

A vintage microphone on a stand is the central focus, surrounded by colorful streamers and confetti. The background is a dark blue gradient. The entire scene is framed by a thin white border.


GROUP 17

KARAOKE PORTABLE SYSTEM

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Motivation



- Karaoke is a newer form of entertainment in America
 - It's origins lie within the Asian market, starting with the first Karaoke machine in the 1970's.
 - The basic premise of Karaoke is to provide a backing track for artists or hobbyist to sing songs without the need for a complete band
 - Karaoke is often accompanied by lighting effects and multiple monitors to display lyrics to everyone in attendance, including the performer.
 - Bring together family and friend to enjoy a time of singing and fun.
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Goals and Objectives

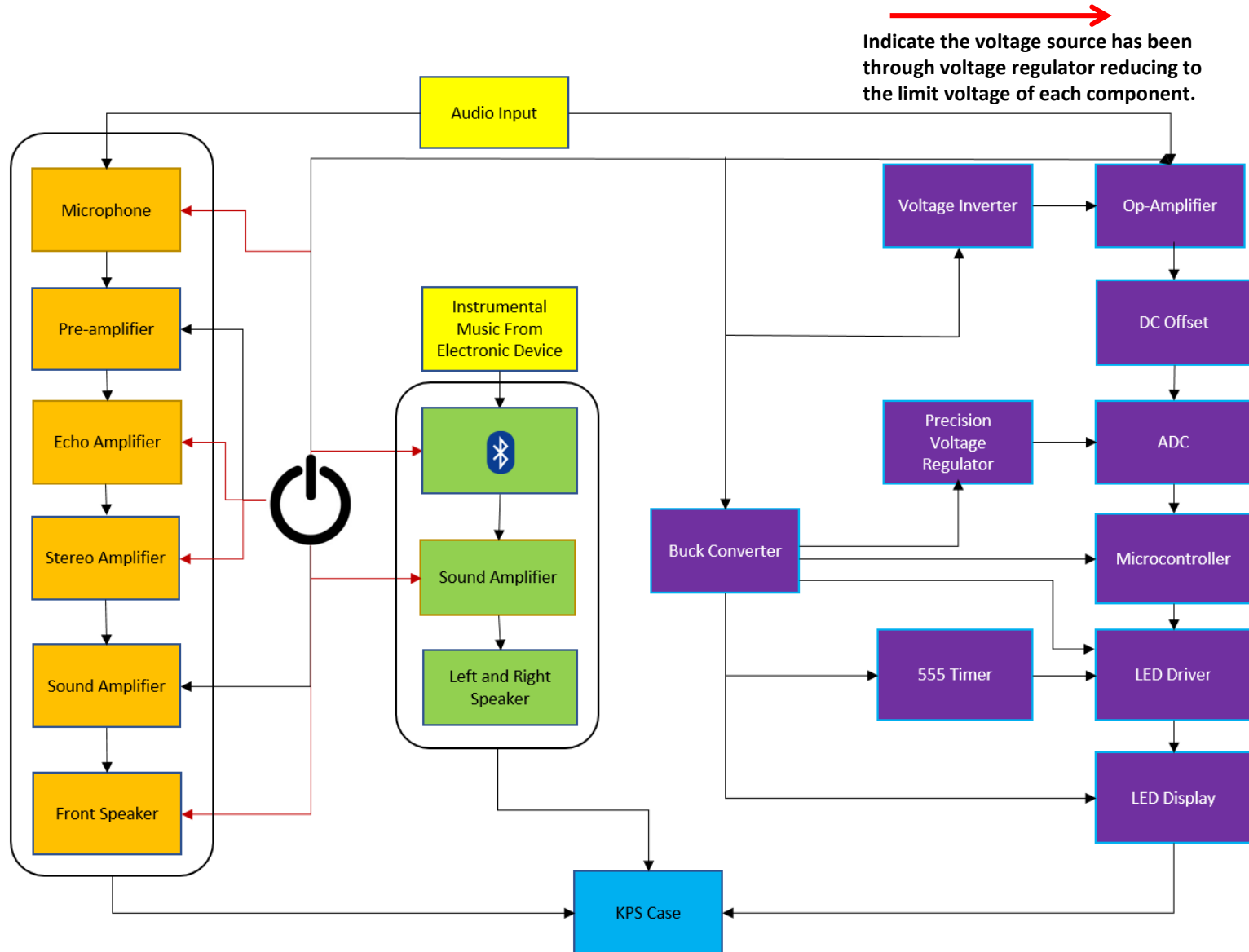


- Have a karaoke system that is portable
 - Provide performers the ability to sing to their favorite songs in front of an audience and access the songs on any device wirelessly.
 - KPS will bring the technology of Bluetooth to karaoke allowing for Karaoke to exist in any moment, and at any time.
 - Will connect to any cell phone (Apple or Android platform)
 - Three built in speakers
 - Audio and Voice effects
 - Lighting effects
 - Have a karaoke system that combines portable audio, voice and lighting into one device for karaoke, so that any one can put on an impressing show
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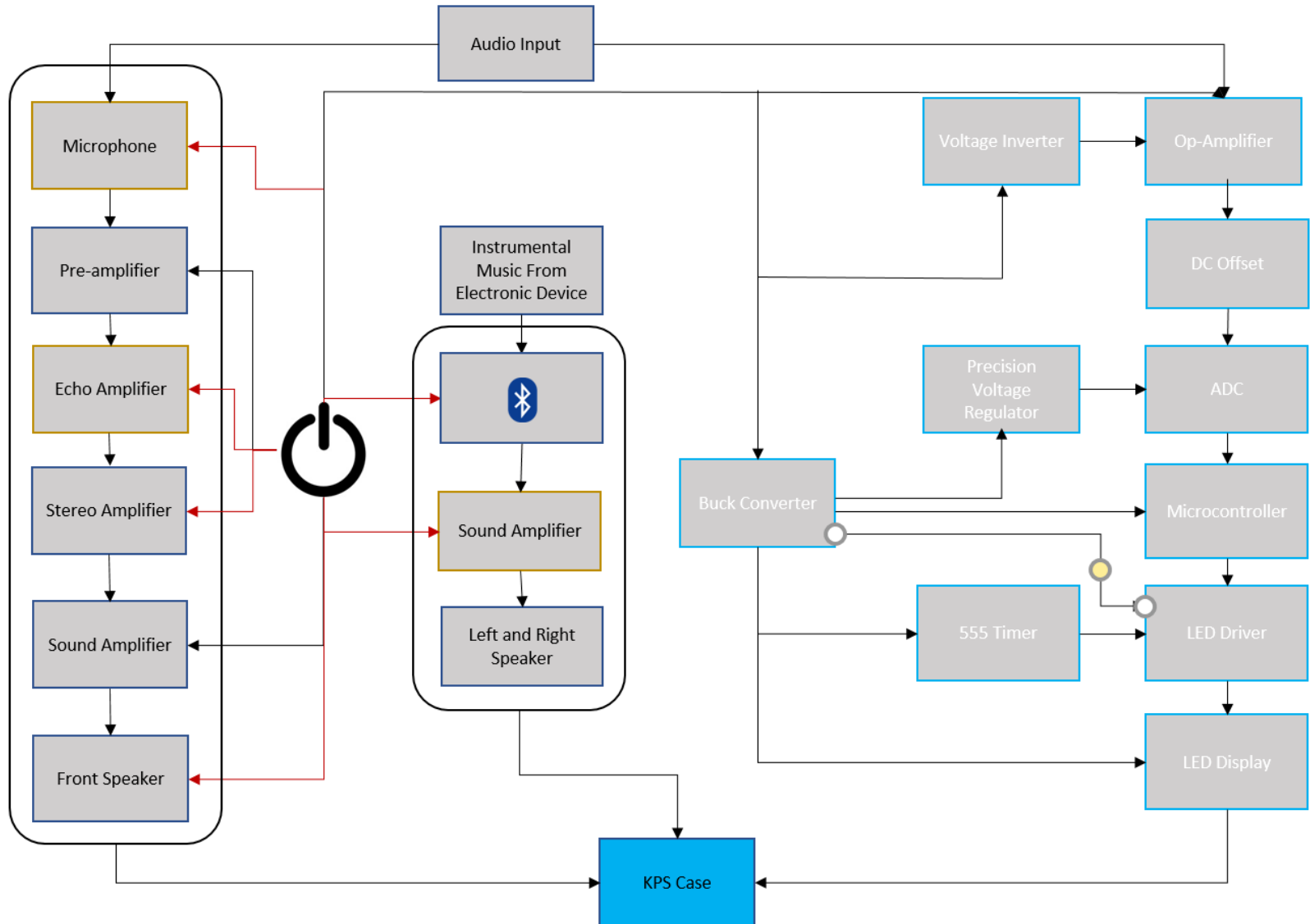
Specifications

Weight	Less than 2lbs
Volume	1 dBA – 25 dBA
Frequency	100 Hz – 10 KHz
Battery	12V 9800mAh Lithium-Ion Rechargeable
Speakers	3 Speakers: 4 Ohms and 5 Watts
Supporting System	All Electronic Devices with Bluetooth
Bluetooth Range	Up to 10 Meters
Microphone	Condenser Microphone (2V-10Vdc)
LEDs	Display an Array of Colors
Costs	Around 300 USD

Overall Block Diagram

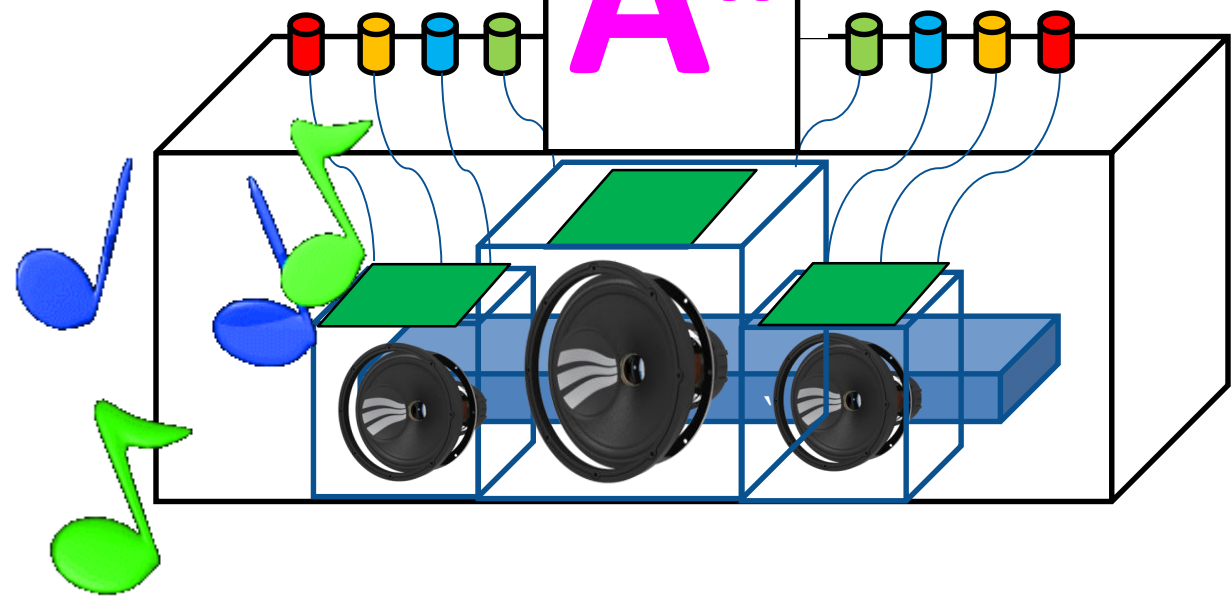


KPS Case

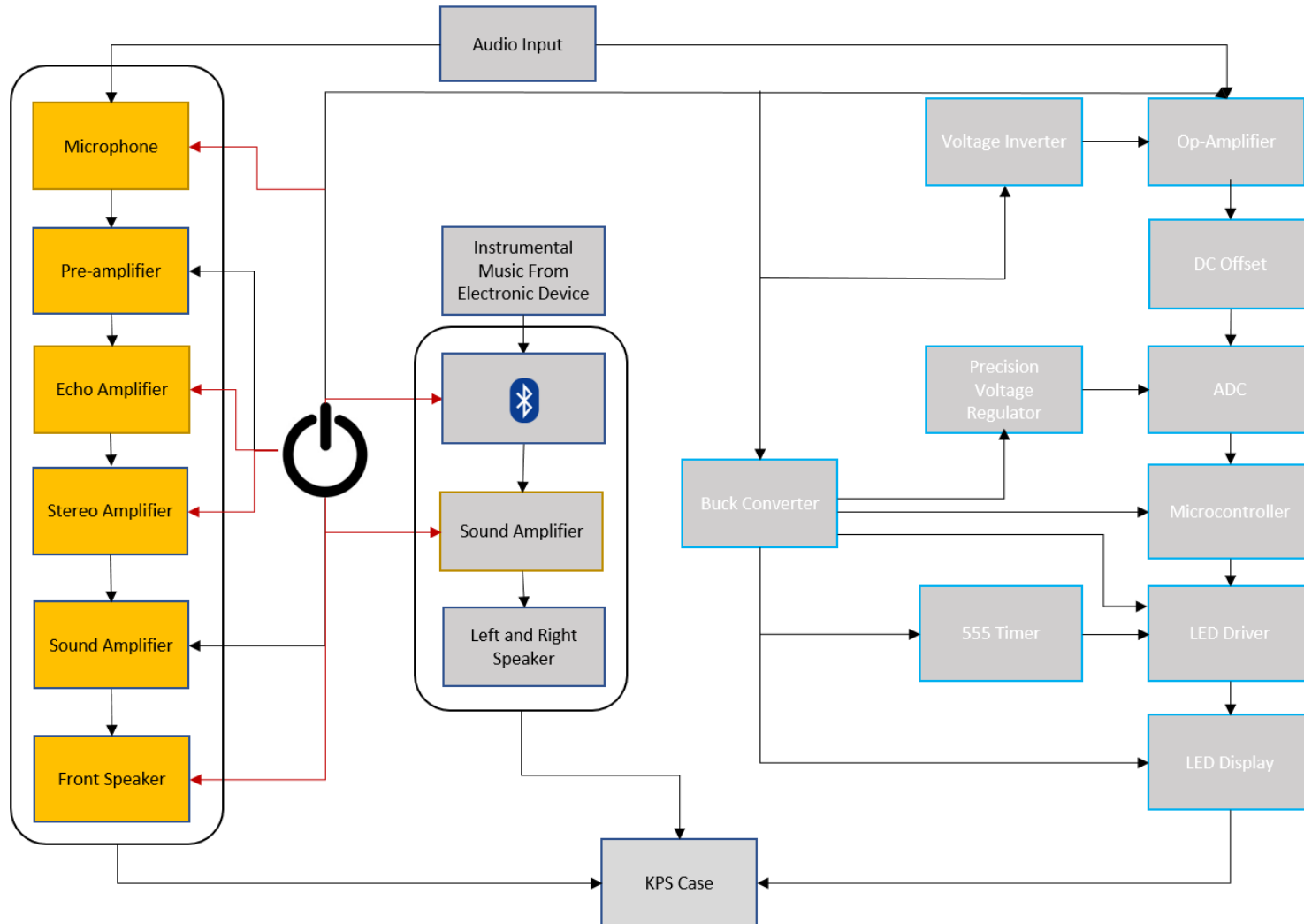




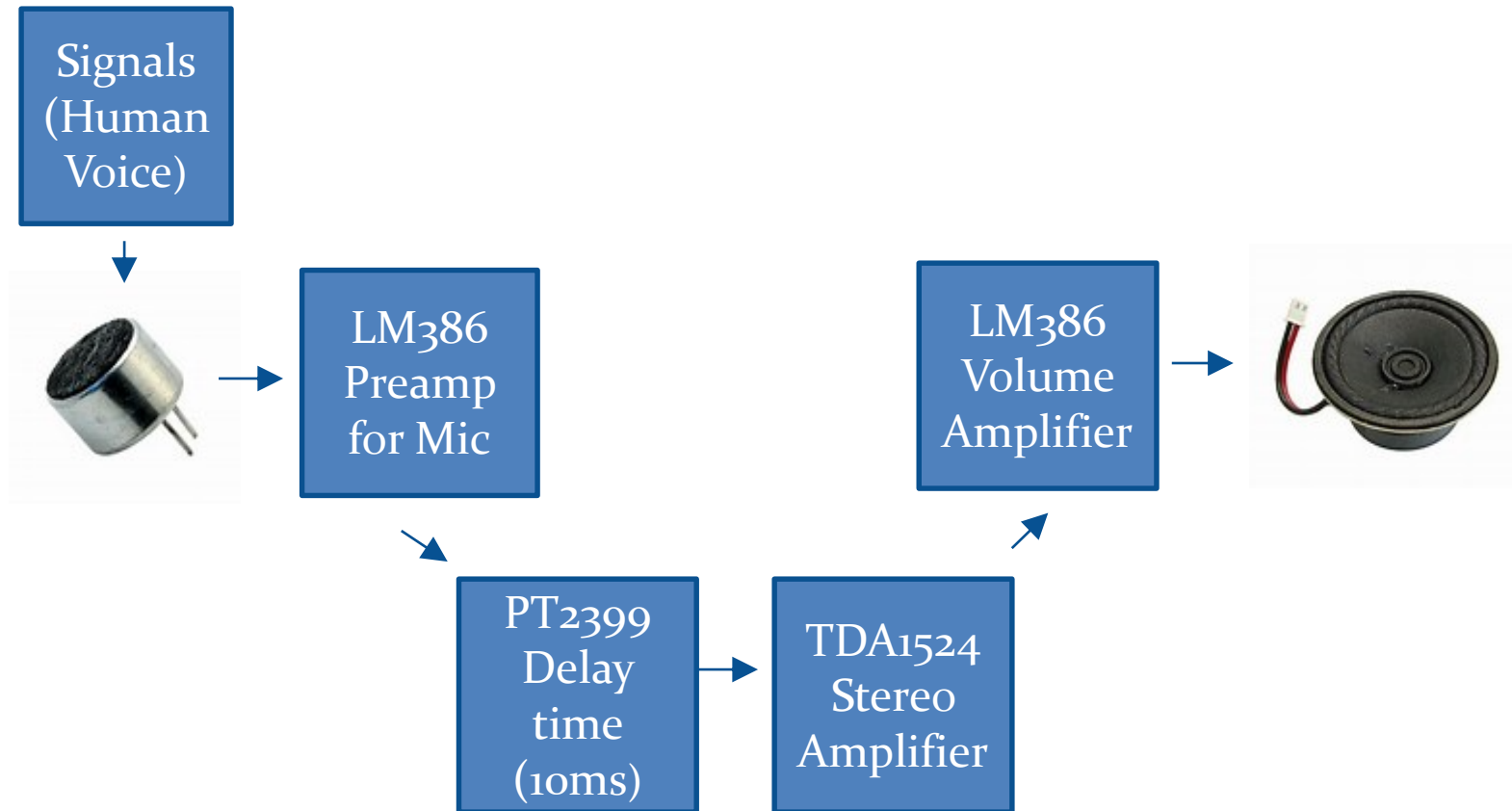
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Microphone System

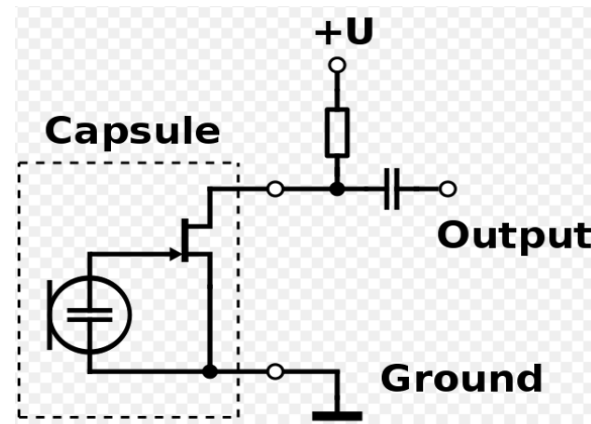


Echo and Stereo Block Diagram



Condenser Microphone

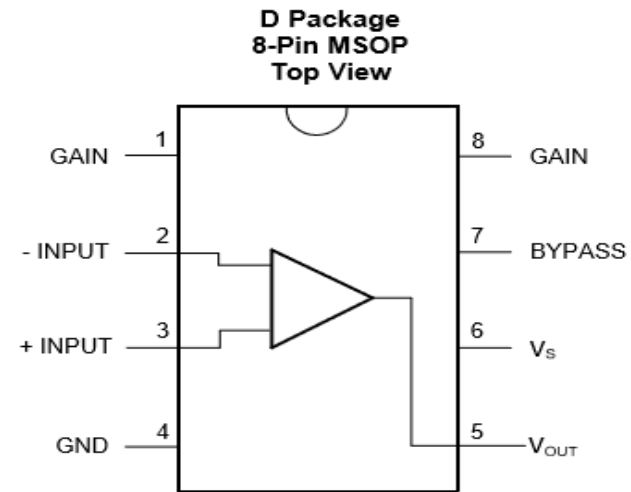
- Voltage Range: 2V – 10V
- Current Supply: 500uA
- Frequency Range: 30Hz ~ 15kHz
- Sensitivity: -42dB \pm 3dB
- S/N Ratio: 60dB
- Output type: Analog
- Direction: Omnidirectional
- Impedance: 2.2K
- Voltage – Rated: 2V



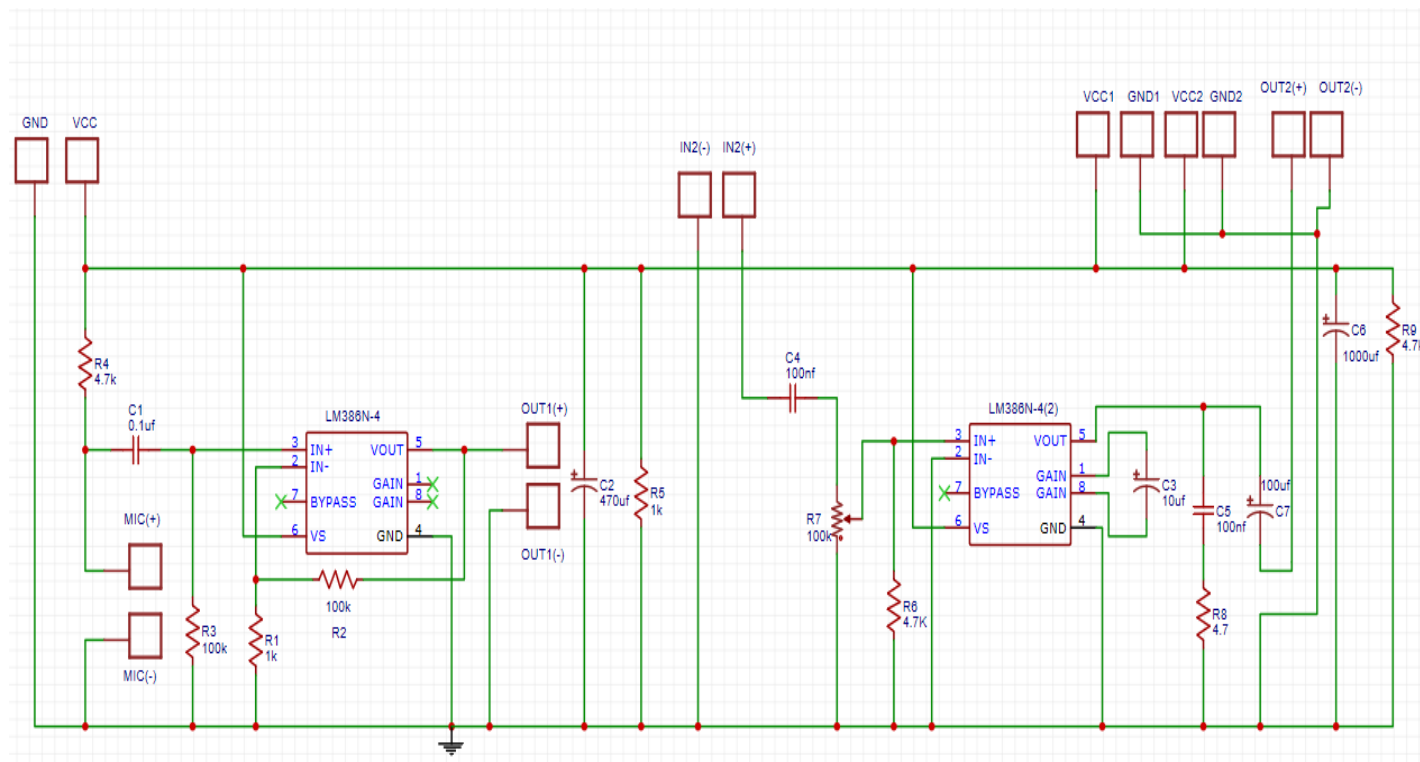
Pre-Amp for Mic and Volume Amplifier(LM386)

- Packages: LM386N-1, LM386N-3, LM386N-4, LM386M-1, LM386MX-1, LM386MMX-1

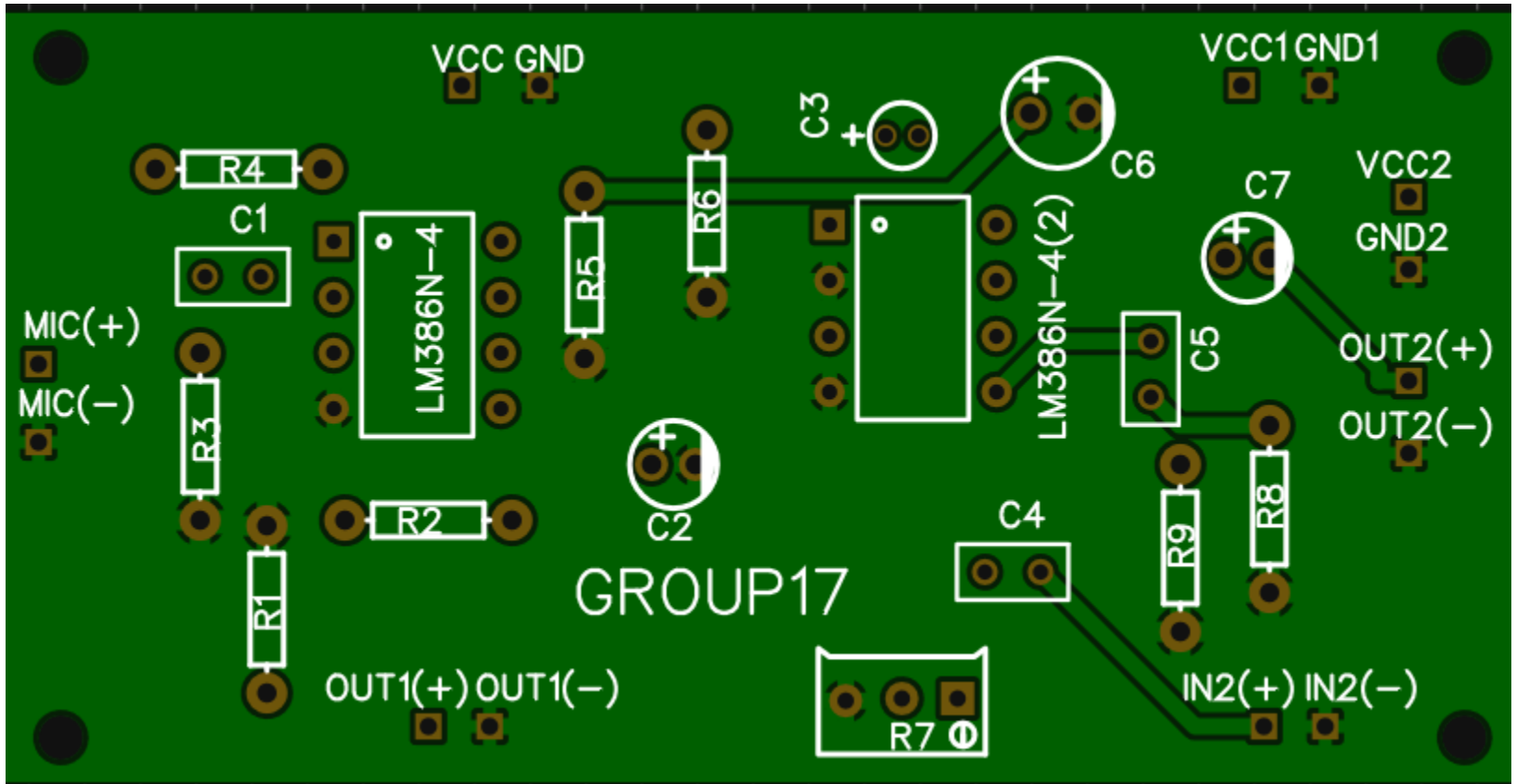
- LM386N-4 Specifications:
- Supply Voltage: 5V - 18V
- Analog input voltage: $-0.4V - 0.4V$
- Operating free-air temperature: $0 - 70^{\circ}C$
- Storage Temperature: $-65^{\circ}C - 150^{\circ}C$
- Output Power: 0.7W - 1.3W
- Voltage Gain: **typical:** 26 dB
special: 46 dB (put 10uF between pin 1 and pin 8)



Preamp and Volume Amplifier Diagram(LM386N-4)

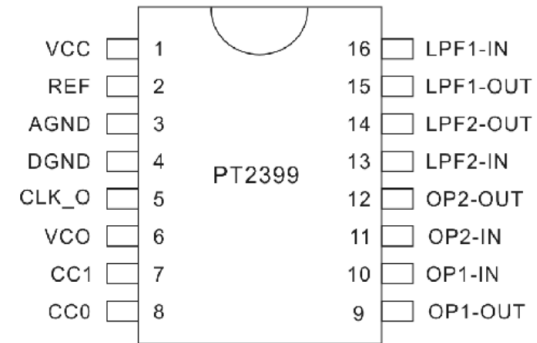


Preamp and Volume Amplifier PCB

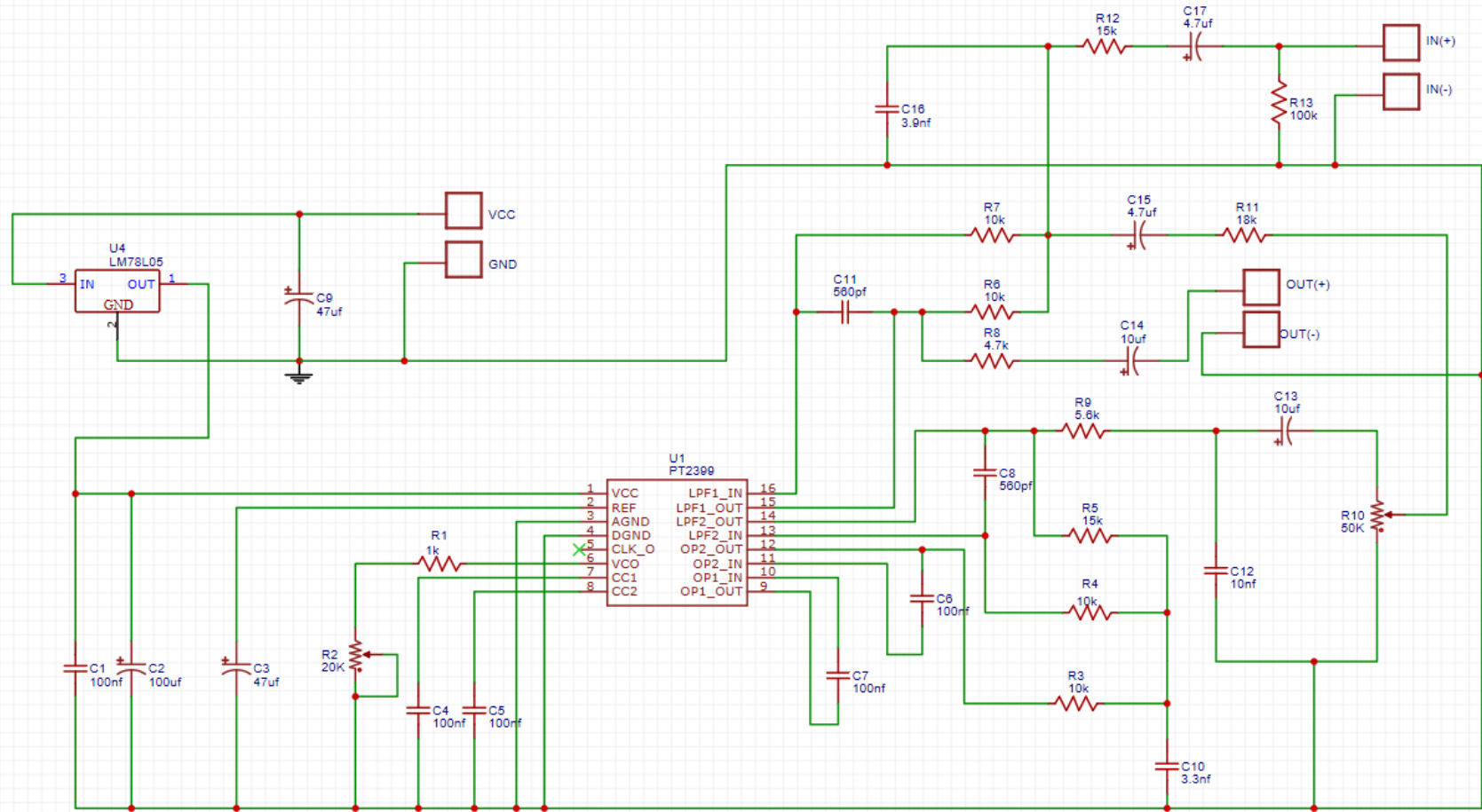


PT2399 Delay Chip

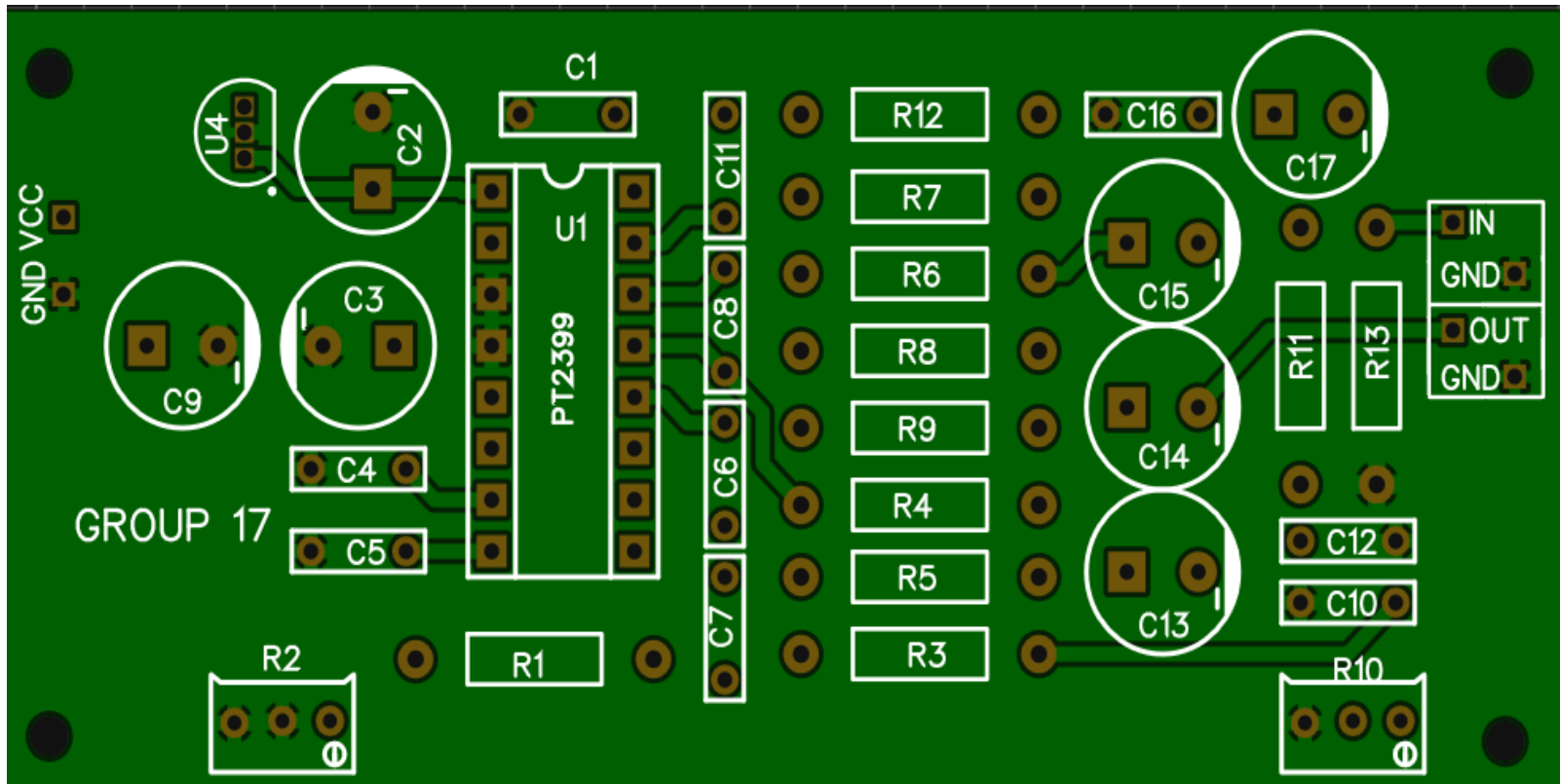
- Echo Digital Chip (ADC and DAC)
- Memory Storage: 44Kbit RAM
- Voltage Supply: 4.5V – 5.5V
- Voltage Gain: 0.5dB - 2.5dB
- Output Noise Voltage: -95 dBV - -80 dBV
- Pin 6: VCO uses to change the delay time by put a potentiometer



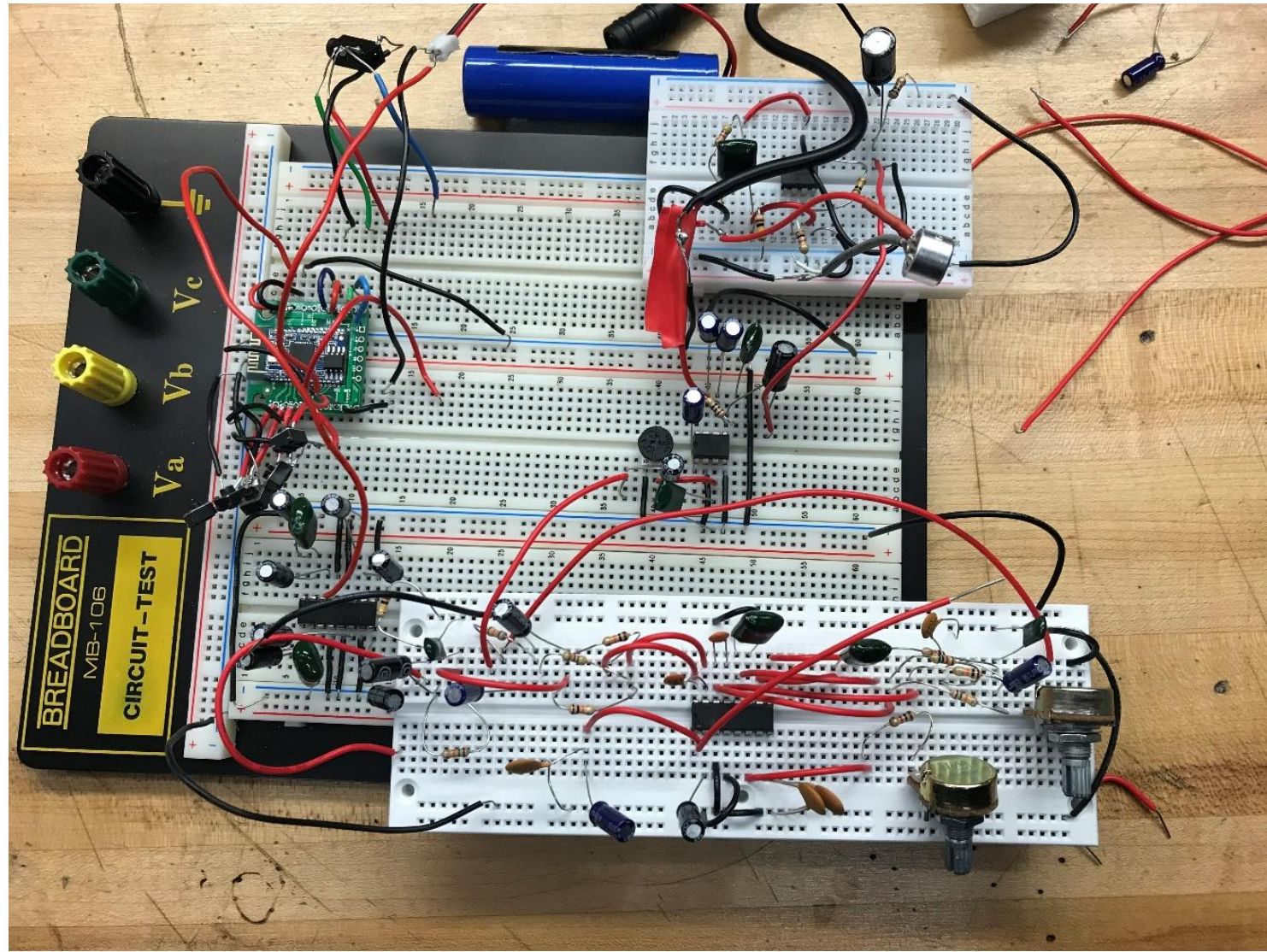
PT2399 Circuit Diagram




PT2399 Delay PCB Board




Echo Amplifier Prototype

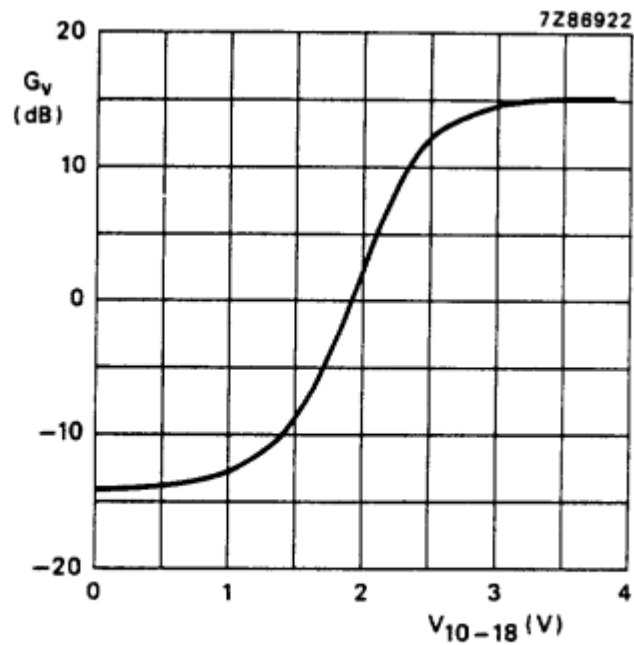




Stereo Amplifier - Bass and Treble Amplifier (TDA1524A)

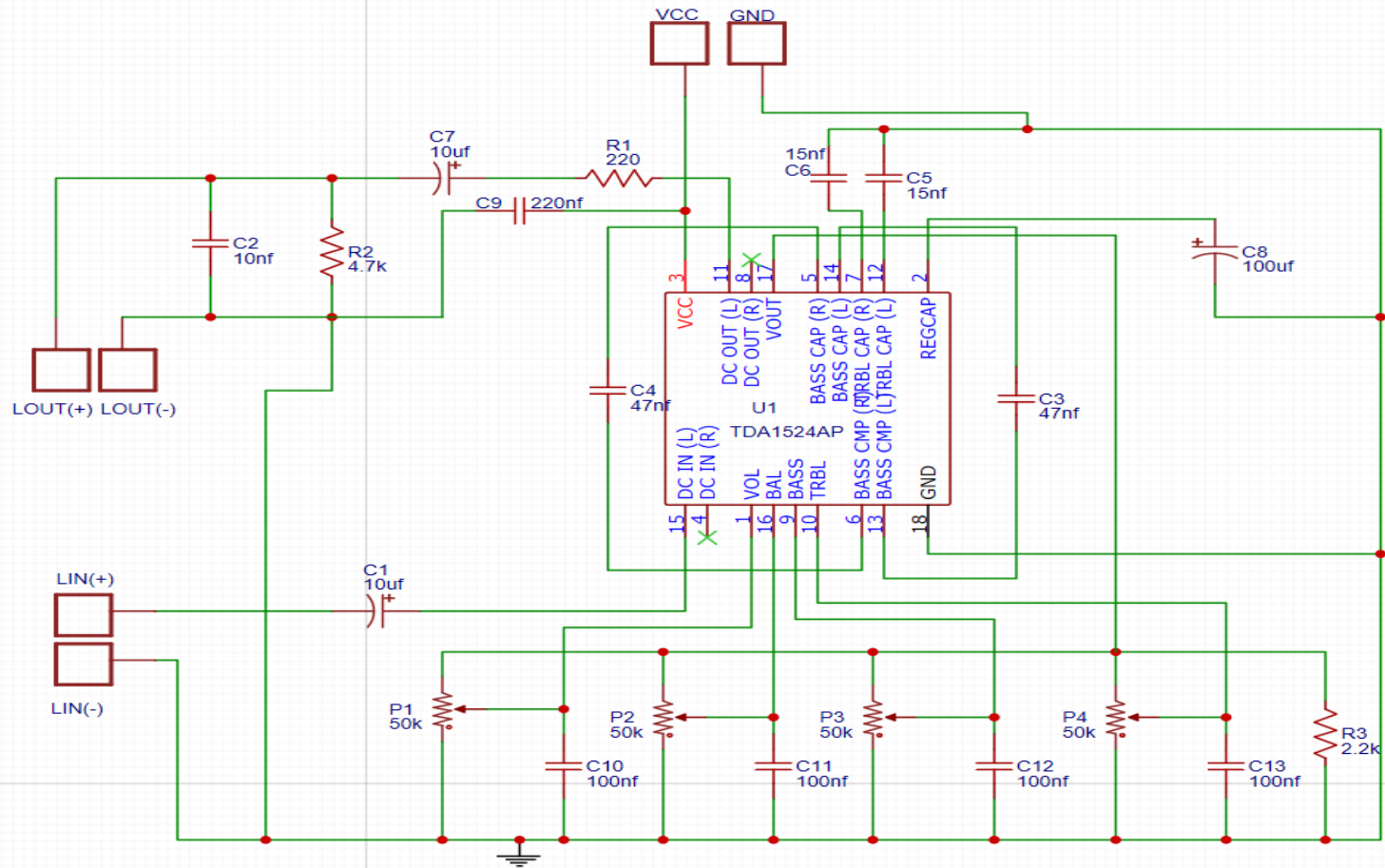
- To tone control the sound
 - Volume control, Balance, Bass and Treble tone controls.
 - 20 dB of voltage gain, +/-15 dB of bass and treble control
 - 12 Vdc Voltage Supply
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Test Curves

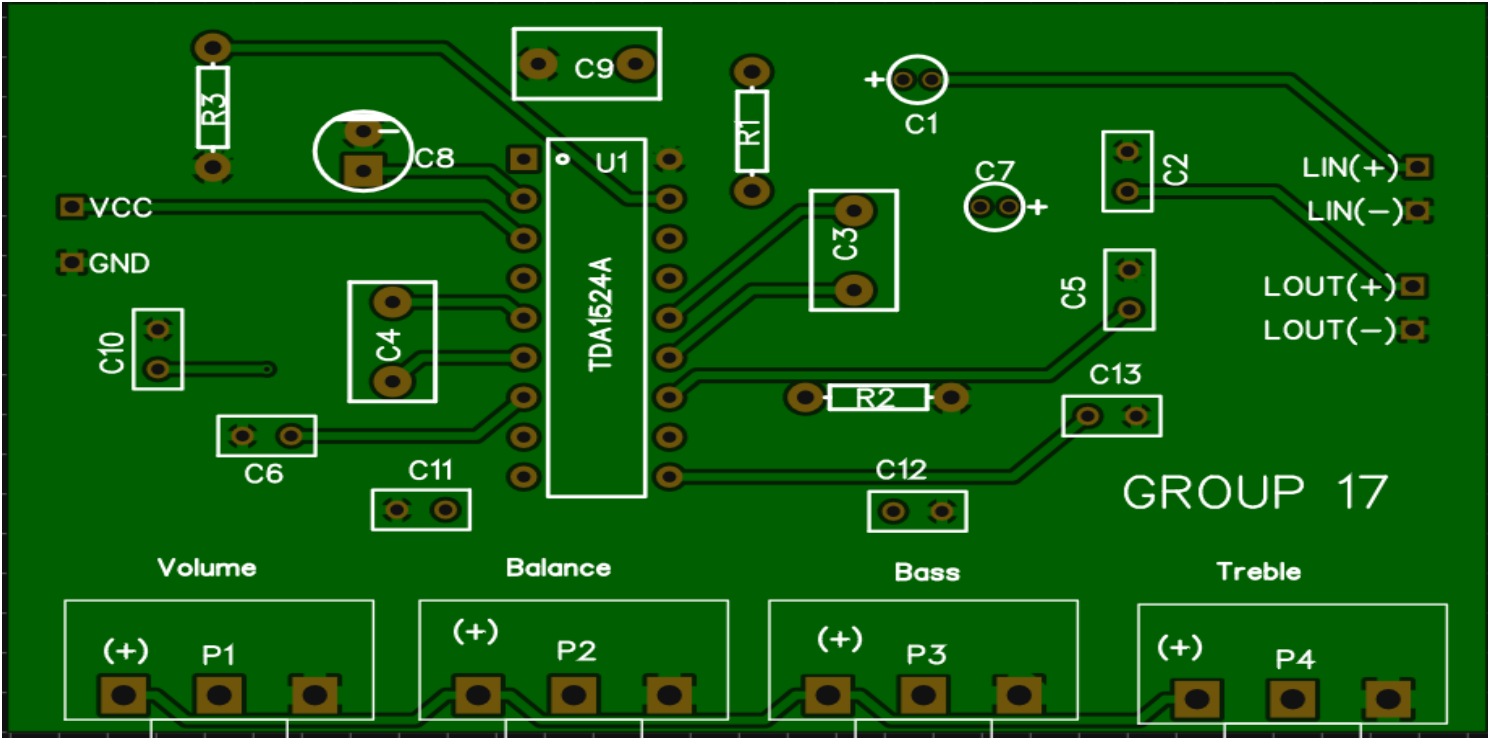


Treble control curve; voltage gain (G_v) as a function of control voltage (V_{10-18}).

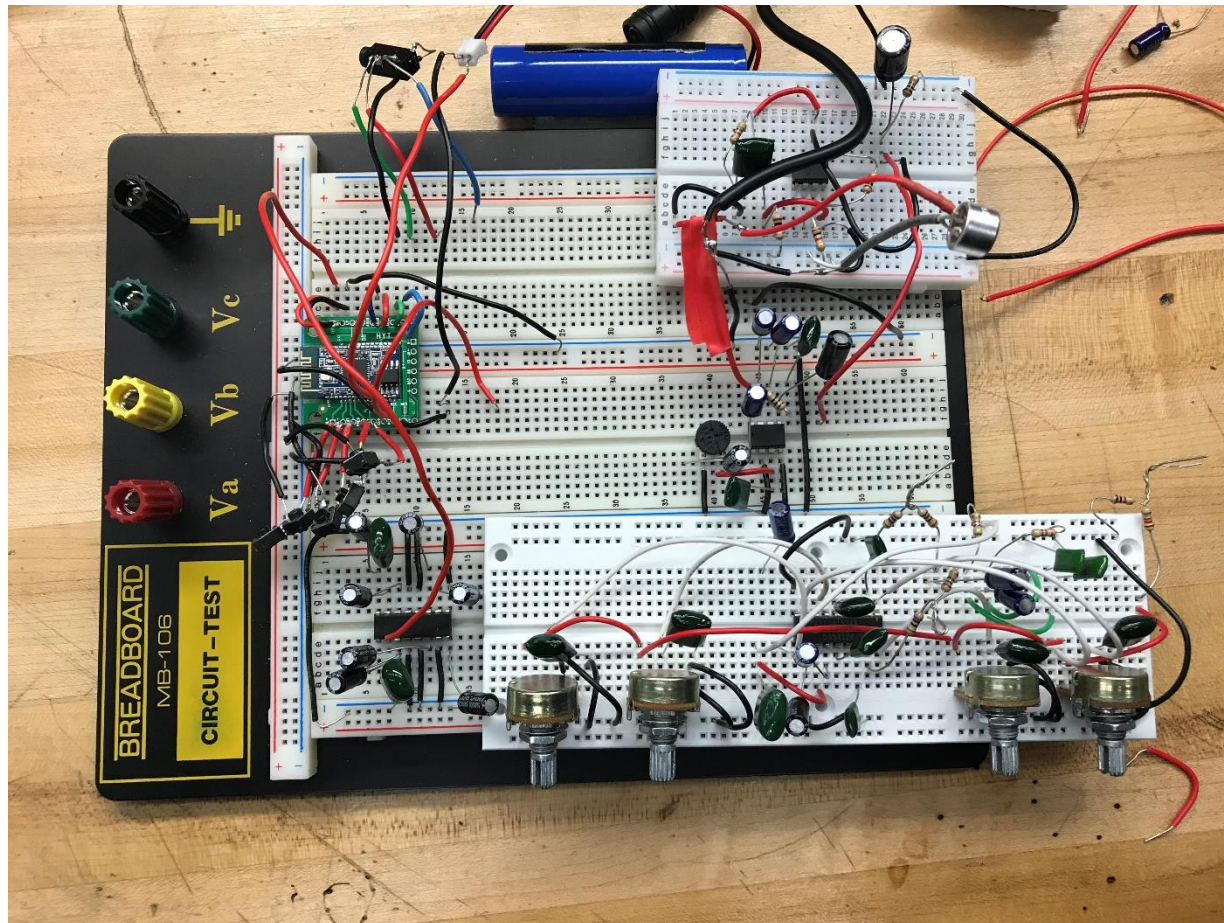
Tone Control Schematic Circuit



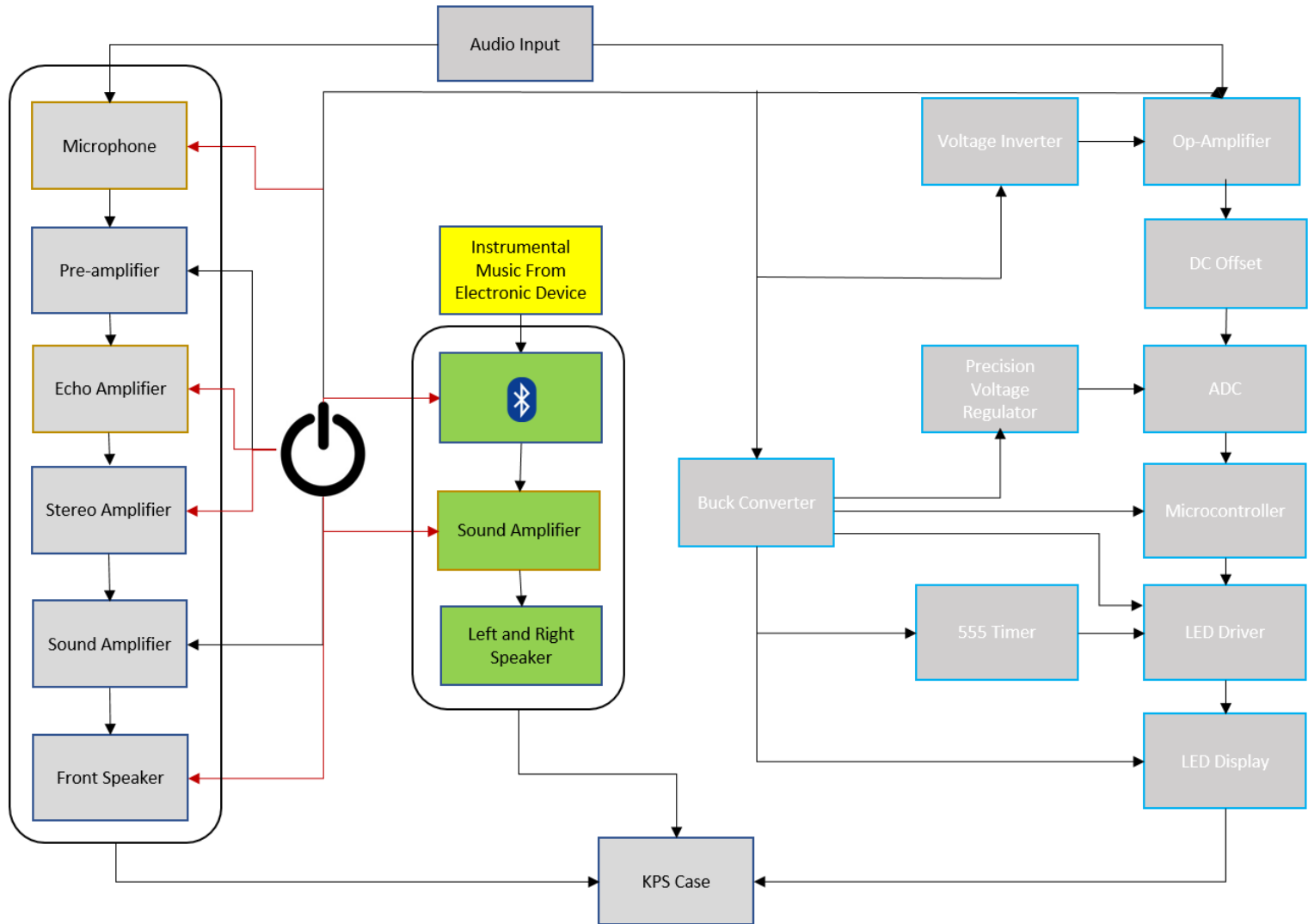
Tone Control PCB board



Stereo Amplifier Prototype




Instrumental (Beat) Music





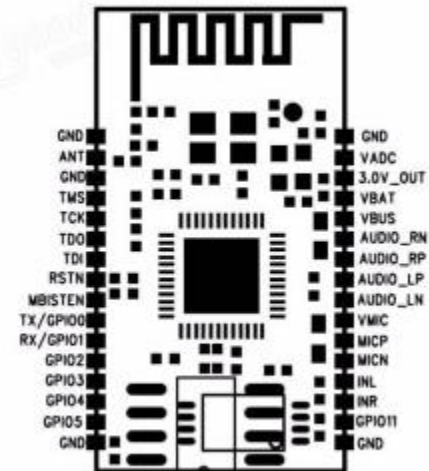
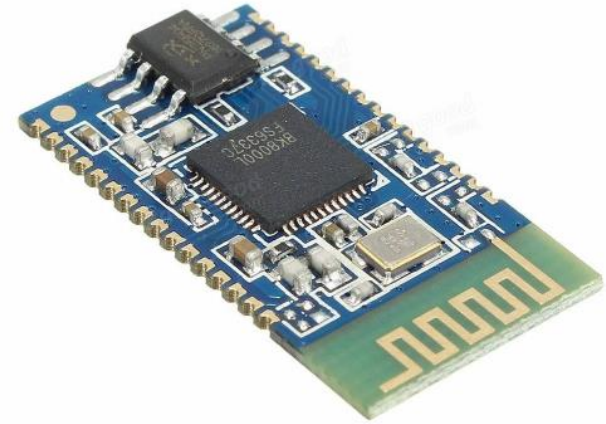
Wireless Technology

- Wireless connection from electronic device (phone, laptop, tablet ,etc.)
 - Bluetooth technology with short range consumes less energy, fit for portable device.
 - BK8000L Bluetooth Module is chosen for this project
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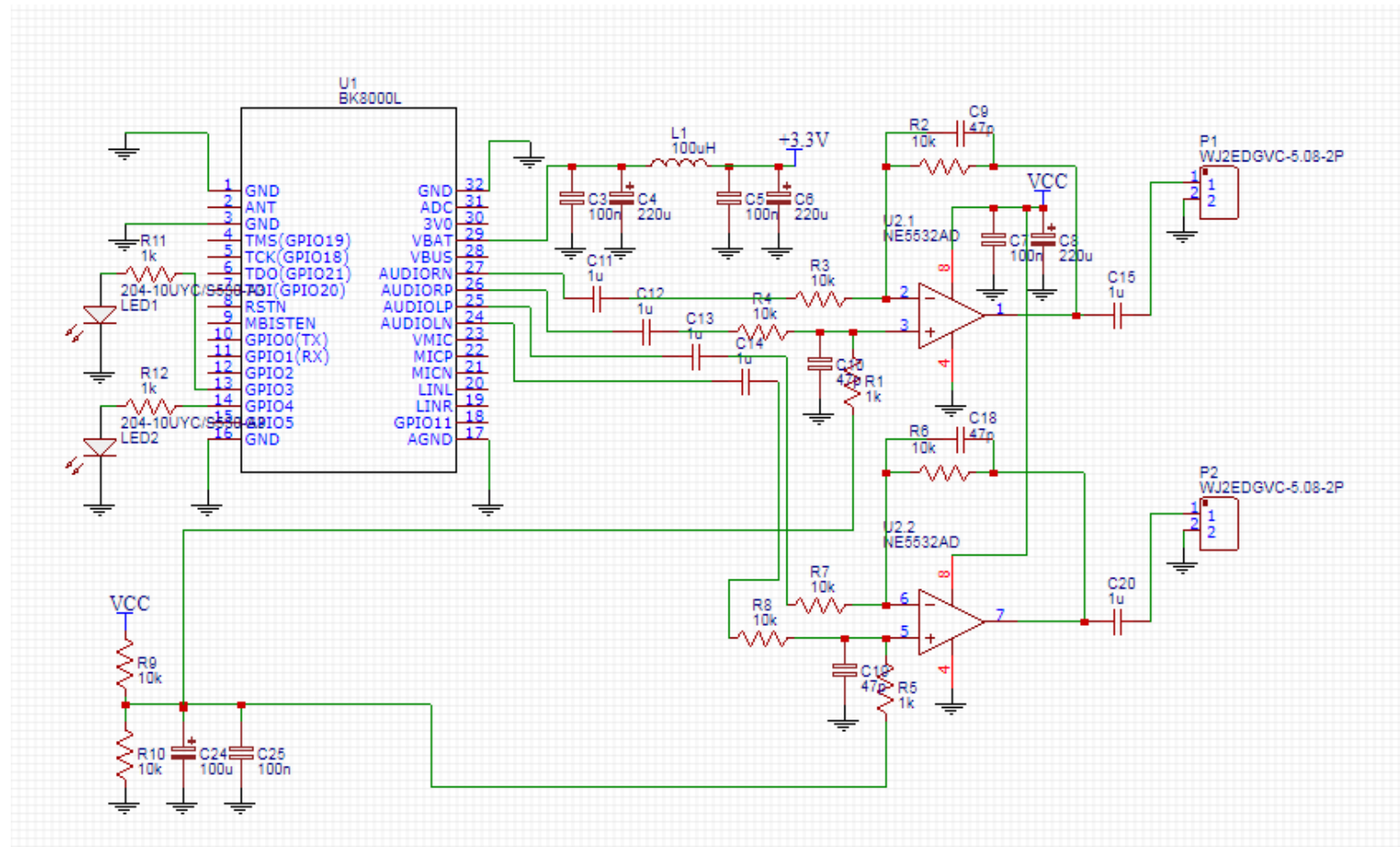
BK8000L Stereo Bluetooth Module

Specification:

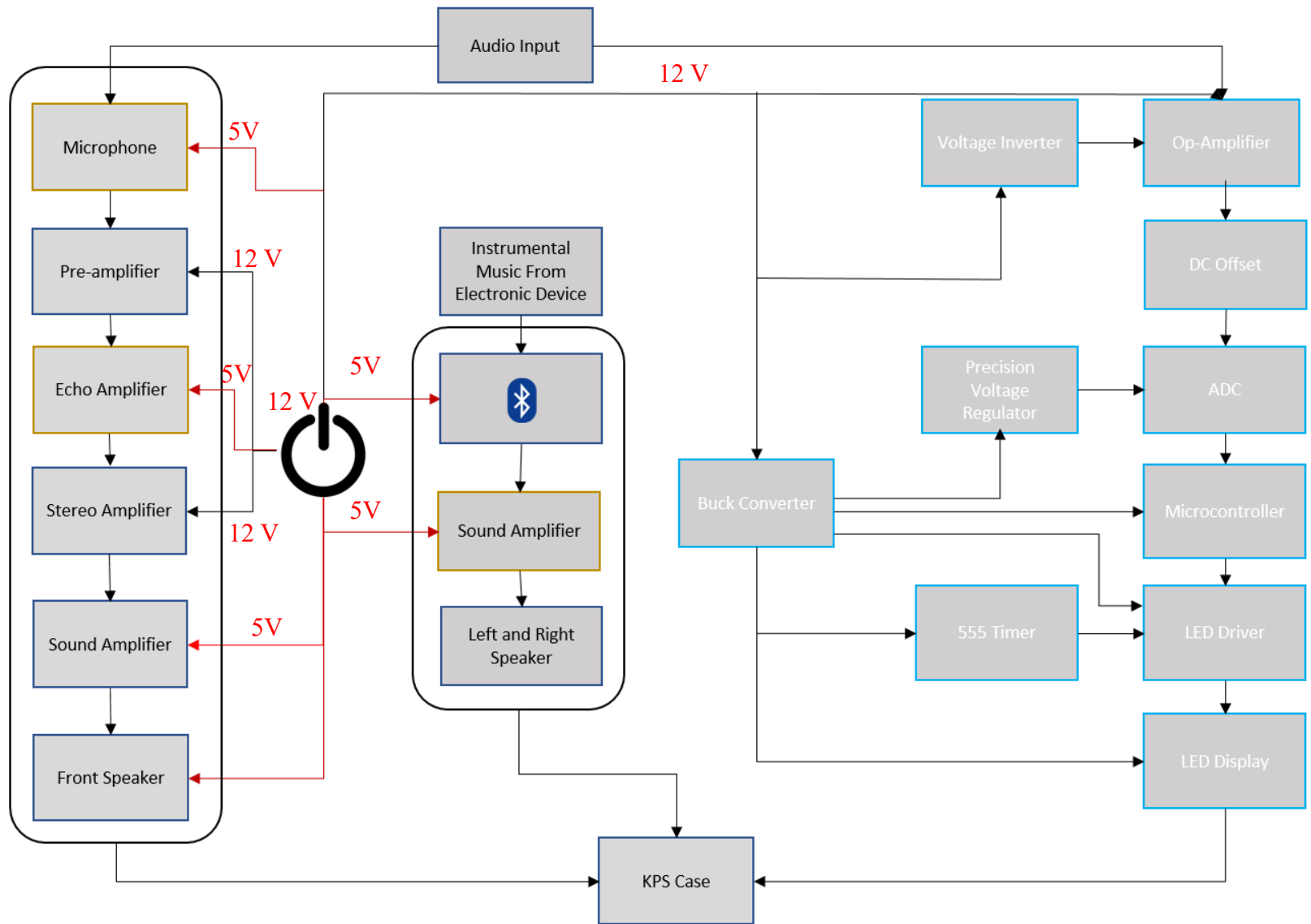
Manufacturer	Details
Power Supply	2.8-5V
Brand	Sparkfun
Interface	I2C & UART
Frequency Range	2.4GHz ~ 2.480GHz
Price	\$4
Wireless Transmission Range	<10 meters
Bluetooth Type	V2.1+EDR
Dimension	13.5 mm x 25 mm x 1.5 mm



BK8000L Schematic




Power System



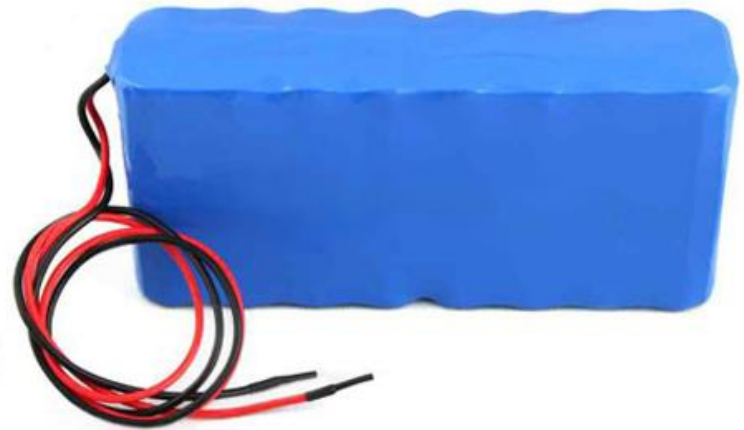


Power

- We have multiple boards.
 - Extra board for power distribution does not fit into the project box
 - Voltage regulator for each board.
 - Using battery with 12V voltage supply.
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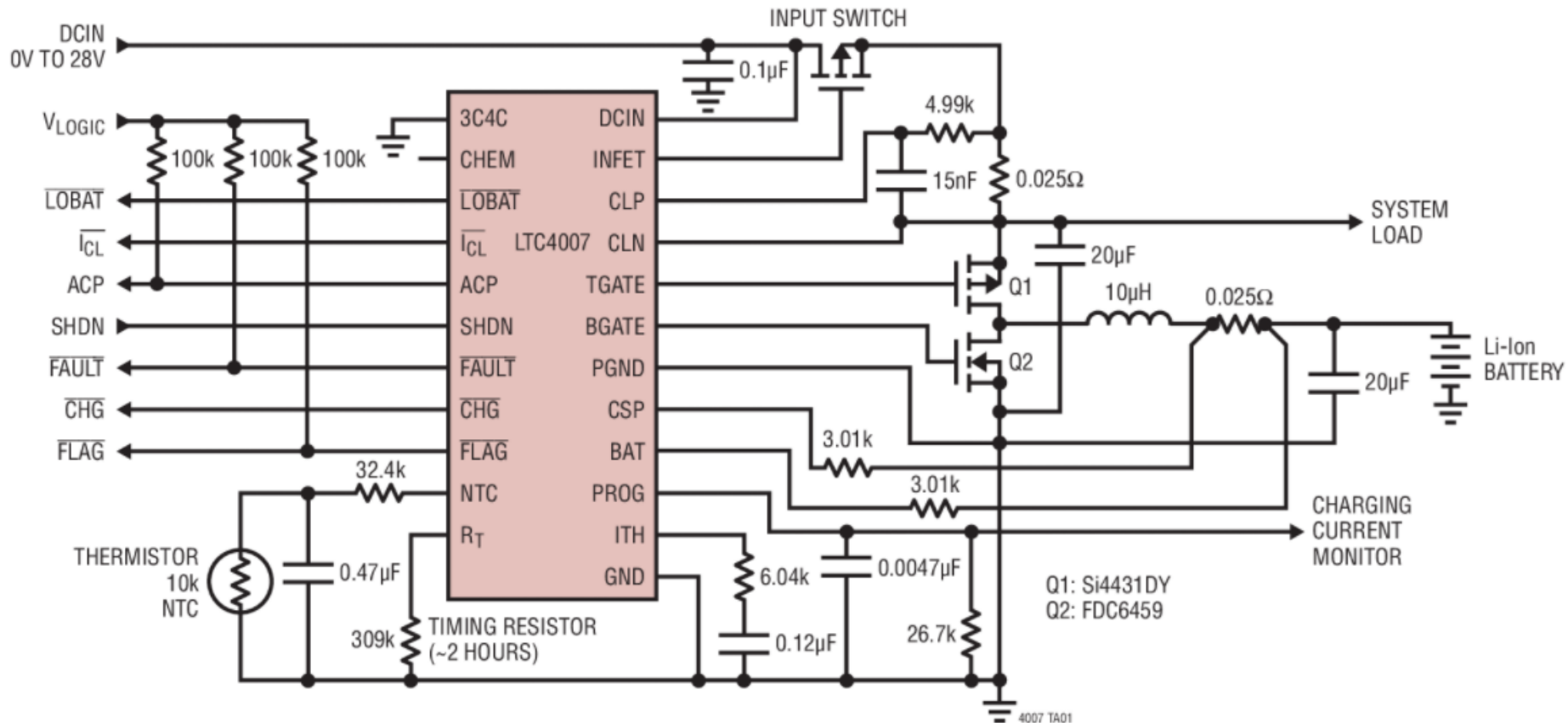
Lithium-Ion Battery

- Rechargeable
- High energy density
- High capacity 9800mAh
- Low self-discharge
- Durable
- 10.8 – 12.6 V

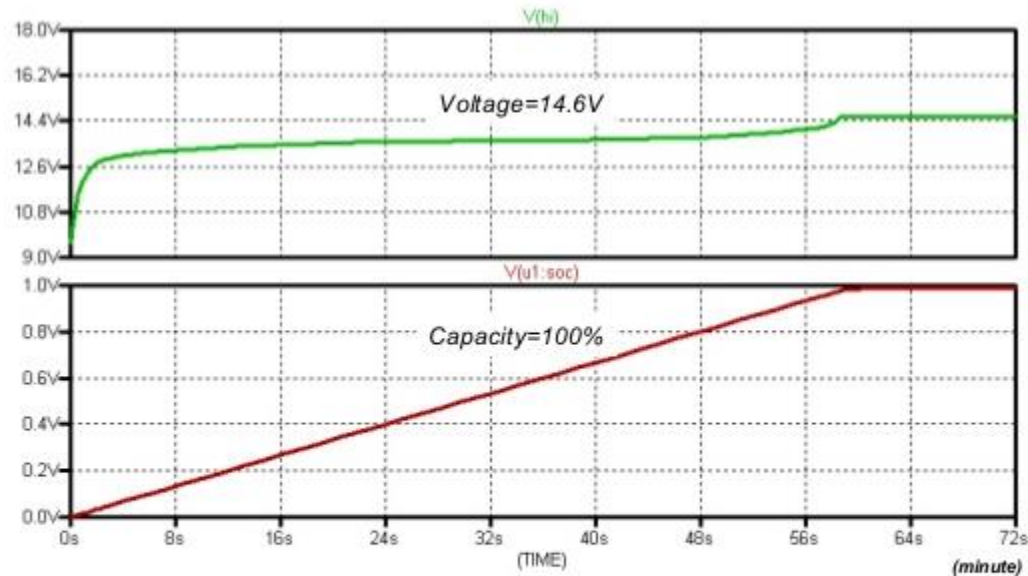


LM3622 Battery Charger Circuit

12.6V, 4A Li-Ion Battery Charger



Charging Characteristic

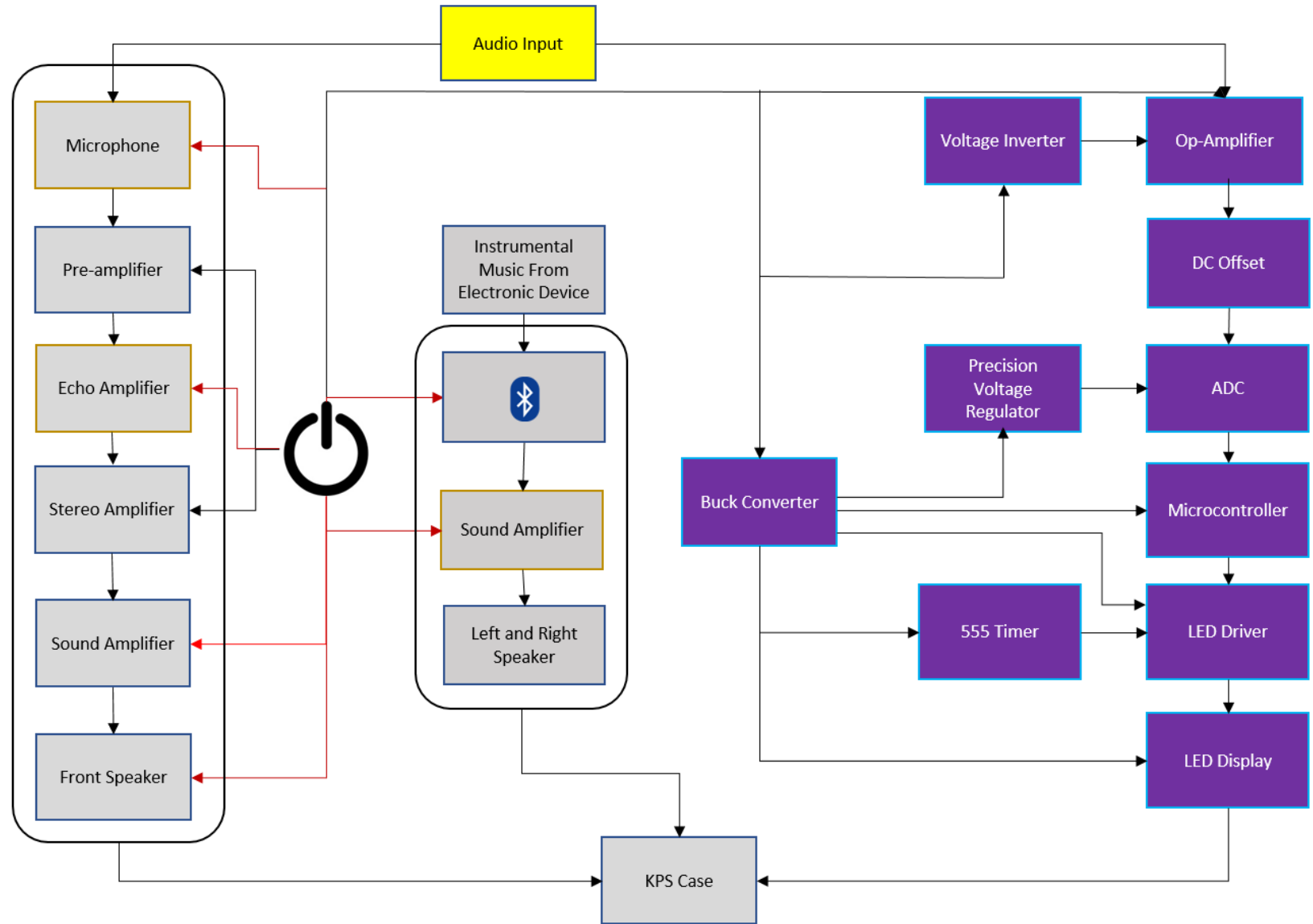


- Input Voltage: 20V
- Charging Voltage: 14.6V
- Charging Current: 10000mA (1 Charge)

Power Consumption Calculation


Qty.	Devices	Working Current (mA)	Total Consumption (mA)
2	Pre-Amplifier (LM386)	4	8
2	Amplifier (LM386)	4	8
1	Tone Control (TDA1524)	50	50
1	Speakers 4 Ohms 5W	312	624
1	Speakers 4 Ohms 10W	625	625
1	Echo (PT2399)	100	100
1	Bluetooth Module	45	45
TOTAL			1460
	Battery = 9800 mAh	≈ 7 hours	

LED DISPLAY

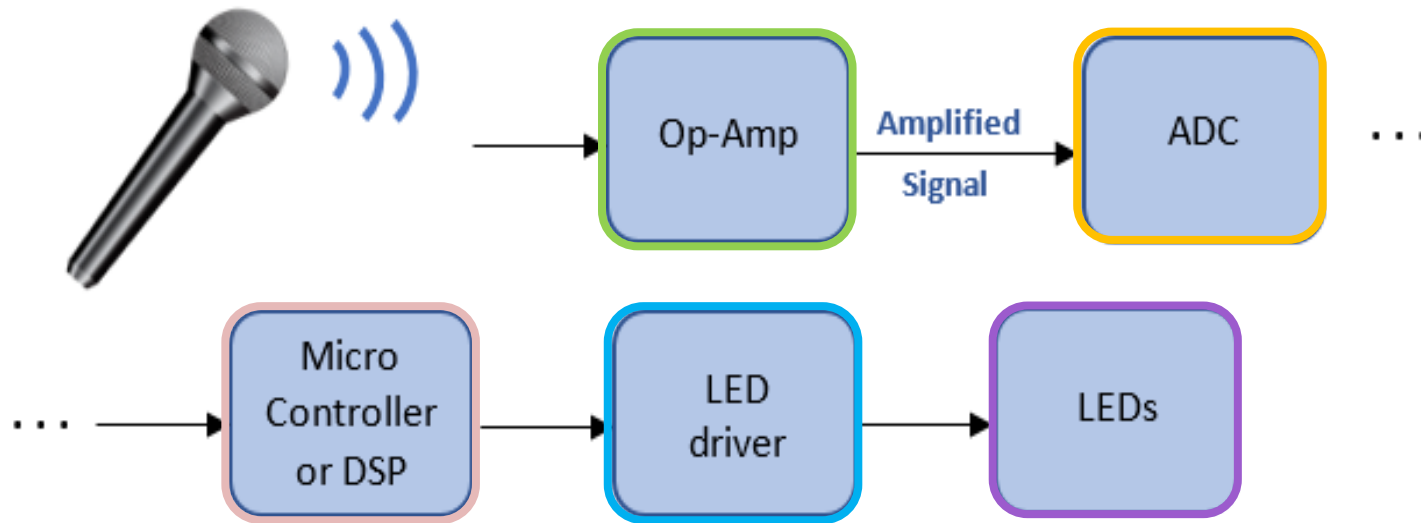


LED Display Goals



- Map frequency to an LED
 - Multiple modes and color
 - Simple light show with configurable tempo
 - Random pattern and random color
 - No noticeable delay in light
 - Light changing speed, that can be changed to either slow or fast
 - Provide an effective lighting show, that could also aid in instruction and guidance for aspiring singers.
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LED Display Block Diagram



EMBEDDED TECHNOLOGIES

DSP



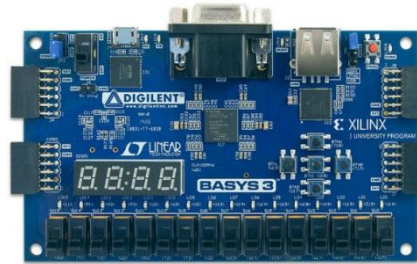
PROS

- optimized for fast operational needs
- Can process data in real time
- Ideal for audio signal processing

CONS

- Proprietary software
- Configuration of DSP chips can be complex
- Expensive break out boards

FPGA



PROS

- Reprogrammable chips
- Provide hardware-timed speed and reliability
- Parallel in nature

CONS

- Volatile memory
- Power consumption
- Requires more components

MCU



PROS

- Familiarity
- Endless resource because of the open source nature.
- Onboard Memory

ATMEGA328

ATMEGA2560

ADC121S01: Analog to Digital Converter

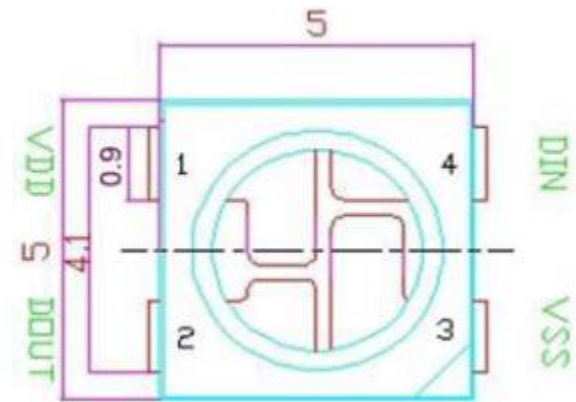
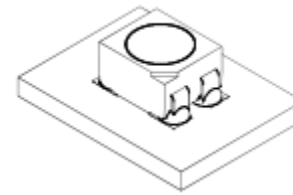
Manufacturer	Series	Architecture	Resolution (bits)	Sampling Rate(Hz)	Cost
Maximum Integrated	MAX1243	SAR	10	73K	\$5.51
Texas Instruments	TLV2541	SAR	12	200K	\$4.55
	ADC121S101	SAR	12	1M	\$3.93
Analog Devices	AD7478	SAR	8	1M	\$3.90

Reason for chip selection:

- Highest resolutions, highest speeds
- Relatively cheap, only falling second by three cents to the Analog Devices AD7478

RGB LED - Worldsemi

- Part: WS2812B
- Addressable RGB LED
- LEDs are configured to work well with the WS2811 driver.
- Input voltage: 5
- 20 mA of current draw
- Small in size

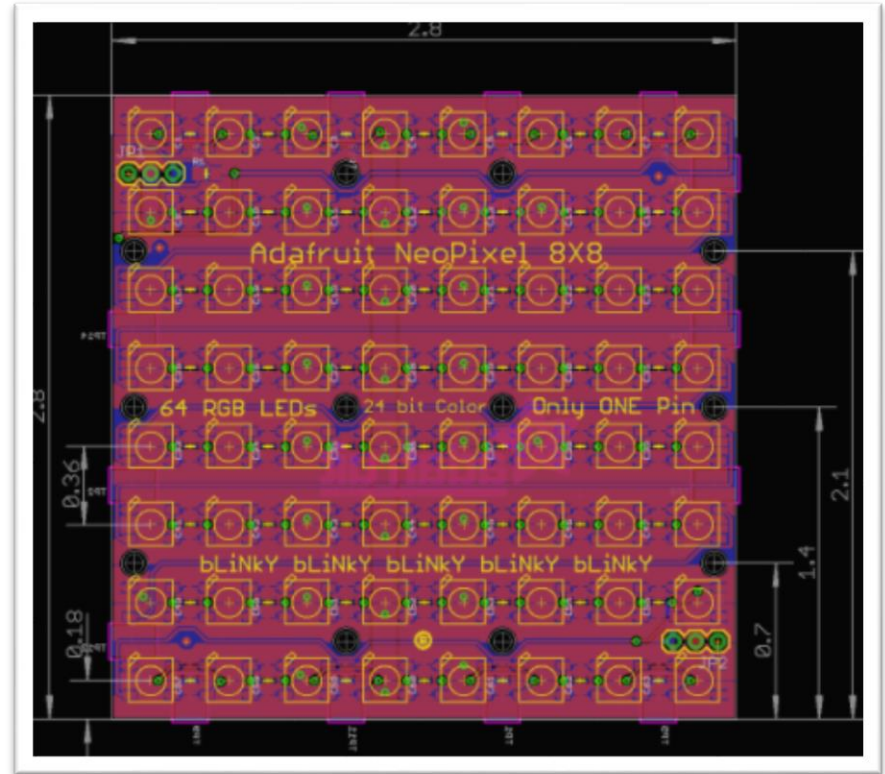


Common Anode (+)



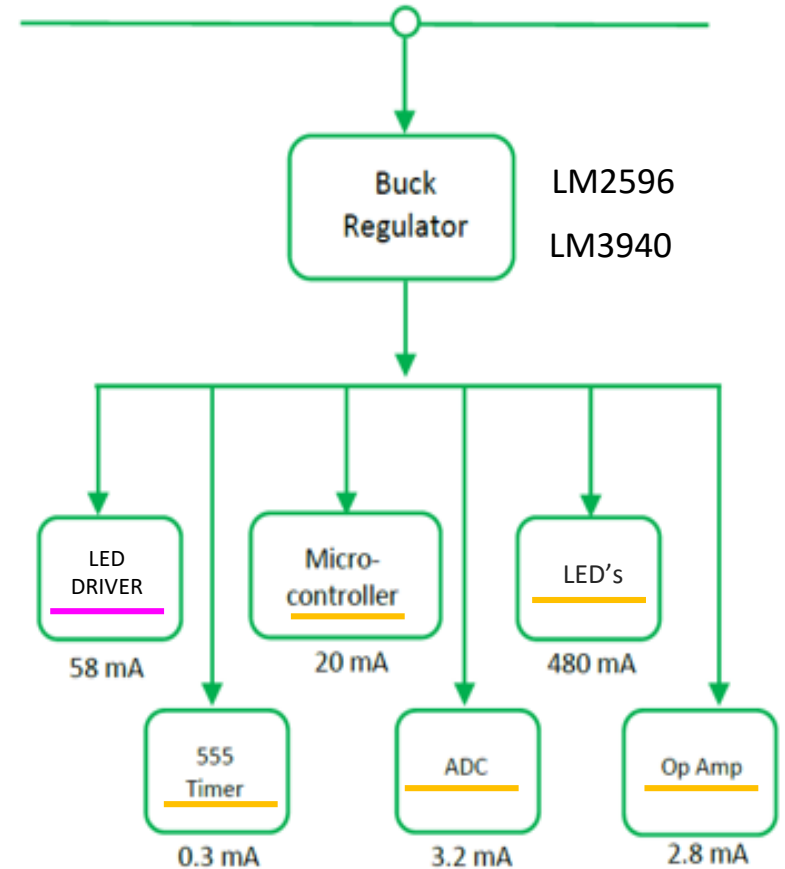
NeoPixel: 64 RGB LED Pixel Matrix

- 64 LEDs each with three outputs (R, G, B). An integrated driver is used to configure the LEDs.
- WS2811 driver: 3 channel constant current LED drive IC
- LED power supply voltage up to 10V
- Scan frequency not less than 400Hz/s

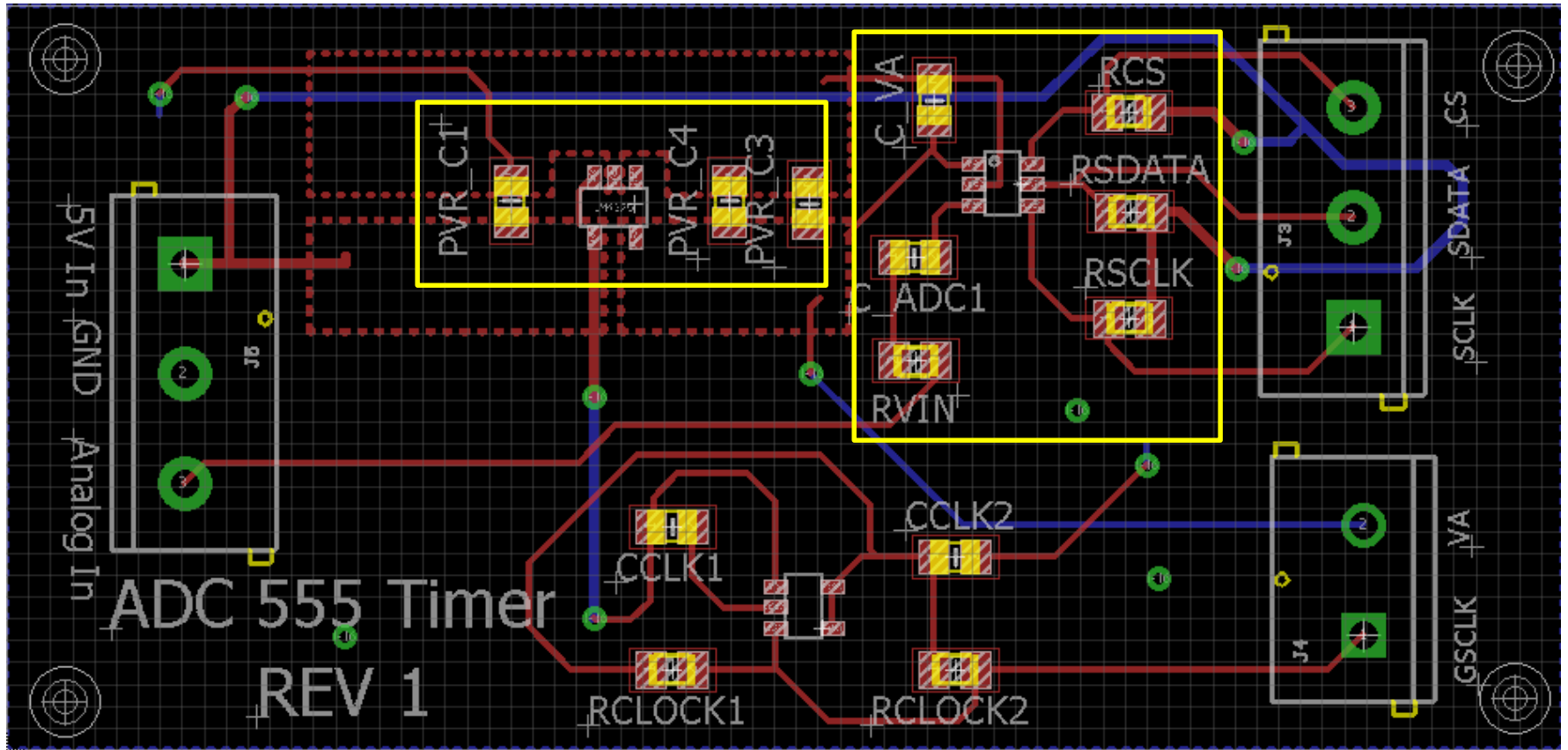


Powering the LED Display

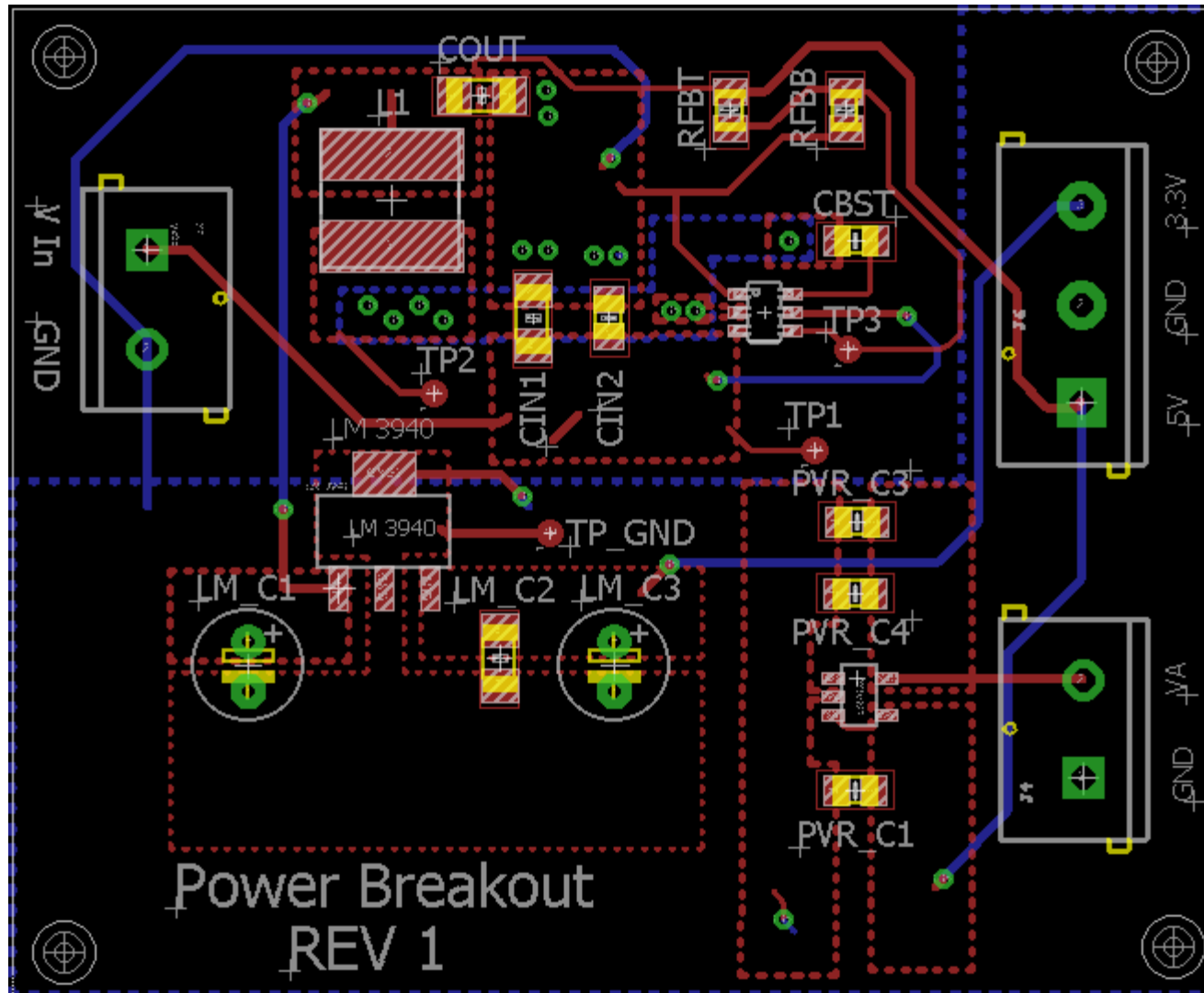
	PER UNIT			TOTAL
	Min Voltage	Max Voltage	Max Amperage	
TLC5955	-3V	+5.5V	29mA	60mA
ADC121S101	+2.7V	5.25V	3.2mA	
MIC 1555	+2.7V	+18V	300μA	
ATMEGA 2560	4.5V	5.5V	2.0mA	
OPA376	2.2V	5.5V	1mA	
LEDs			20mA	480mA



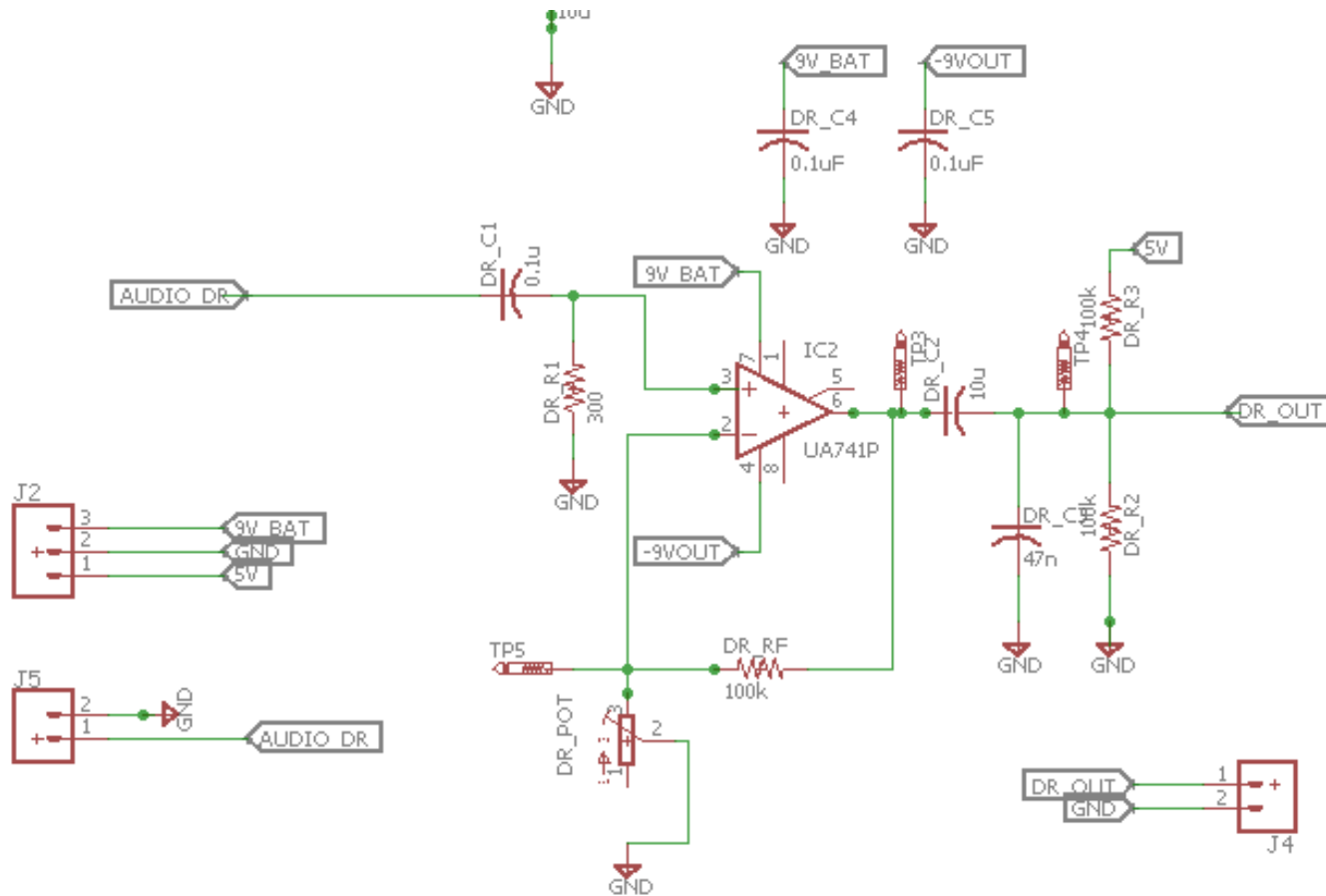
LED Display PCB -ADC



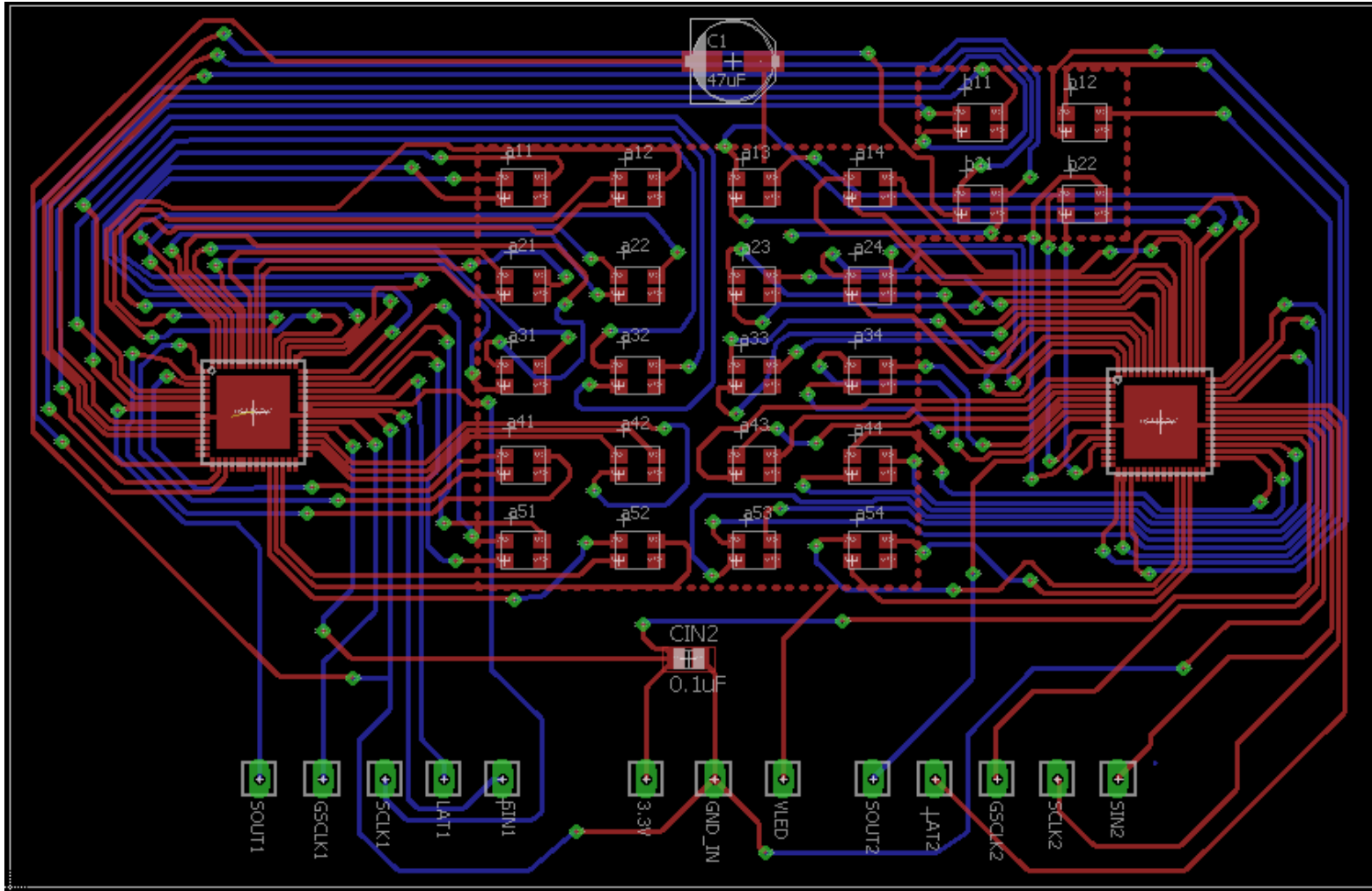
LED Display PCB- Power



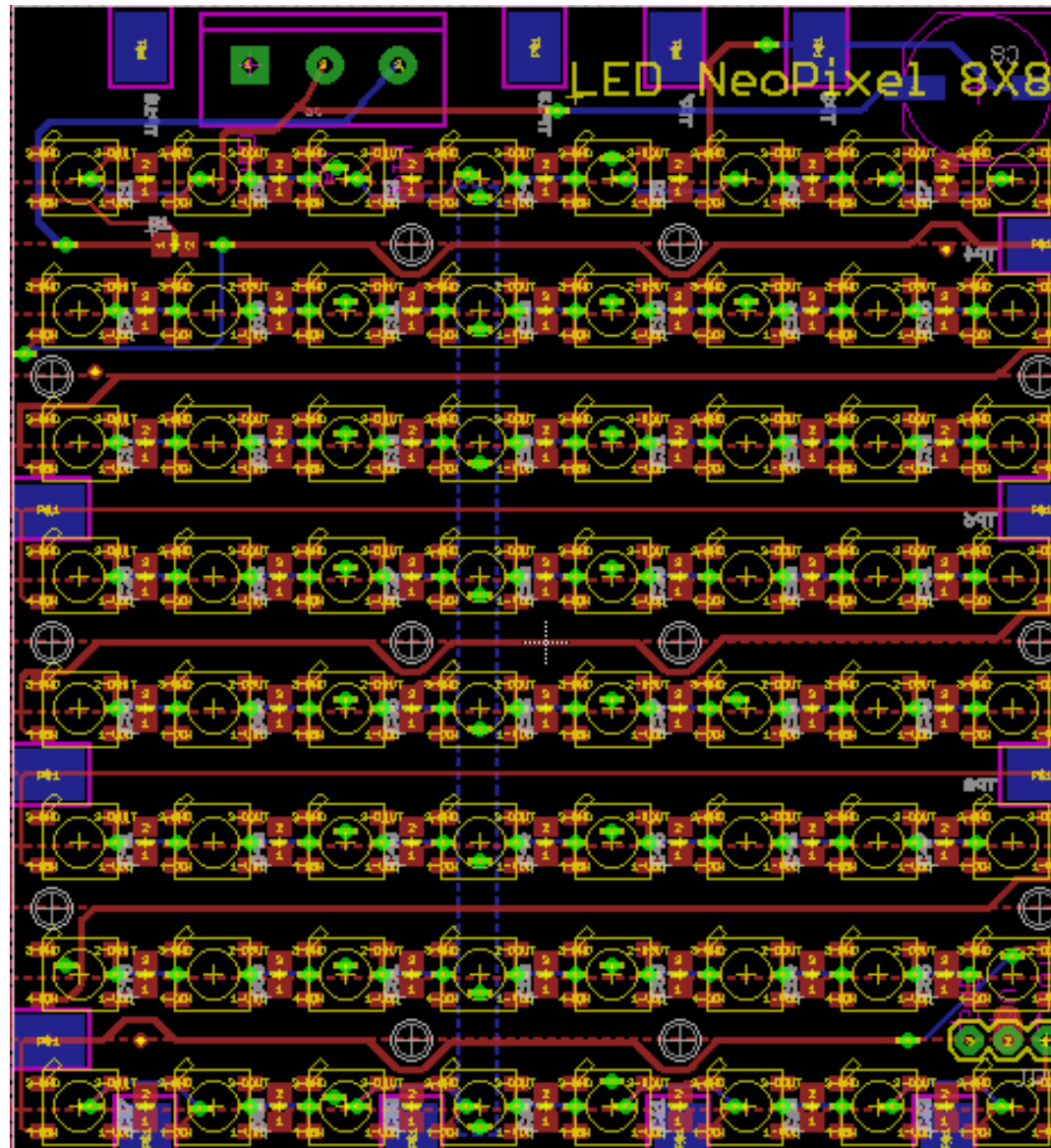
LED Display PCB



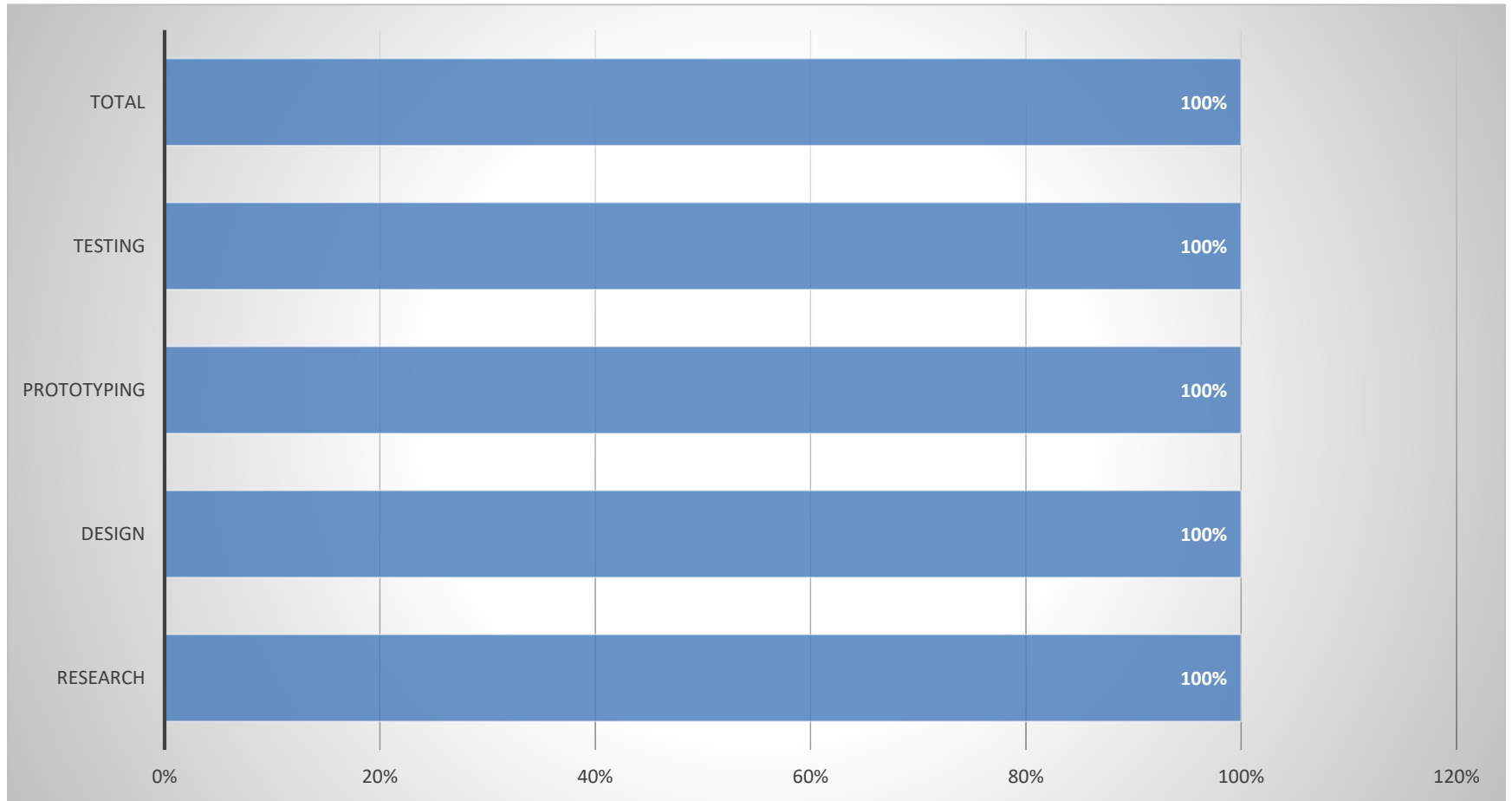
LED Display PCB



LED Display PCB



Progress



Budget


KPM Parts List

Description	Price per Unit	Developing Amount	Developing Total	Project Amount	Project Total
Charging Cable	Donate	1	\$0	1	\$0
TDA1524A	\$2	10	\$20	1	\$2
PT2399	\$2	10	\$20	1	\$2
LM386	\$3	10	\$30	2	\$6
Audio/Recording Cable	Donate	1	\$0	1	\$0
PCB Boards	\$20	10	\$200	6	\$120
Electret Microphone	\$2	10	\$20	2	\$4
Cover (Fiber Glass)	\$100	0	0	1	\$100
Speakers	\$8	5	\$40	3	\$24
Rechargeable Battery	\$20	2	\$40	1	\$20
Bluetooth Module	\$15	3	\$45	1	\$15
Microcontroller	\$15	1	\$15	1	\$15
LEDs	\$0.75	30	\$40	30	\$40
Misc.	\$30	2	\$60	1	\$30
TOTAL			\$530		\$378

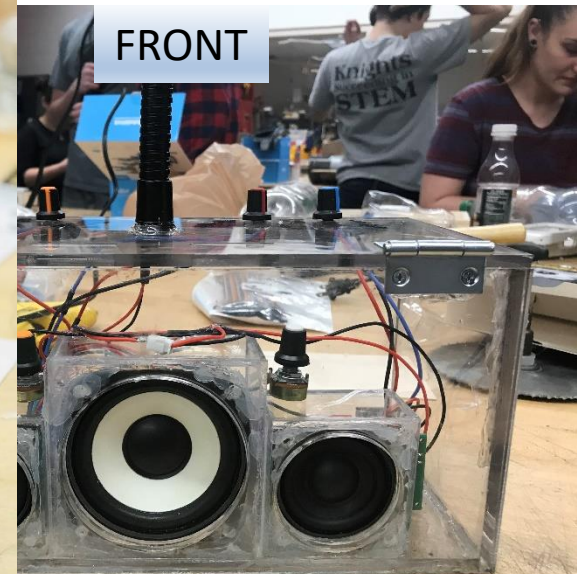
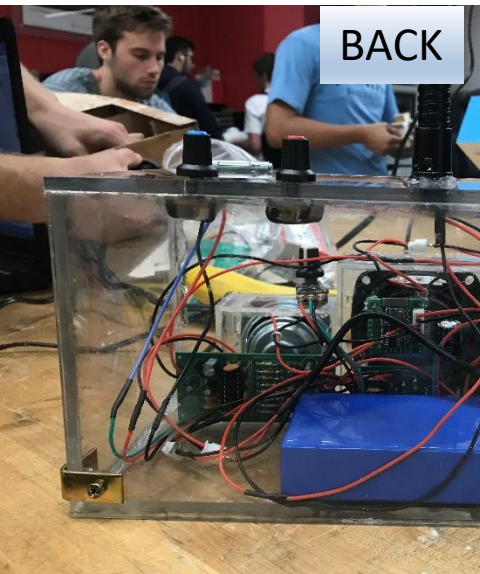
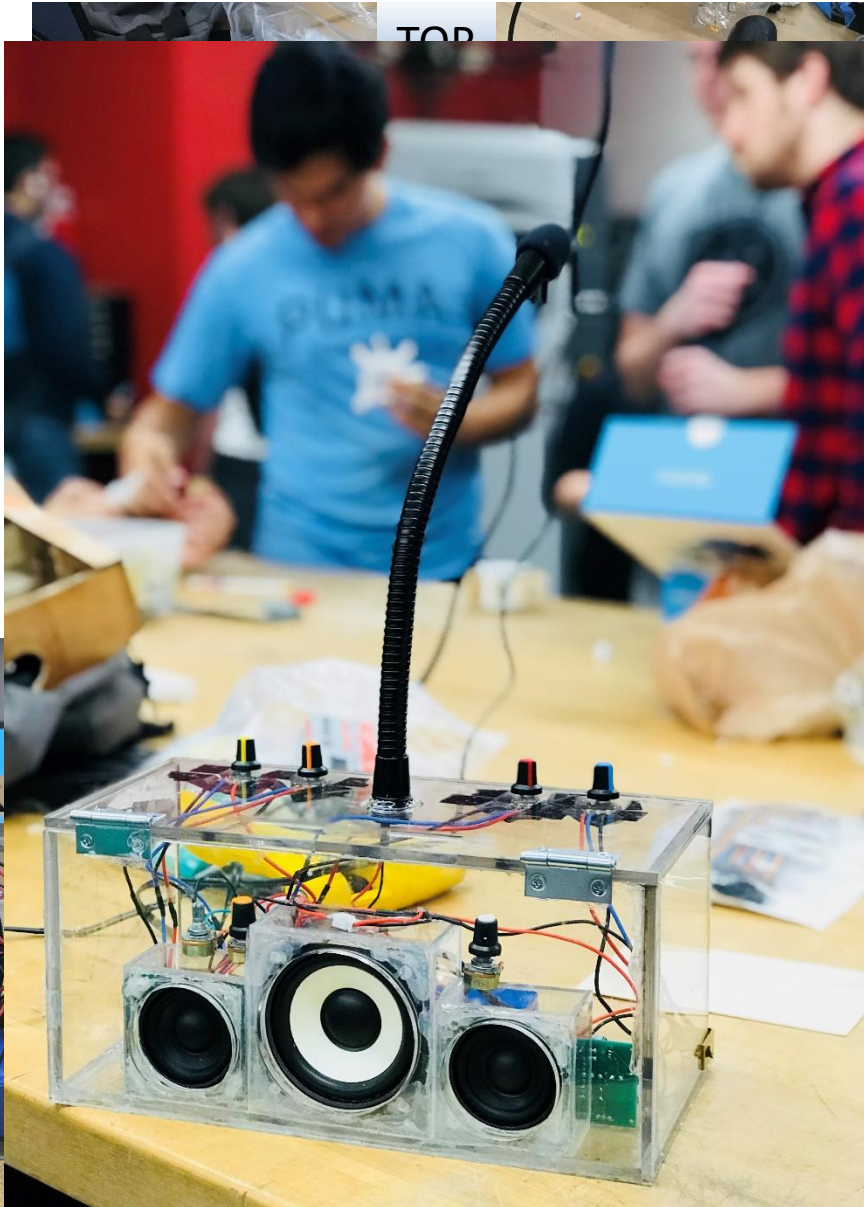


Challenges vs. Solutions

Challenges	Solutions
Noise + Distortion	- Research and build filter to the amplifiers
Many circuits -> Errors	- The case can be opened to repair PCBs.
Huge PCB board + Small and Portable Device	- Separate the circuits into 4 PCB boards and mount them on the case. -Easy to find error.



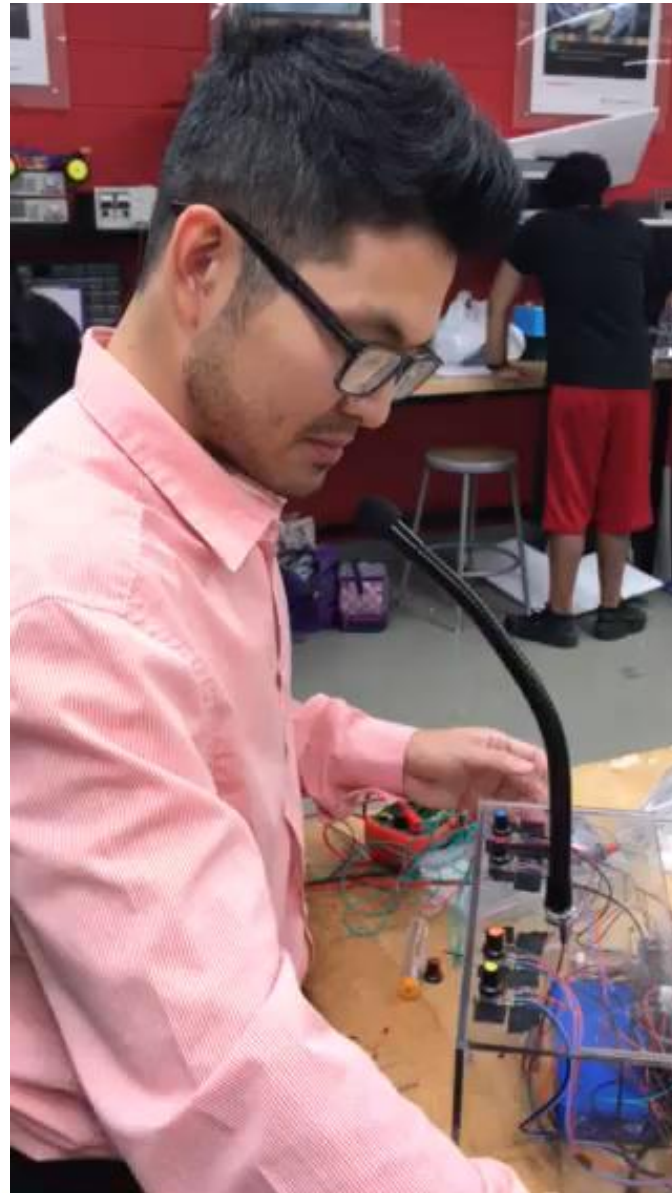
Picture



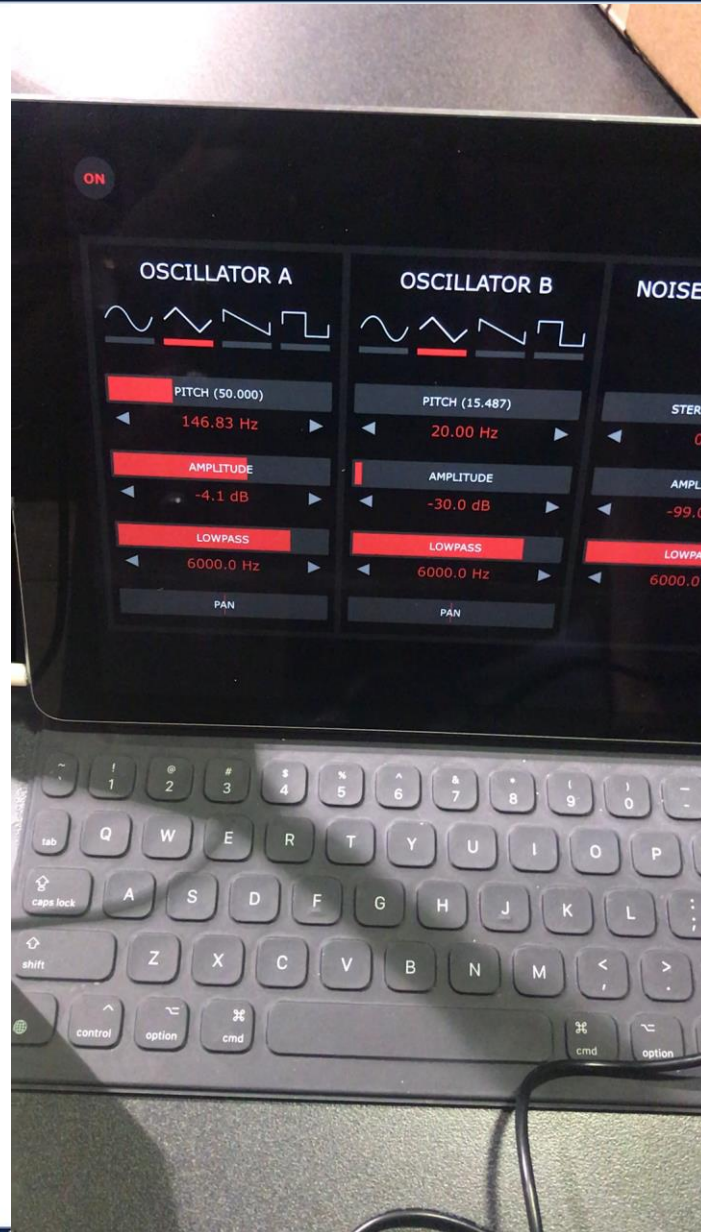
Picture



Video



Video



What's next?

- Create Website
- Complete paper
- Graduate

QUESTIONS?

