UM-SJTU Joint Institute

ELECTRONIC CIRCUIT LABORATORY

(ECE3110J)

Laboratory Report

Lab 1

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1 Voltage Regulator

1.1 Obtain the value of V_L under DC voltage

According to the data sheet, V_L should equal to 3.3v. But in our experiment, the output voltage is around 2.8v as shown in the figure below.

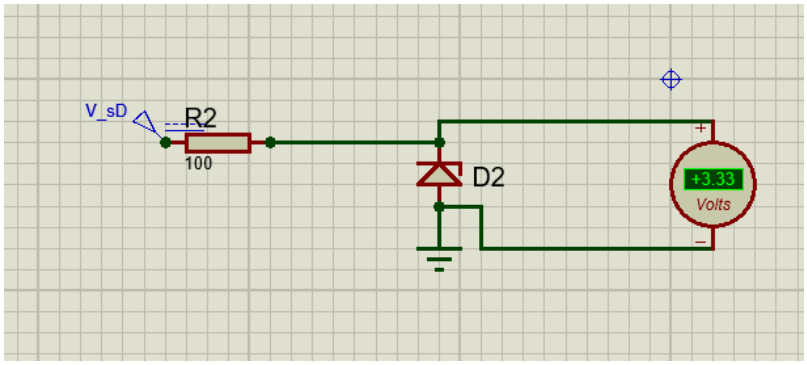

Figure 1: Simulation of 1.1

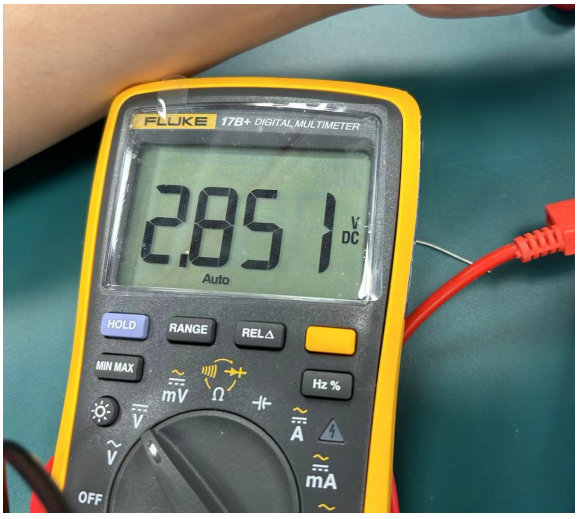

Figure 2: 1.1's experiment result

1.2 V_L under sine wave voltage

In this section, we alternate DC voltage source with a sine wave: $5 + 0.5\sin(120\pi t)$. In the experiment: we obtain that Vspp = 440mV and VLpp = 160mV. We can calculate that:

$$\frac{R_Z}{R + R_Z} = 0.36$$

So, R_Z equals to 57.134.

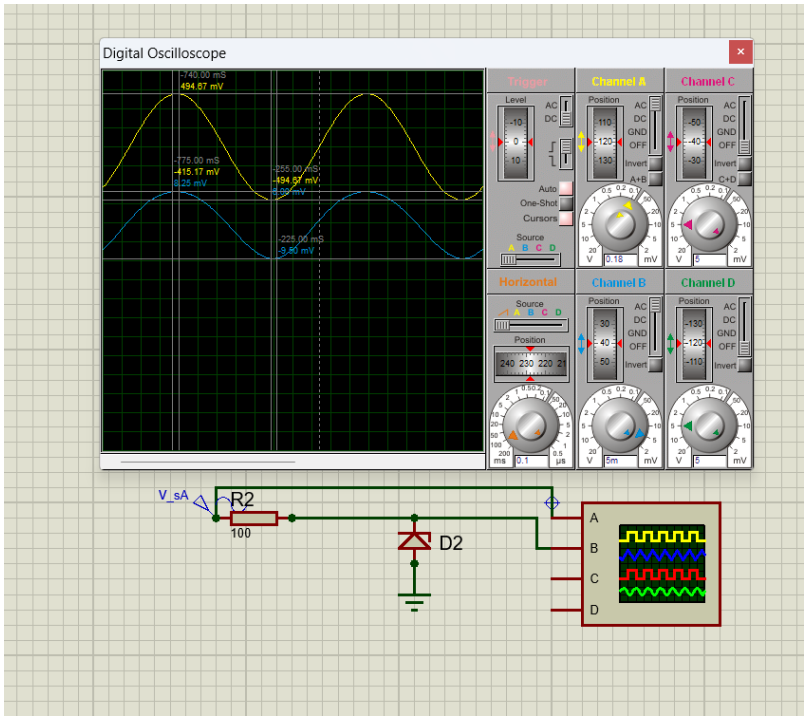

Figure 3: Simulation of 1.2

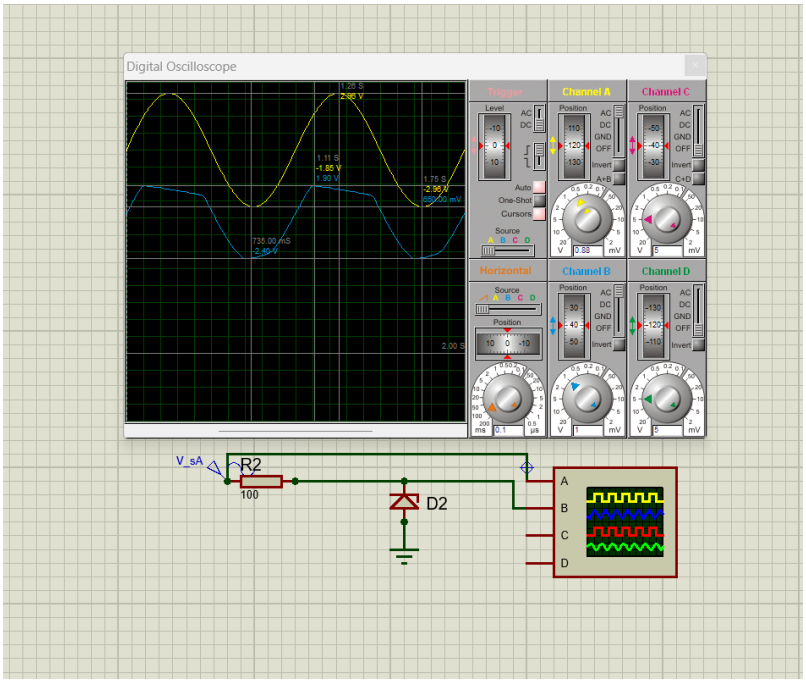

Figure 4: 1.2's discussion

The discussion part is when we alternate the voltage source into $= 2 + 3\sin(120\pi t)$.

1.3 Stop Working!

In the experiment, the voltage regulator stops when $R_L = 70.9\Omega$, which is shown below($V_L = 2.003$):

Figure 5: V_L in the experiment 1.3

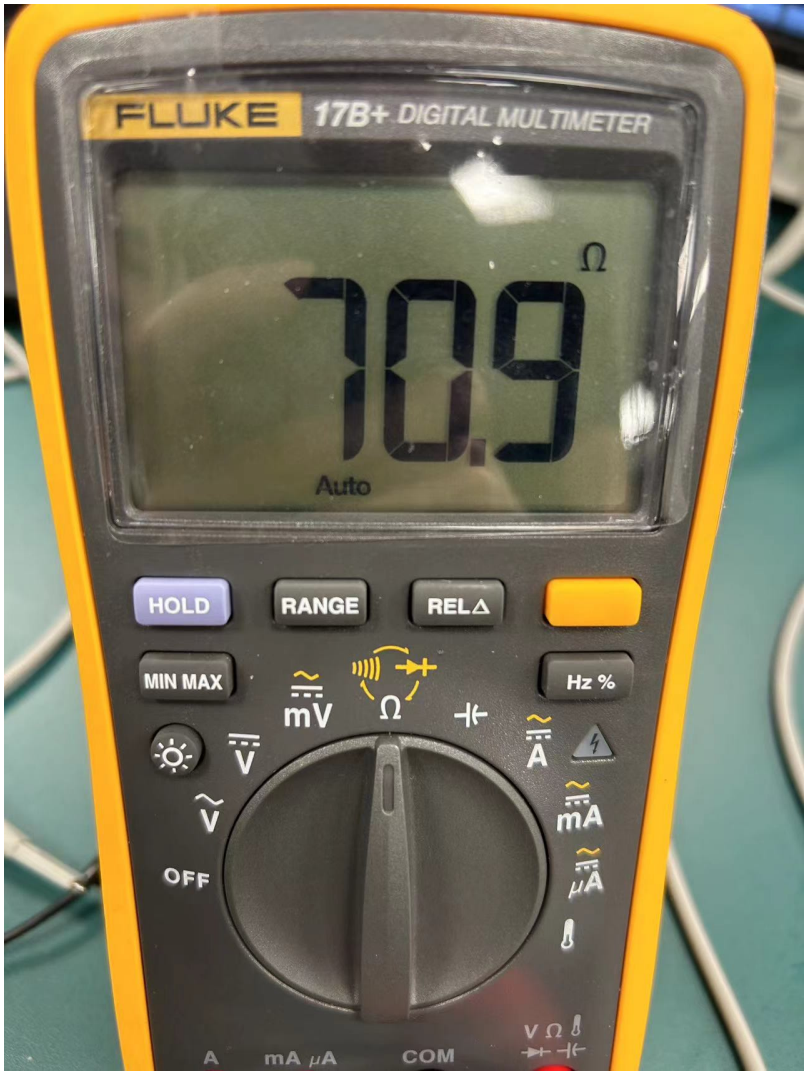

Figure 6: R_L in the experiment 1.3

2 Half-Wave Rectifier

In the experiment, the capacitor should exceed 1000μF so that the ripple voltage is smaller than 0.1mV.

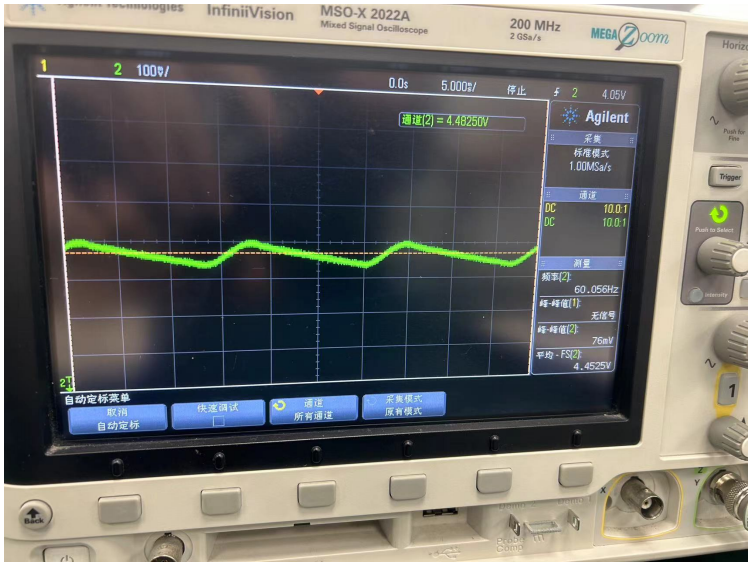

Figure 7: Result of ripple voltage in the experiment 2

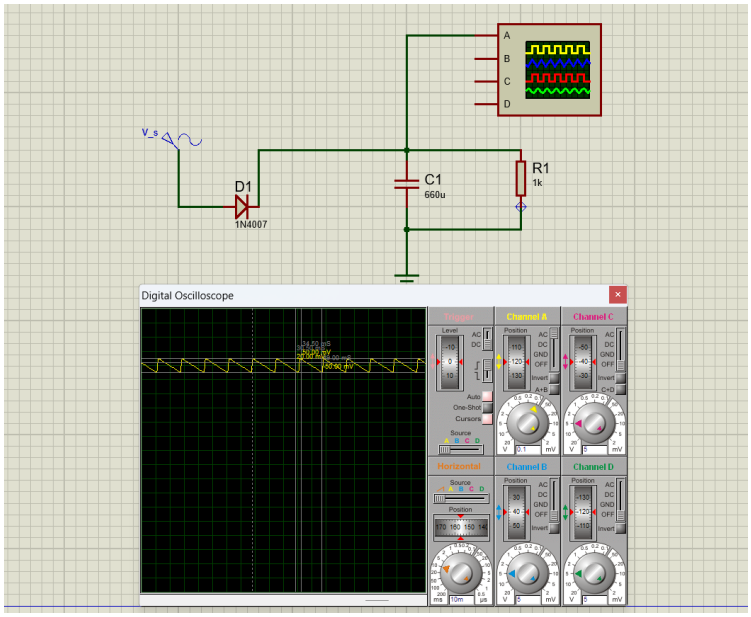

Figure 8: Simulation of ripple voltage in the experiment 2

We can derive that: if input is 5sin(240πt), the V_R will be lower than 0.05V(halved).

$$C_{min} = 700\mu F$$

$$V_{dc} = 4.2V$$

$$I_{dc} = \frac{V_{dc}}{R} = 4.2mA$$

$$\theta_c = \sqrt{\frac{2V_r}{V_s}} = 0.2\text{rad}$$

$$\Delta T = \frac{\theta_c}{\omega} = 5.3 \times 10^{-4}s$$

$$I_{peak} = \frac{2I_{dc}T}{\Delta T} = 0.264A$$

$$I_{surge} = \omega C V_s = 1.319A$$

$$PIV = 2V_s - V_r = 9.9V$$

3 Reference

1. VE311 Electronic Circuit Lab 1 Manual, 2024 Summer Term, Shanghai Jiao Tong University, ECE3110J.
2. Vishay Semiconductors, "1N4728A to 1N4761A Zener Diodes Datasheet," November 2021.

3. ON Semiconductor, "1N4001 to 1N4007 Axial Lead Standard Recovery Rectifiers Datasheet," August 2005.