

Experiment No. 4
Power Supply Design
ECE 311

Peter CHINETTI

April 30, 2014

Date Performed: April 30
Instructor: Professor SALETTA

1 Introduction

This lab will explore four designs of power supply, zeener and Op-Amp based (with and without power transistor), and the LM317 adjustable regulator.

2 Procedure

- a. Build and test transformer
- b. Build and test zeener and Op-Amp based regulation
- c. Build and test zeener and Op-Amp with power transistor based regulation
- d. Build and test LM 317 regulation

3 Equipment

- Oscilloscope
- Transformer
- $\mu A741$, LM 317
- Resistors and capacitors

4 Observations

This section is more clearly broken into corresponding steps in the procedure.

4.1 Transformer

Changing the polarity of the transformer changes the sign of the output wave. $V_{oc} = 12.950V_{rms}$, the resistance required to load down the transformer to $12v$ is 20Ω . Therefore, using the voltage divider equation, $R_{trans} = 1.58333\Omega$, which is small enough to ignore. For plots of lab measurements, see figures 1 — 4.

4.2 Zeener Diode With Op-Amp

See figures 5 — 6 for input and output ripple for this circuit with $C = 33\mu F$, and $R_l = 560\Omega$. Plots of the circuit at open circuit and loaded to failure with $C = 4.7\mu F$ can be found in figures 7 — 8, with $C = 33\mu F$ can be found in figures 9 — 10.

4.3 Zeener Diode With Op-Amp and Power Transistor

The results of testing this circuit can be found in figures 11 — 14. Oddly, the $4.7\mu F$ capacitor version of this circuit failed at a higher resistance.

4.4 LM 317

The LM 317 fails to regulate below its “drop out voltage” in this case $1.2v$. Refer to figure 15 for a scope trace of the output ripple.

5 Conclusions

The purpose of this lab was achieved. A number of designs of power supplies were built and tested. The measurements generally complied with the calculated values.

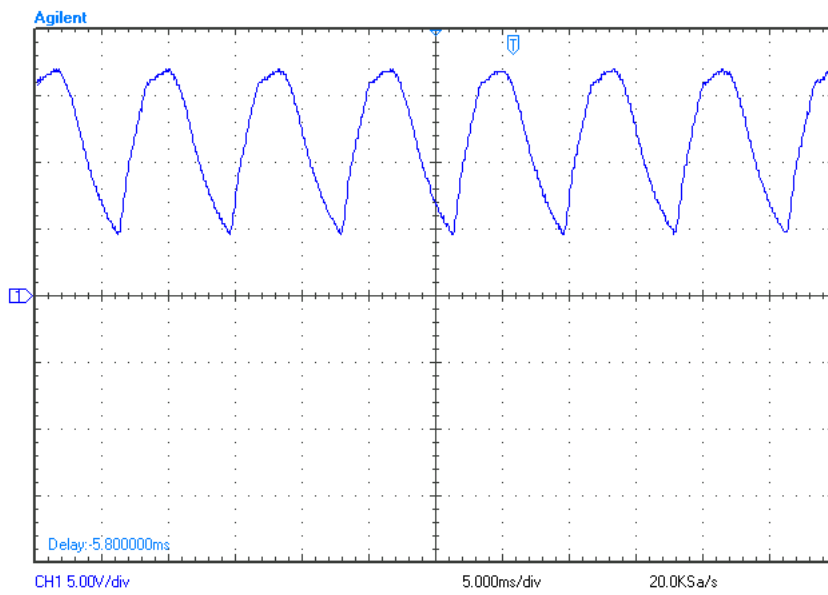


Figure 1: Voltage at R_l with C_f of $4.7\mu F$

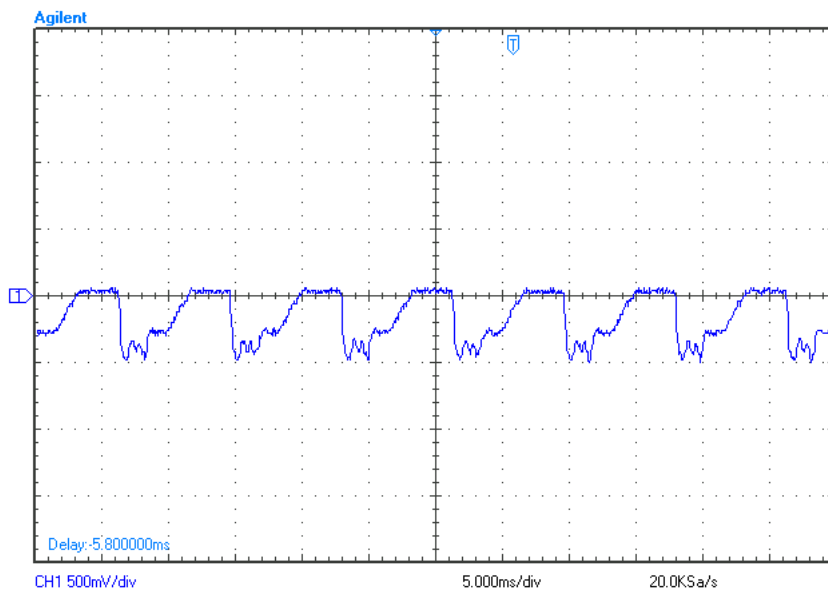


Figure 2: Voltage at I_d resistor with C_f of $4.7\mu F$

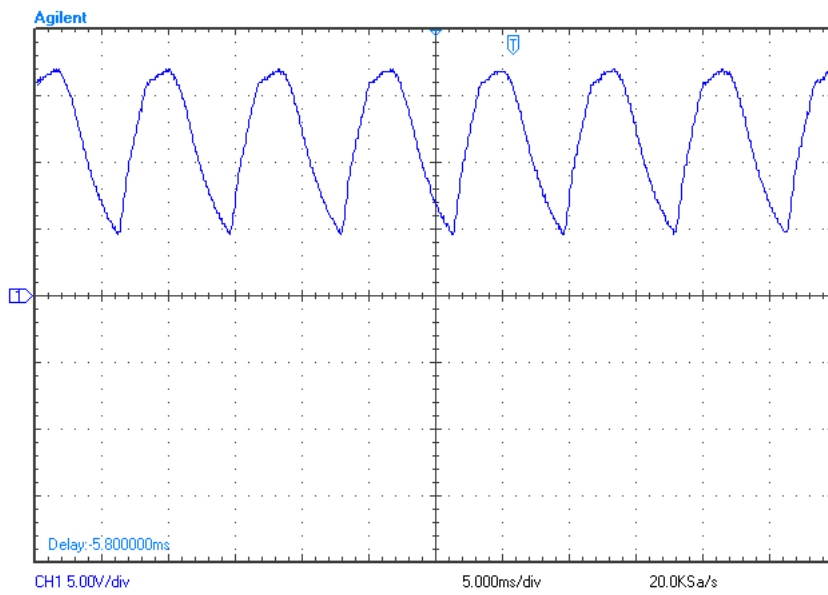


Figure 3: Voltage at R_l with C_f of $33\mu F$

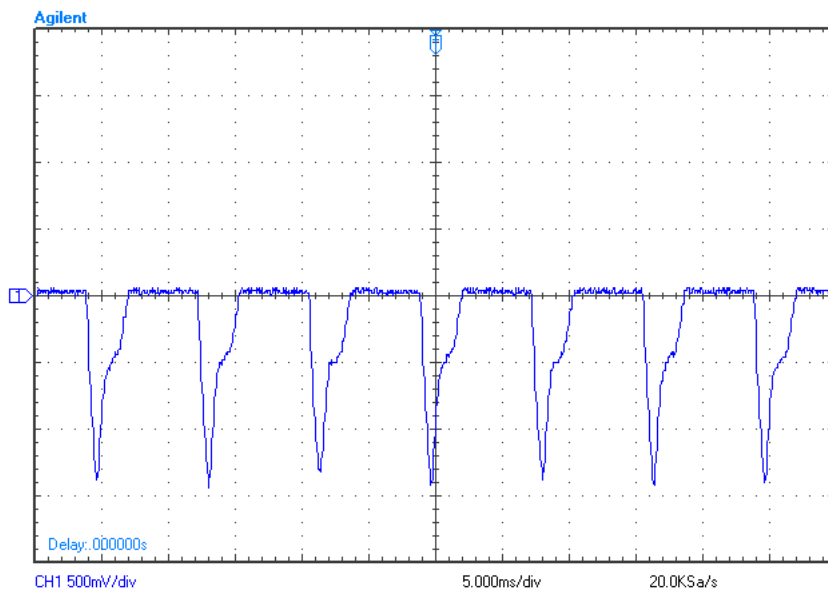


Figure 4: Voltage at I_d resistor with C_f of $33\mu F$

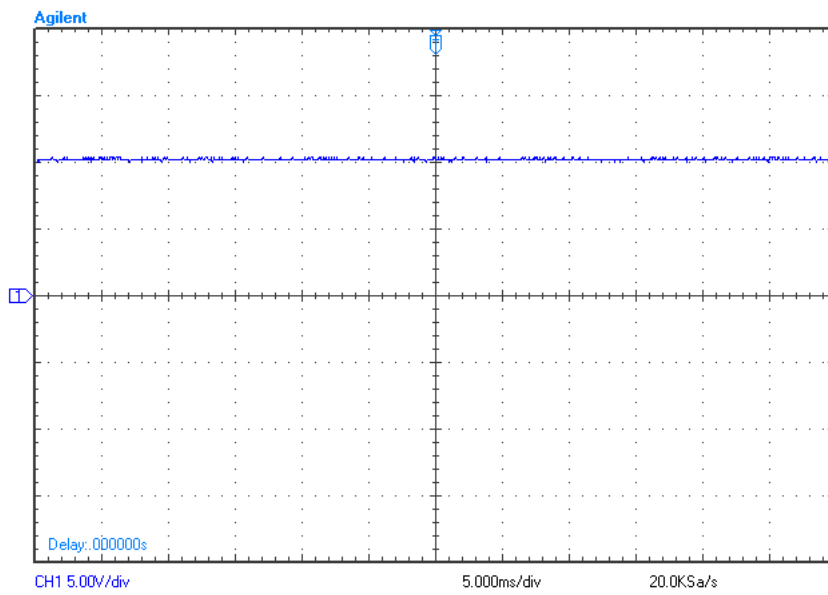


Figure 5: Voltage at R_l with C_f of $33\mu F$

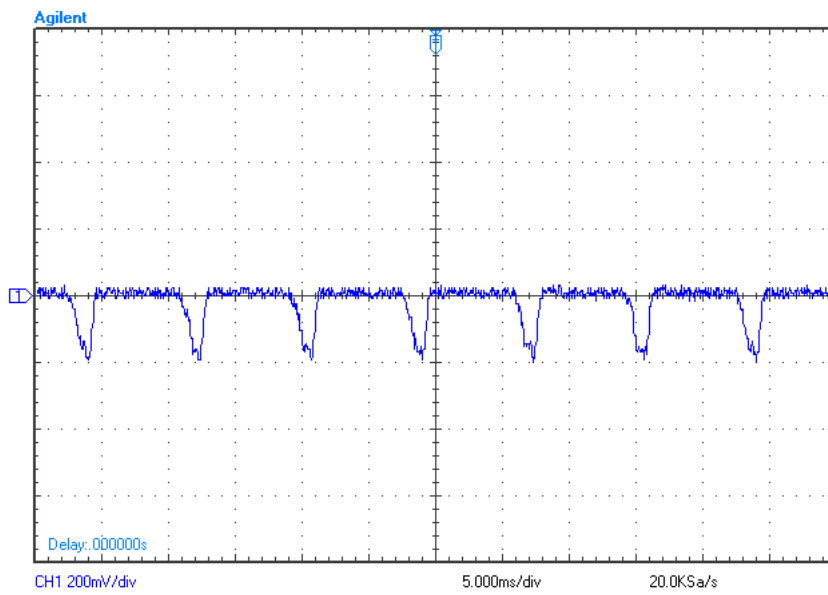


Figure 6: Voltage at I_d resistor with C_f of $33\mu F$

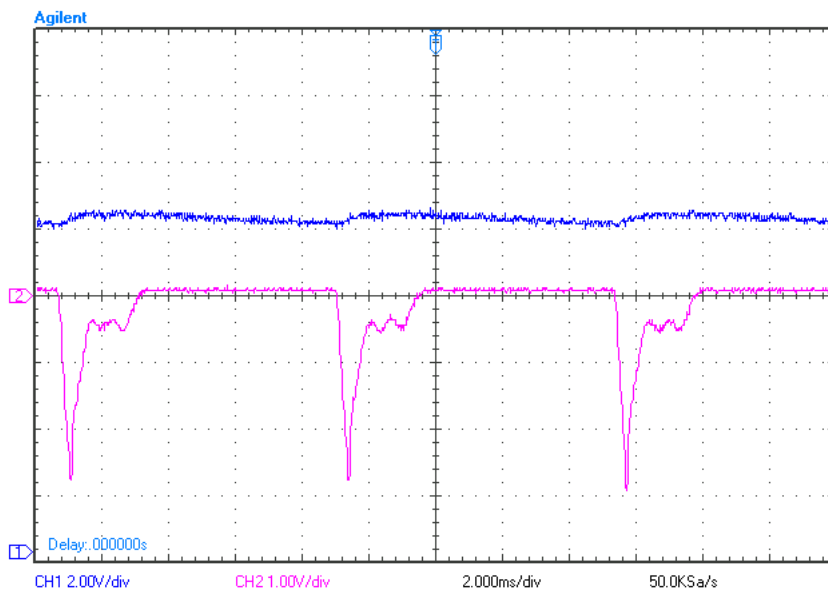


Figure 7: Voltage at R_l and I_d with C_f of $4.7\mu F$, and $R_l = \infty\Omega$

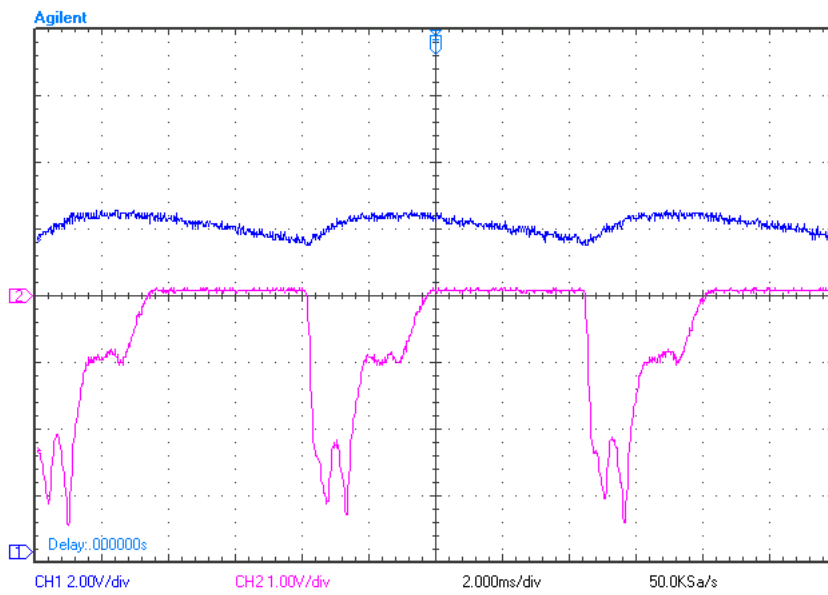


Figure 8: Voltage at R_l and I_d with C_f of $4.7\mu F$, and $R_l = 2190\Omega$

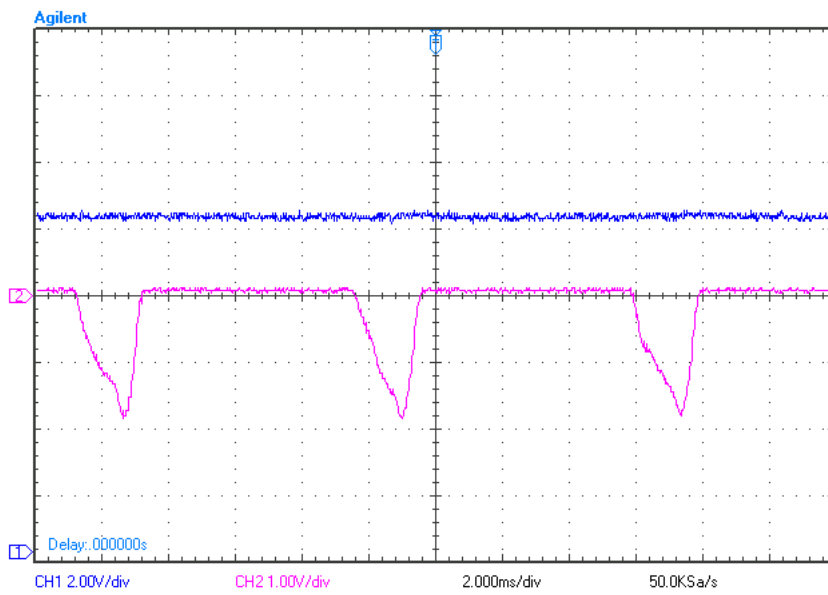


Figure 9: Voltage at R_l and I_d with C_f of $33\mu F$, and $R_l = \infty\Omega$

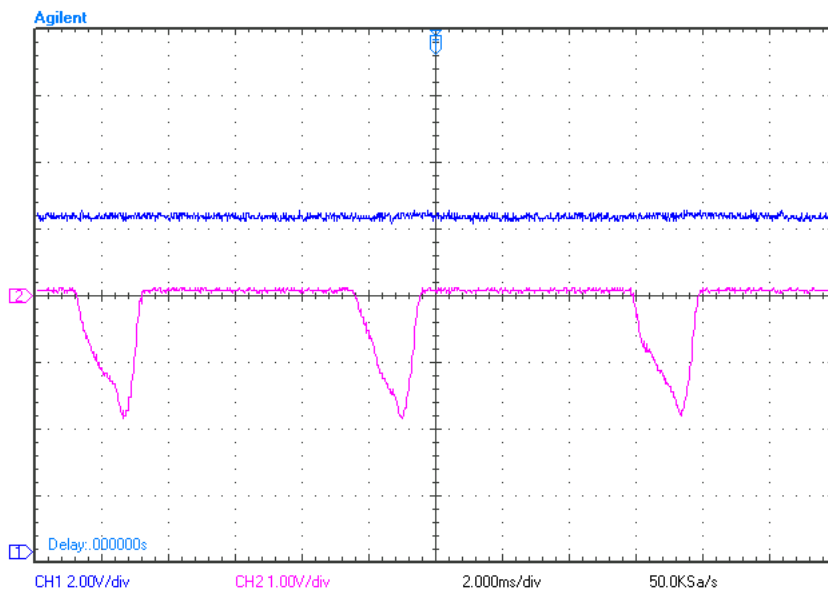


Figure 10: Voltage at R_l and I_d with C_f of $33\mu F$, and $R_l = 630\Omega$

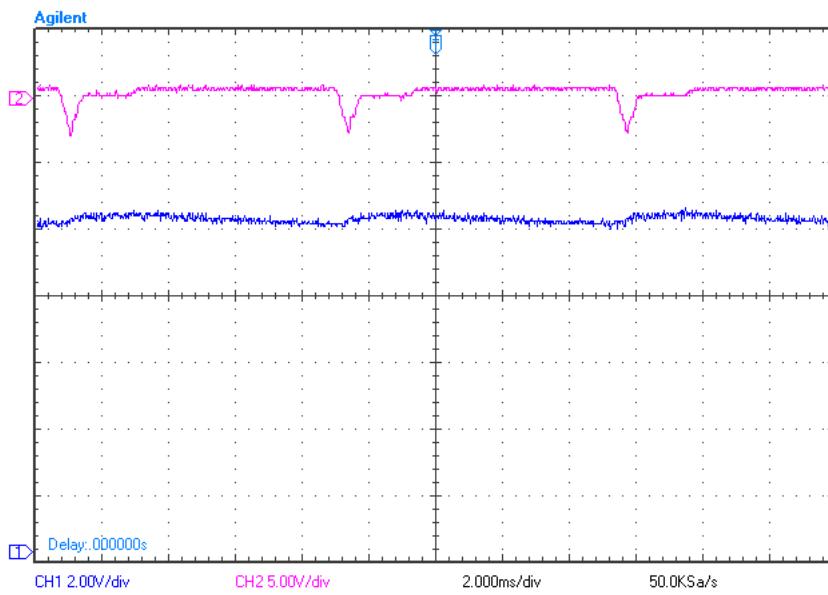


Figure 11: Voltage at R_l and I_d with C_f of $4.7\mu F$, and $R_l = \infty\Omega$

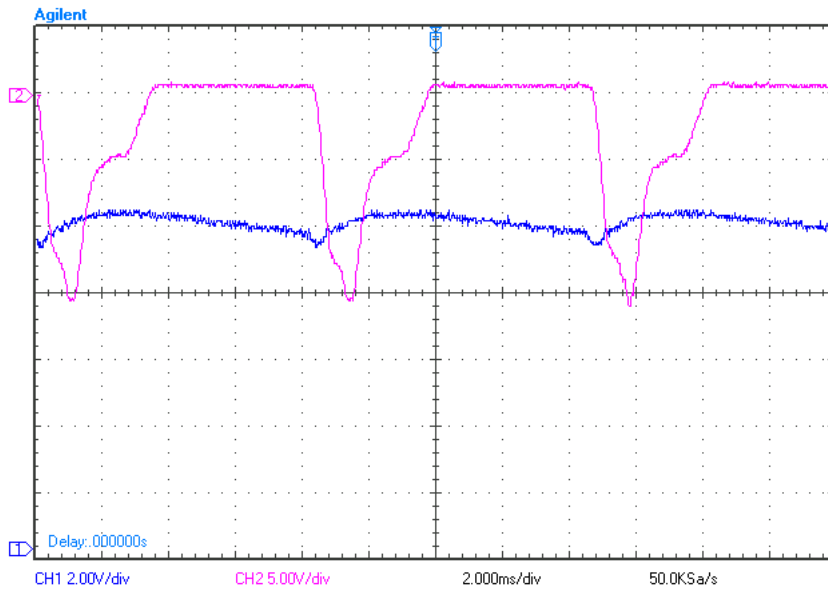


Figure 12: Voltage at R_l and I_d with C_f of $4.7\mu F$, and $R_l = 25000\Omega$

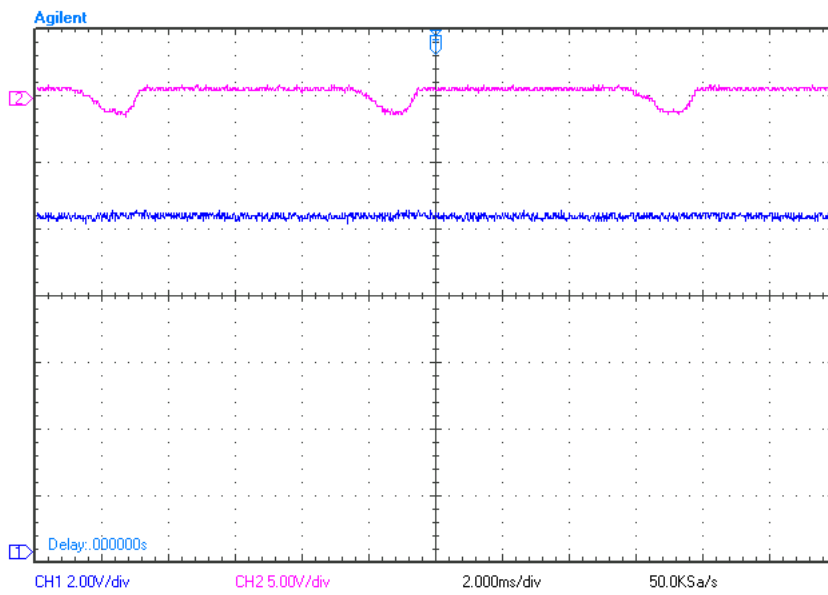


Figure 13: Voltage at R_l and I_d with C_f of $33\mu F$, and $R_l = \infty\Omega$

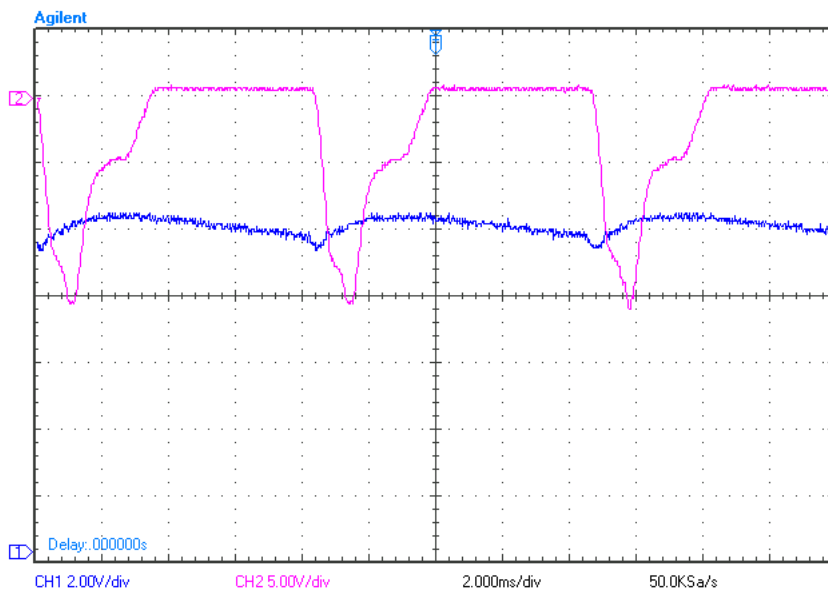


Figure 14: Voltage at R_l and I_d with C_f of $33\mu F$, and $R_l = 330\Omega$

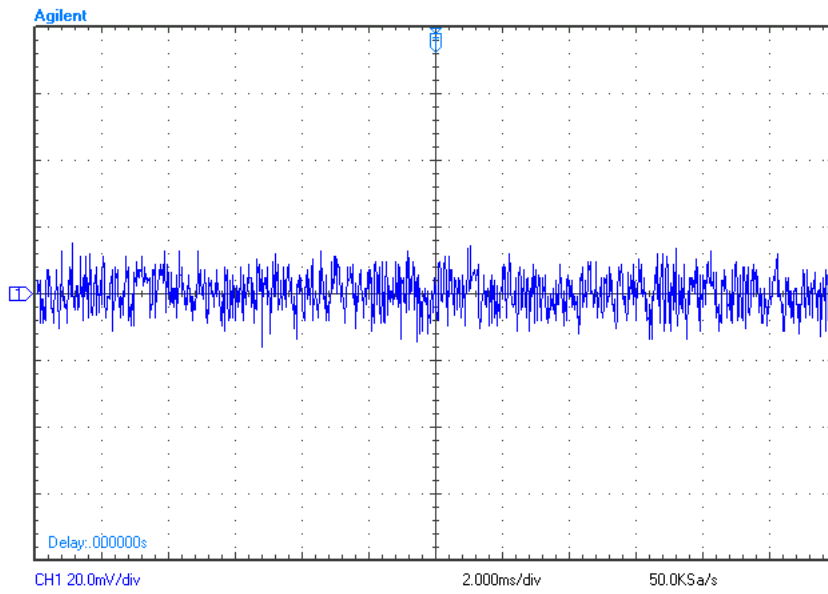


Figure 15: Voltage at R_l with the LM 317