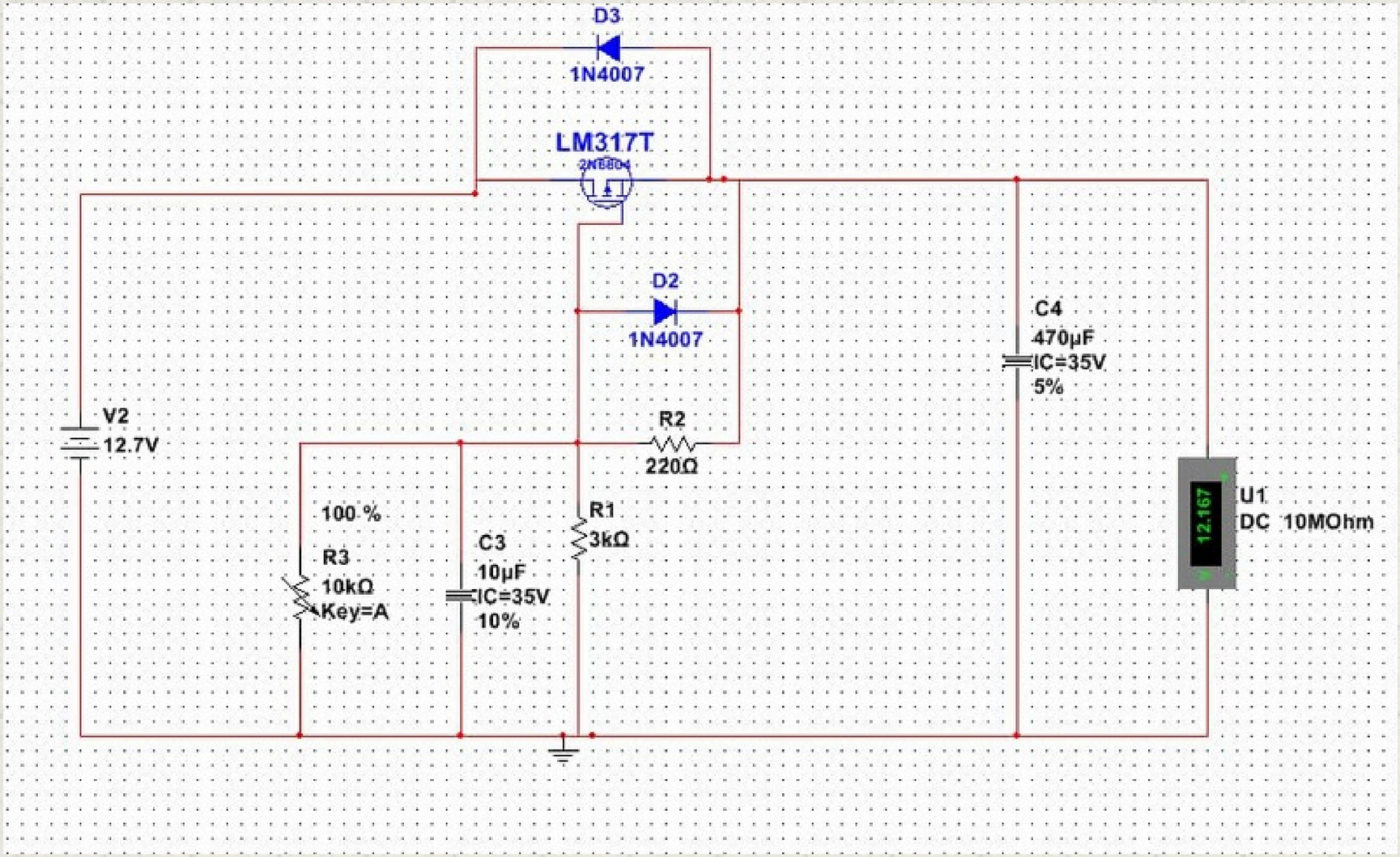
assume $R=220\ K\Omega$

$12.7 = 1.25\ (1 + (R`/220K\Omega) )$ ⟿ $R` = 2.015\ K\Omega$

$R` = R1\ //\ R2$

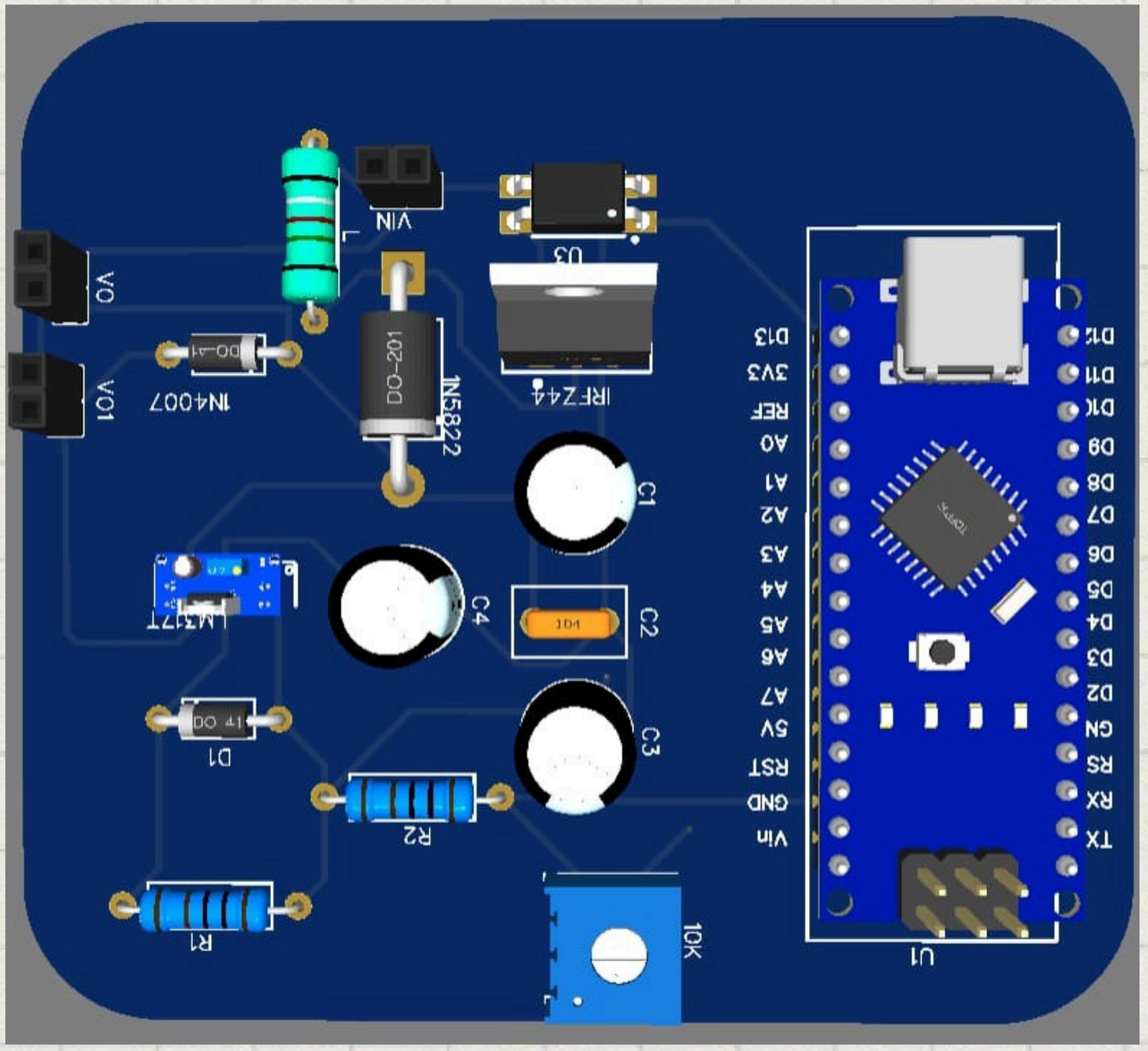
assume $R1 = 3K\Omega$ ⟿ $R3 = 10\ K\Omega$

SIMULATION RESULT



Vo = 12.167 V ✓

PCB DESIGN


VIN
L
VO
VO1
IN4007
DO-41
DO-201
IN5822
Q3
IRFZ44
C1
C4
C2
C3
LM317T
D1
R2
R1
10K
U1
Vin
GND
RST
5V
A7
A6
A5
A4
A3
A2
A1
A0
REF
3V3
D13
TX
RX
RS
GN
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12

THANK YOU!