جامعة بيرزيت

BIRZEIT UNIVERSITY

**Faculty of Engineering & Technology**
**Department of Electrical & Computer Engineering**
**ENEE2103-Circuit And Electronics Laboratory**
**PreLab#6**

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**Section:**
Sec1

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**Date:**
22/3/2024

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## 1. DIODE CHARACTERISTICS

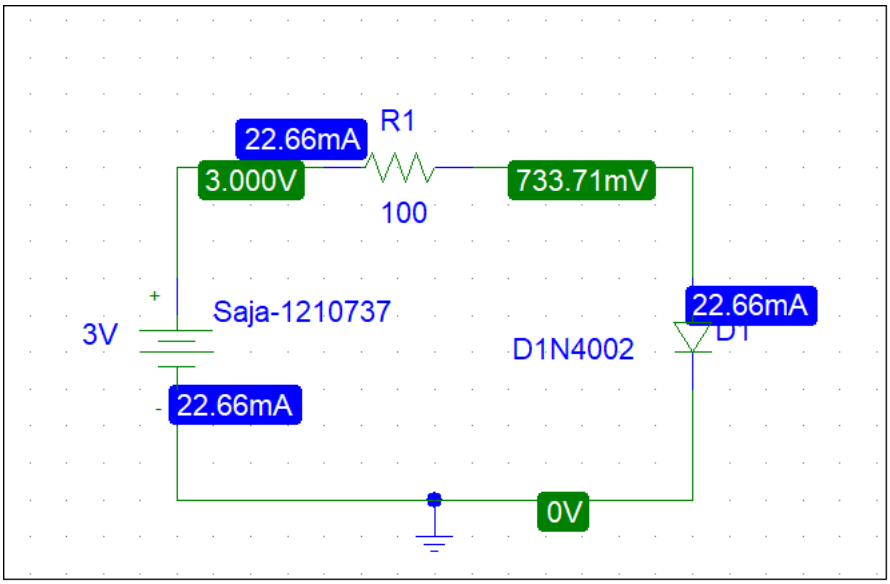


**Figure1 : Diode characteristics**

I changed the value of VDC according to table1 and fill the result.
As shown in figure1 the value of $V_D$ is automatically found by the PSpice but the value of $V_R$ it will found by the KVL →$-V_s+V_R+V_D=0$→$V_R=V_s-V_D$

**Table 1:Diode characersitics table**

| $V_s$ | $V_R$ | $V_D$ | $I_D$ |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0.1 | 0.01mv | 99.99mv | 85.47nA |
| 0.2 | 0.07mv | 199.93mv | 684.15nA |
| 0.3 | 0.48mv | 299.52mv | 4.844uA |
| 0.4 | 3.23mv | 396.77mv | 32.27uA |
| 0.5 | 17.26mv | 482.74mv | 172.58uA |
| 0.6 | 56.46mv | 543.54mv | 564.59uA |
| 0.7 | 118.44mv | 581.56mv | 1.184mA |
| 0.8 | 193.28mv | 606.72mv | 1.933mA |
| 0.9 | 275.14mv | 624.86mv | 2.751mA |
| 1 | 361.16mv | 638.84mv | 3.612mA |
| 1.5 | 0.819v | 681.00mv | 8.190mA |
| 2 | 1.29532v | 704.68mv | 12.95mA |
| 2.5 | 1.77888v | 721.12mv | 17.79mA |
| 3 | 2.26629v | 733.71mv | 22.66mA |

If we reverse the diode and repeat the simulation:

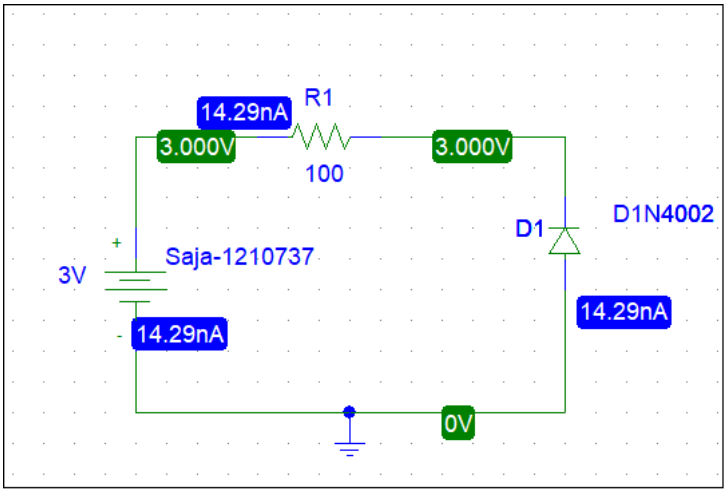


**Figure 2: Diode charactristics when diode reverse**

→I note from the previous two circuits that the diode that has two terminals anode and cathode only passes current when the voltage on the anode is higher than the voltage of the cathode. When it was forward(the anode is on the side of the positive terminal of the voltage source) it worked as a voltage source as shown in table1, however when it was reversed on any value of the applied voltage source the current was always very close to zero and the voltage on the diode was the same as the input voltage, so it was obvious that diode acted like an open circuit where the voltage on the resistor was also very close to zero as shown in figure2.

## 2. RECTIFICATION .

### 2.1 HALF - WAVE RECTIFICATION.

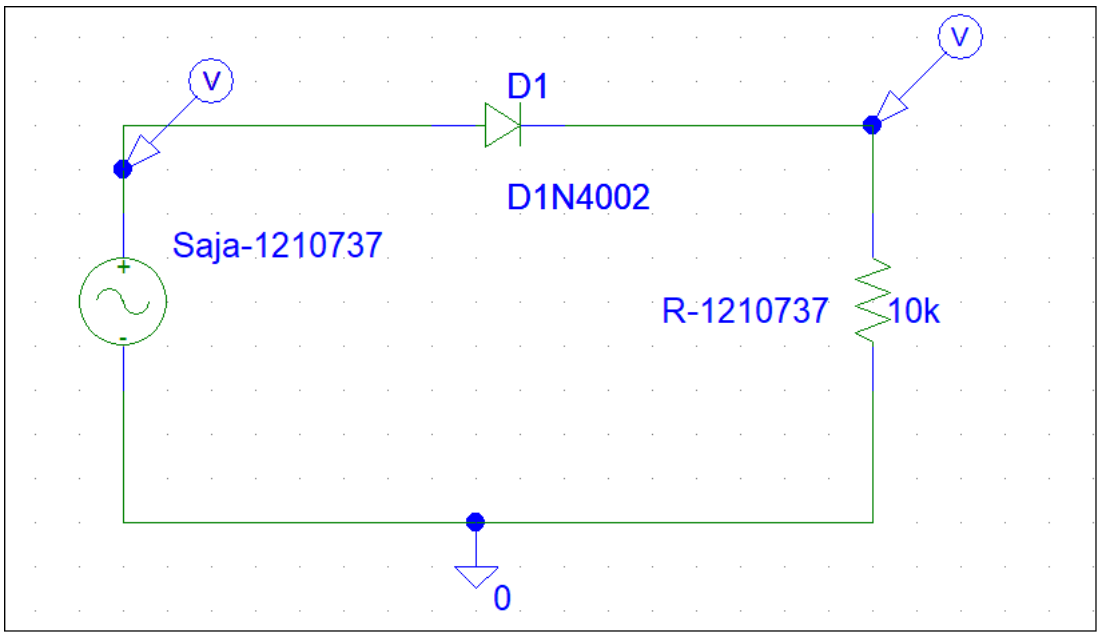


Figure 3:Half Wave Rectification

As the frequency = 200 Hz, each wave needs 1/200 seconds which is equal to 5ms, so 25ms for 5 cycles .

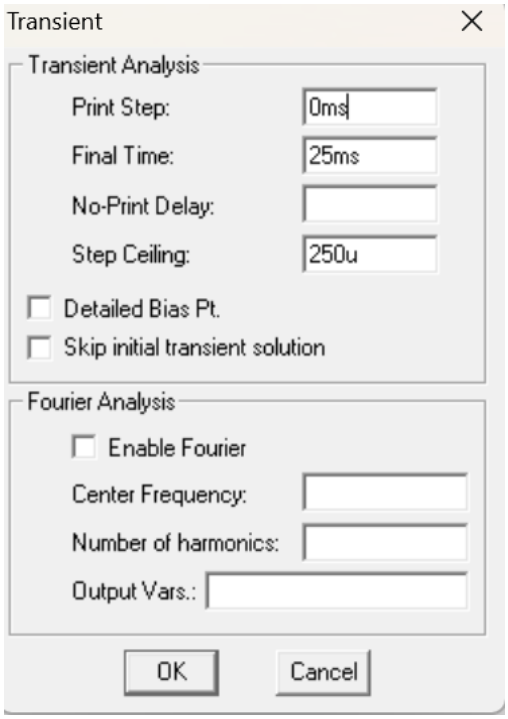


Figure 4: Transient Analysis for half wave

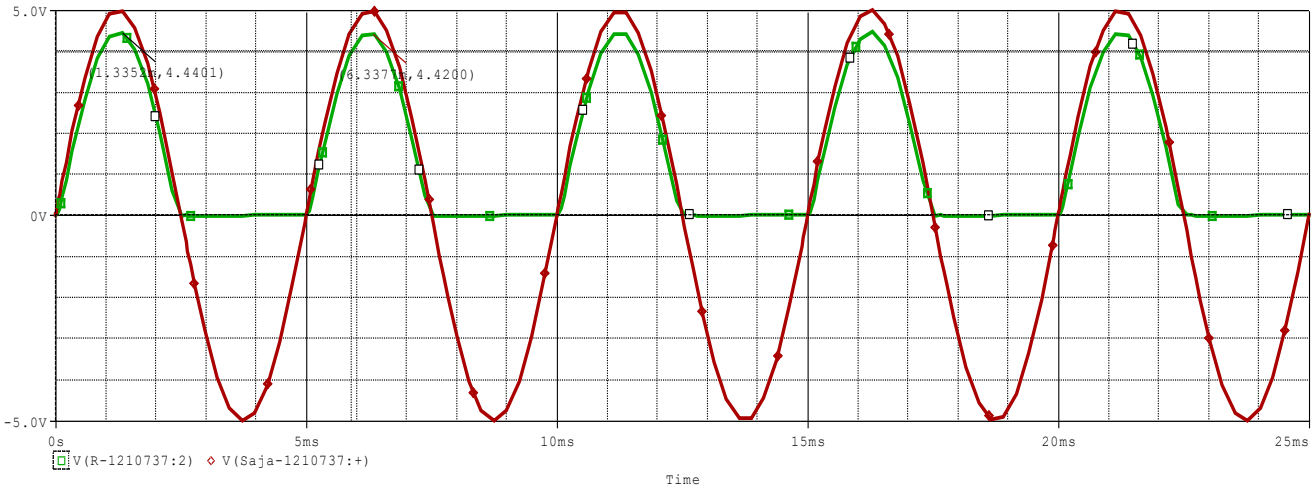


Figure 5: Half-Wave rectifier curve

Vp-p in the output is: 4.4401v.
T(period) = 6.3377m – 1.3352m = 5.0025m A.
Dc = Vp-p/π = 1.5923v.

Now , if we reversed the diode:

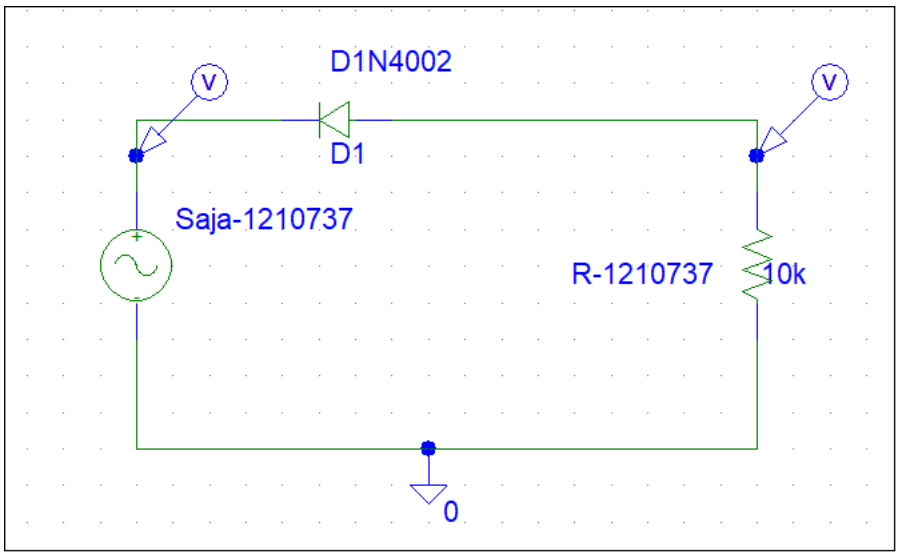


Figure 6: Half-Wave rectifier with diode reversed

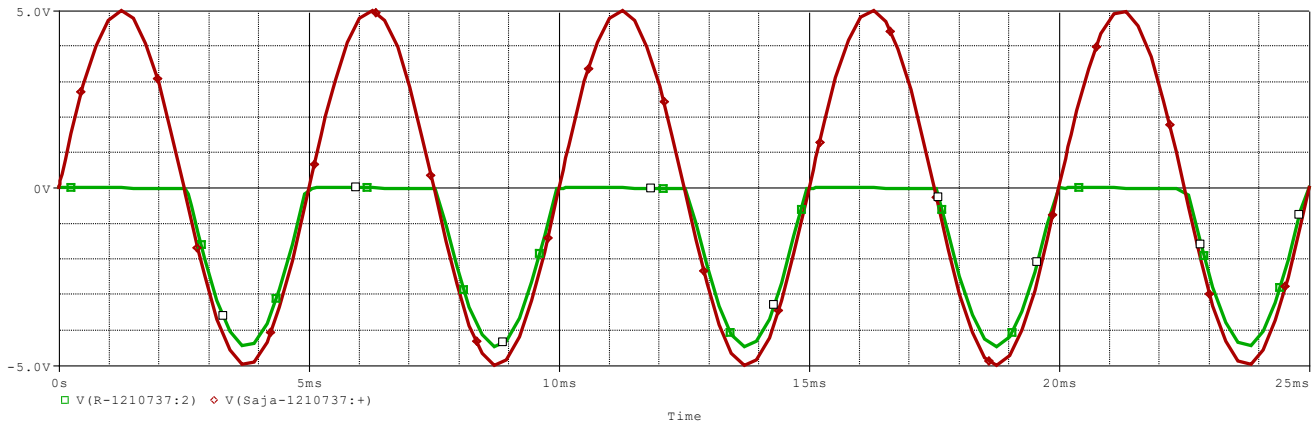


Figure 7: Half-Wave rectifier curve when the diode reversed

Now adding the capacitor with a value of 2.2 uF, as shown in the figure below.

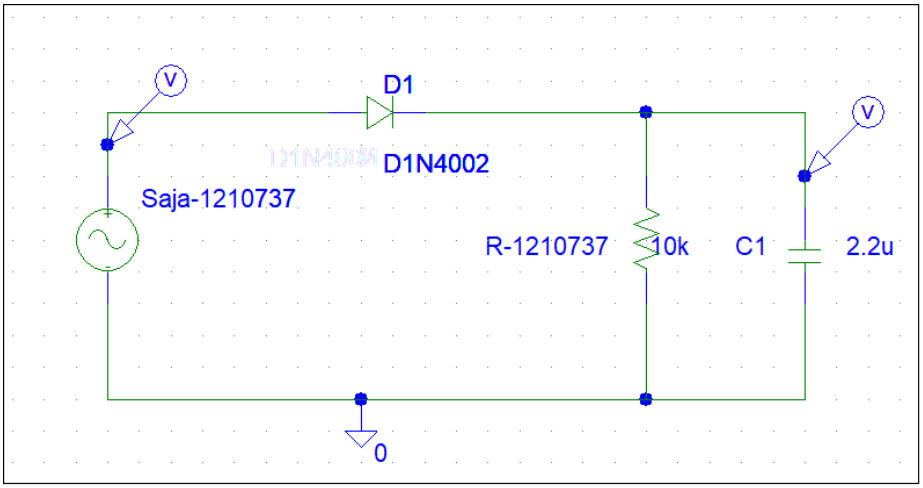


Figure 8:Half-wave Rectifier with capacitor

The output is :

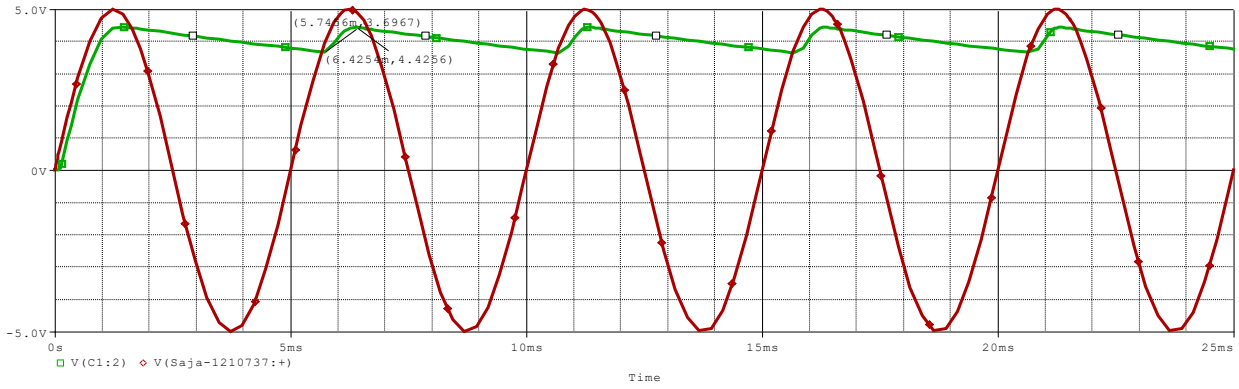


Figure 9:Half-Wave rectifier with capacitor curve

Vp-p = 4.4256 – 3.6967 = 0.7289.

Vdc = (4.4256 + 3.6967)/2 = 4.06115v.

Now, I change the capacitor value to 47uF:

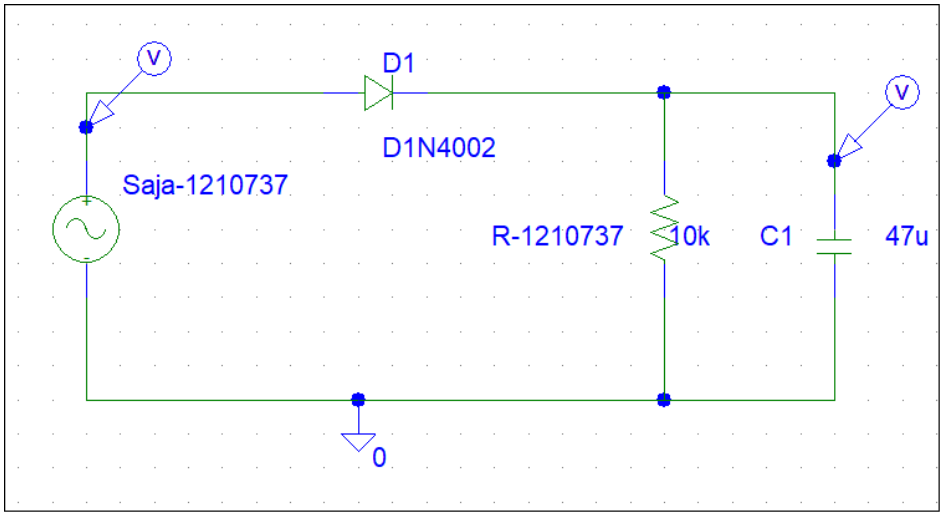


**Figure 10:Half-wave rectifier with 47uF capacitor**

The output is:

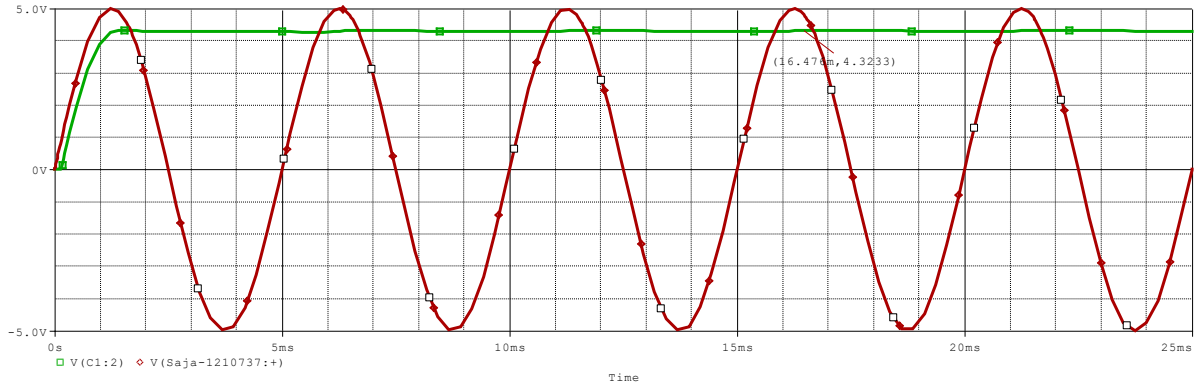


**Figure 11:Half-wave rectifier with 47uF capacitor curve**

Vdc=4.3233v

## 2.2 FULL-WAVE RECTIFICATION

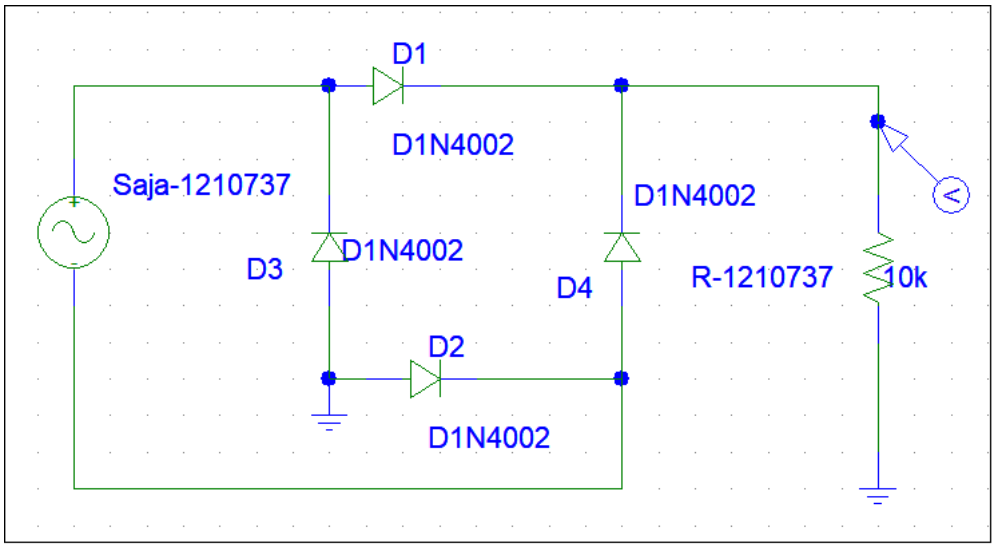


Figure 12:Full-Wave rectifier

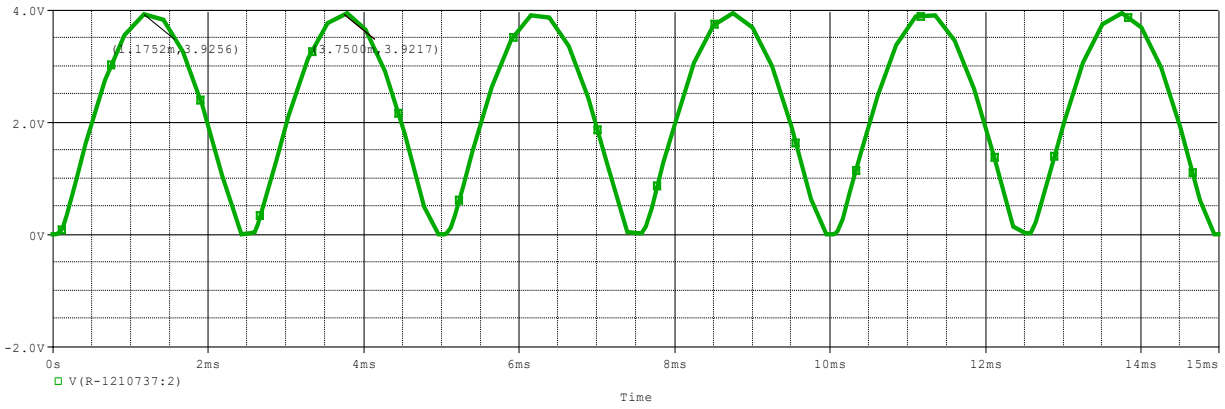


Figure 13:Full-wave rectifier curve

Vp-p = 3.9256v.

Dc = Vp-p/ π =1.4296v.

Then, I add a capacitor with value 2.2uF :

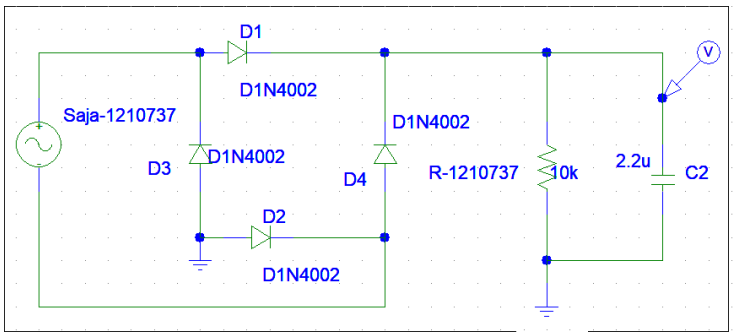


Figure 14:Full-Wave rectifier with capacitor

And the output is:

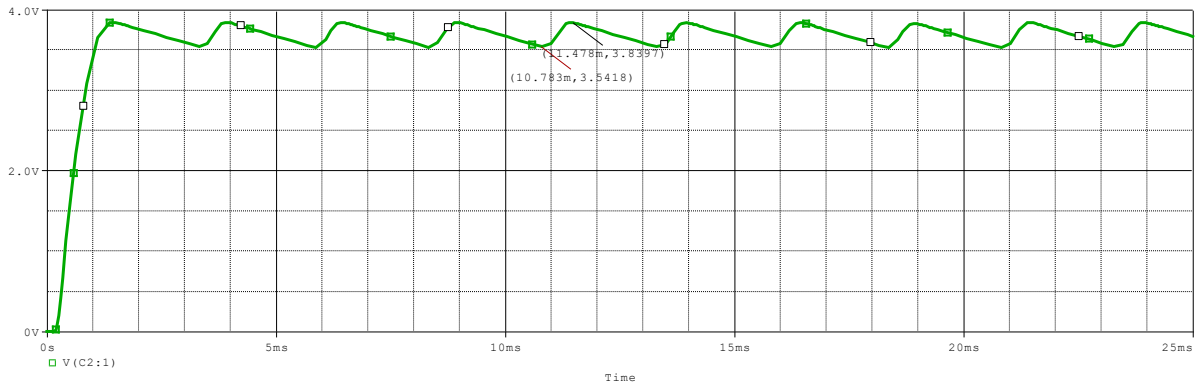


**Figure 15:Full-Wave with capacitor curve**

Ripple peak = 3.8397 – 3.5418= 0.2979v, and the DC voltage = 3.69v

## 3-other applications:

### 3.1clipping:

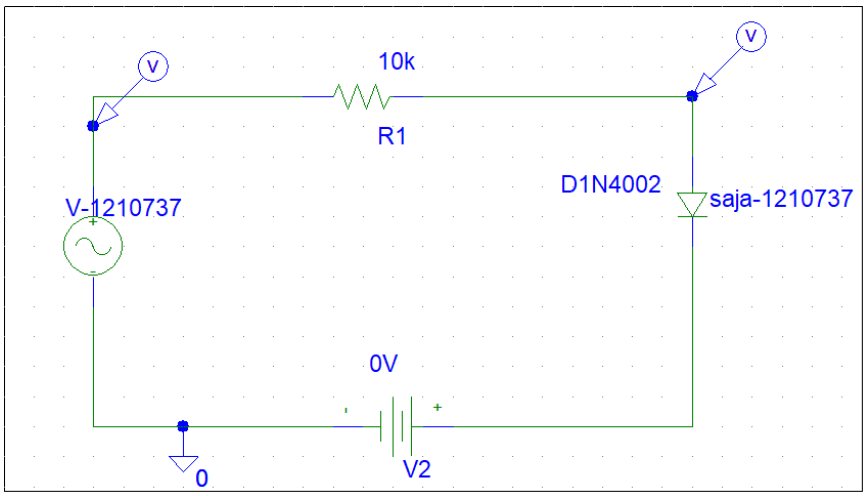


Figure 16:Clipping with 0 Dc

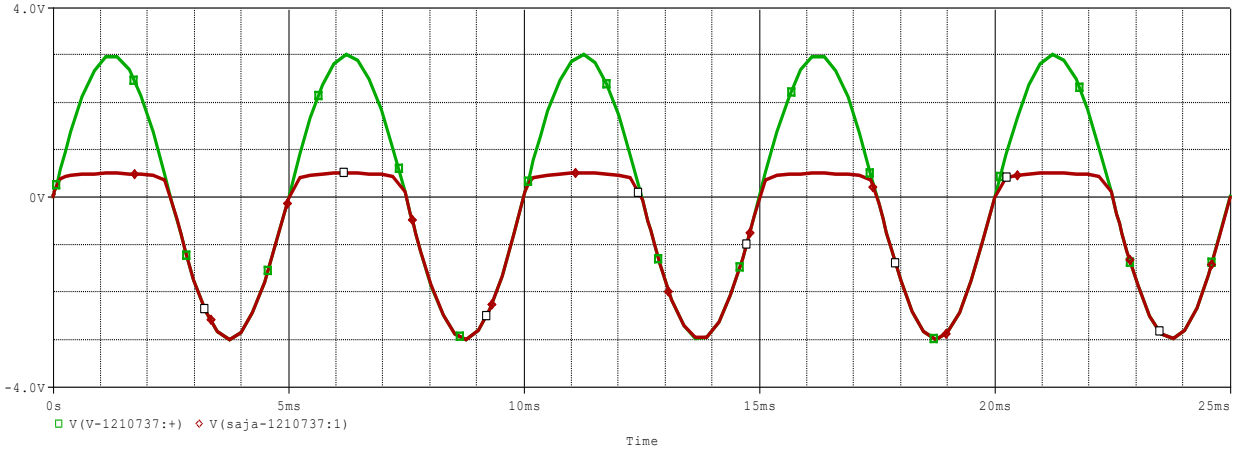


Figure 17:Clipping with 0 DC graph

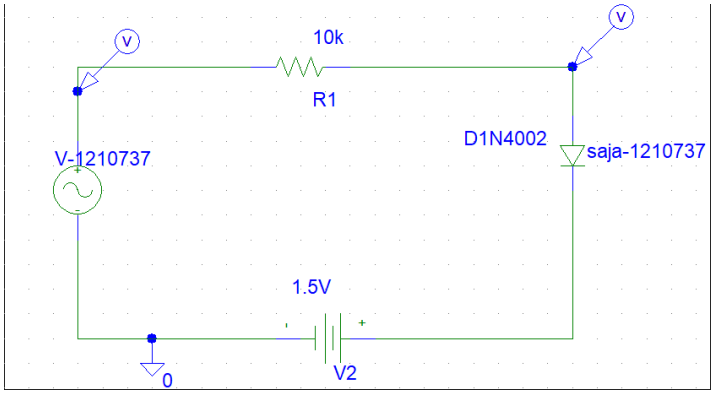


Figure 18:Clipping with 1.5 Dc

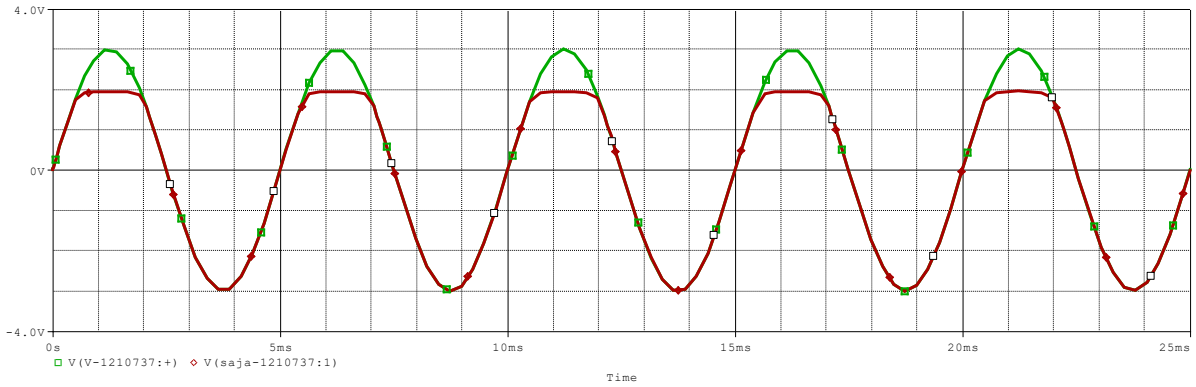


Figure 19:Clipping with 1.5 DC graph

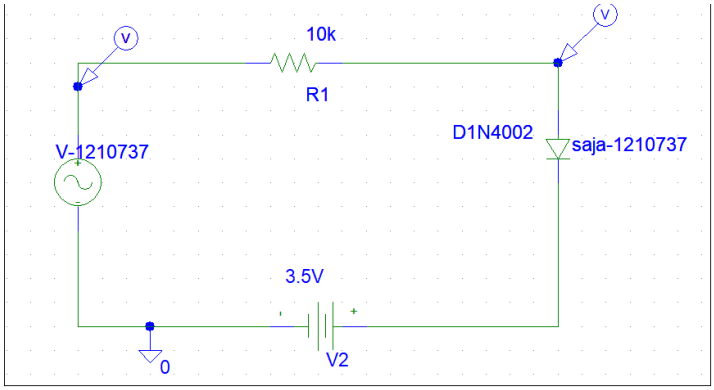


Figure 20:Clipping with 3.5 DC

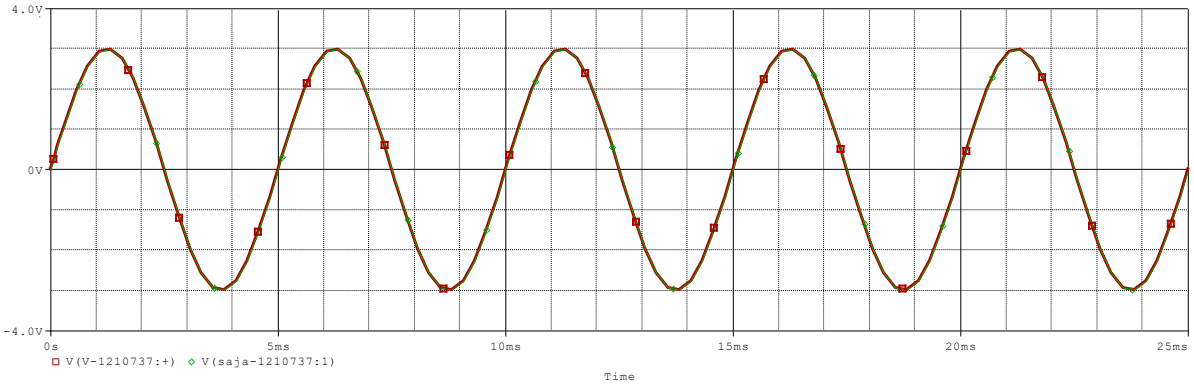


Figure 21:Clipping with 3.5 DC curve

Note that in figure21 there are two identical graphs, the reason is because since the input's voltage ranges between [-3, 3] it will always be less than the DC voltage so the diode will act as open circuit and the output voltage will equal the input voltage.

## 3.2 Clamping:

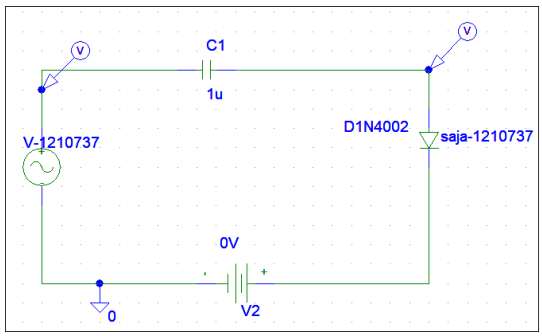


Figure 22:Clamping with 0 DC

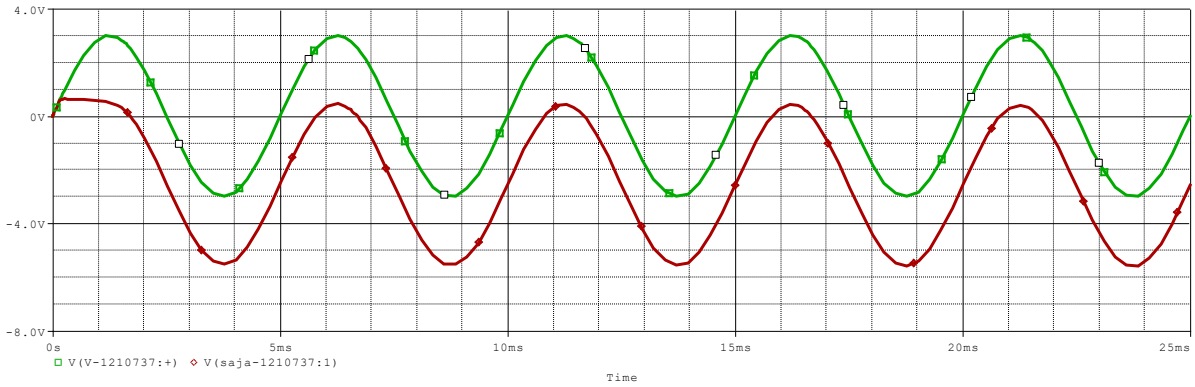


Figure 23:Clamping with 0 DC graph

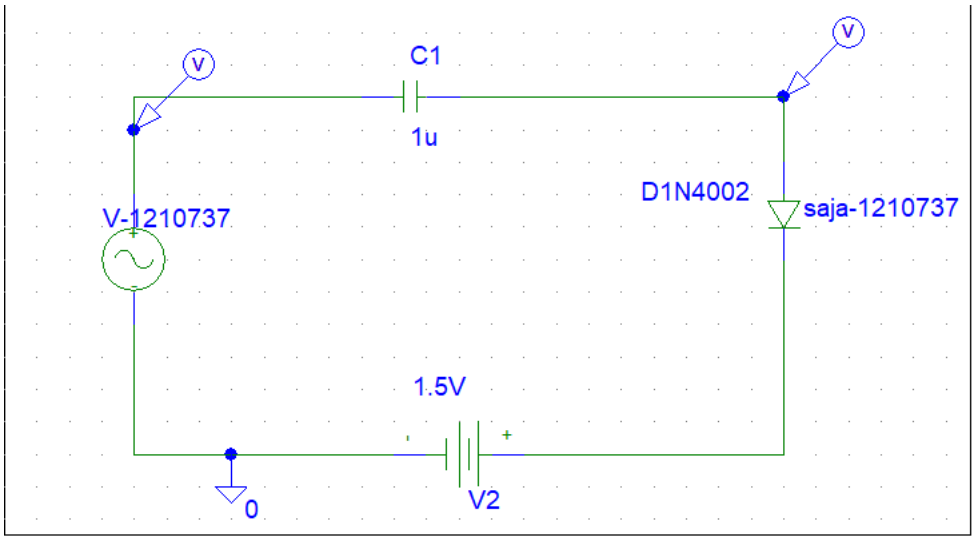


Figure 24:Clamping with 1.5 DC

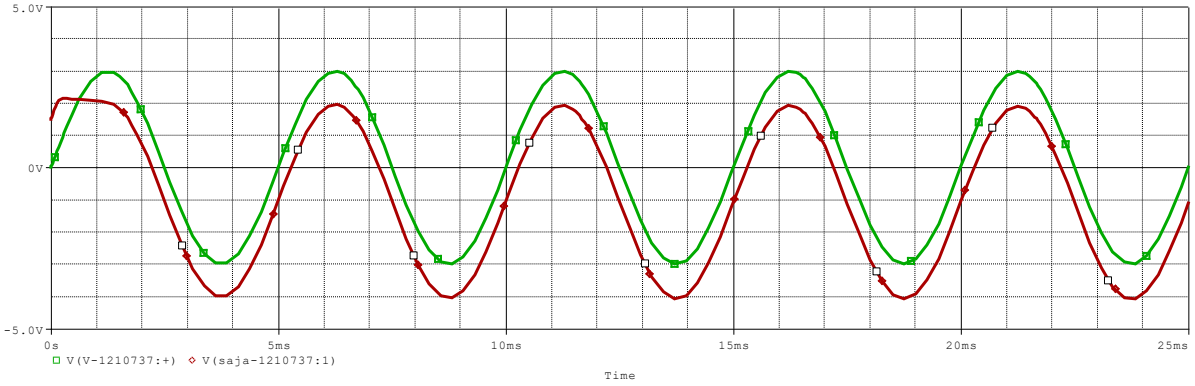


Figure 25:Clamping with 1.5 DC graph

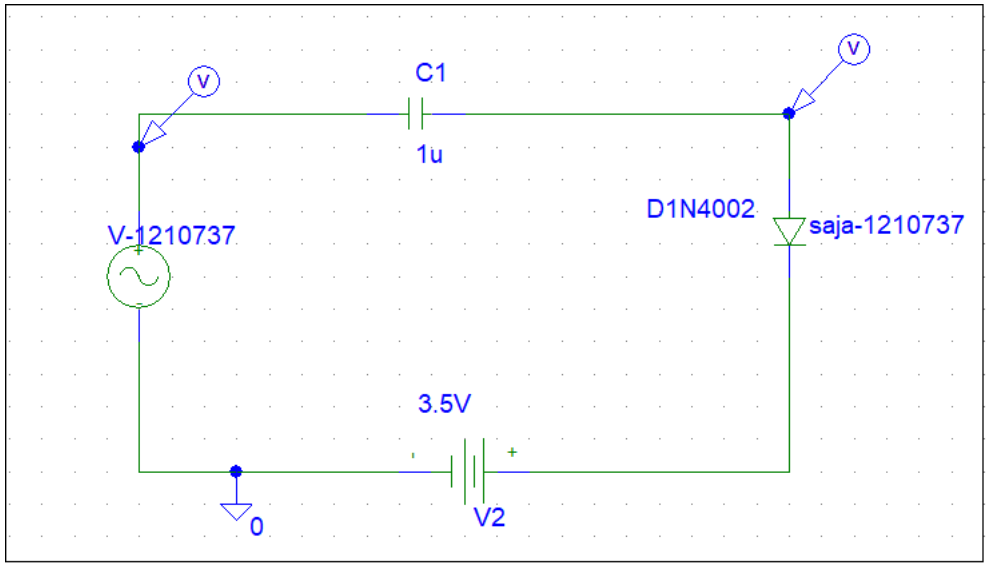


Figure 26: Clamping with 3.5 DC

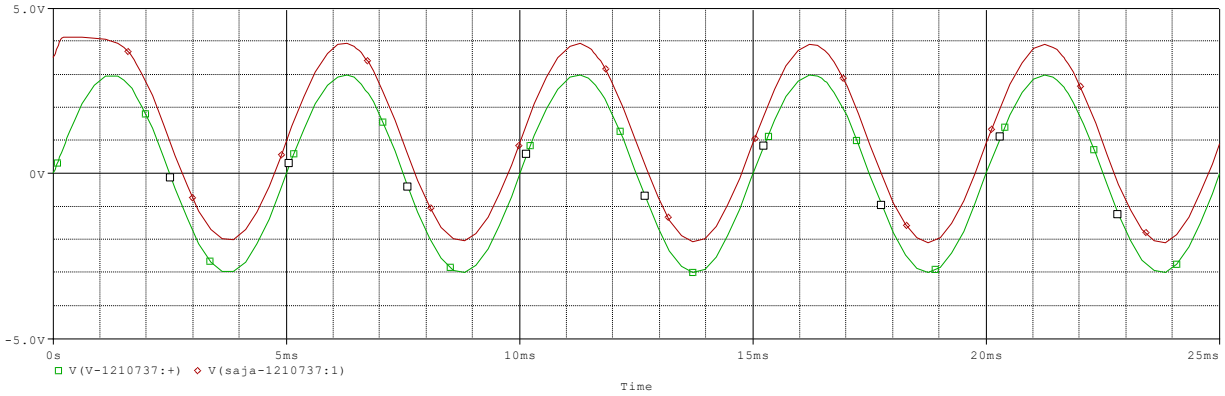


Figure 27: Clamping with 3.5 DC graph

## 4.VOLTAGE MULTIPLIER CIRCUITS

*note that this part not found in lab manual 2023-2024 ,so I brought it from the old lab manual .

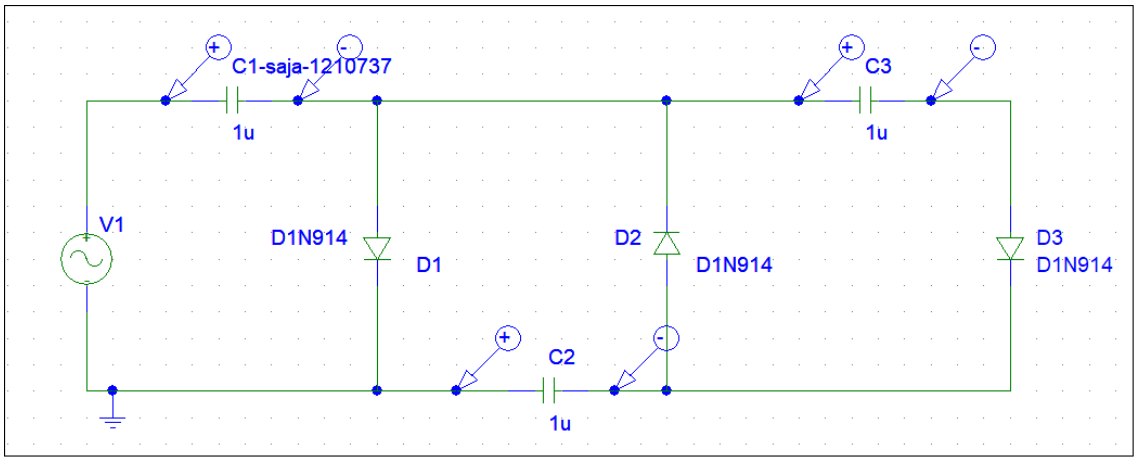


Figure 28:Voltage Multiplier Circuit to find voltage for all capacittor

The figure below shows the plot of all the voltages of the capacitors for 5 cycles.

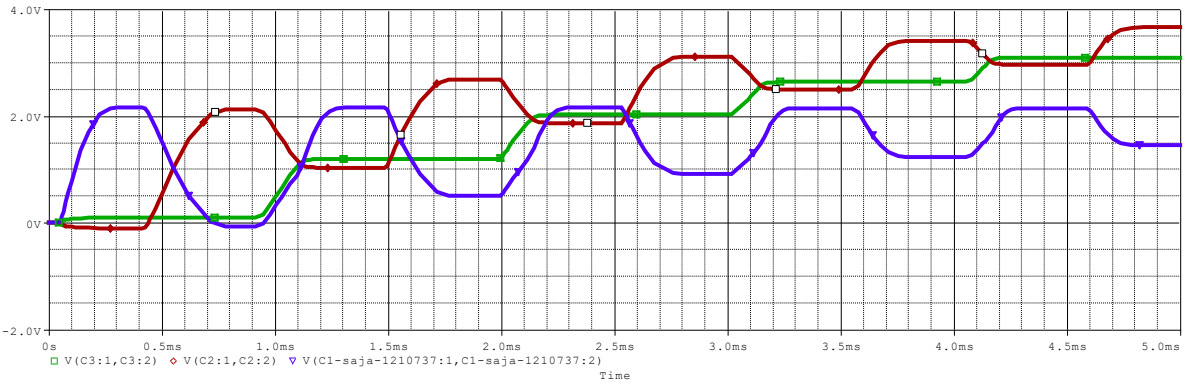


Figure 29:Voltage for capacitors in voltage multiplier circuit

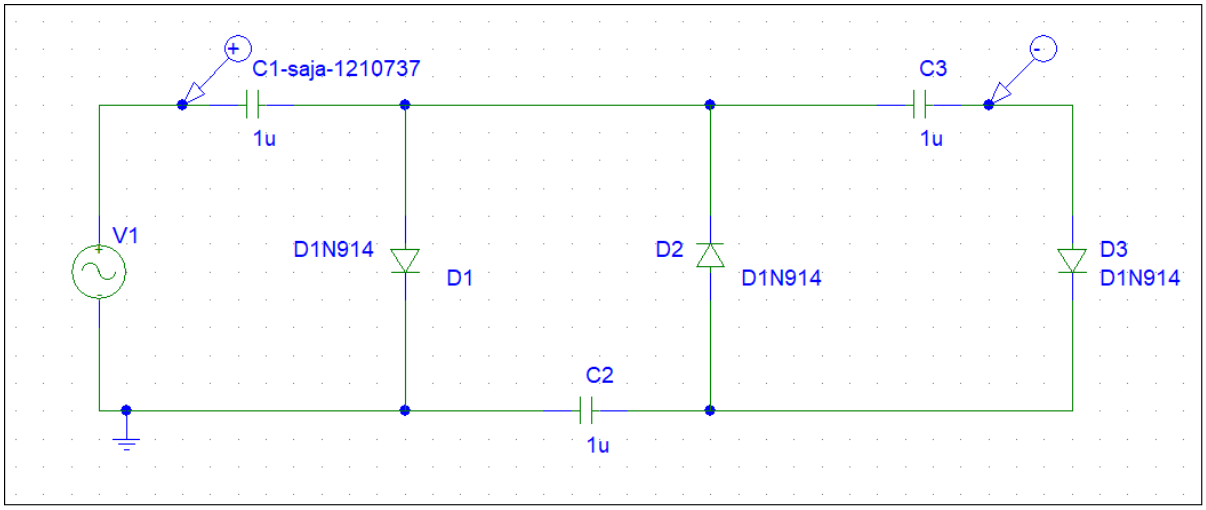


Figure 30:voltage multiplier circuit to find C1+C3

The figure below shows the voltage of C1 + C3.

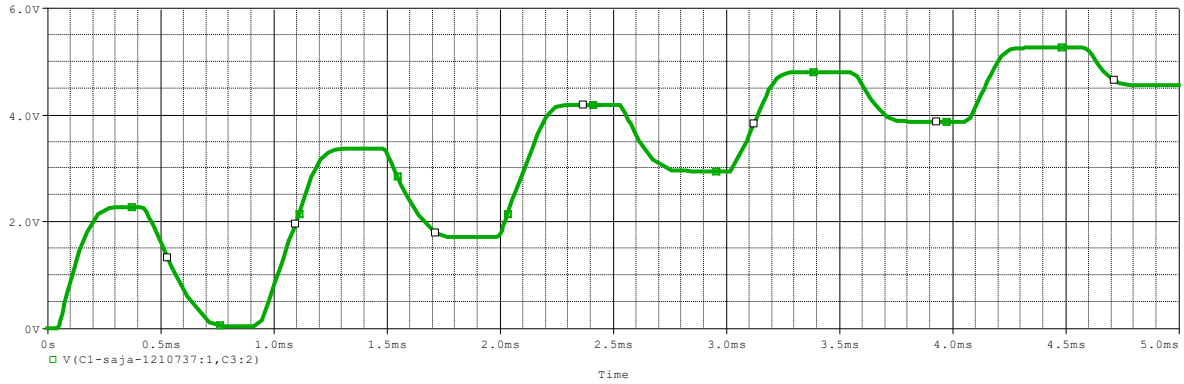


**Figure 31:vlotage for C1+C3 graph in voltage multipler circuit**