# Linear Integrated Circuits
# UE21EC343AB2

## Mobile detection using Op-Amp

**Project by**

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## Abstract

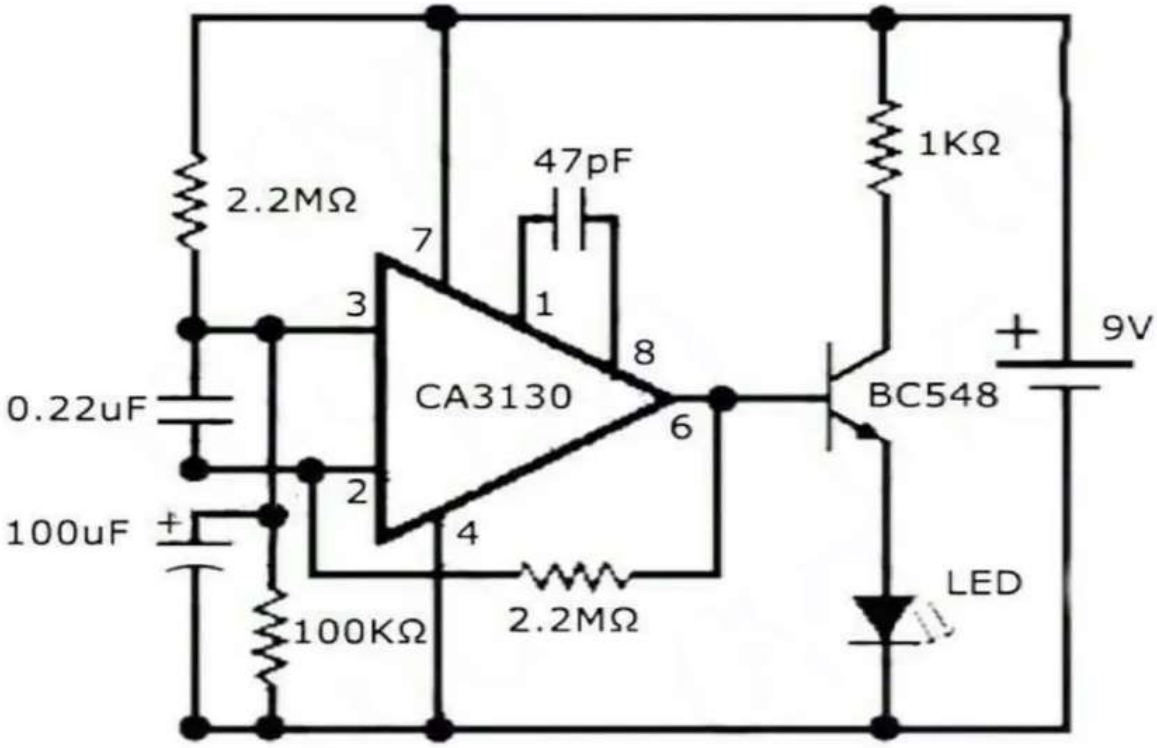
This study introduces an innovative mobile device detection system using operational amplifiers (op-amps). With the pervasive use of mobile devices in diverse settings, there is a growing demand for efficient and cost-effective detection methods. Our proposed system harnesses the capabilities of op-amps to create a straightforward yet robust detection system. The op-amp circuit, carefully **designed to capture** and process **electromagnetic signals** emitted by mobile devices, relies on distinctive signal characteristics for discrimination. This includes features like amplitude and frequency modulation patterns, enabling accurate differentiation between mobile devices and other electronic signals. The system's **advantages** lie in its **simplicity**, **low cost**, and **energy efficiency**, making it suitable for applications such as security systems and smart environments.

Experimental results validate its effectiveness, showcasing accurate mobile device identification while minimizing false positives. The scalable and adaptable nature of the op-amp architecture positions it as a promising solution for integration into diverse infrastructures.


## Introduction

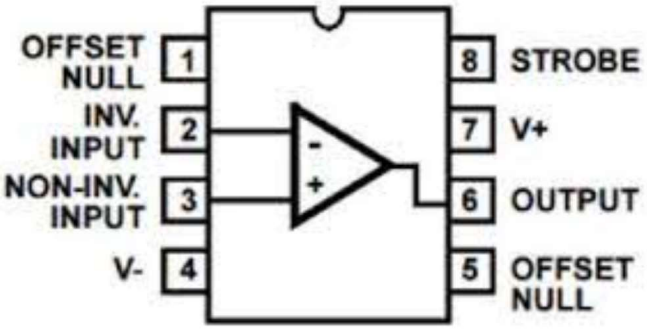
Operational amplifiers, commonly referred to as op-amps, are integral components in electronic circuits due to their versatile nature and amplification capabilities. This research delves into the inventive use of op-amps in the context of mobile device detection. Given the widespread use of mobile devices in contemporary settings, there is a growing demand for dependable and effective detection methods. This study introduces a unique mobile detection system that capitalizes on op-amps' distinctive characteristics, utilizing their ability to analyze electromagnetic signals emitted by mobile devices. Through meticulous design of op-amp circuits to scrutinize signal features such as amplitude and frequency modulation patterns, this approach presents a straightforward, cost-efficient, and energy-effective solution for precise identification of mobile devices across various applications.

## Circuit Diagram




## Working using Circuit Components

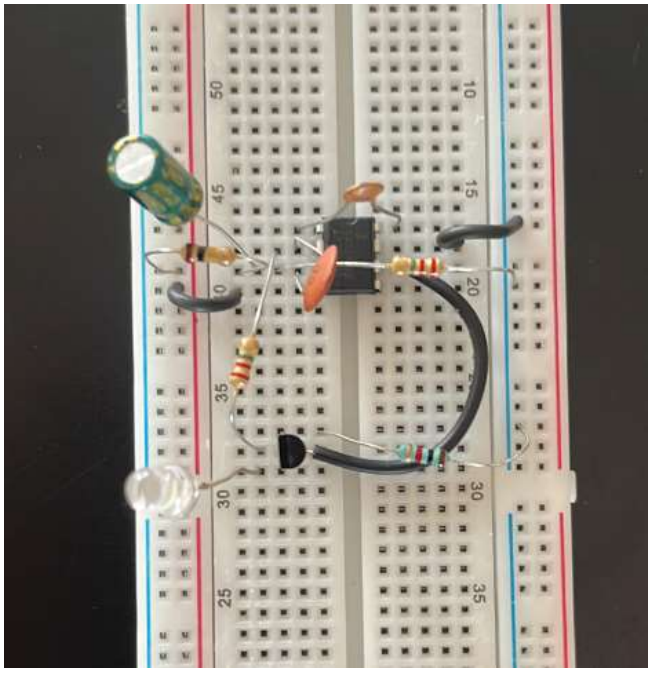
- CA3130 IC
  - CMOS version gate-protected p-channel MOSFET
  - Acts as a Differential Amplifier.
  - Used in the circuit as a Current to Voltage converter.
  - Provides very high input impedance, very low input current and very high speed of performance.

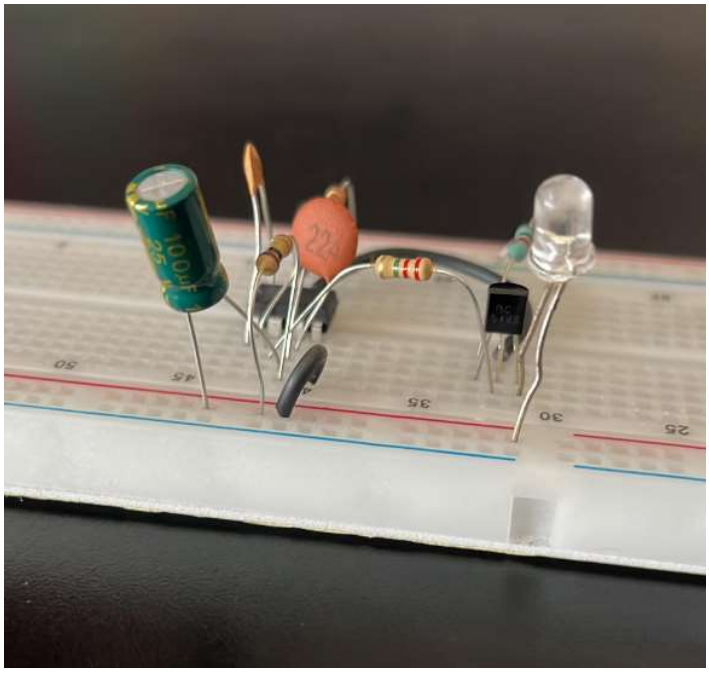


- 1k ohm resistor
    - Color code sequence Brown, Black, Red, Gold.
    - Keeps the non-inverting input stable for easy swing of the output to high state
- 100k ohm resistor
    - Color code sequence Brown, Black, Yellow, Gold.
    - Provides the discharge path for 0.22 µF Capacitor.
- 0.22 uF Capacitor
    - Ceramic capacitor type.
    - Acts as a small gigahertz (GHz) loop
    - antenna to collect the RF signals from the mobile phone.
    - The lead length of the is 18 mm with a spacing of 8 mm between the leads to get the desired frequency
- 100 uF Capacitor
    - Electrolytic capacitor
- BC548 transistor
    - n-p-n type epitaxial silicon transistor.
    - B indicates the material silicon and C stands for low audio frequency.
    - Mainly used for switching and amplification purposes
- 9V Battery
    - Rectangular prism shape with round edges and a polarized snap connector at the top.
    - This type is commonly used in walkie talkies, clocks and smoke detectors.
- Battery clip
    - Necessary for holding the battery into place
    - Keep in mind the polarity, while using a battery clips
- LED
    - LED with two lead semiconductor light source
    - It is a p-n junction diode, which emits light when activated
- 2.2M ohm resistor
    - Color code: Red,Red,Green and Gold
    - Makes the inverting input high when output becomes high’
- 47 pF Capacitor
  Ceramic capacitor acts as the dielectric

## Working Principle

- The transmission frequency of mobile phones ranges from 0.9 to 3 GHz with wavelengths of 3.3 to 10 cm.
- So a circuit detecting GHz signals is required.
- Here 0.22 µF disk capacitor is used to capture the RF signals from the mobile phone. This along with the leads act as a small GHz loop antenna to collect the RF signals.
- One lead of the capacitor gets DC from the positive rail and the other lead goes to the negative input of IC
- The capacitor gets energy for storage. This energy is applied to the input of the IC. So the input of the IC is almost balanced and output is almost zero. But at any time IC can give a high output if a small current is induced to its inputs
- There is a natural electromagnetic field around the capacitor caused by the 50Hz from electrical wiring.
- When the mobile phone radiates high frequency radiation, the capacitor oscillates and releases energy in the inputs of the IC. This oscillation is indicated by the flashing of LEDs.
- The LED blinks until the signal ceases





## Applications

- This circuit is used to detect the presence of active cell phones at examination halls and meetings
- It can be used to detect active cell phones in Hospitals, Military places, Court of Law and many other places.

## Advantages

- The device is sensitive to even channelize other RF signals belonging to other devices other than cell phones like radios
- It can be used for detecting cell phones used for spying and transmission of unauthorized audios and videos