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ESE 323 Final Project Report

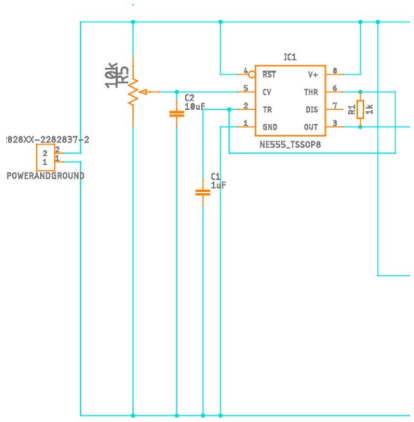
Project Description

The device created in this project is a single-tone synthesizer with a built in distortion module. The synthesizer can be broken down into three different circuitry modules. The first being a VCO, the second being a distortion module, and finally a demultiplexer (the circuitry will be discussed in more detail in the following section). Once a 9V battery is connected to the synthesizer, it will start producing a tone. From here, the user has two methods of input which are a potentiometer to control the frequency of the tone and a switch to enable the distortion module.

Circuit Description

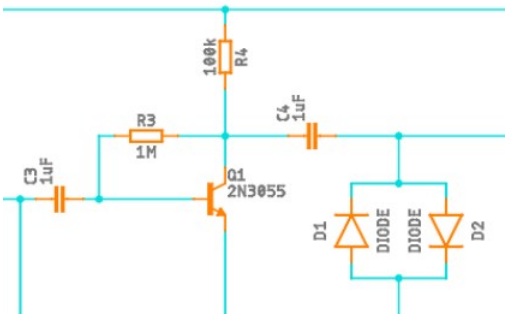
As stated in the previous section, the circuitry can be broken down into three modules.

VCO:

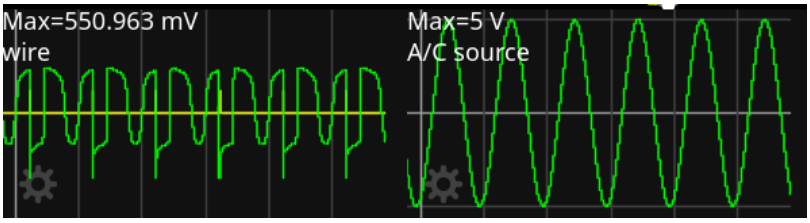


Above is the VCO portion of the synthesizer which is controlled by a potentiometer. The VCO, given the values of the capacitors and resistor, has a range between around 100Hz and 10,000Hz. To the left of the VCO, there is a wire module which will be connected to a 9V battery and, therefore, power the circuit.

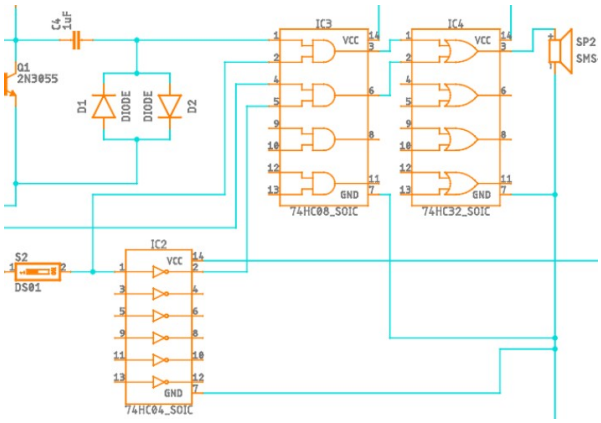
Distortion Module:



Above is the distortion module of the circuit that can be “switched on” (the signal from the VCO is put through a clean channel as well as this distortion channel, therefore, a switch will simply choose which signal the speaker will output but this will be discussed shortly). An input signal, in this case the output of the VCO, is inputted into this module at C3 and the output is at the junction connecting C4 and the diode loop. Below are the before (right) and after (left) pictures of a simple sine wave being put through this circuit:



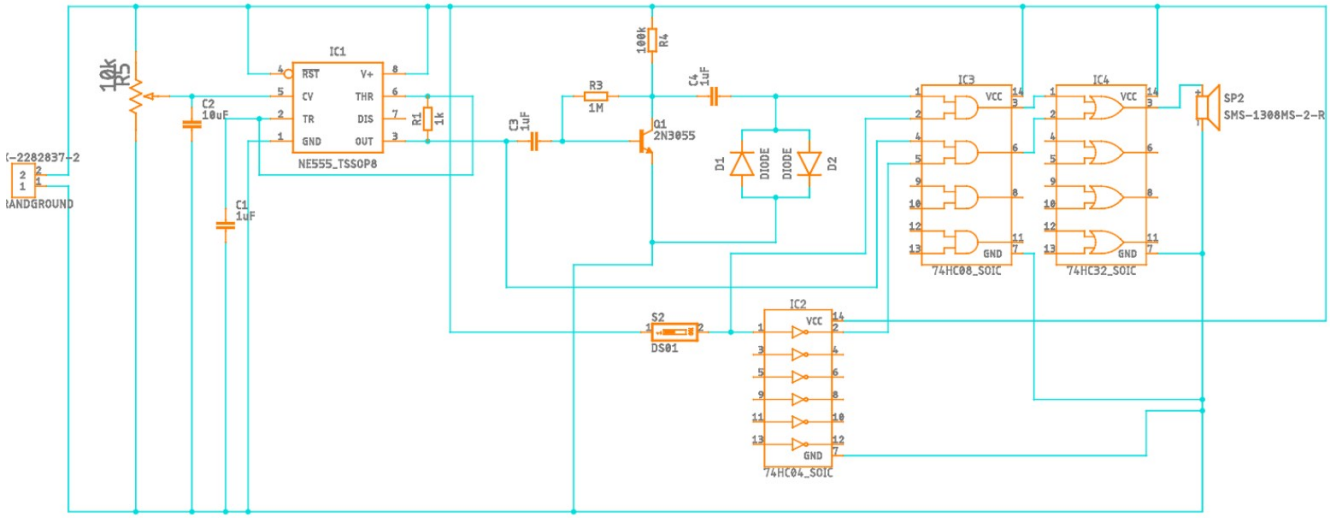
Demultiplexer:



Above is the circuitry for the demultiplexer. Here is the portion of the circuitry that is ultimately responsible for the synthesizer not working due to a mistake made in its implementation but this will be discussed later. This demultiplexer is implemented using logic gates rather then using a integrated

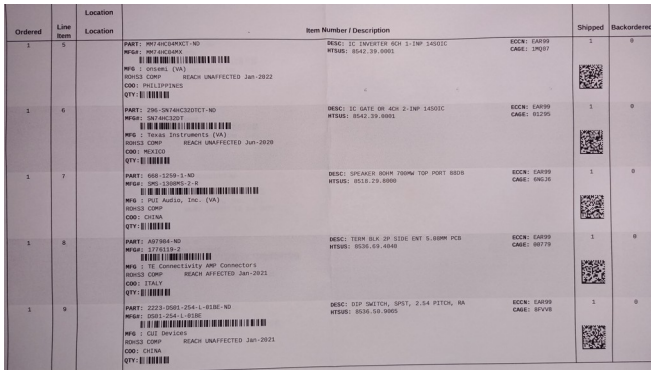
circuit. This decision was initially made because I believed it would be simpler to implement in this way but I was incorrect. Again, more details will be discussed in a later section.

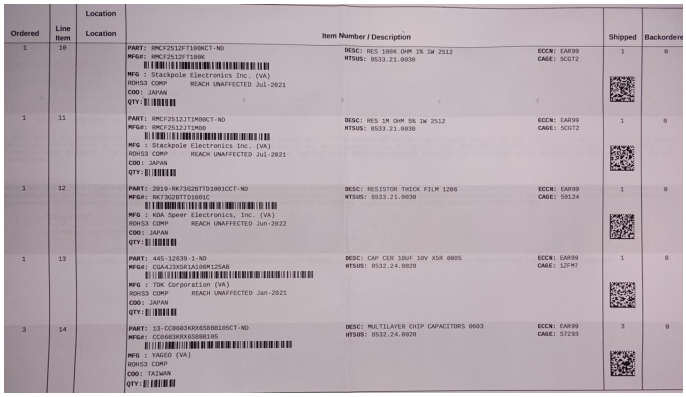
Lastly, the full circuit is shown below:



Bill of Materials

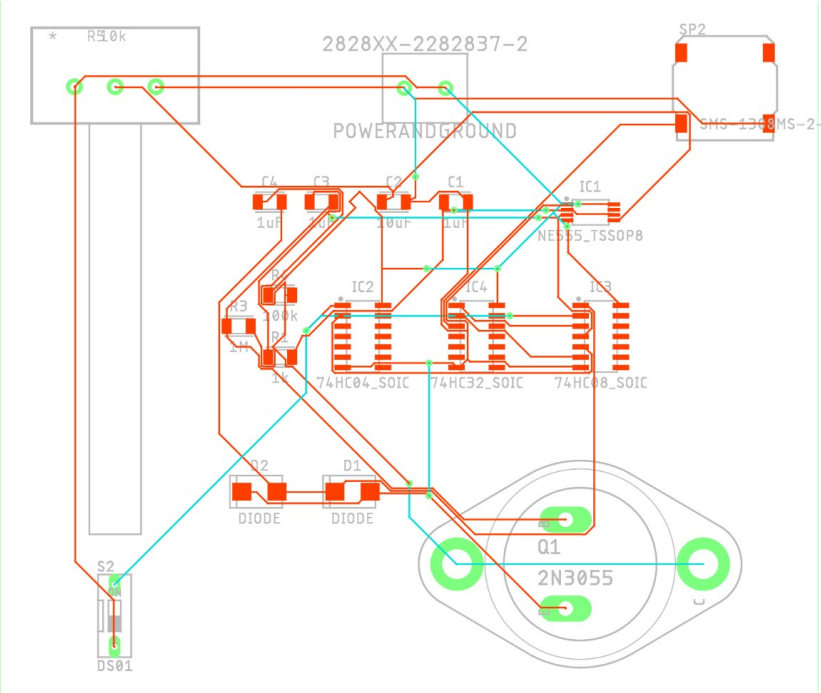
Ordered	Line Item	Location	Item Number / Description			Shipped	Backordered
1	1		PART: A105766-ND MFG#: 23ESA103MMF50NF MFG : TE Connectivity Passive Product ROHS3 COMP REACH NOT AVAILABLE Jan-2021 COO: UNITED KINGDOM QTY:	DESC: POT 10K OHM 0.4W CARBON LINEAR HTSUS: 8533.40.8070	ECCN: EAR99 CAGE: 00779	1	0
1	2		PART: 2N3055AGOS-ND MFG#: 2N3055AG MFG : onsemi ROHS3 COMP REACH UNAFFECTED Jun-2022 COO: MEXICO QTY:	DESC: TRANS NPN 60V 15A TO204 HTSUS: 8541.29.0095	ECCN: EAR99 CAGE: 1MQ07	1	0
1	3		PART: MM74HC08M-ND MFG#: MM74HC08M MFG : onsemi ROHS3 COMP REACH UNAFFECTED Jun-2022 COO: PHILIPPINES QTY:	DESC: IC GATE AND 4CH 2-INP 14SOIC HTSUS: 8542.39.0001	ECCN: EAR99 CAGE: 1MQ07	1	0
2	4		PART: 13-1.0SMB12A/TR13CT-ND MFG#: 1.0SMB12A/TR13 MFG : YAGEO (VA) ROHS3 COMP COO: CHINA QTY:	DESC: 1.0SMB, DO-214AA, 10.2V, 16.7V, HTSUS: 8541.10.0080	ECCN: EAR99 CAGE: S7293	2	0



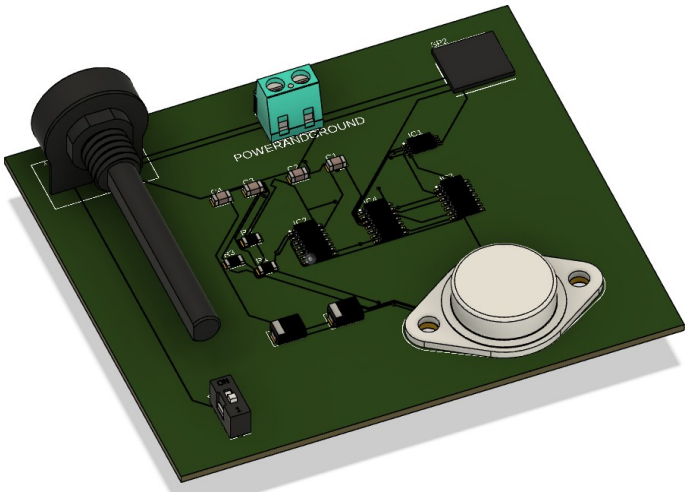


Ordered	Line Item	Location	Item Number / Description			Shipped	Backordered
1	15		PART: 296-29904-1-ND MFG#: NE555PWR MFG : Texas Instruments (VA) ROHS3 COMP REACH UNAFFECTED Jun-2020 COO: MALAYSIA QTY:	DESC: IC OSC SGL TIMER 100KHZ 8TSSOP HTSUS: 8542.39.0001	ECCN: EAR99 CAGE: 01295	1	0

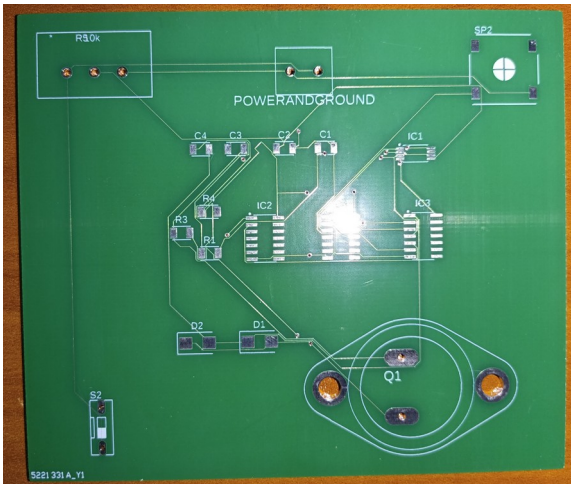
PCB



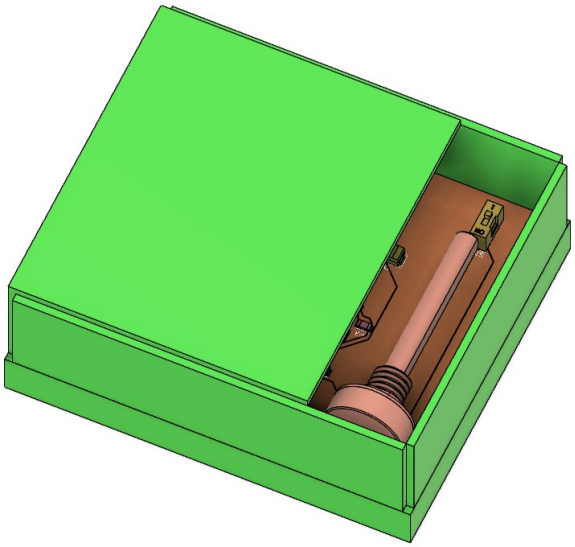
PCB Rendered Layout



Unpopulated Board



3D Enclosure



Results/What I Would Do Differently

As mentioned earlier, this synthesizer will not work. This is due to the implementation of the demultiplexer using logic gates. With a digital signal this logic gate implementation of the demultiplexer would work but with analog signals it simply will not. This is the biggest thing I would do differently and next time I would use a integrated circuit version of a demultiplexer. Moreover, if I were to redo this project, I would implement the different portions of the circuit on separate PCBs. For example, I would have the VCO on one PCB and the distortion circuit on another. Each PCB would have a audio jack port which would connect all of the boards.

What You Should Do Differently

I honestly feel that, besides maybe 342, this class has thought me the most engineering and the engineering process. The labs, and especially the final project, was very educational. The only thing that I feel could have been better this semester is feedback regarding the project. For example, I never got any feedback from TA's about my initial project idea even though it was unrealistically complicated. Also, the final project could have been spaced out better.