

Project Report

ECTE212 - Electronics



Lab Instructor: Miss Ayesha Qureshi

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# About the Power Amplifier

This section will explain the theoretical information regarding the Power Amplifier we created.

The purpose of the project was to create a power amplifier that only operates when the touch circuit is triggered; otherwise, the amplifier is supposed to be turned off.

We used an Op-Amp circuit that will be linked to an amplifier circuit. The amplifier circuit boosts the current while the Op-Amp circuit amplifies and inverts the input voltage. As a result, the input power is amplified and transmitted to the load. The voltage gain value's specified range was expected to be between 10 and 15.

The components used to make the circuit are PNP and NPN transistors, resistors, diodes, capacitors, AC power and the inverting amplifier.

The functionality of each component are as follows:

**NPN transistor (BD139)-** An NPN transistor is made up of a layer of P-doped semiconductor placed between two layers of N-doped material, with electrons flowing from the emitter to the collector instead. The emitter subsequently "emits" electrons into the base, with the number of electrons emitted controlled by the base. NPN transistors are commonly utilised in amplifying circuits. When an NPN transistor is employed as an amplifier, most charge carrier electrons from the N-type emitter go from the emitter to the base and then from the base to the collector. (Latest Open Tech From Seeed, 2020)

**PNP transistor (BD140)-** PNP transistors are transistors that have one n-type material doped with two p-type materials. It is a device that is powered by current. The minimal quantity of base current regulates both the emitter and collector currents. A PNP transistor is used as an amplifier in the common-base configuration. (Admin, 2021)

**Diodes-** The role of a diode is to allow electric current to flow in one direction while preventing it from flowing in the opposing direction. It is often connected between the current source and the amplifier's input. The diode, among other things, prevents the amplifier from interacting with some undesirable properties of the current source, such as capacitance and resistance. It also prevents current sources from interacting with one another and allows the use of intrinsic diode properties to modify the current source output signal. (diode | Definition, Symbol, Types, & Uses | Britannica, 2022)

**Inverting amplifier-** An inverting operational amplifier (op amp) is a type of operational amplifier having an output voltage that varies in the opposite direction as the input value. In other terms, it is 180 degrees out of phase. An op amp inverter is an operating amplifier-based inverting buffer. An inverting buffer reverses the signal's direction without enhancing it. (Maximintegrated.com, 2020)

# Final Designs

* **Final Power Amplifier - Simulation Design**

|  |  |
| --- | --- |
| **Simulated Circuit** | **Oscilloscope Graph** |
|  |  |

* **Final Circuit Design - Simulation**

|  |  |
| --- | --- |
| **Simulated Circuit** | **Oscilloscope Graph** |
|  |  |

For the above simulation circuits, the power circuit needed to be modified, from its initial stage (discussed in the later section) to accommodate to the resistors available in the lab, when constructing the breadboard circuit and to get a proper graph on the oscilloscope.

* **Breadboard Circuit**

|  |  |
| --- | --- |
| **Breadboard Circuit** | **Oscilloscope Graph** |
|  |  |

When comparing the oscilloscope graph with the simulation graphs, there is a noticeable amplification of the output graph. However, the only difference is the shape, which doesn’t seem to be a perfect sinusoidal wave. This might be due to lose connections, which weren’t detectable through the conductivity test on the multimeter.

# Testing, Evidence & Calculations

The simulation for the Power Amplifier circuit was tested on Multisim before the circuit could be implemented on the breadboard. The following cases, were considered:

## Case 1:

|  |  |
| --- | --- |
| **Simulated Circuit** | **Oscilloscope Graph** |
|  |  |

## Case 2:

|  |  |
| --- | --- |
| **Simulated Circuit** | **Oscilloscope Graph** |
|  |  |

## Calculations

To obtain the values in the non- inverting amplifier, the following calculations were carried out:

* **Gain:** 10
* **(Assume) R1 =** 50kΩ

# Project Applications

A power amplifier's role is to increase the power level of an input signal. It must deliver a huge quantity of power and manage a large current. To accommodate high currents, the transistor's base is thickened. (Tutorialspoint.com, 2022)

An amplifier takes an input signal from a source, such as a laptop, turntable, or CD player, and multiplies it before sending it to the speakers. It receives the power to accomplish this from your mains energy, which is routed straight to the amplifier's power source. (Burns, 2020)

There are many applications of power amplifiers. The following are some examples of power amplifier uses in various industries:

* **Consumer Electronics**

Audio power amplifiers are found in essentially every consumer electronic gadget, including microwave ovens, headphone drivers, televisions, mobile phones, and home theatre systems, as well as theatrical and concert reinforcement systems.

* **Industrial**

Most industrial actuator systems, such as servos and DC motors, are controlled by switching type power amplifiers.

* **Wireless Communication**

High power amplifiers are essential for transmitting cellular or FM broadcasting signals to consumers. Higher power levels enabled by power amplifiers improve data transmission speeds and usability. They are also found in satellite communication systems.

(Electronics Hub, 2021)

# References

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| --- | --- | --- |
| **Team Member** | **Contribution** | **Percentage Claim** |
| Razveen Kashif | Report, Circuits, Simulation |  |
| Suraksha Kotte | Report, Circuits, Simulation |  |
| Bassam Babar | Circuits construction and testing, Simulation |  |

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