AIM : To design a simple amplifier circuit to drive a loudspeaker.

COMPONENTS REQUIRED:

1. LM386 Audio Amplifier IC
2. 1000uF capacitor (Quantity-1) (A capacitor,is a device for storing electrical energy, consisting of two conductors in close proximity and insulated from each other.)
3. 100uF capacitor (Quantity-2)
4. 10uF capacitor (Quantity-1)
5. 0.05 µF Capacitor (two 0.1 µF Ceramic Capacitors in series would do the job)
6. 10 Ω Resistor (1/4 Watt)
7. 4 Ω Speaker
8. 12V Power Supply
9. Connecting Wires
10. Perfboard (dot PCB)
11. Soldering iron
12. Soldering paste

INTRODUCTION:

Amplifiers are a basic component of all the music systems available in the market. The need for this intermediate circuitry exists so that we can hear crystal clear music from the music systems. Mini Audio Amplifier project is a mini version of such amplifier systems. This is easy to implement and test with the help of audio jack. The signals given by an audio transmitter device such as a cell phone through a 3.5mm audio jack cable is very low in amplitude. Such a signal if given to the speaker, the sound output given by the speaker will be very less and might not be audible even to a nearby person. So instead we give the audio input to the amplifier circuitry. The amplifier circuitry amplifies this audio signal. The amplified version of the audio input is fed to the input of the speaker which then converts it into sound output. Audio frequency range lies in the frequency range of 20Hz – 20KHz. The purpose of audio amplifier lies in to increase the amplitude of signals lying in this frequency range and suppress the rest. So the audio amplifier circuitry is configured in such a way that it will multiply the audible range signals with a positive gain factor. With the help of two potentiometers we can vary the gain factor or the volume of the audio amplifier.

THEORY:

The LM386 is an operational amplifier that has been specifically designed for use in audio applications.which means its performance is based on the assumption that it will be driving speakers. However it can, like most other basic audio amplifier chips, be used as a regular op-amp as well.

It has a default gain of 20x - meaning it will multiply the voltage it receives on the input by 20 times, passing this through to the output. The gain value can be adjusted if needed.

The pins of LM386:

1, 8 - Gain

Pins 1 and 8 are used to adjust the gain level from the default 20x using specific values of connected capacitors.

2 - Negative Input

3 - Positive Input

These are the standard op-amp inputs. Typically in a simple LM386 circuit, the negative input will be tied to ground while the positive input will receive the audio signal from the source.

4 - GND

5 - Vout

Pin 5 is the op-amp output, in our case the amplified signal which we send on to the speaker.

6 - Vs

The Voltage Supply pin receives the power required to operate the amplifier.

7 - Bypass

This pin provides direct access to the signal input, primarily used to remove power supply noise (preventing noise from being amplified).

Specifications

The LM386N ("N" signifying the preferred DIP package for our purposes) comes in 4 flavours: LM386N-1, -2, -3 and -4. The "3" and "4" versions have slightly higher output power, with the "4" version more so given its ability to handle more input voltage (at the cost of a higher minimum voltage requirement). For the rest of this article I'll refer to the LM386N-1, as it's the chip I had laying around and represents the most basic of the variants.

Supply Voltage (Vcc):

The chip requires a minimum of 4V to operate, with a maximum of 12V.

Speaker impedance:

The LM386 was primarily designed for a 4Ω speaker load, but is rated for 8Ω and 32Ω loads as well.

Distortion:

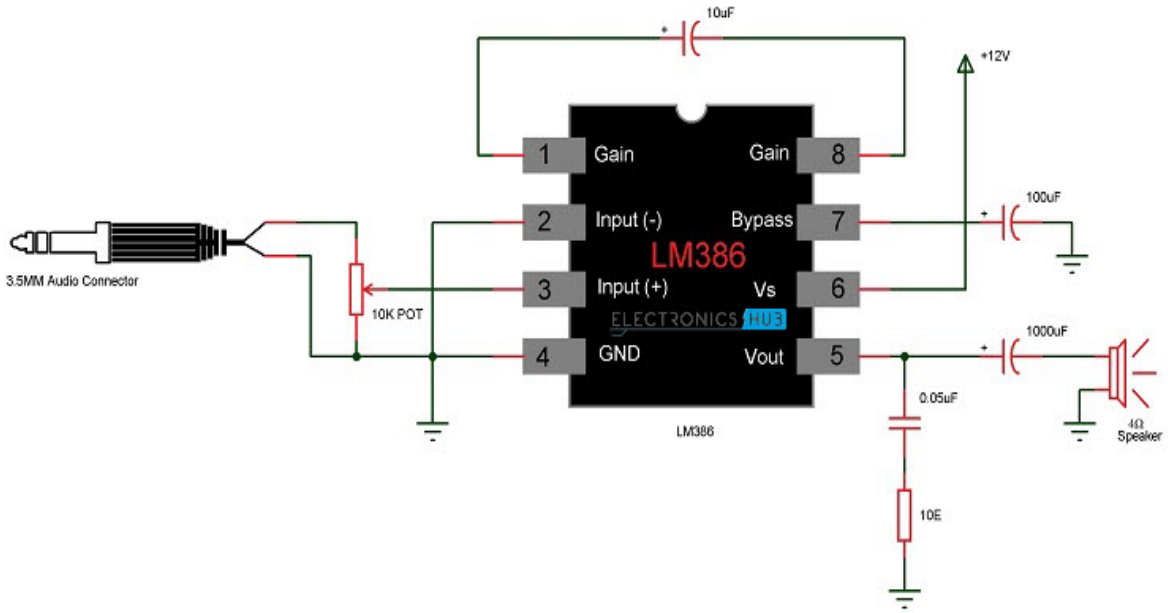
Under ideal conditions, 0.2% total harmonic distortion (THD) when driven with 6V of power into an 8Ω speaker at low power ratings, and up to ~10% THD closer to maximum power.

Output power:

Under ideal conditions you can expect about ~700mW of clean output power, or 0.7W.

CIRCUIT DIAGRAM:

Project

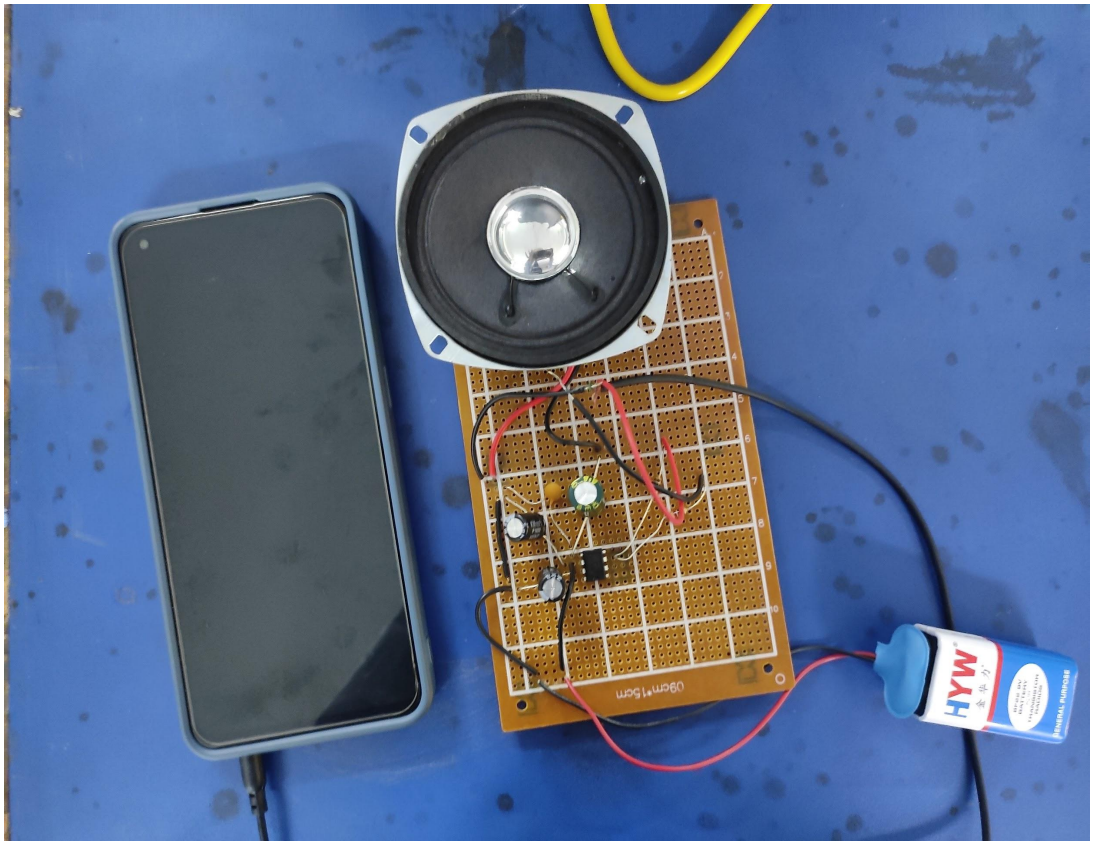


CIRCUITRY:

First, we have to connect the power supply pins (Pins 6 and 4) to 12V and Ground respectively.The maximum power supply for LM386 is 15V.Next, we need to connect the input.The input can be given from any audio source like mobile phone or a microphone. We will give the audio input from a mobile phone using the 3.5mm connector. If we want to control the level of the input, we need to connect a 10 KΩ Potentiometer at the input. Since we are doing this project on a perfboard, we did not connect any input volume control POT. Additionally, a small capacitor has to be connected in series with the input to filter out the DC Components.

Internally, the gain of the LM386 Audio Amplifier is set to 20 (without any gain control circuitry). We will connect a 10 µF Capacitor between the gain control pins i.e. pins 1 and 8. Hence, the gain will get set to a factor of 200. Although the data sheet of LM386 says the bypass capacitor at Pin 7 is optional, connecting a 100 µF capacitor is helpful as it helps in reducing the noise. It can be left open for normal operations.

PROJECT PHOTOS:



LIMITATIONS:

There are many audio amplifier circuits designed using LM386 IC.The main problem with these circuits is noise and interference.The noise from the Amplifier Circuit designed in this project is considerably less and if designed on a proper circuit board, this will make a great Audio Amplifier.

CONCLUSION:

LM386 IC is an integrated class AB amplifier and is good for beginners in small audio amplifier applications.For example,used in a RF receiver,small Stereo system ,cheap low voltage amplifier etc. It's only drawback is that it cannot handle much power and hence creates distortion and gets easily interfered with noise..