

AUDIO AMPLIFIER

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“AUDIO AMPLIFIER”

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ABSTRACT

In this digital era amplifiers plays major role. The amplifiers are used in wireless communications board in the casting and in audio equipment of all kind. In this project we worked on audio amplifiers. Amplifiers are the devices which are used to increase the strength of an audio signal. The amplifiers are used to increase the gain of an audio .A BJT is a semiconductor device used to amplify audio signal .In this project we have signed and built an audio amplifier. First we analyzed the circuit in PSPICE. We studied the different kind of amplifier to building a low budget audio amplifier. In the circuit the input stereo signal given through a 3.5 headphone jack and audio signal is being amplified in the amplifier circuit. The amplified signal is given to the input of speaker which then converts into the audio signal. Here we are using a BJT transistor instead of MOSFET transistor, because here we are preparing a basic audio amplifier. BJT is enough to amplify a low input signal, we can use MOSFET for amplifying a high input signal .MOSFET is expensive than BJT .So, we are using a BJT transistor for a basic audio amplifier.

CHAPTER 01

INTRODUCTION

Audio amplifier was first invented by LEE DE FOREST in 1909 for our experiment we use amplifier to boost the weak audio signals to the strong audio signals. In olden days audio is passed by using triode vacuum tubes and next level by using amplifiers and now by using transistors and ICs. when we pass audio signals directly to the speaker then it produces no sound with low gain in dB and efficiency noticing the unclear voice or noise in the speaker to get rid of all these problems we are using audio amplifiers the range of human hearing is 20Hz to 20KHz. Humans can hear from 0dB to 120dB while hearing at 120dB it causes immediate damage to ears or hearing. We are giving stereo signals from the portable music playback as the input. The signal is amplified and produces an output from the speaker with high sound and with more voltage gain in dB as compared when the audio is given directly to the speaker. To increase the sound, efficiency and clear voice and noise cancellation in audio amplifier. We use class AB amplifiers to overcome the cross over distortion this occurs when two or more signals are mixed together then it produces output as noise so to eliminate that noise cross distortion we used class AB amplifiers. For our experiment we are using BJT transistor rather than the MOSFET transistor because we are giving low voltage as the input that BJT can amplify where the MOSFET is expensive and it is used to amplify high frequency audio signals.

In this if we give stereo signal the amplifier first pre amplifies the signal and the two amplifiers amplify the signal this is AB class amplifier. we used AB class rather than class B because class AB amplifier overcomes the crossover distortion in class B amplifier. In class B amplifier efficiency is 78.5% and the Q point is above the cut off region and it is in between 180 degree and 360

CHAPTER 02

LITERATURE SURVEY

The audio amplifiers are first invented by Lee De Forest in year of 1906. He invented the triode vacuum tube amplifier it consists of three electrodes in vacuum tube with a heating filament this triode vacuum tube is firstly used in FM radios and later the vacuum tube amplifier is developed by the Williamson in 1947 and named it as Williamson amplifier .later the amplifiers are modified into a solid transistors like BJT (bi polar junction transistor) and MOSFET(metal oxide semiconductor filed effect transistor) these amplifiers are used highly with more features and light weight and with low maintenance than compared to the vacuum tube amplifiers . After using the BJT transistors they knew that BJT amplifies only low frequency audio signal and started working on the MOSFET. So, further power amplifiers are designed by Jun-Ichi-Nishizawa in 1974. These are used to amplify high frequency audio signal. Initially MOSFET is invented by Mohamed Atalla and Dawon Kahang at bell labs in 1959. The power MOSFET is manufactured by Yamaha, JVC, Pioneer and Sony to amplify the higher frequency audio signal. Later the Hitachi introduced the new transistors LDMOS (lateral diffused MOS) in 1977. Class D amplifier is used in LDMOS and these are the fast switching amplifiers usually mosfets are used in power sections where the cross over distortion curve is more in vacuum tubes.

CHAPTER 03

PROPOSED METHODOLOGY

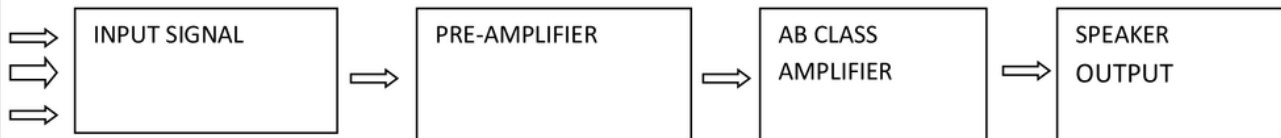


Fig (3.1) BLOCK diagram

First we chosen audio amplifier as our mini project .We have gone through some literature surveys who has previously worked on audio amplifier. In these circuits everyone has done with a lot of components, So we have prepared a circuit with less component. Then we finalized a circuit diagram and we implemented on PSPICE and we brought the components and we connected as per the circuit diagram on the board. When a stereo signal is given a signal through head phone jack 3.5 then the capacitor blocks the direct current and allows only ac current to the circuit there we used coupling capacitors first it block dc and we are not sure that the current passing through it is only ac so we used another capacitor this is called coupling capacitors. The diodes provide constant voltage for the transistors Q2 and Q3. Q1 transistor works as pre amplifier. Pre amplifiers means when we give a low input the pre amplifier boosts the signal and send to the main amplifier for amplification. The Another two transistors drive the speaker means let say when you need supply 0.30mV to the speaker the power source supply stay stable at the current level required by the speaker requires . Generally speakers are of low impedance they required a great a current deal here. We used AB class amplifier because class A Amplifier conducts full 360 degree for the input signal class B conducts 180 degree input signal to overcome the cross over distortion produced in b class amplifier. we used AB class amplifier it conducts between 180 degree and 360 degree to eliminate cross over distortion .we provide forward bias at the BE junction it helps us to move the Q point slight above the cut off region in region in class AB amplifier. We can use capacitors resistors and diodes .Here we used diodes only because they can provide a constant bias voltage which over comes the cross over distortion produced by the class B amplifier

CHAPTER 04

PROJECT DESCRIPTION

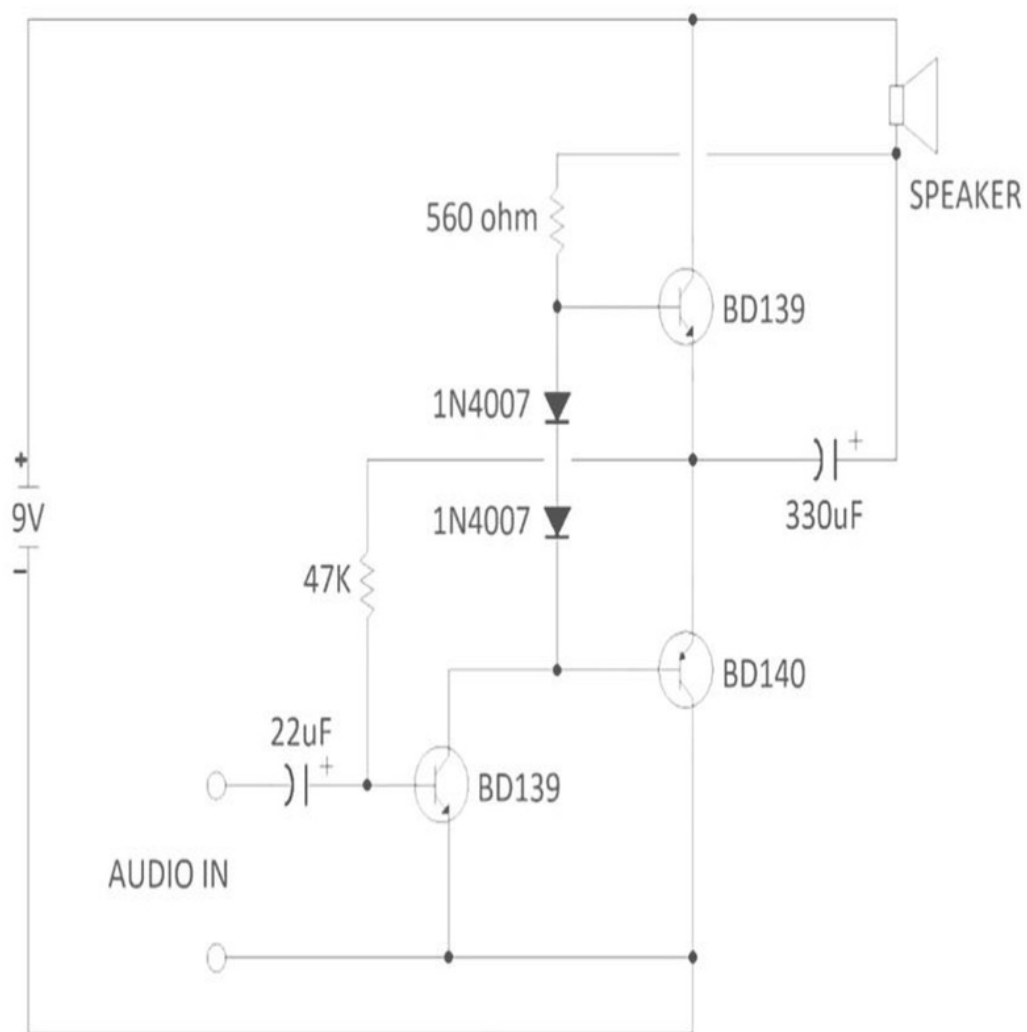


Fig (4.0) circuit diagram

A stereo signal is given through a head phone jack 3.5 then the capacitor blocks the direct current and allows only ac current to the circuit there we used coupling capacitors first it block dc and we are not sure that the current passing through it is only ac so we used another capacitor this is called coupling capacitors. The diodes provide constant voltage for the transistors Q2 and Q3. Q1 transistor works as pre amplifier. Pre amplifiers means when we give a low input the pre amplifier boosts the signal and send to the main amplifier for amplification. The Another two transistors drive the speaker means let say when you need supply 0.30mV to the speaker the power source supply stay stable at the current level required by the speaker requires . Generally speakers are of low impedance they required a great a current deal here. We used AB class amplifier because class A Amplifier conducts full 360 degree for the input signal class B conducts 180 degree input signal to overcome the cross over distortion produced in b class amplifier. we used AB class amplifier it conducts between 180 degree and 360 degree to eliminate cross over distortion .we provide forward bias at the BE junction it helps us to move the Q point slight above the cut off region in region in class AB amplifier. We can use capacitors resistors and diodes .Here we used diodes only because they can provide a constant bias voltage which over comes the cross over distortion produced by the class B amplifier

Table (4.1) components table

S.NO	Required Components	Remarks	Quantity
1	Diodes	1N4007	2
2	Transistors	BD139, BD140	2 1
3	Capacitors	22uf 330uf	1 1
4	Resistors	47k 560	1 1
5	Speaker	16ohms	1

1. DIODE: A Diode is a two terminal electrical component that can conduct current in one direction as long as the diode operated in the specific voltage level . Ideal diode has zero resistance in one direction and infinite resistance in reverse direction

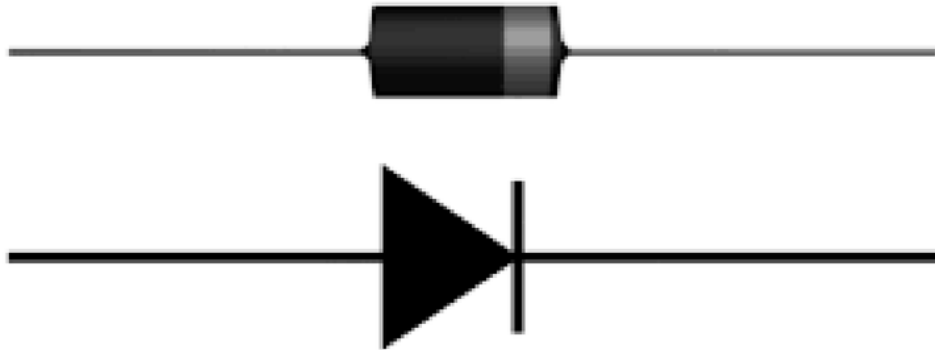


Fig (4.1) Diode

In this project we used 1n4002 the following features are there

Features

- Plastic package has underwriters Laboratories Flammability classification 94v-0
- Void free molded technique is used in Construction
- This diode has low reverse leakage
- Surge capability of this diode is high
- It is capable of high soldering guaranteed 260 Celsius /10sec
- Dimensions are 0.375(9.5mm)lead length,5lbs (2.3kg) tension

2. TRANSISTOR:

Transistor is a semiconductor device used to amplify or switch electronics signals.

It is made up of semiconductor with three terminals for connection for external circuit.

Transistors are two types BJT and MOSFET. A bipolar junction will have both electrons and holes as charge carriers BJT is divided into two types

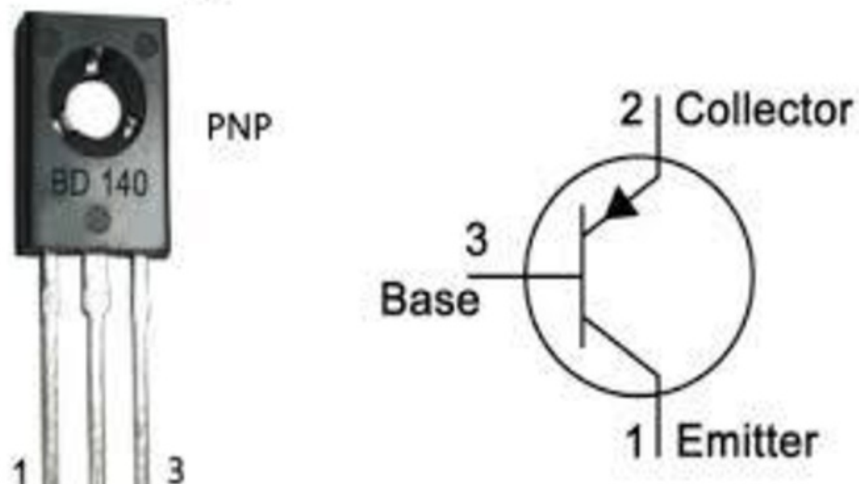
NPN transistor

PNP transistor

A PNP junction transistor consists of n doped semiconductors between two p doped layer .A

NPN transistor consists of p doped semiconductor between the two n doped layers

We have used BD 139 and BD 140 .Here BD 139 is a NPN transistor and BD 140 is a pnp transistor



Fig(4.2)transistorbd140

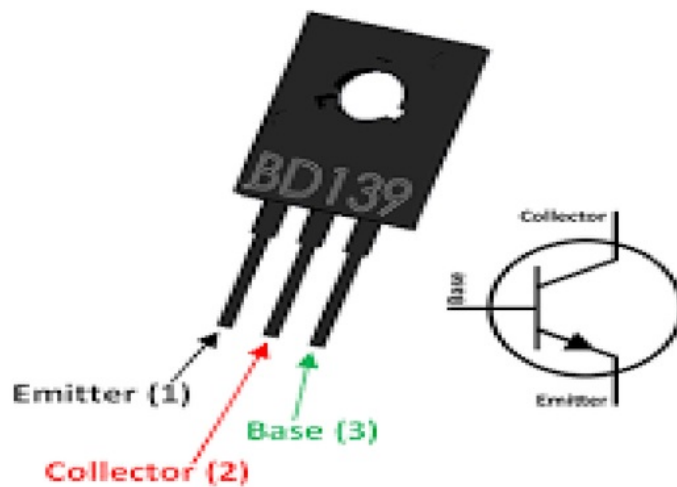


Fig (4.3) transistor bd139

BD 139 Features;

The package type is from TO 126 NPN

The maximum collector current $I_C = 1.5A$

The maximum collector- emitter voltage $V_{CE} = 80V$, collector –base voltage $V_{BC} = 80V$, base emitter voltage $V_{BE} = 5V$.

The maximum beta gain $H_{FE} = 25$

The minimum beta gain is $H_{FE} = 250$

The frequency of the transistor is 190MHz

It operating and storing junction temperature range is from -55 to +150 Celsius

It is also available in PB Free State.

BD 140 Features:

The package type is from TO 18

The type of transistor is PnP.

The maximum collector current is $I_C = -1.5A$

The maximum collector base voltage is $V_{CB} = -80V$

The maximum base emitter voltage is $V_{BE} = -5V$

The maximum gain H_{FE} is 250

The maximum and operating temperature should be: -55 to 150 centigrade

3. Capacitor:

Capacitors are device that are used to store electrical energy in electrical field. Capacitors are passive two terminal electrical components

Capacitors are used to block through them here we used electrolytic capacitors

How much a electrical energy that a capacitors depends upon capacitance of the capacitor

22uf Features

Fig(4.4)capacitor 22uf

Category: electrolytic capacitor

Capacitance: 22 μ F

Tolerance: +_20%

Voltage rated: 50v

Size (mm): 5*11

Lead spacing (mm): 2

Operating temperature: -40degreeC to 150degreeC

Life time temperature: 2000hrs @ 105degreeC

330UF Features

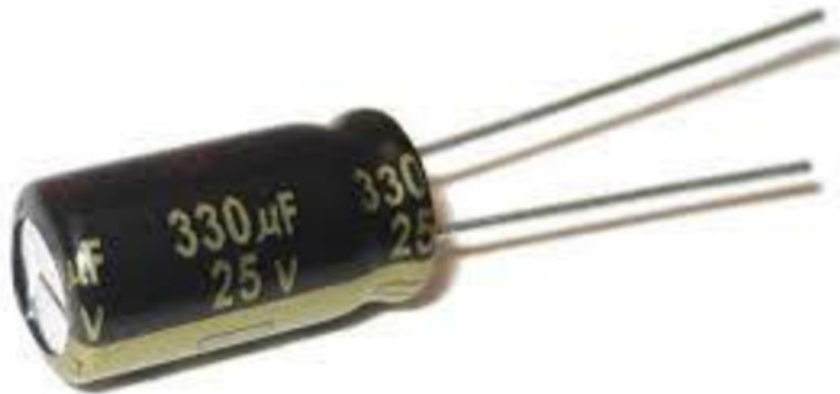


Fig (4.5) capacitor330uf

Electrolytic capacitors storage conditions 35degreeC, <46% R H

Operating temperature: -55degreeC up to + 105degreeC

Load life: 7000he + 105degreeC /25W

Size (mm):10*17

Lead spacing (mm): 5

4. Resistors

Resistors are two terminal passive electrical components resistors are generally used to slow down the flow in electrical circuits and also used for adjust signal levels and divide a resistor value by color coding on them

47k FEATURES



Fig(4.6)resistor47k

Power: 2W

Tolerance $\pm 5\%$

Composition carbon film

Temperature coefficient $0/-600/\text{degree C}$

FEATURES 560 ohms



Fig(4.7)resistor 560ohms

Simplifies the circuit design

Reduces the board space

Reduces component count

Power =1/6w, 1/4w

Tolerance =+-2%

SPEAKER FEATURES

The speaker is 16 ohm to 0.5watt speaker it produces sound up to 90 dB.

The frequency of 16 ohm speaker is 5.7 KHz to 7 KHz.

Power rating or power supply range is from 50mw to 1w.

Terminating style of 16 speakers is solder lug and solder pad.

Minimum temperature condition for working of speaker is at -20c.

Maximum temperature condition to drive a speaker is at 60c.

Diameter of the speaker is from 20mm to 40mm range.

Depth of the speaker is from 3mm to 10.6mm range.



Fig (4.8) speaker (16 ohm)

CHAPTER 05

RESULT AND DISCUSSION

The working model of the audio amplifier project was effectively planned and executed the model is tested for different small signals. The amplifier is perfectly working the audio input is first get boosted by the preamplifier to the range of the main amplifier requires. The two transistors are used to drive the speaker the other to transistors provides voltage and constant power source to the speaker requires. Generally speakers are of low impedance so we have to provide the voltage and power levels required by the speaker



Fig (5.1) preamplifier graph

First the input signal is amplified by the Preamplifier if the input signal is low the pre amplifier boosts the signal

Voltage gain in pre amplifier $A_v = \text{output voltage} / \text{input voltage}$

$$= 8.69 / 30 \times 10^{-3}$$

$$= 289.6 \text{v}$$

$$= 20 \log (A_v)$$

$$= 20 \log (289.6)$$

$$= 49.23 \text{db}$$

The pre amplifier boosts the input up to 49.23db

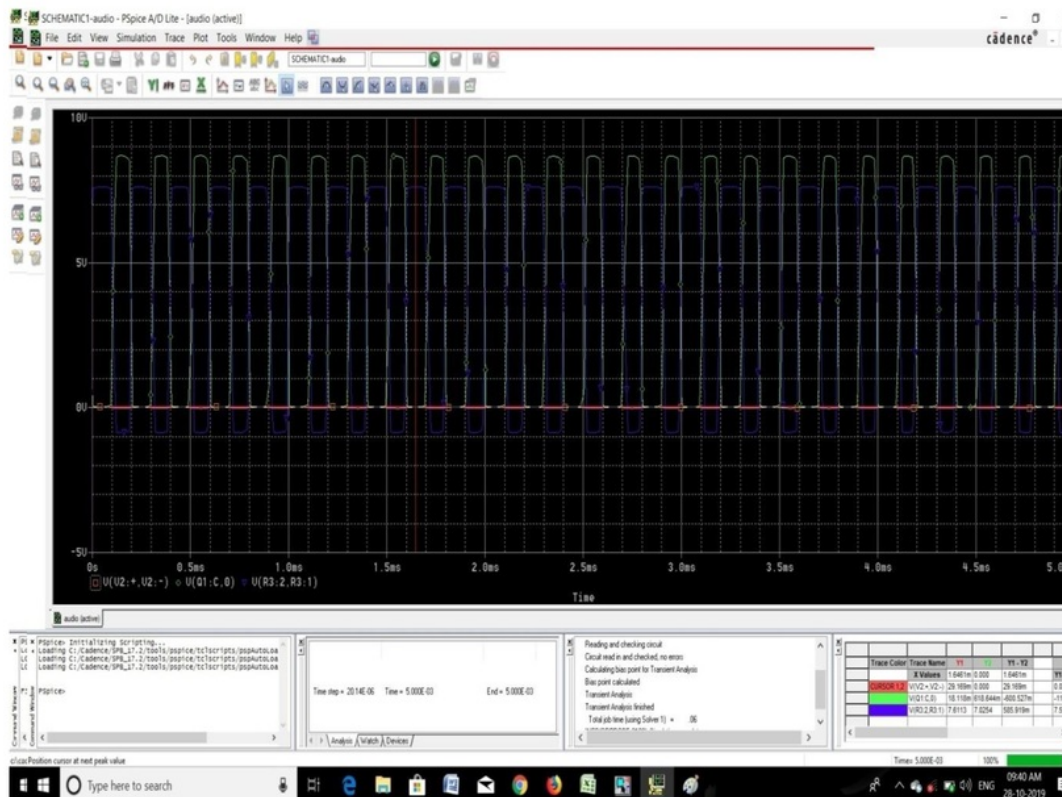


Fig (5.2) AB class amplifier drive the speaker

The two amplifiers drive the speaker the final gain of the audio amplifier is

Voltage gain of the circuit is $A_v = \text{output}/\text{input}$

$$= 7.89 / 30 \times 10^{-3} \text{ -----}$$

$$= 263.4$$

Total voltage gain $= 20 \log (A_v)$

$$= 20 \log (263.4)$$

$$= 48.3 \text{ db}$$

The output of the project is it amplified up to 48.3 db.

S.NO	INPUT VOLTAGE	OUTPUTVOLTAGE	GAIN
1	30×10^{-3}	7.89	48.3
2	40×10^{-3}	7.90	45.9
3	50×10^{-3}	7.96	44.03
4	60×10^{-3}	8.00	42.3

Table (4.2)

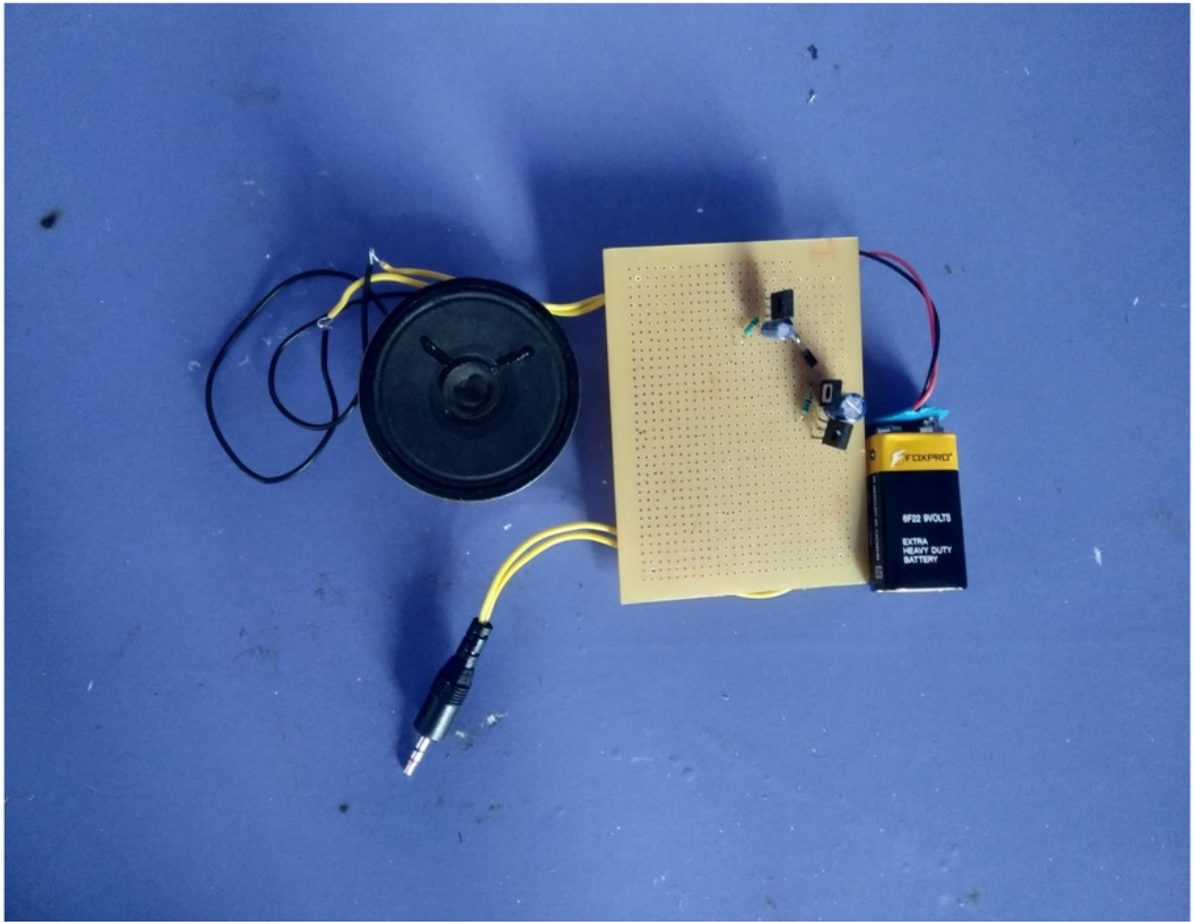


Fig (5.3) prototype of audio amplifier

CHAPTER 06

CONCLUSION AND FUTURE SCOPE

The audio amplifier systems that are available in the market are known and the achievable of these systems is analyze .The internal structure of the BJT transistor used in to increase the small signal and develop it to large signal. In our project we have used 2 NPN and 1 PNP transistors. We have studied different classes of amplifier and the equivalent PSPICE models are modeled and the results are matched with simulated models successfully .In our project we have studied about class AB amplifier .we have prepared a amplifier with low cost and mini and compact with noise less signal In future we can expect of amplifier with low cost.

Amplifiers helped sound engineers to evaluate the distortion process.

ADVANTAGES AND DISADVANTAGES OF CLASS AB AMPLIFIER

- It is a simple application
- It is of low cost
- The circuit of this very easy we can make it easily.
- This amplifier circuit uses capacitors, resistors, diodes and transistors as it is low expensive.

THANK YOU

AUDIO AMPLIFIER

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