Report for E-design 344

by

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E-Design final report (Assignment # 3)

September 2019

Declaration

By submitting this report electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualifcation.

**** Put your signature here and remove this line ****

Signature: ....
E. Stewdent

Date: ....

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Nomenclature

Constants

g = $9.81\,\mathrm{m/s^2}$

Variables

P Power . . . . [W]

Chapter 1

System design

1.1 System overview

Here you insert a block diagram of your operational signal conditioning system. Try to explain **what** configiation you chose and **why**. There is no need to specify the capacitor and resistor values here, but you want to capture the higher-level functional arrangement you have opted for. The diagram ties together the other chapters in this report and helps the reader understand how you have connected the different funtional blocks together to produce the outputs. For example, a block could be "Differential aplifier" or "level shifting op-amps" or the like. Fig. 1.1 as an example that is completely irrelevant and just holds space for your beautiful system diagram.

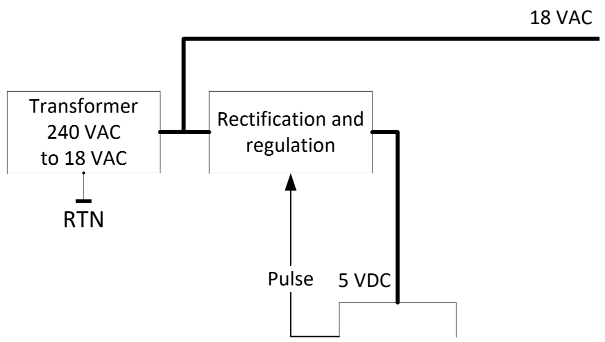


Figure 1.1: System diagram

Chapter 2

Power conversion

2.1 Design

In this section, you need to capture your design, which should include the following:

- Design rationale, i.e. what your thinking was behind the design.
- References to literature/sources as appropriate [1]. You can assume the reader has an E&E degree, and will not need trivial explanations or references.
- Design calculations, for example to determine resistor values and capacitor values, or to check for allowed voltage and current ranges and levels.
- Schematic circuit diagram, like in Figure 2.1

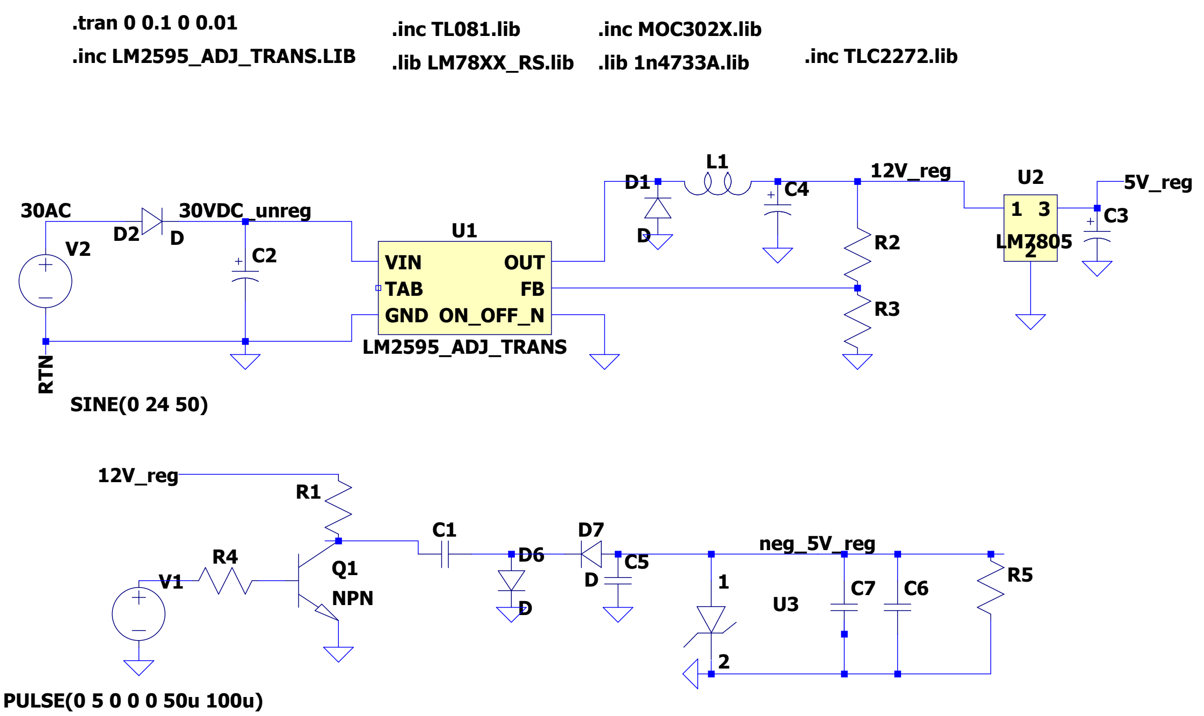


Figure 2.1: Power conversion circuit diagram.

2.2 Simulation

In this section, you want to demonstrate, by means of referring to simulation results, using the designed circuit, how your circuit is expected to behave. Present and report on your simulated results in Figures 2.2a, 2.2c and 2.2e Be absolutely sure that the text and information in your report are readable.

2.3 Measurements

In this secion, you must present and report on your measured results similar to Figures 2.2b, 2.2d and 2.2f - you can use a photo or screenshot of the scope, as long as I can zoom in to see the necessary detail.

2.4 Summary and implementation

State whether your design performs as expected. Give a snapshot of the relevant part of your circuit in Figure 2.3.

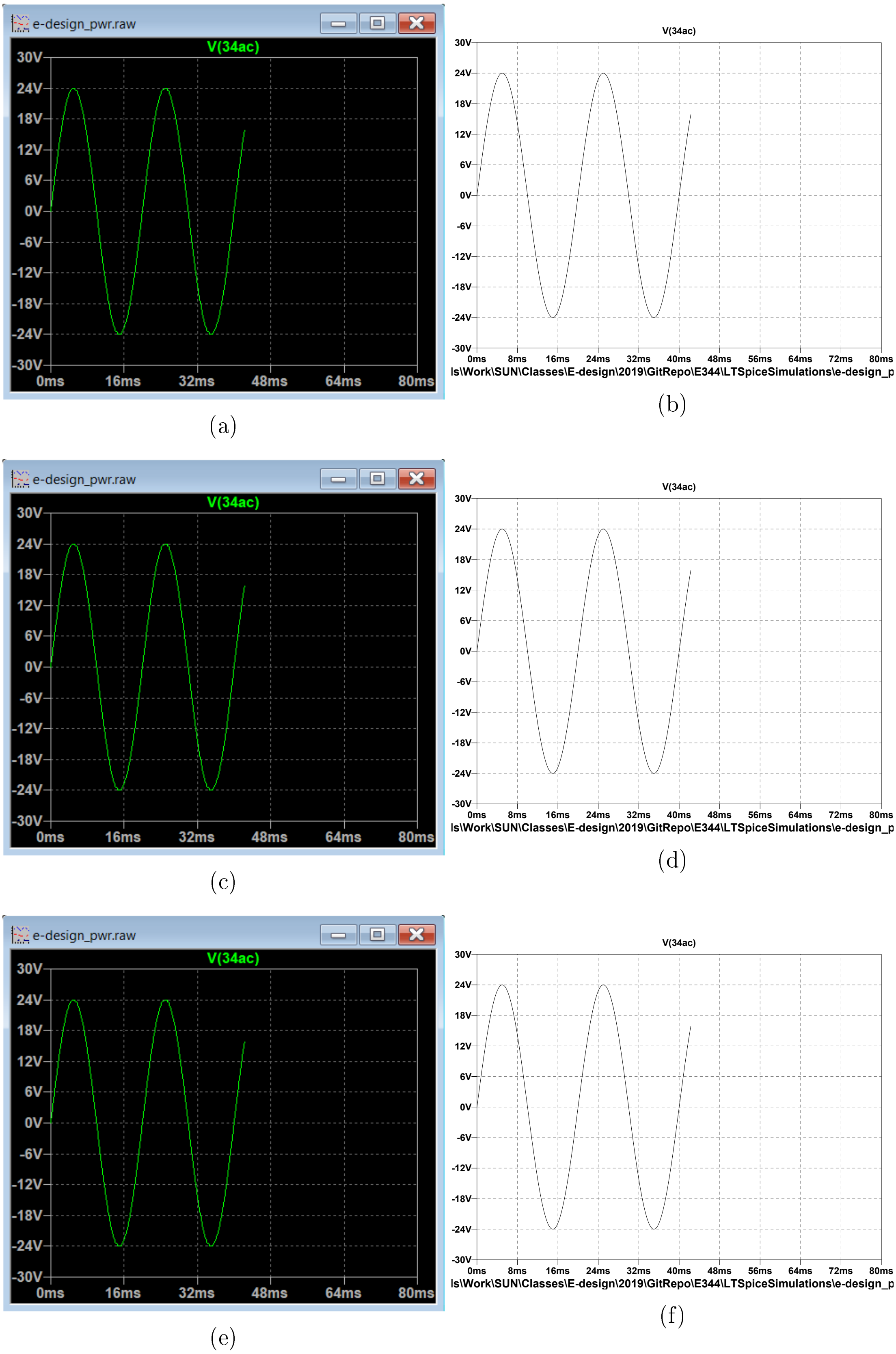


Figure 2.2: Power conditioning: (a) Simulation of the rectification showing the input AC and the rectified signal. (b) Measurement of the rectification showing the input AC and the rectified signal. (c) Simualtion output of the voltage rail levels. (d) Measurement of the output voltage rails levels. (e) Simulation output of the noise on the voltage rails. (f) Measurement of the noise on the voltage rails.

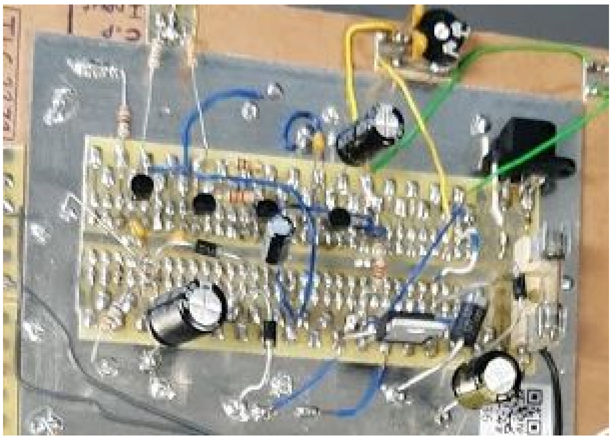


Figure 2.3: Implementation of the power conversion circuitry.

Chapter 3

Signal conditioning

3.1 Voltage transducer

3.1.1 Design

3.1.2 Simualtion

Here refer to Figures 3.2a and 3.2c.

3.1.3 Measurent

Here you can re-use the tables from Assignment 2. Here refer to Figures 3.2b and 3.2d.

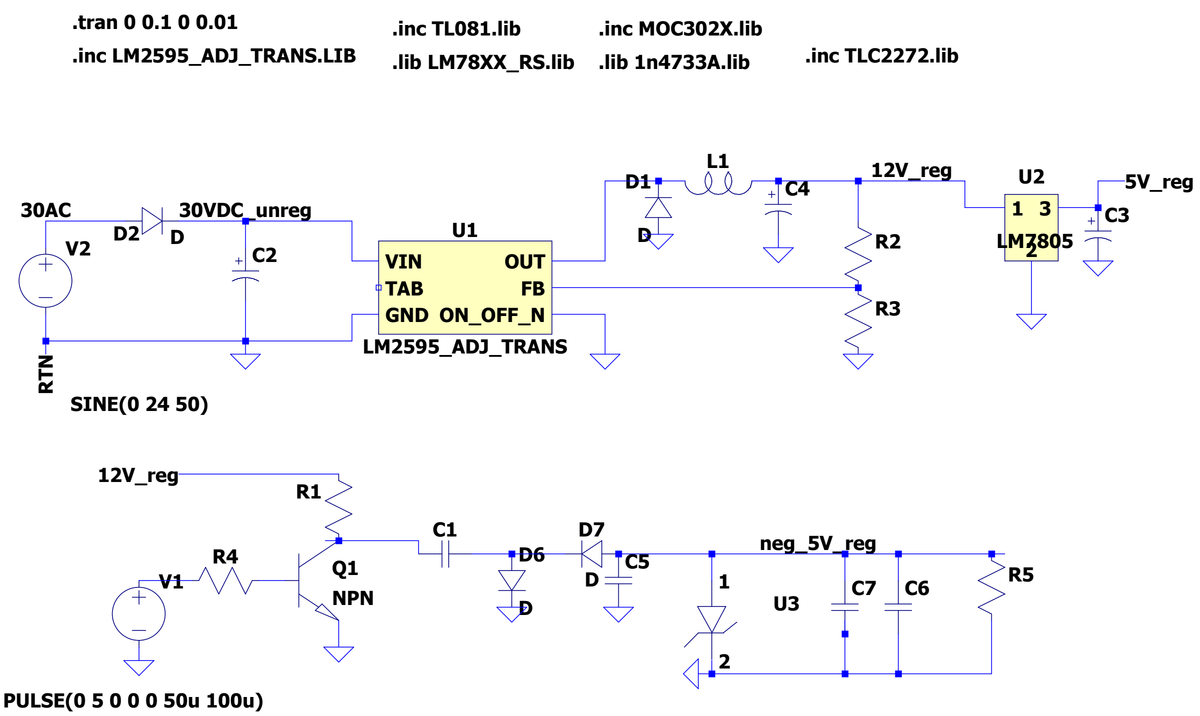
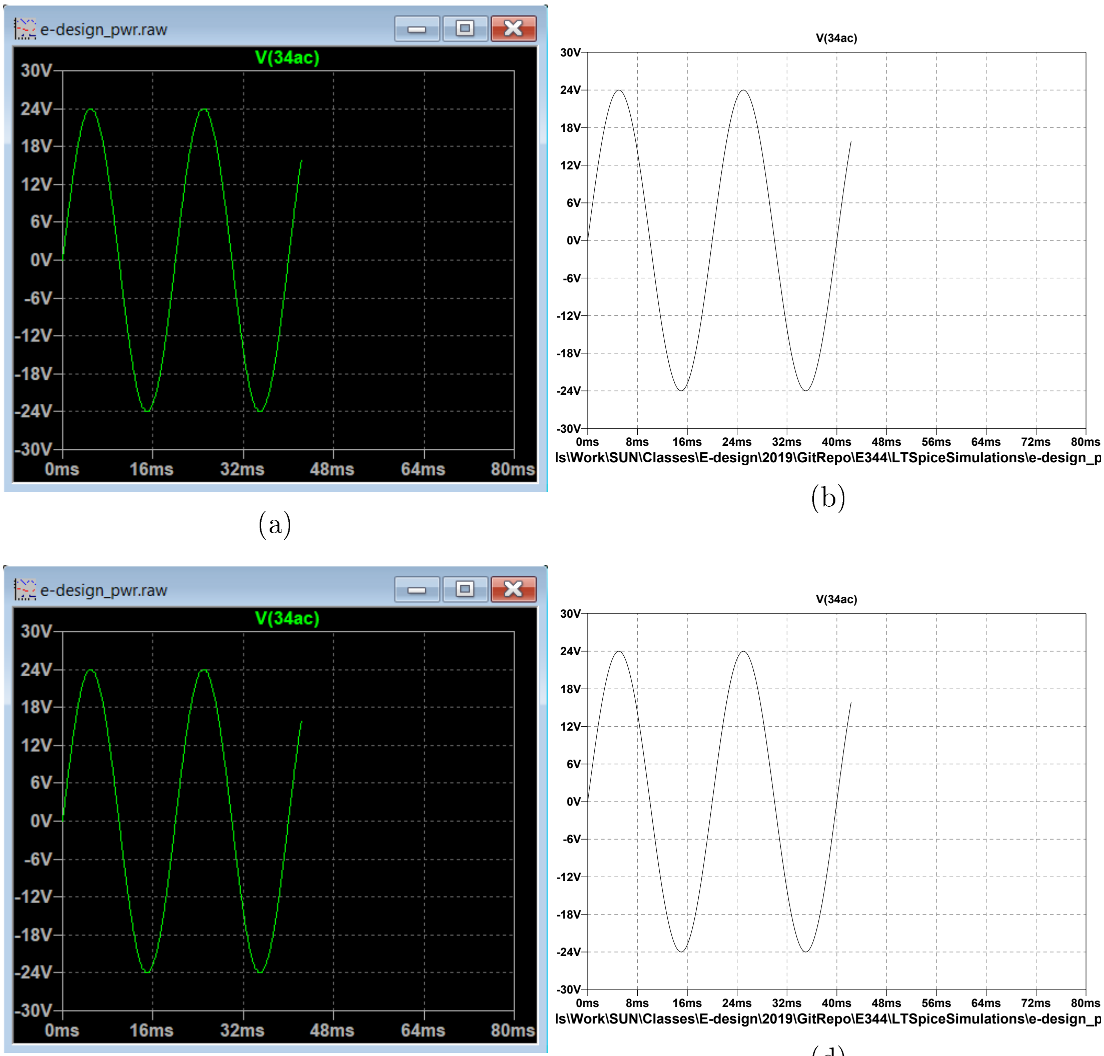


Figure 3.1: Voltage transducer circuit diagram.



(a) (b)

(c) (d)

Figure 3.2: Voltage transducer results. (a) No load simulated. (b) No load measured. (c) Mid-sized load simulated. (d) Mid-sized load measured. (c)

3.2 Current transducer

3.2.1 Design

3.2.2 Simualtion

Here refer to Figures 3.4a and 3.4c.

3.2.3 Measurent

Here you can re-use the tables from Assignment 2. Here refer to Figures 3.4b and 3.4d.

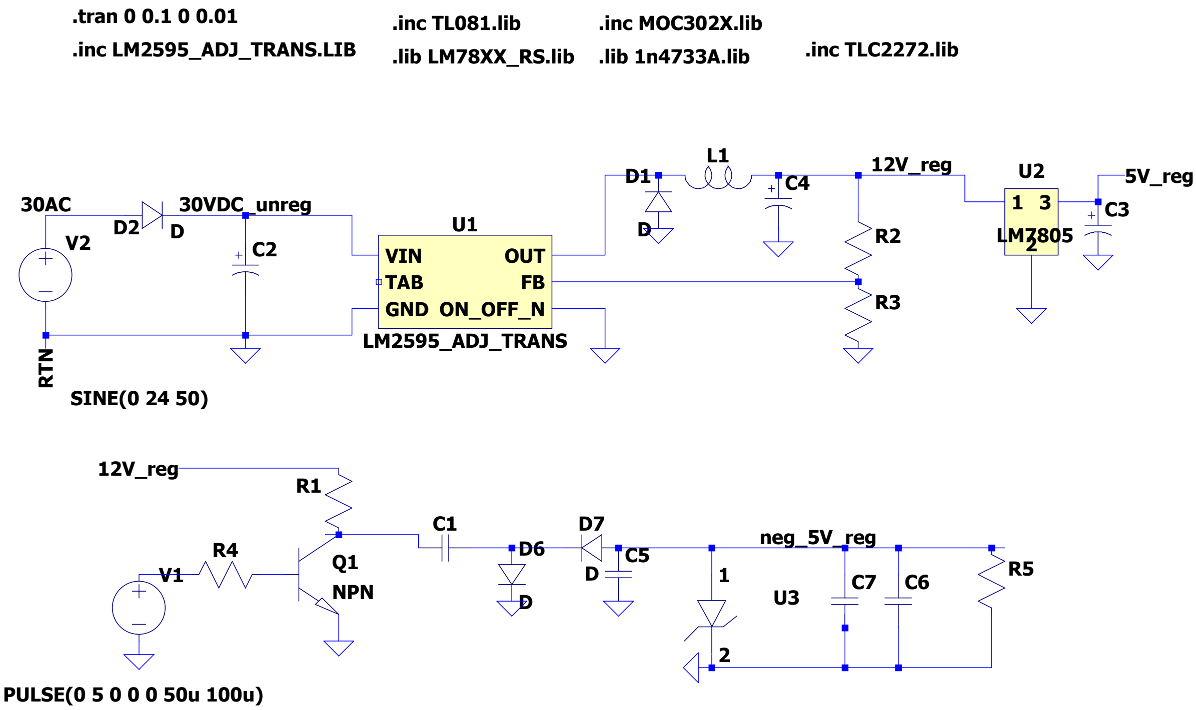


Figure 3.3: Current transducer circuit diagram.

3.3 Phase-shift transducer

3.3.1 Design

3.3.2 Simualtion

Here refer to Figures 3.6a and ??.

3.3.3 Measurent

Here you can re-use the tables from Assignment 2. Here refer to Figures 3.6b and ??.

3.4 Summary and implementation

State whether your design performs as expected. Give a snapshot of the relevant part of your circuit in Figure 3.7.

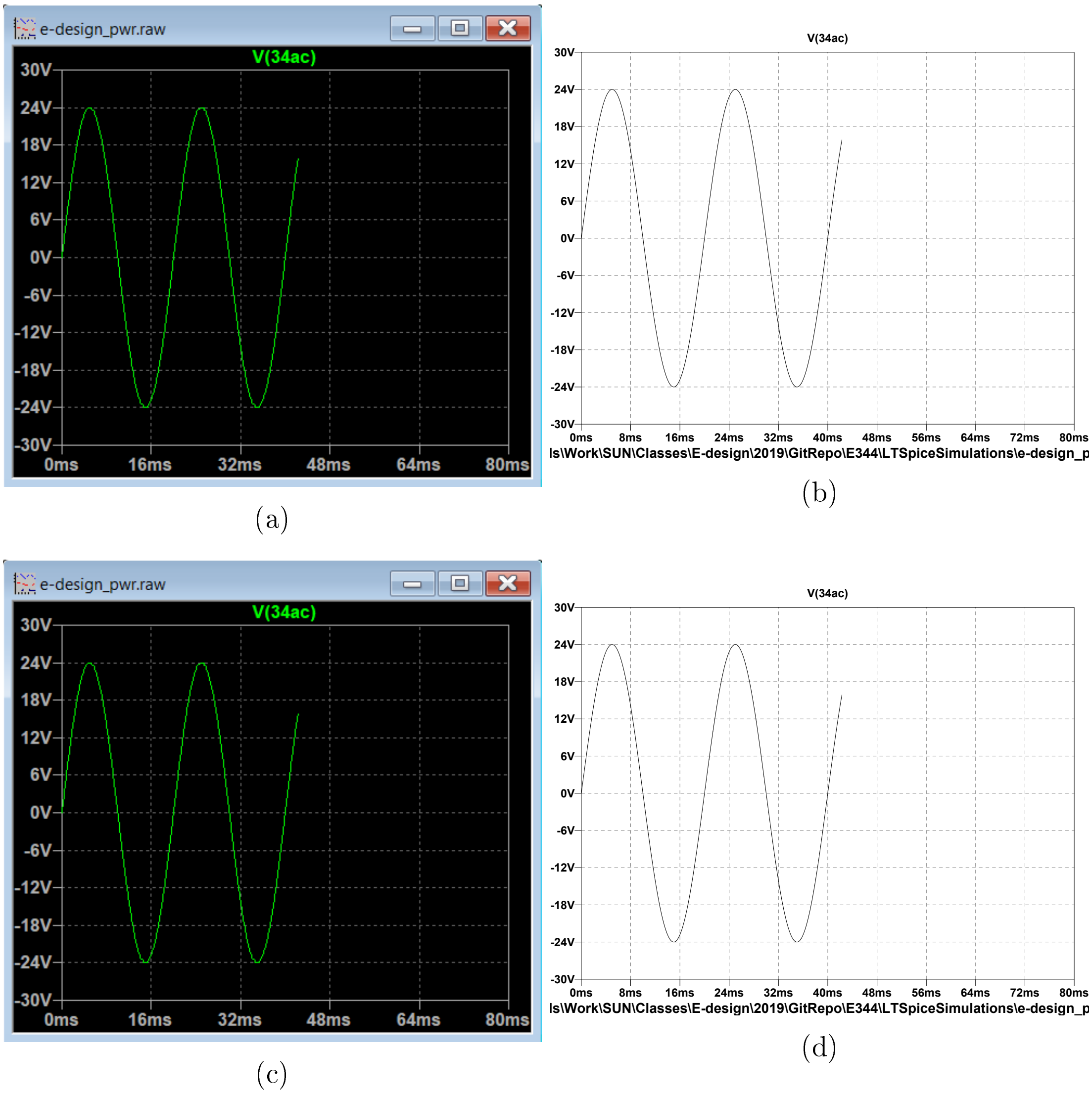


Figure 3.4: Current transducer results. (a) No load simulated. (b) No load measured. (c) Mid-sized load simulated. (d) Mid-sized load measured. (c)

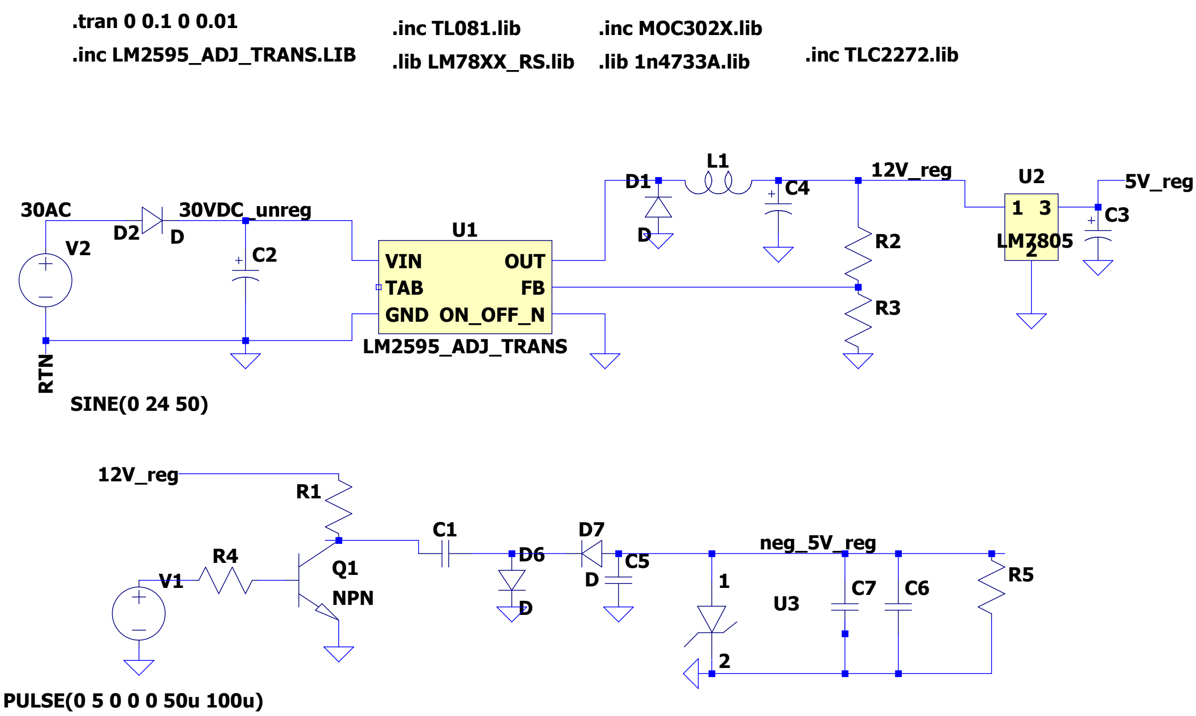


Figure 3.5: Phase-shift transducer circuit diagram.

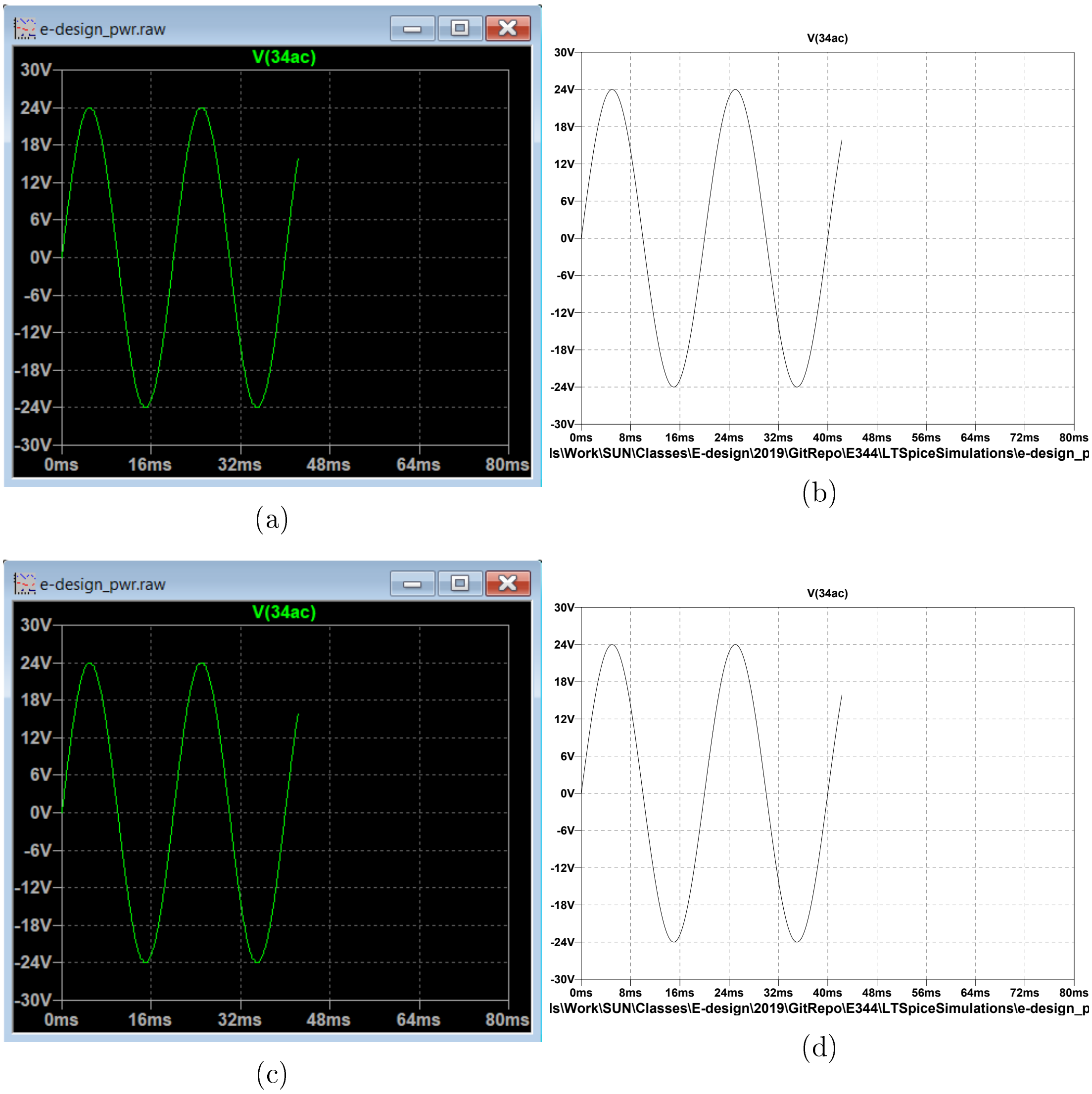


Figure 3.6: Phase-shift transducer results. (a) Resistive load simulated. (b) Resistive load measured. (c) Mid-sized capacitive load simulated. (d) Mid-sized capacitive load measured. (c)

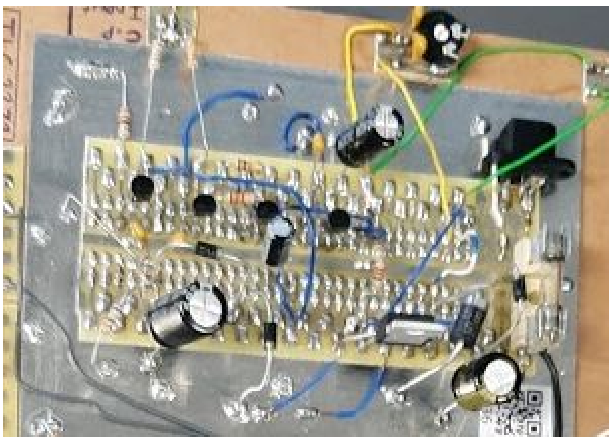


Figure 3.7: Implementation of the transducers circuitry.

Chapter 4

Over-current protection

Follow the same format as the previous chapters - circuit diagram, and then simulated and measured results.

4.1 Design

4.2 Simulation

4.3 Measurements

Chapter 5

Reporting

5.1 Design

Here give a flow diagram or psuedocode listing of your Arduino code and a flow diagram or psuedocode of your Python code. Give a circuit diagram and/or description of how you connected the grounds vs voltages and how you protected the interface to the Beetle agains over-voltage conditions. Maybe show a screengrab of the scope measuring the UART line.

5.2 Results

Show some screen grabs of your GUI.

Chapter 6

Extra functionality

Be very clear about what the extra functionality is, and convince the reader.

Chapter 7

System and conclusion

7.1 System

Photo of your student card next to your PCB. Indicate the functional blocks of your PBC here (preferably by overlaying blocks using something like powerpoint.

7.2 Lessons learned

Write down at least five of the most important things you have learned or lessons you acquired from E344.

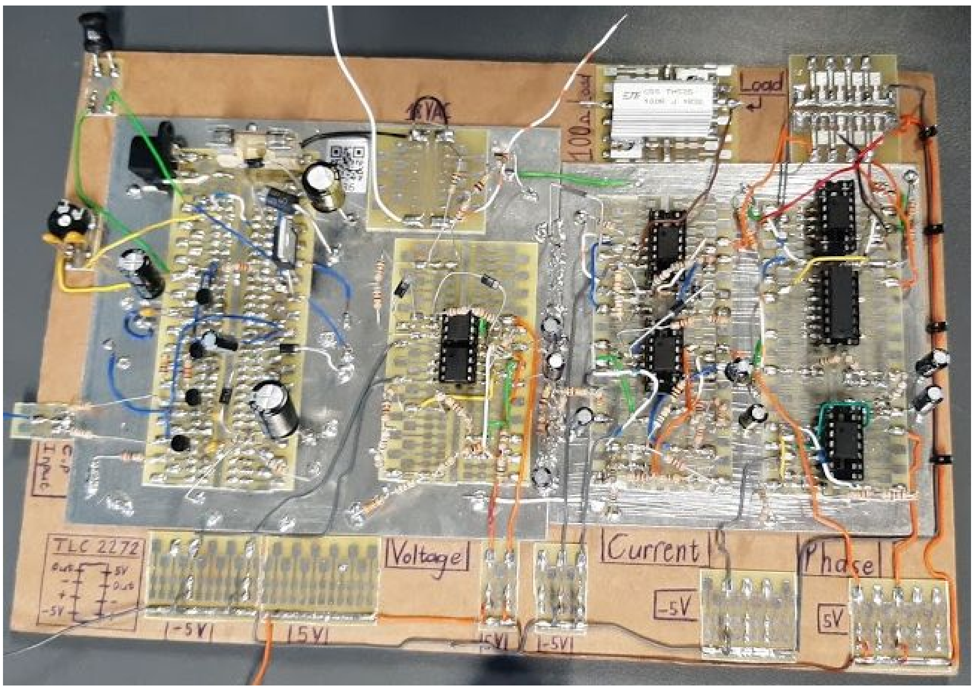
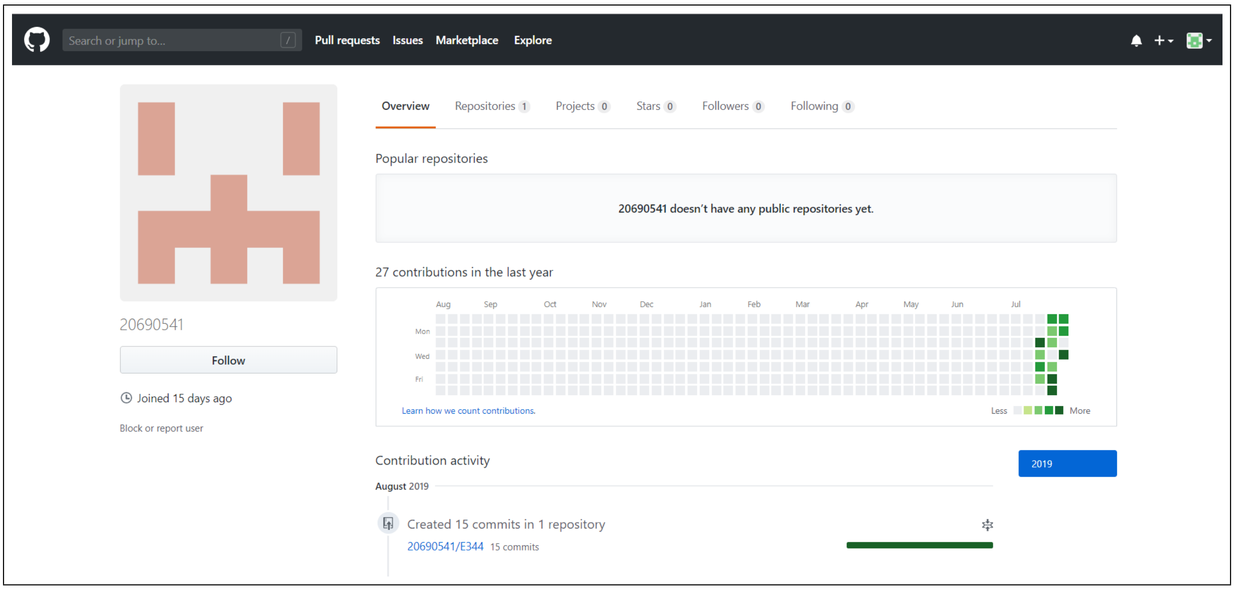


Figure 7.1: Complete PCB.

References

[1] BBC: How to make opamps amp op. 2018.
Available at: `www.electronics-tutorials.ws`

Appendix A: GitHub Activity Heatmap



Appendix B: Stuff you want to include

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Appendix C: More stuff you want in

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