UM–SJTU Joint Institute
Electronic Circuits Summer (ECE3110J)

Lab1 Report

Voltage Regulator and Half-wave Rectifier

Instructed by

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1 Voltage Regulator

1.1 Exercise 1.1.1

The experimental value of V_L is 3.202V. According to the datasheet which shows V_z=3.3V for 1N4728, the obtained V_L is acceptable.

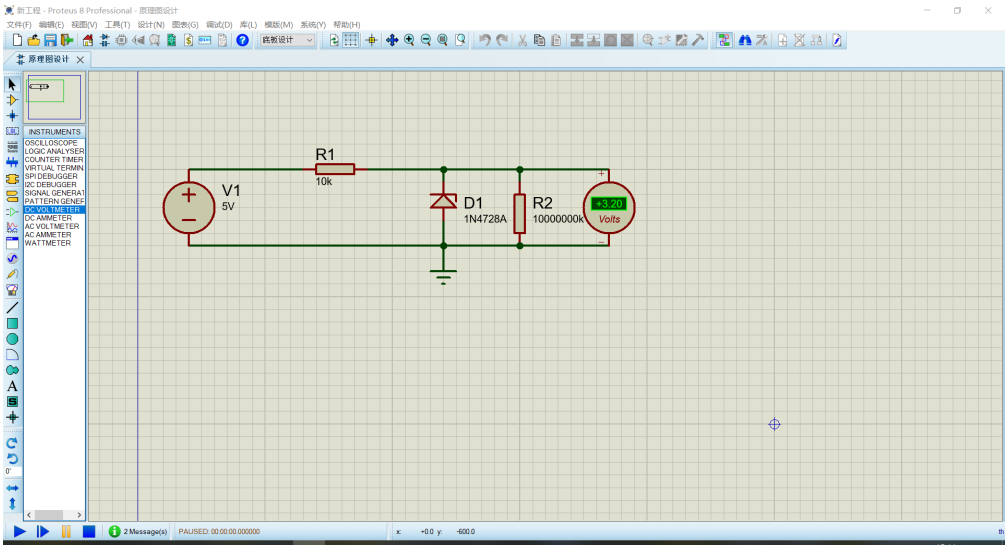

Figure 1: Simulation Results of 1.1.1

However, the value that I got from the experiment is much smaller than 3.3V. This can be caused by the precision of the instrument or by human error.

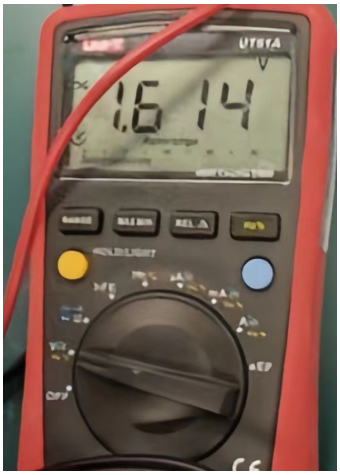

Figure 2: Actual Results of 1.1.1

1.2 Exercise 1.1.2

The experimental value of V_L in half a period is 640mV. The experimental value of V_s in half a period is 1070mV. Using 0.598, we calculate RZ is 14883Ω.

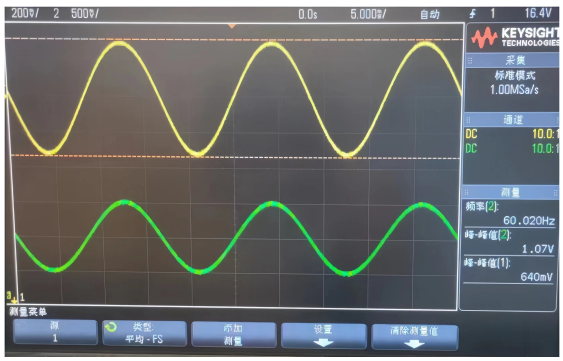

Figure 3: Actual Results of 1.1.2

However, the value that I got from the experiment is much smaller than 14883Ω. Based on the simulation of V_s = 5 + 0.5sin (2π60· time), it can be known that V_L=8.5mV and V_S=0.5V. Then it can be calculated that the line regulation equals to 0.017 and R_z=173Ω.

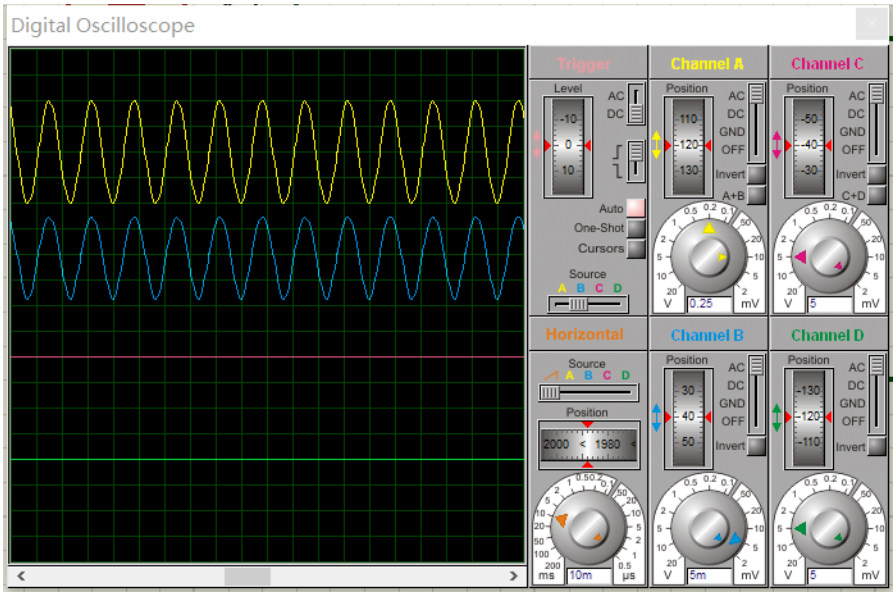

Figure 4: Simulation1 Results of 1.1.2

If V_s = 2 + 3sin (2π60· time), the result will be like this

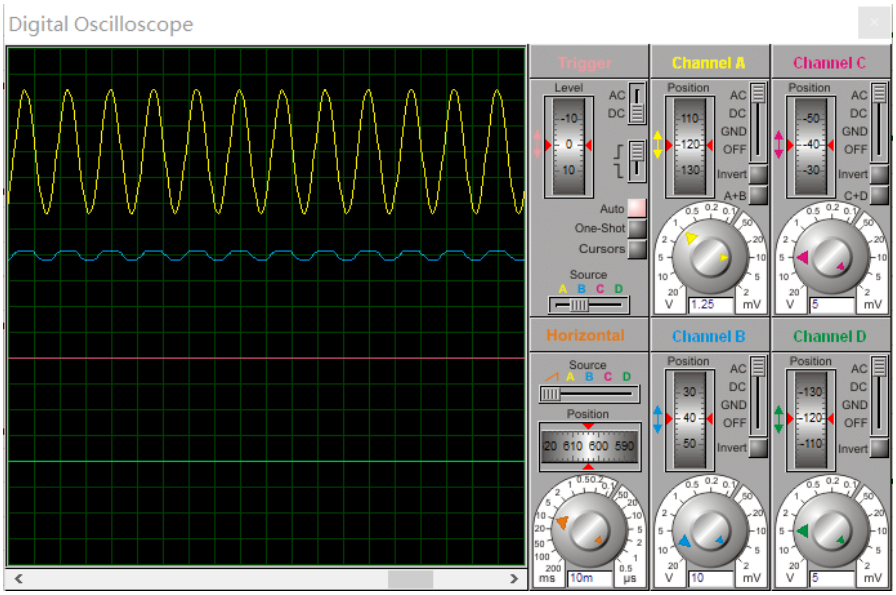

Figure 5: Simulation2 Results of 1.1.2

1.3 Exercise 1.1.3

If we take the voltage down for 20% as the symbol that regulators stop working, then $R_L = 9600\Omega$.

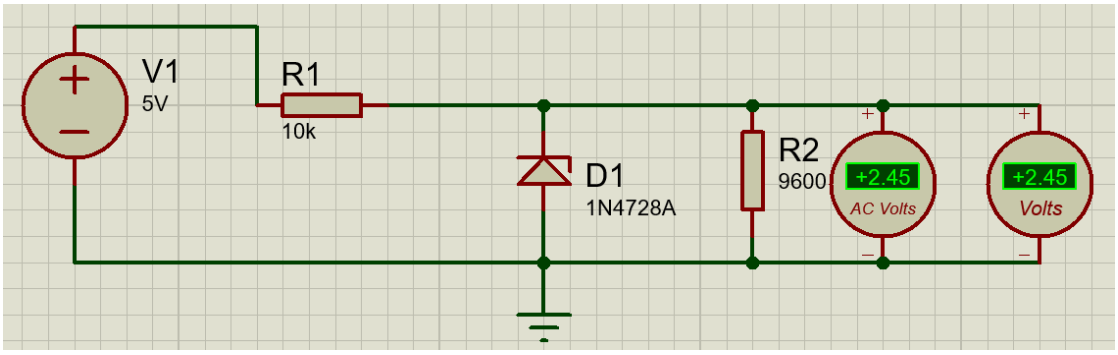

Figure 6: Simulation Results of 1.1.3

If we want $R_{L,min}$ to be 2 times smaller, we need to make R 2 times smaller.

2 Half-Wave Rectifier

According to the equation to calculate V_R:

$$V_R = (V_S - V_{on}) \times T/RC < 0.1 \tag{1}$$

We can get that capacitance C should be larger than 6.6×10^{-4}F. The actual and simulation waveform will be like this:

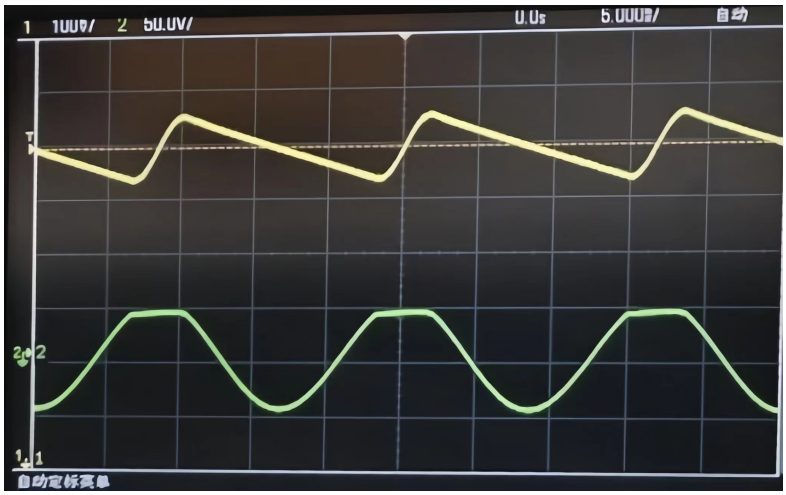

Figure 7: Actual Results of 2.1

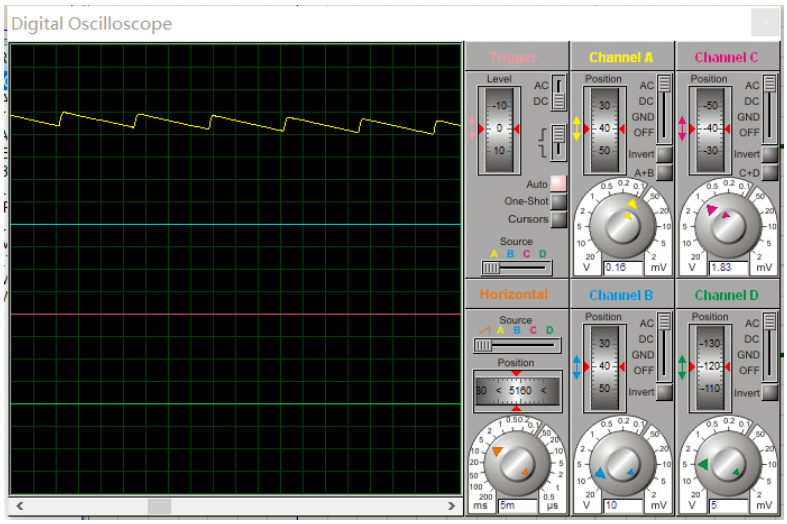

Figure 8: Simulation Results of 2.1

According to the simulation results, we can get that V_{dc}=4.2V, I_{dc}=4.2mA, θ_C= 0.2rad, ΔT =0.53ms, I_{peak}=0.264A, I_{surge}=1.32A, PIV=9.2V.

Based on the equation:

$$V_R = (V_S - V_{on}) \times T/RC \tag{2}$$

If ω doubles, T will be half and V_R will also be half