

Distortion Pedal Upgrade

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Abstract

Use schematic design principles to simplify the design and maintain the sound quality of electric guitar pedal circuits. Apply design techniques that will generate new sounding pedals which beginner, experienced, and master musicians can rely on.

Introduction

Circuit design techniques and the reverse engineering of professional pedals were used along with knowledge of enclosure manufacturing and the development process of a printed circuit board. The objective of this project is to redesign and simplify complex circuits of current guitar pedals to save space (Reference Figure 1) while keeping the overall sound quality.

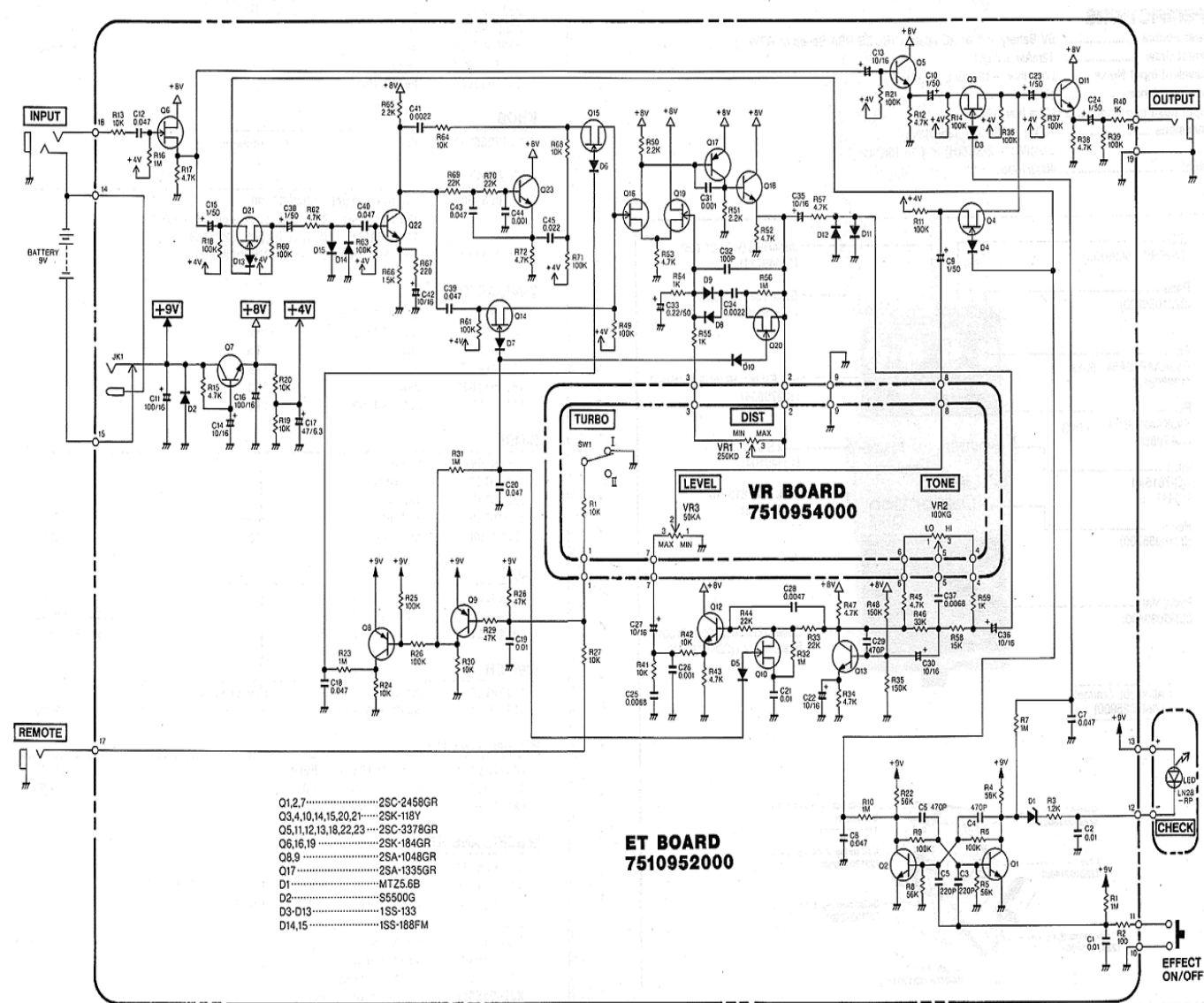


Figure1: Boss-Distortion

Methods/Materials

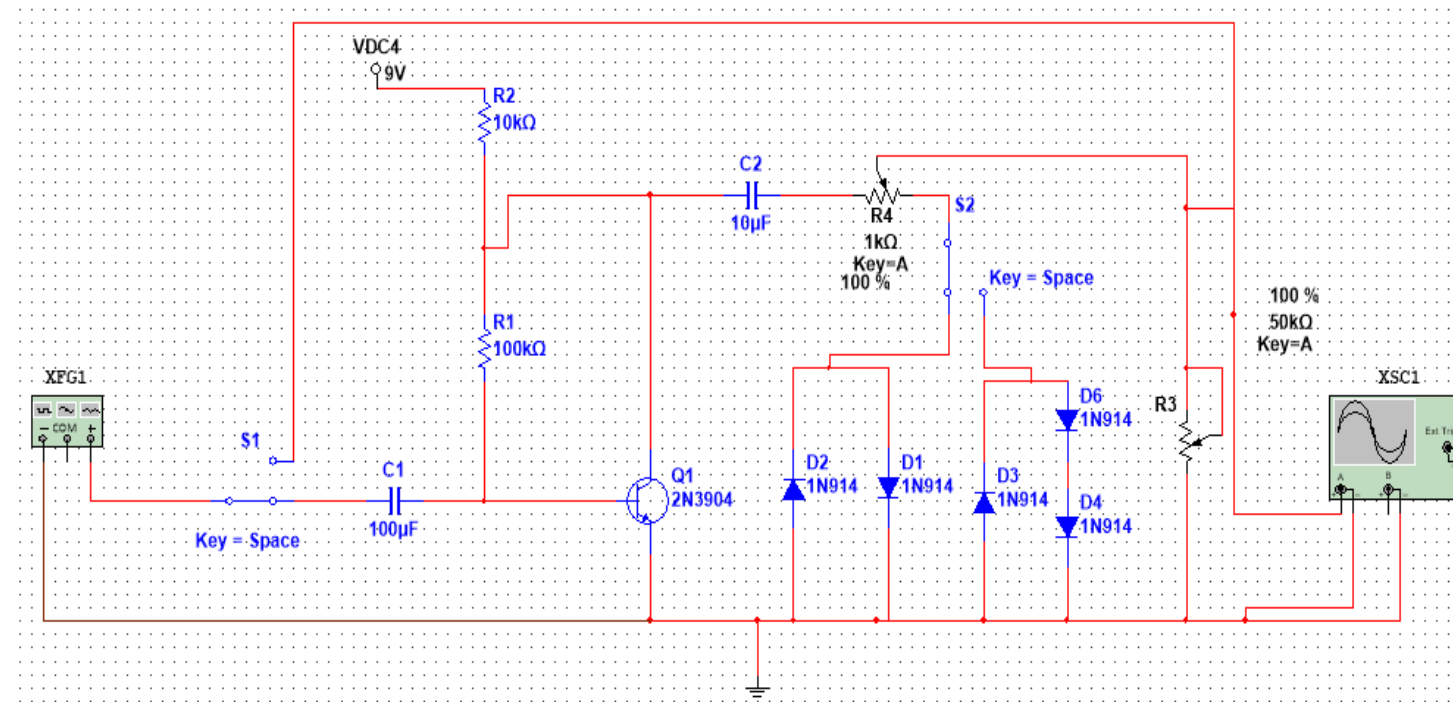


Figure2: Schematic

Diode Clipping: This circuit utilized symmetrical and asymmetrical diode configurations. Both hard and soft clipping waveforms were created.

Since the threshold of a clipping diode is additive when diodes are in series the positive and negative wave cycles can be different.

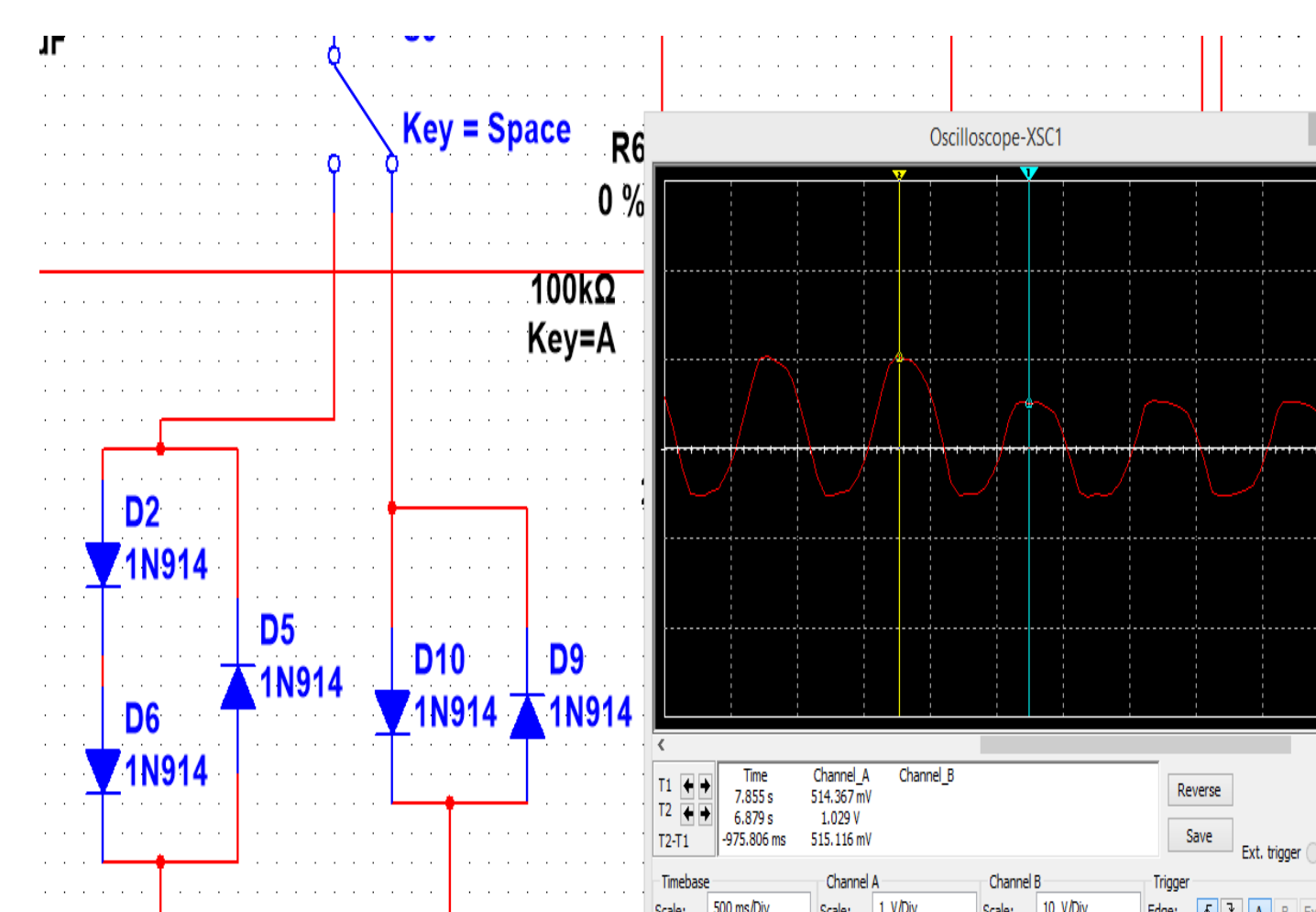


Figure3: Diode Clipping

Combined with diode clipping, the use of transistor biasing gives the pedal a fuzzy, distortion tone. Below are the calculations used to select specific components.

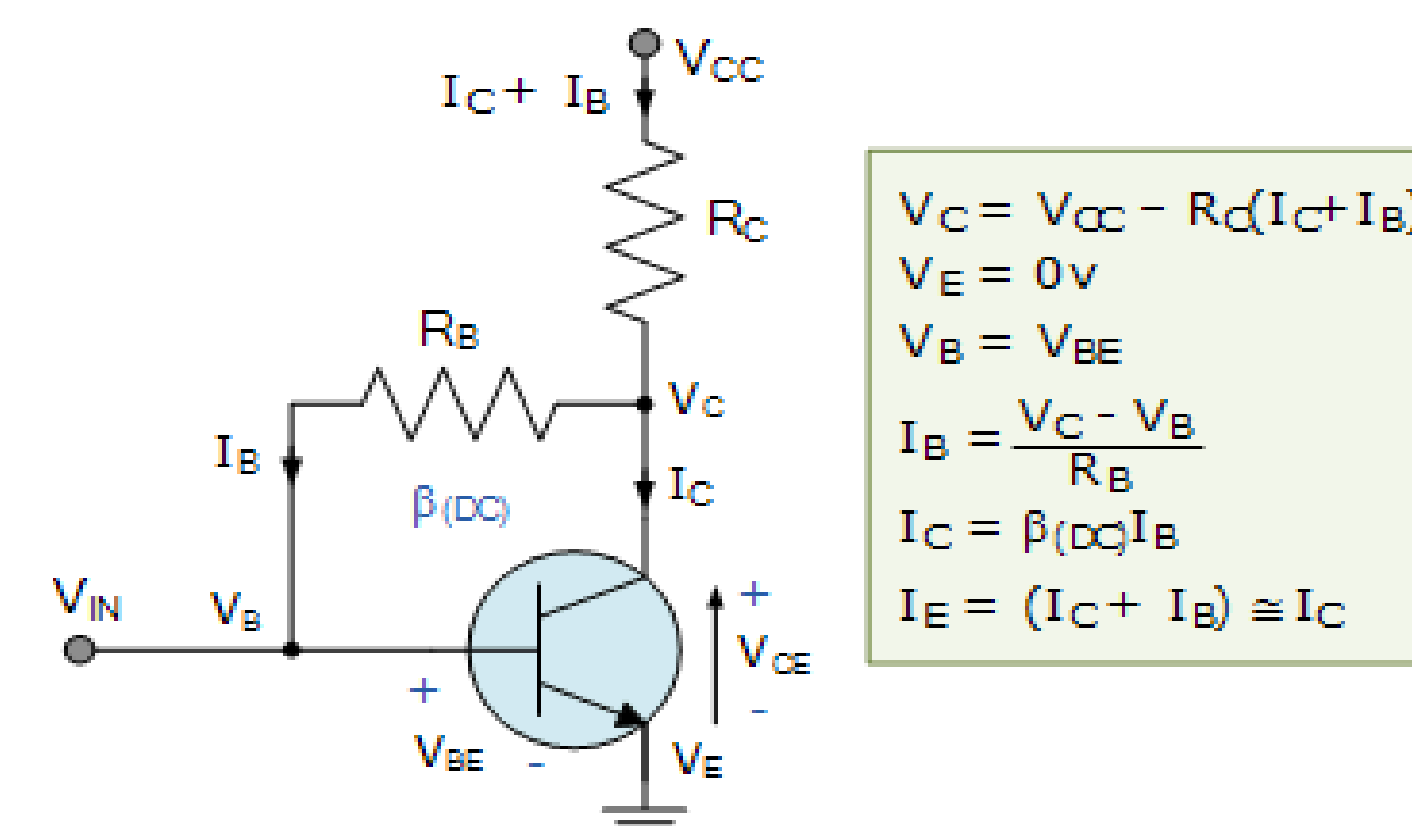


Figure4: Transistor Biasing

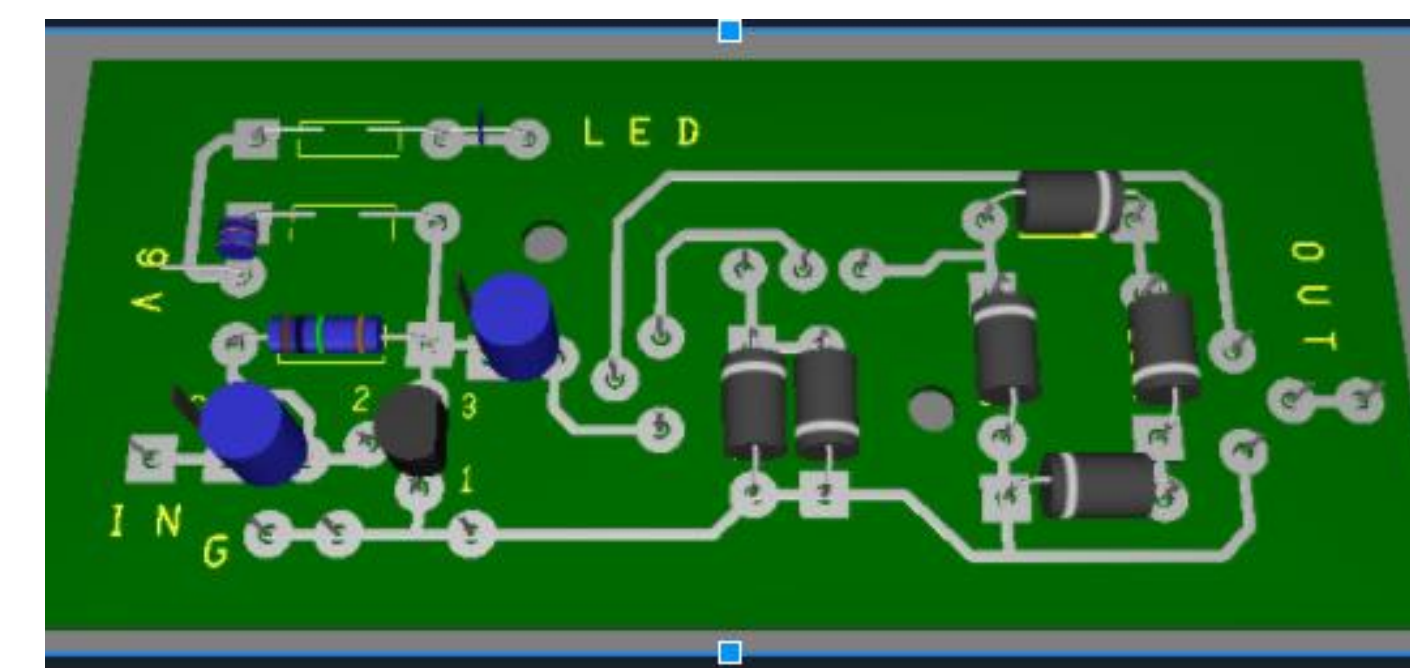


Figure5: Ultiboard PCB

Ultiboard utilizes accurate component sizes, and provides a 3D view of the design to aid in the process. A basic printed circuit board design of a general circuit (Reference Figure 5). was used to get familiar with Ultiboard, as it has fewer components than the final design.

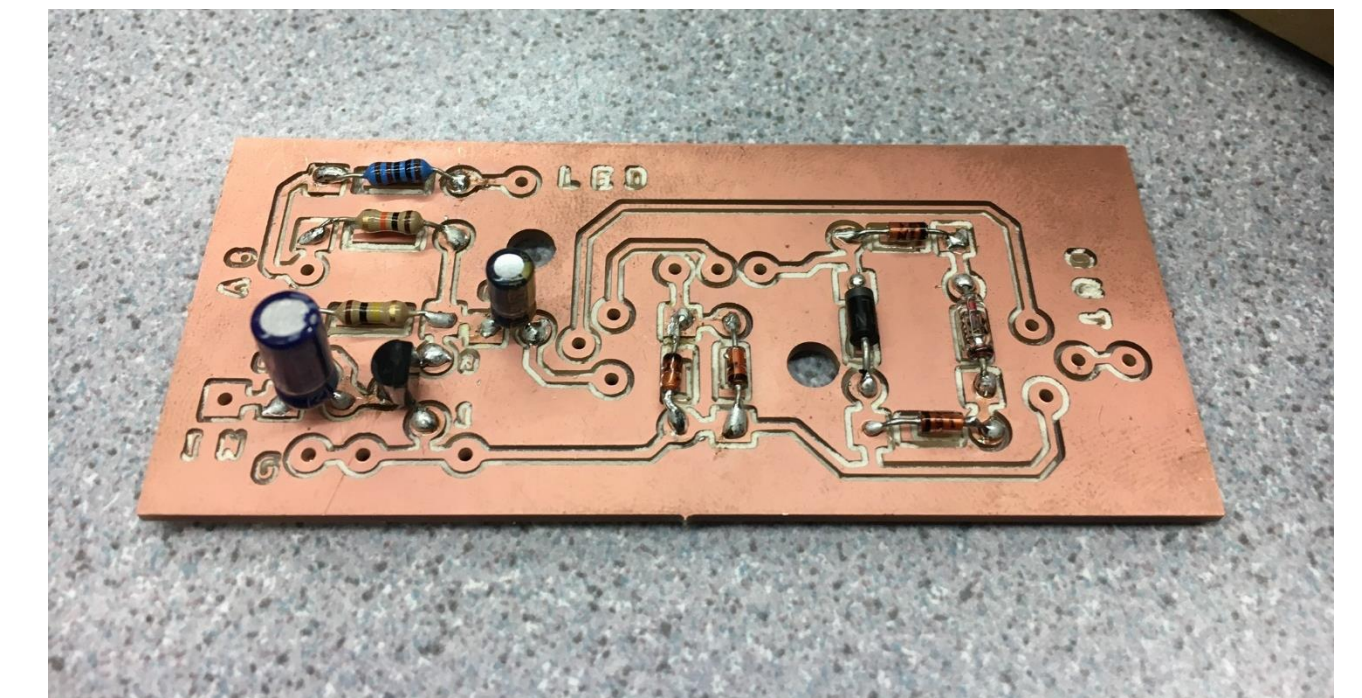


Figure6: Carvey PCB

Above is the populated PCB that was manufactured using a drilling machine called "Carvey". We then used a 3D printer to print the encasing that will fit all of the electrical components and the PCB. (Reference Figure 7)



Figure7: 3D Printed Encasing Conclusions

Reverse engineering was a strategy that allowed us to learn more about how different guitar pedals work, as well as obtaining ideas for designing a simpler circuit. Advanced circuit design techniques such as soft/hard clipping of diodes and were researched heavily and implemented into the design.