

Ring Modulator Stomp Box

My second project for the semester, the Ring Modulator Stomp Box, was an idea and design of Professor Errede's. It somewhat stemmed from the talkbox project in that it is another way to modulate guitar sounds. The Ring Modulator Stomp Box takes two audio inputs and multiplies their signals, creating and effects output signal.

The circuit diagram can be seen in Appendix I, as designed by Professor Errede. The AD633 is a four-quadrant analog multiplier chip. It is powered by two nine-volt batteries. The chip converts the two differential X and Y inputs to differential currents by voltage-to-current converters. The product of these currents is generated by a multiplying core. The sum of $(X*Y)/10 + Z$ is then applied to the output amplifier. A block diagram of the chip is shown in Figure 1. The transfer function of the chip is shown in Equation 1, which simplifies to Equation 2 since pins 2, 4, and 6 are all grounded in my design.

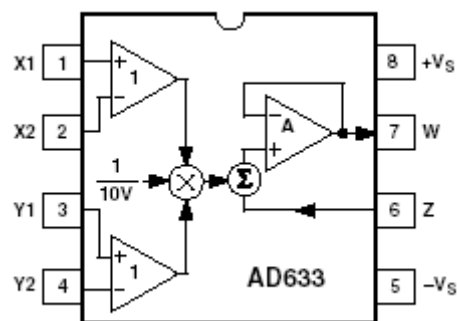


Figure 1: Functional Block Diagram – AD633 Pinout

$$W = \frac{(X_1 - X_2)(Y_1 - Y_2)}{10 V} + Z \quad \text{Equation (1)}$$

$$W = (X_1 * Y_1) / 10V \quad \text{Equation (2)}$$

The circuit has two inputs (*IN1* and *IN2*) and four outputs (*OUT1/FX OUT1*, *OUT2*, *FX OUT1*, and *FX OUT2*). A three-pole double-throw footswitch allows the signal to be sent directly out *OUT1* and *OUT2* with now modulation or to be sent to the ring modulator circuit. In the latter case the effects output signal is sent to three of the outputs: *OUT1/FX OUT1*, *FX OUT1*, and *FX OUT2*.

There are also three potentiometers used for controlling the input signals (*IN1* and *IN2*) and the effects output volume. Besides the footswitch, there is another switch used for powering the box on and off.

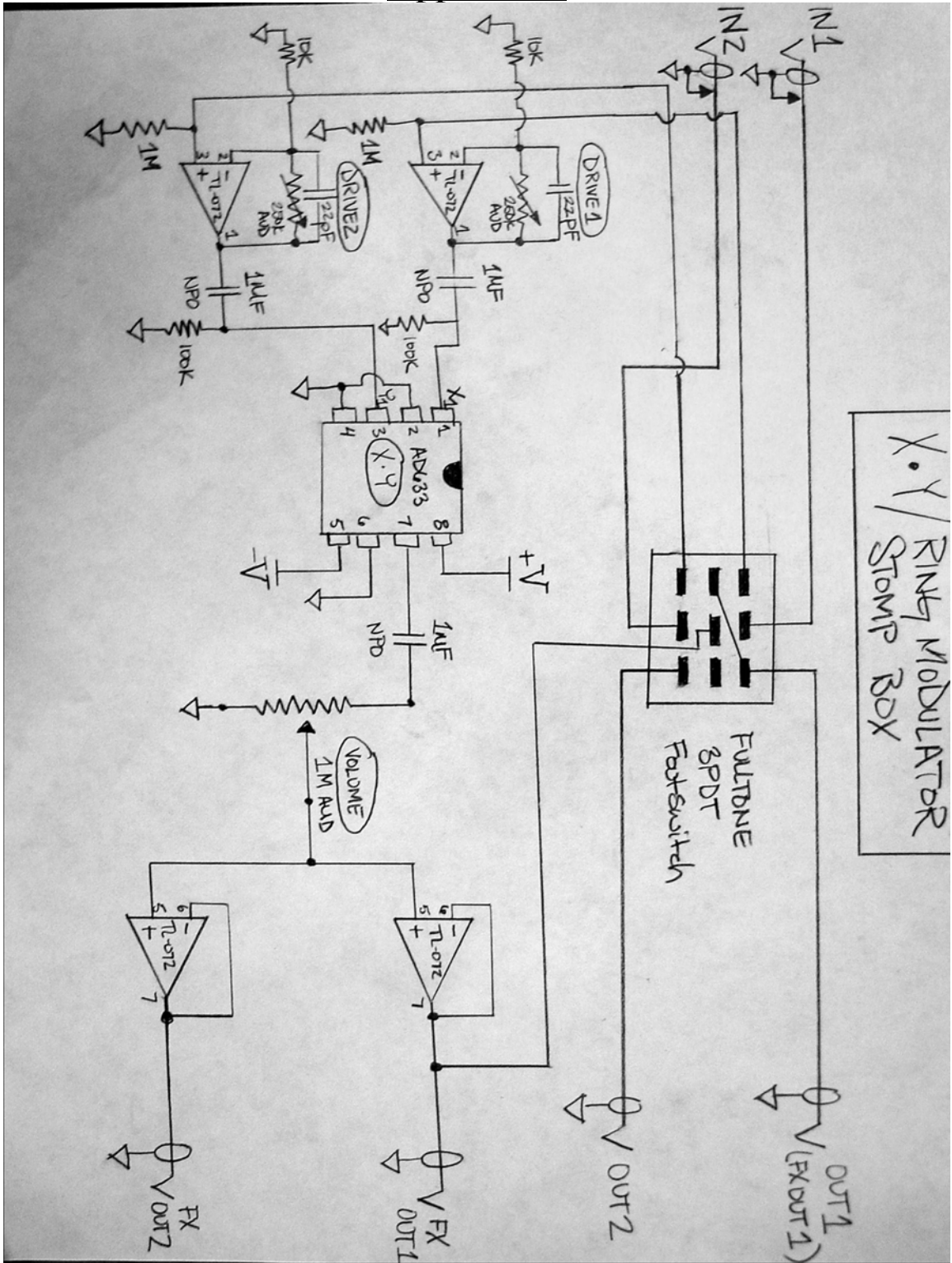
The actual construction of the circuit was a very tedious process of cutting wires and soldering all of the parts on the PC board. Holes had to be drilled in the chase for all of the external parts as well. Pictures of the inside and outside of the box can be seen in Appendix II.

After completing the Ring Modulator Stomp Box, I tried it out with some different input signals to see what kind of sounds it could make. First I tried multiplying a guitar signal and signal produced by a waveform generator. I found that a sine wave at low frequencies produced a beautiful tremolo effect. I also tried multiplying a guitar signal with a synthesizer. Trying different presets on the synthesizer created some very interesting sounds.

Having never built an audio device of this sort, I feel that I gained much knowledge in the process of doing this project. I now know how to read a circuit diagram

and how to construct and solder the circuit on PC board. I also learned how many different parts inside audio devices work, such as switches, potentiometers, jacks, etc. I have yet to try the Ring Modulator Stomp Box with other audio signals, but am excited to find out what kinds of sounds can be produced with it.

Appendix I



Appendix II



