CELLULAR ACTIVITY DETECTOR

Project report submitted in partial fulfillment of the requirements for the degree of

B.Tech
In
ELECTRICAL ENGINEERING

By

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CERTIFICATE of RECOMMRNDATION

We hereby recommend that the project report prepared under my supervision and guidance by **Sagar Pramanik, Priyanka Ranjan, Riteek Kumar**, **Juhi Kumari and Atanu Chatterjee** entitled "**Cellular Activity Detector**" be accepted in partial fulfillment of the requirements for the award of the degree of "**B.Tech in Electrical Engineering**" at **Camellia Institute of Technology**. The project, in my opinion, is worthy of its acceptance.

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CERTIFICATE OF APPROVAL *

The forgoing report is hereby approved as a creditable study of an Engineering subject carried out and presented in a satisfactory manner to warrant its acceptance as pre-requisite to the degree for which it has been submitted. It is noticed to be understood that by this approval, the undersigned do not necessarily endorse or approve any statement made, opinion expressed and conclusion drawn therein but approve the report only for the purpose for which it has been submitted.

Final Examination for Evaluation of report

Examiners

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Declaration of Originality and Compliance of Academic Ethics

We hereby declare that this thesis contains literature survey and original research work by the undersigned candidate, as part of his **B.Tech in Electrical Engineering** studies.

All information in this document have been obtained and presented in accordance with academic rules and ethical conduct.

We also declare that, as required by these rules and conduct, we have fully cited and referenced all material and results that are not original to this work.

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Date:
Place: CIT, Kolkata

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(Sagar Pramanik,
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ABSTRACT

This handy, pocket-size mobile transmission detector or sniffer can sense the presence of an activated mobile cell phone from a distance of one and-a-half meters, whereas the devices which are available in market is only the range of one meter. So it is an extra bit range. As It is also useful for detecting the use of mobile phone for Spying and unauthorized video transmission. It can be used to prevent use of mobile phones in examination halls, confidential rooms, petrol pump, gas station, civilian aircraft, some areas in hospital, historical places, places, court of laws and where not. The circuit can detect the incoming and outgoing calls SMS and video transmission even if the mobile phone is kept in the silent mode. The moment the Bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases. Assembling the circuit on a general purpose PCB as compact as possible and enclose in a small box like junk mobile case. And what the most exciting is it is under cheap budget and extremely long life. The device is small in size and minimal in weight, lower power dissipation and generally greater energy efficiency. Capacitor C3 have a lead length of 18 mm with lead spacing of 8 mm. carefully solder the capacitor in standing position with equal spacing of the leads. The response can be optimized by trimming the lead length of C3 for the desired frequency. There is a short telescopic type antenna.

Use the miniature 9V battery of a remote control and a small buzzer to make the gadget pocket-size. The unit will give the warning indication if someone uses Mobile phone within a radius of 1.5 meters.

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CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

GSM	Global System for Mobile
RF	Radio Frequency
AM	Amplitude Modulation
FM	Frequency Modulation
LED	Light Emitting Diode
BJT	Bipolar Junction Transistor
UJT	Unipolar Junction Transistor
FET	Field Effect Transistor
JFET	Junction Field Effect Transistor
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
CMOS	Complementary Metal Oxide Semiconductor
TTL	Transistor-Transistor Logic
OP-AMP	Operational Amplifier
UHF	Ultra High Frequency

CHAPTER – 1

INTRODUCTION

1.1 Overview

As increase in the technology in the world using the electronic equipments are being used in a wrong way like, in the examination halls and confidential rooms. To avoid this we are introducing a project called CELLPHONE DETECTOR

This handy, pocket-size mobile transmission detector or sniffer can sense the presence of an activated mobile cell phone from a distance of one and-a-half meters. So it can be used to prevent use of mobile phones in examination halls, confidential rooms, etc. It is also useful for detecting the use of mobile phone for Spying and unauthorized video transmission. The circuit can detect the incoming and outgoing calls, SMS and video transmission even if the mobile phone is kept in the silent mode. The moment the Bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases.

1.2 Problem Statement

Previously, there was no technology to detect the cell phones in the examination hall and in cell phone restricted areas. There is manual checking and there is still a chance of having the cell phone with the person if he is not checked properly. So to avoid this problem, an automatic detection of cell phone is introduced.

1.3 Motivation

Cell phones are used in good way and also in a bad way. When the class is going on, students intend to use their cell phones and not listening to what is being taught. These days, students are also carrying their cell phones to the examination halls to copy which would help them to get good marks.

To avoid this problem, the cell phone detector is introduced.

CHAPTER – 2

HARDWARE DESCRIPTION

2.1 CIRCUIT DIAGRAM

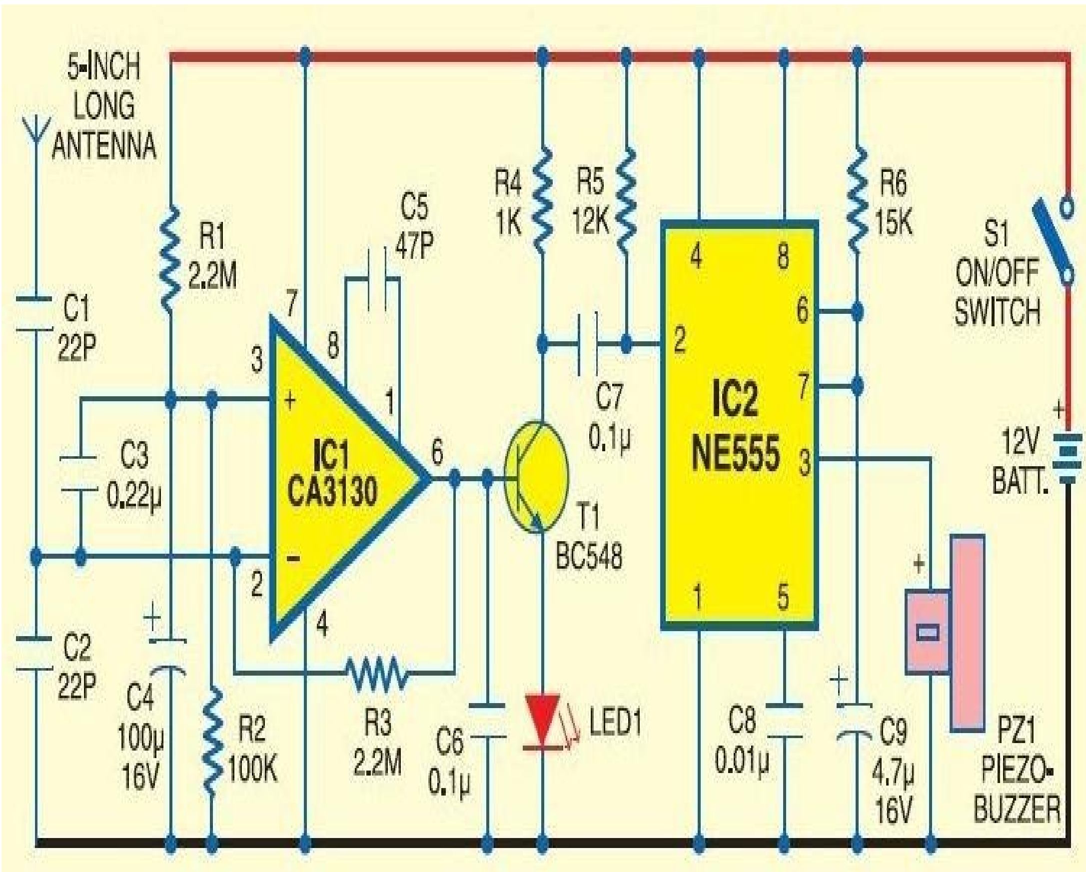


Figure .1.Circuit diagram

2.2 COMPONENTS LIST

RESISTOR

1. R1 ________2.2M
2. R2 ________100K
3. R3 ________2.2M
4. R4 ________1K
5. R5________12K
6. R6________15K

CAPACITOR

7. C1 ________22pF
8. C2 ________22pF
9. C3 ________0.22µF
10. C4 ________100µF
11. C5_________47pF
12. C6 _________0.1µF
13. C7_________ 0.1µF
14. C8_________ 0.01µF
15. C9__________4.7µF
16. IC CA3130
17. IC NE555
18. T1 BC548
19. LED
20. ANTENNA
21. PIEZO BUZZER
22. 5 INCH LONG ANTENNA
23. ON/OFF SWITCH
24. POWER SUPPLY

2.2.1 Resistor

Figure .2.Three resistors

Electronic Symbol

 EUROPE

 US

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current through it in accordance with Ohm's law: V=IR

Resistors are elements of electrical networks and electronic circuits and are ubiquitous in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nickel/chrome).The primary characteristics of a resistor are the resistance, the tolerance, maximum working voltage and the power rating. Other characteristics include temperature coefficient, noise, and inductance. Less well-known is critical resistance, the value below which power dissipation limits the maximum permitted current flow, and above which the limit is applied voltage. Critical resistance depends upon the materials constituting the resistor as well as its physical dimensions; it's determined by design. Resistors can be integrated into hybrid and printed circuits, as well as integrated circuits. Size and position of leads (or terminals) are relevant to equipment designers; resistors must be physically large enough not to overheat when dissipating their power.

2.2.2 Capacitor

Figure 3. Modern capacitors, by a cm rule.

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

An ideal capacitor is characterized by a single constant value, capacitance, which is measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them. In practice, the dielectric between the plates passes a small amount of leakage current. The conductors and leads introduce an equivalent series resistance and the dielectric has an electric field strength limit resulting in a breakdown voltage.

Capacitors are widely used in electronic circuits to block the flow of direct current while allowing alternating current to pass, to filter out interference, to smooth the output of power supplies, and for many other purposes. They are used in resonant circuits in radio frequency equipment to select particular frequencies from a signal with many frequencies.

(1)Ceramic capacitor

In electronics ceramic capacitor is a capacitor constructed of alternating layers of metal and ceramic, with the ceramic material acting as the dielectric. The temperature coefficient depends on whether the dielectric is Class 1 or Class 2. A ceramic capacitor (especially the class 2) often has high dissipation factor, high frequency coefficient of dissipation.

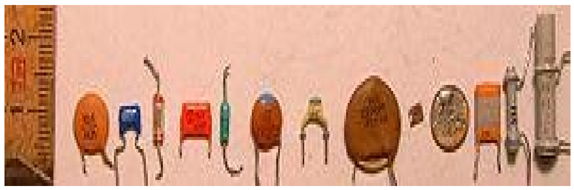


Figure .4. Ceramic capacitors

A ceramic capacitor is a two-terminal, non-polar device. The classical ceramic capacitor is the "disc capacitor". This device pre-dates the transistor and was used extensively in vacuum-tube equipment (e.g., radio receivers) from about 1930 through the 1950s, and in discrete transistor equipment from the 1950s through the 1980s. As of 2007, ceramic disc capacitors are in widespread use in electronic equipment, providing high capacity & small size at low price compared to other low value capacitor types.

Ceramic capacitors come in various shapes and styles, including:

disc, resin coated, with through-hole leads multilayer rectangular block, surface mount bare leadless disc, sits in a slot in the PCB and is soldered in place, used for UHF application tube shape, not popular now

(2)Electrolytic capacitor

Figure .5. Axial lead (top) and radial lead (bottom) electrolytic capacitors

An electrolytic capacitor is a type of capacitor that uses an ionic conducting liquid as one of its plates with a larger capacitance per unit volume than other types. They are valuable in relatively high-current and low-frequency electrical circuits. This is especially the case in power-supply filters, where they store charge needed to moderate output voltage and current fluctuations in rectifier output. They are also widely used as coupling capacitors in circuits where AC should be conducted but DC should not.

Electrolytic capacitors can have a very high capacitance, allowing filters made with them to have very low corner frequencies.

2.2.3Transistor

Figure .6. Assorted discrete transistors

A transistor is a semiconductor device commonly used to amplify or switch electronic signals. A transistor is made of a solid piece of a semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals. Because the controlled (output) power can be much more than the controlling (input) power, the transistor provides amplification of a signal. Some transistors are packaged individually but most are found in integrated circuits.

The transistor is the fundamental building block of modern electronic devices, and its presence is ubiquitous in modern electronic systems.

Usage

The bipolar junction transistor, or BJT, was the most commonly used transistor in the 1960s and 70s. Even after MOSFETs became widely available, the BJT remained the transistor of choice for many analog circuits such as simple amplifiers because of their greater linearity and ease of manufacture. Desirable properties of MOSFETs, such as their utility in low-power devices, usually in the CMOS configuration, allowed them to capture nearly all market share for digital circuits; more recently MOSFETs have captured most analog and power applications as well, including modern clocked analog circuits, voltage regulators, amplifiers, power transmitters, motor drivers, etc

Advantages

The key advantages that have allowed transistors to replace their vacuum tube predecessors in most applications are

- .Small size and minimal weight, allowing the development of miniaturized electronic devices.
- Highly automated manufacturing processes, resulting in low per-unit cost.
- Lower possible pirating voltages, making transistors suitable for small, battery- powered applications.
- No warm-up period for cathode heaters required after power application.
- Lower power dissipation and generally greater energy efficiency.
- Higher reliability and greater physical ruggedness.
- Insensitivity to mechanical shock and vibration, thus avoiding the problem of micro phonics in audio applications.

Limitations

Silicon transistors do not operate at voltages higher than about 1,000 volts (Sic devices can be operated as high as 3,000 volts). In contrast, electron tubes have been developed that can be operated at tens of thousands of volts.
High power, high frequency operation, such as used in over-the-air television broadcasting, is better achieved in electron tubes due to improved electron mobility in a vacuum.
On average, a higher degree of amplification linearity can be achieved in electron tubes as compared to equivalent solid state devices, a characteristic that may be important in high fidelity audio reproduction.
Silicon transistors are much more sensitive than electron tubes to an electromagnetic pulse, such as generated by an atmospheric nuclear explosion.

Types

Bipolar junction transistor

The bipolar junction transistor (BJT) was the first type of transistor to be mass- produced. Bipolar transistors are so named because they conduct by using both majority and minority carriers. The three terminals of the BJT are named emitter, base, and collector. The BJT consists of two p-n junctions: the base–emitter junction and the base–collector junction, separated by a thin region of semiconductor known as the base region (two junction diodes wired together without sharing an intervening semiconducting region will not make a transistor). "The [BJT] is useful in amplifiers because the currents at the emitter and collector are controllable by the relatively small base current. In an NPN transistor operating in the active region, the emitter-base junction is forward biased (electrons and holes recombine at the junction), and electrons are injected into the base region. Because the base is narrow, most of these electrons will diffuse into the reverse-biased (electrons and holes are formed at, and move away from the junction) base-collector junction and be swept into the collector; perhaps one-hundredth of the electrons will recombine in the base, which is the dominant mechanism in the base current. By controlling the number of electrons that can leave the base, the number of electrons entering the collector can be controlled. Collector current is approximately β (common-emitter current gain) times the base current. It is typically greater than 100 for small-signal transistors but can be smaller in transistors designed for high-power applications.

Unlike the FET, the BJT is a low–input-impedance device. Also, as the base–emitter voltage (V_{be}) is increased the base–emitter current and hence the collector–emitter current (I_{ce}) increase exponentially according to the Shockley diode model and the Embers-Moll model. Because of this exponential relationship, the BJT has a higher transconductance than the FET.

Bipolar transistors can be made to conduct by exposure to light, since absorption of photons in the base region generates a photocurrent that acts as a base current; the collector current is approximately β times the photocurrent. Devices designed for this purpose have a transparent window in the package and are called phototransistors.

2.2.4 Light-emitting diode

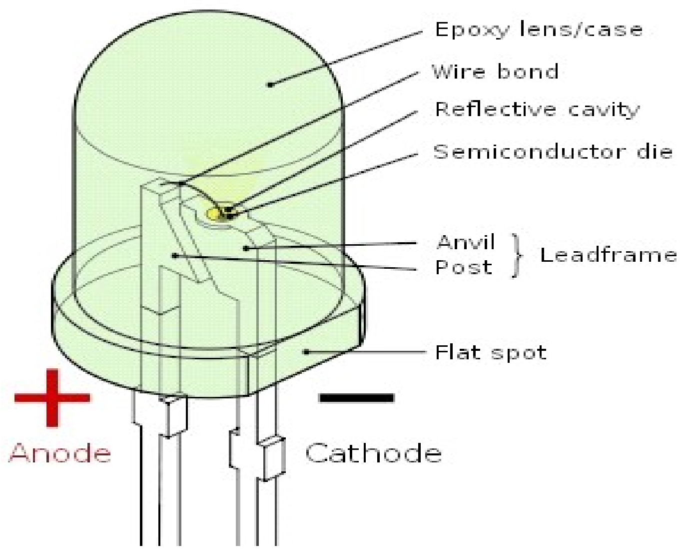
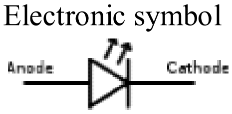


Figure .7. LED

Type	Passive, optoelectronic
Working principle	Electroluminescence
Invented	Nick Holonyak Jr. (1962)

Electronic symbol



Pin configuration	Anode and Cathode

A light-emitting diode (LED) is an electronic light source. LEDs are used as indicator lamps in many kinds of electronics and increasingly for lighting. LEDs work by the effect of electroluminescence, discovered by accident in 1907. The LED was introduced as a practical electronic component in 1962. All early devices emitted low-intensity red light, but modern LEDs are available across the visible, ultraviolet and infra red wavelengths, with very high brightness.

LEDs are based on the semiconductor diode. When the diode is forward biased (switched on), electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the color of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm^2) with integrated optical components to shape its radiation pattern and assist in reflection.

LEDs present many advantages over traditional light sources including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching. However, they are relatively expensive and require more precise current and heat management than traditional light sources.

Applications of LEDs are diverse. They are used as low-energy indicators but also for replacements for traditional light sources in general lighting, automotive lighting and traffic signals. The compact size of LEDs has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in communications technology.

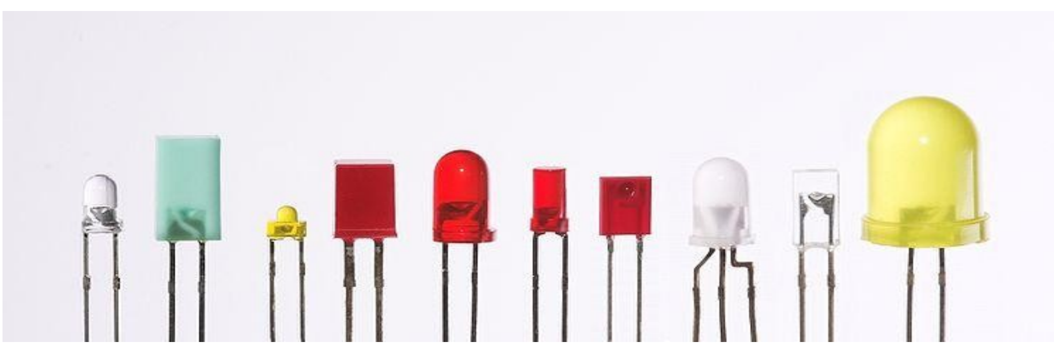


Figure .8. Various types LED

2.2.5 PIEZO BUZZER

Piezoelectricity is the ability of some materials (notably crystals and certain ceramics, including bone) to generate an electric field or electric potential in response to applied mechanical stress. The effect is closely related to a change of polarization density within the material's volume. If the material is not short-circuited, the applied stress induces a voltage across the material. The word is derived from the Greek piezo or piezein, which means to squeeze or press.

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as microwave ovens, or game shows.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to an 8- ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

In game shows it is also known as a "lockout system" because when one person signals ("buzzes in"), all others are locked out from signaling. Several game shows have large buzzer buttons which are identified as "plungers". The buzzer is also used to signal wrong answers and when time expires on many game shows, such as Wheel of Fortune, Family Feud and The Price is Right

The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles.Other sounds commonly used to indicate that a button has been pressed are a ring or a beep

Figure .9. Buzzer

2.2.6 IC CA 3130

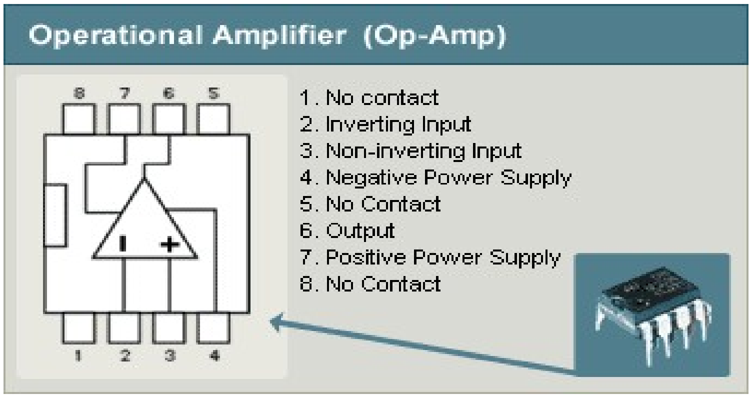


Figure .10. IC CA 3130

This IC is a 15 MHz BiMOS Operational amplifier with MOSFET inputs and bipolar output. The inputs contain MOSFET transistors to provide very high input impedance and very low input current as low as 10pA. It has high speed of performance and suitable for low input current applications.

CA3130A and CA3130 are op amps that combine the advantage of both CMOS and bipolar transistors. Gate-protected P-Channel MOSFET (PMOS) transistors are used in the input circuit to provide very-high-input impedance, very-low-input current and exceptional speed performance. The use of PMOS transistors in the input stage results in common- mode input-voltage capability down to0.5V below the negative-supply terminal, an important attribute in single-supply applications.

A CMOS transistor-pair, capable of swinging the output voltage to within 10mV of either supply-voltage terminal (at very high values of load impedance), is employed as the output circuit.

The CA3130 Series circuits operate at supply voltages ranging from 5V to 16V, (2.5V to 8V). They can be phase compensated with a single external capacitor, and have terminals for adjustment of offset voltage for applications requiring offset-null capability.

Terminal provisions are also made to permit storing of the output stage. The CA3130A offers superior input characteristics over those of the CA3130.

Features

- MOSFET Input Stage Provides:
  - Very High ZI = 1.5 T
  - Very Low current = 5pA at 15V Operation
- Ideal for Single-Supply Applications
- Common-Mode Input-Voltage Range Includes Negative Supply Rail; Input Terminals can be Swung 0.5VBelow Negative Supply Rail
- CMOS Output Stage Permits Signal Swing to Either (or both) Supply Rails

Applications

- Ground-Referenced Single Supply Amplifiers
- Fast Sample-Hold Amplifiers
- Long-Duration Timers/ Mono stables
- High-Input-Impedance Comparators (Ideal Interface with Digital CMOS)
- High-Input-Impedance Wideband Amplifiers
- Voltage Followers (e.g. Follower for Single-Supply D/A Converter)
- Voltage Regulators (Permits Control of Output Voltage Down to 0V)
- Peak Detectors
- Single-Supply Full-Wave Precision Rectifiers
- Photo-Diode Sensor Amplifiers

2.2.7 IC NE555 TIMER

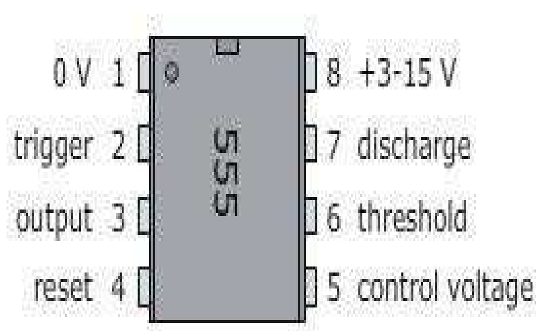


Figure .11. IC NE 555 Timer

The NE555 IC is a highly stable controller capable of producing accurate timing pulses. With a monostable operation, the time delay is controlled by one external resistor and one capacitor. With an astable operation, the frequency and duty cycle are accurately controlled by two external resistors and one capacitor.

DETAILS OF PIN

1. Ground, is the input pin of the source of the negative DC voltage
2. Trigger, negative input from the lower comparators (comparator B) that maintain oscillation capacitor voltage in the lowest 1 / 3 Vcc and set RS flip-flop
3. Output, the output pin of the IC 555.
4. Reset, the pin that serves to reset the latch inside the IC to be influential to reset the IC work. This pin is connected to a PNP-type transistor gate, so the transistor will be active if given a logic low. Normally this pin is connected directly to Vcc to prevent reset
5. Control voltage, this pin serves to regulate the stability of the reference voltage negative input (comparator A). This pin can be left hanging, but to ensure the stability of the reference comparator A, usually associated with a capacitor of about 10nF to pin ground
6. Threshold, this pin is connected to the positive input (comparator A) which will reset the RS flip-flop when the voltage on the capacitor from exceeding 2 / 3 Vcc
7. Discharge, this pin is connected to an open collector transistor Q1 is connected to ground emitter. Switching transistor serves to clamp the corresponding node to ground on the timing of certain
8. Vcc, pin it to receive a DC voltage supply. Usually will work optimally if given a 5-15V. The current supply can be seen in the datasheet, which is about 10-15mA.

Features

- High Current Drive Capability (200mA)
- Adjustable Duty Cycle
- Temperature Stability of 0.005% /C
- Timing from Sec to Hours
- Turn off time less than 2mSec

Applications

- Precision Timing
- Pulse Generation
- Time Delay Generation
- Sequential Timing

CHAPTER – 3

HARDWARE IMPLEMENTATION

3.1 BASIC CONCEPT AND WORKING OF CELLPHONE DETECTOR

Purpose of the circuit

This circuit is intended to detect unauthorized use of mobile phones in examination halls, confidential rooms etc. It also helps to detect unauthorized video and audio recordings. It detects the signal from mobile phones even if it is kept in the silent mode. It also detects SMS.

CONCEPT

Mobile phone uses RF with a wavelength of 30cm at 872 to 2170 MHz That is the signal is high frequency with huge energy. When the mobile phone is active, it transmits the signal in the form of sine wave which passes through the space. The encoded audio/video signal contains electromagnetic radiation which is picked up by the receiver in the base station. Mobile phone system is referred to as “Cellular Telephone system” because the coverage area is divided into “cells” each of which has a base station. The transmitter power of the modern 2G antenna in the base station is 20-100 watts.

When a GSM (Global System of Mobile communication) digital phone is transmitting, the signal is time shared with 7 other users. That is at any one second, each of the 8 users on the same frequency is allotted 1/8 of the time and the signal is reconstituted by the receiver to form the speech. Peak power output of a mobile phone corresponds to 2 watts with an average of 250 mili watts of continuous power. Each handset with in a „cell‟ is allotted a particular frequency for its use. The mobile phone transmits short signals at regular intervals to register its availability to the nearest base station. The network data base stores the information transmitted by the mobile phone. If the mobile phone moves from one cell to another, it will keep the connection with the base station having strongest transmission.
Mobile phone always tries to make connection with the available base station.

That is why, the back light of the phone turns on intermittently while traveling. This will cause severe battery drain. So in long journeys, battery will flat within a few hours.

AM Radio uses frequencies between 180 kHz and 1.6 MHz, FM radio uses 88 to 180 MHz, TV uses 470 to 854 MHz Waves at higher frequencies but within the RF region is called Micro waves. Mobile phone uses high frequency RF wave in the micro wave region carrying huge amount of electromagnetic energy. That is why burning sensation develops in the ear if the mobile is used for a long period. Just like a micro wave oven, mobile phone is cooking‟ the tissues in the ear. RF radiation from the phone causes oscillation of polar molecules like water in the tissues. This generates heat through friction just like the principle of microwave oven. The strongest radiation from the mobile phone is about 2 watts which can make connection with a base station located 2 to 3 km away.

How the circuit works?

Ordinary LC (Coil-Capacitor) circuits are used to detect low frequency radiation in the AM and FM bands. The tuned tank circuit having a coil and a variable capacitor retrieve the signal from the carrier wave. But such LC circuits cannot detect high frequency waves near the microwave region. Hence in the circuit, a capacitor is used to detect RF from mobile phone considering that, a capacitor can store energy even from an outside source and
Oscillate like LC circuit.

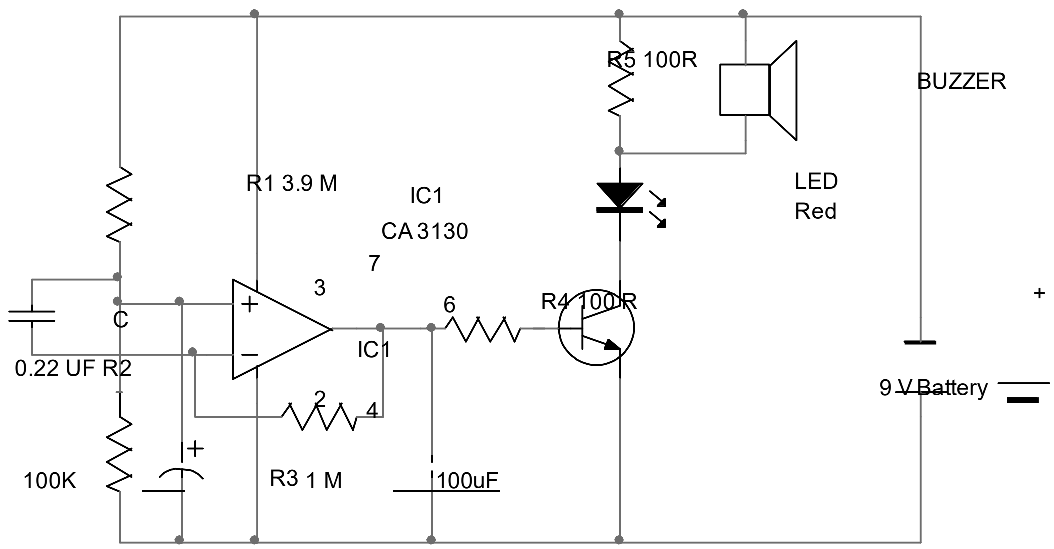


Figure .12.Circuit diagram

Use of capacitor

A capacitor has two electrodes separated by a „dielectric" like paper, mica etc. The non polarized disc capacitor is used to pass AC and not DC. Capacitor can store energy and pass AC signals during discharge. 0.22µF capacitor is selected because it is a low value one and has large surface area to accept energy from the mobile radiation. To detect the signal, the sensor part should be like an aerial. So the capacitor is arranged as a mini loop aerial (similar to the dipole antenna used in TV).In short with this arrangement, the capacitor works like an air core coil with ability to oscillate and discharge current.

How the capacitor senses RF?

One lead of the capacitor gets DC from the positive rail and the other lead goes to the negative input of IC1. So the capacitor gets energy for storage. This energy is applied to the inputs of IC1 so that the inputs of IC are almost balanced with 1.4 volts. In this state output is zero. But at any time IC can give a high output if a small current is induced to its inputs. There a natural electromagnetic field around the capacitor caused by the 50Hz from electrical wiring. When the mobile phone radiates high energy pulsations, capacitor oscillates and release energy in the inputs of IC. This oscillation is indicated by the flashing of the LED and beeping of Buzzer. In short, capacitor carries energy and is in an electromagnetic field. So a slight change in field caused by the RF from phone will disturb the field and forces the capacitor to release energy.

3.2 APPLICATION

It can be used to prevent use of mobile phones in examination halls, confidential rooms, etc.
It is also useful for detecting the use of mobile phone for spying and unauthorized video transmission.
It is useful where the use of mobile phone is prohibited like petrol pumps and gas stations, historical places, religious places and court of laws

CHAPTER – 4

RESULT

The moment the Bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases

Result

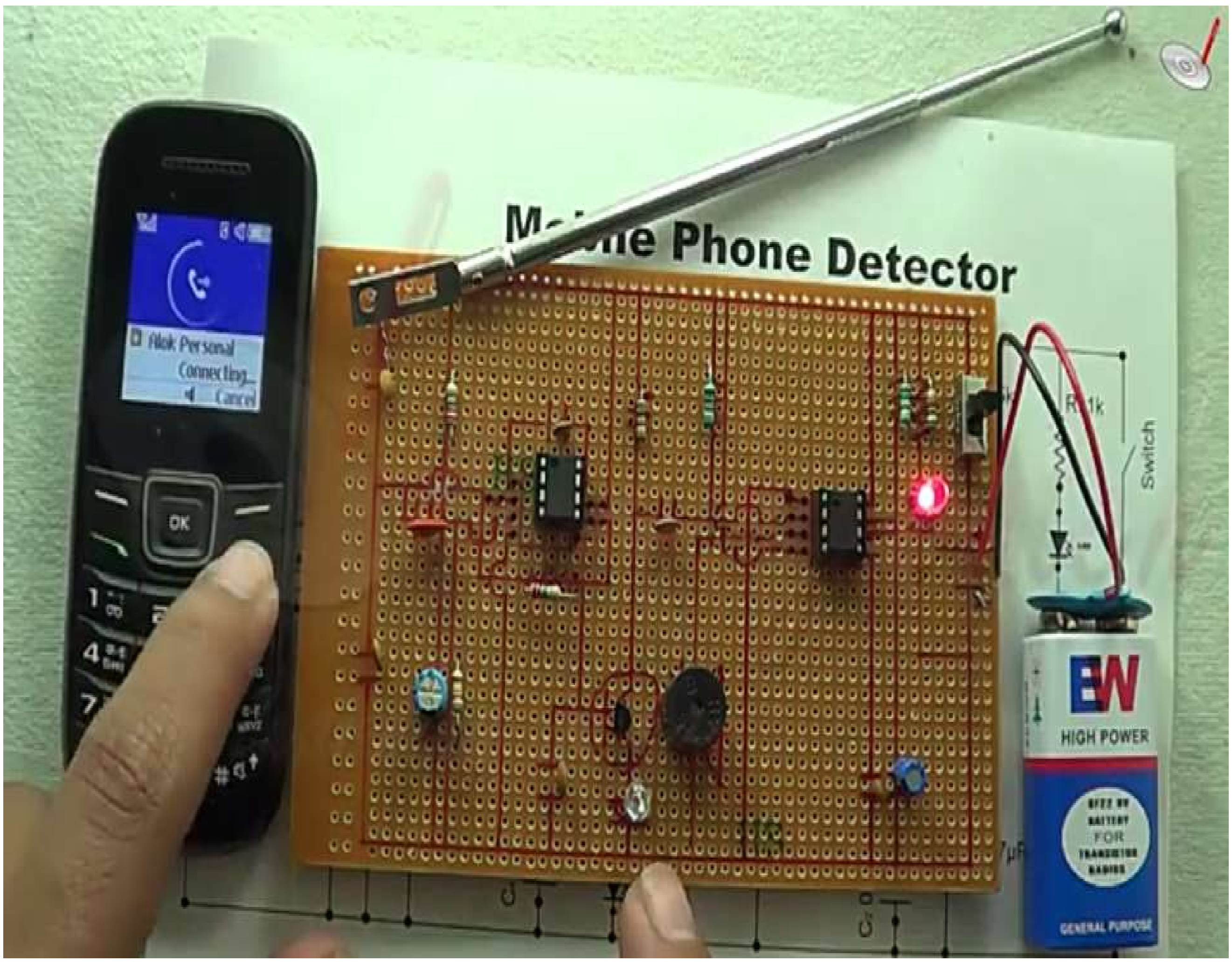


Figure .13. Circuit when not detecting the cell phone

Figure .14. Circuit when detecting a cell phone

CHAPTER – 5

CONCLUSION and FUTURE SCOPE

5.1 CONCLUSION

This pocket-size mobile transmission detector or sniffer can sense the presence of an activated mobile cell phone from a distance of one and-a-half meters. So it can be used to prevent use of mobile phones in examination halls, confidential rooms, etc. It is also useful for detecting the use of mobile phone for spying and unauthorized video transmission. Since cellular phone detection is a more recent problem, there are only a few articles that have already researched this area. Two articles were published in 2007 and provide good analysis. The first article, "Detecting and Locating Cell Phones in Correctional Facilities," was written by EVI Technology, LLC. The second article, "Cell Phone Detection Techniques," was written by a Contractor hired by the U.S. Department of Energy (DOE).

After testing, it was decided that this design was not the most efficient. A better design would have BNC connectors on the input and output for easy connection to antennas, spectrum analyzer, and signal generator. It would also eliminate the need for 1 GHz probes by just using a simple BNC coax cable. Building this design brought about the decision to go another route and not rebuild the circuit using a PCB. Instead after some more research it was found that using a using a down converter would make the design easier to work with by providing a signal at a lower frequency.

Cellular phone technology is gaining new data capabilities very rapidly. New features like Bluetooth, high resolution cameras, memory cards, and Internet make them ideal for getting data in and out of secure facilities. A cellular phone uses many different transmission protocols such as FDMA or CDMA. These protocols dictate how a cellular phone communicates with the tower. Typically cellular phones in the United states operate between 824 - 894 MHz Many businesses depend on keeping information protected and build fortresses that called secure facilities to protect their investment. Currently the only way to ensure that no one is bringing a cellular phone into a secure facility is to search everyone entering and exiting. This requires a lot of manpower and money to implement. The existing technology available off the shelf does not accurately detect cellular phones ina secure facility. Detectors like the Wolfhound or Cell busters sit in the entry way of a facility and randomly detect cellular phones or devices in the area. A better technique for accurately detecting cellular phones is needed. The first signal detection technique, a design from circuit-projects.com was built and tested. This technique utilizes two antennas that are tuned to 900 MHz The antennas resonate at this frequency and the signal is then demodulated. After demodulation, the signal is amplified and sent to a pair of headphones for monitoring.

After building the circuit-projects design using wire wrap, two conclusions were made. Using wire wrap at these frequencies changes the impedance of the circuit and BNC connectors make a much better connection.

With this new information an even better design was conceived. The second signal detection technique, a design utilizing a down converter in conjunction with a band pass filter was built and tested.
A VCO at 800MHz and an 800MHz antenna is fed into the down converter. The VCO frequency is then subtracted from the cellular phone signal coming in around 832 MHz. This produces an output from the down converter around 32 MHz which is sent to a band pass filter with a pass band of 29 - 35 MHz leaving just the 32MHz signal. It can then be converted to a digital output using an analog to digital converter. This design was built and tested in the lab and proven MATLAB, ADS, and PSpice simulation software. Lab results show that a down converter and VCO circuit works, but requires a finely tuned band pass filter which can cost a lot of time and money. Therefore computer simulation results proved that this design will work with an effective band pass filter. This technique, if fully implemented would greatly improve cellular phone detection technology. Businesses would save money on security and save money by not allowing any sensitive information to leak out.

5.2 FUTURE SCOPE

Trying to increase the detecting range of cell phone detector to few more meters for observing wide range of area. The prototype version has only limited range of 2 meters. But if a preamplifier stage using JFET or MOSFET transistor is used as an interface between the capacitor and IC, range can be increased

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APPENDIX

DATASHEETS

1. IC CA3130

15MHz, BiCMOS Operational Amplifier with MOSFET Input/CMOS Output

CA3130 and CA3130 are op amps that combine the advantage of both CMOS and bipolar transistors.

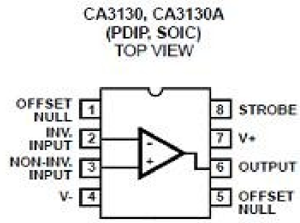
Gate-protected P-Channel MOSFET (PMOS) transistors are used in the input circuit to provide very-high-input impedance, very-low-input current and exceptional speed performance. The use of PMOS transistors in the input stage results in common-mode input-voltage capability down to 0.5V below the negative-supply terminal, an important attribute in single-supply applications.

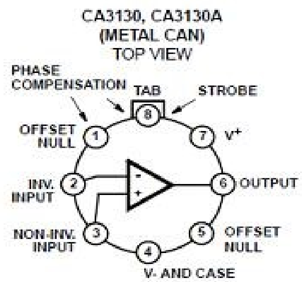
A CMOS transistor-pair, capable of swinging the output voltage to within 10mVof either supply-voltage terminal (at very high values of load impedance) is employed as the output circuit.

The CA3130 series circuits operate at supply voltages ranging from 5V to16V (±2.5V to±8V). they can be phase compensated with a single external capacitor, and have terminals for adjustment of offset-null capability. Terminal provisions are also made to permit strobing of the output stage.

The CA3130A offers superior input characteristics over those of the CA3130.

PINOUTS





FEATURES

MOSFET input stage provides:

- Very high $Z_1 = 1.5T\Omega$ ($1.5 \times 10^{12}\Omega$) (Type)

- Very low I_1 =5pA (Type) at 15V operation

=2pA (Type) at 5V operation

Ideal for single-supply applications

Common-mode input-voltage range includes negative supply rail; input terminals can be swung 0.5V below negative supply rail

CMOS output stage permits signal swing to either (or both) supply rails.

APPLICATIONS

- Ground-referenced single supply amplifiers
- Fast sample-hold amplifiers
- Long-duration timers/mono-stables
- High-input-impedance wideband amplifiers
- Voltage followers (eg. Follower for single supply D/A converter)
- Voltage regulators (Permits control of output voltage down to 0V)
- Peak detectors
- Single-supply full wave precision rectifiers
- Photo-diode sensor amplifiers

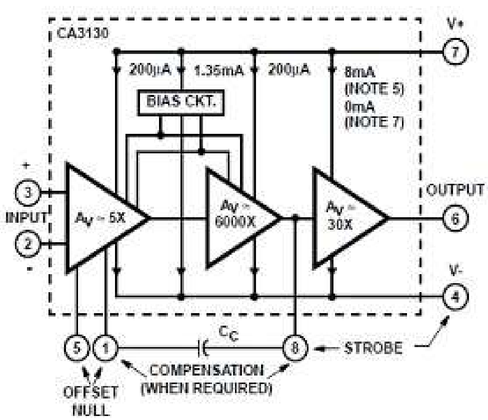
APPLICATION INFORMATION Circuit Description

The first figure is the block diagram of the CA3130 series CMOS operational amplifiers. The input terminals may be operated down to 0.5V below the negative supply rail and the output can be swung very close to either supply rail in many applications. Constantly, the CA3130 series circuits are ideal for single-supply operation. The Class A amplifier stages, having the individual gain capability and current consumption shown in figure, provide the total gain of the CA3130. A biasing circuit provides to potentials for common use in the first and second stages. Terminal 8 can be used both for phase compensation and to strobe the output stage into quiescence. When terminal 8 is tied to the negative supply rail (terminal 4) by mechanical or electrical means, the output potential at terminal 6 essentially rises to the positive supply rail potential at terminal 7.

This condition of essential zero current drain in the output stage under the strobed “OFF” condition can only be achieved when the ohm load resistance presented to the amplifier is very high (e.g. when the amplifier output is very used the drive CMOS digital circuits in comparator application).

INPUT STAGE

The circuit of the CA3130 is shown in the schematic diagram. It consists of a differential-input stage using PMOS field-effect transistors (Q_6, Q_7) working into a mirror-pair of bipolar transistor (Q_9, Q_{10}) functioning as load resisters together with resistors R_3 through R_6. The mirror pair transistors also function as a differential-to- single-ended converter to provide base drive to the second-stage bipolar transistor (Q_{11}). Offset nulling, when desired, can be effected by connecting a 100,000Ω potentiometer across terminal 1 and 5 and the potentio meter slider arm to terminal 4. Cascade connected PMOS transistors Q2, Q_4 are the constant current source for the input stage. The biasing circuit for the constant-current source is subsequently described. The smalldiodes D_5 through D_8 provide gate-oxide protection against high voltage transients, including static electricity during handling for Q_6 and Q_7.



Note:

1. Totally supply voltage (for indicated voltage gains) = 15V with input terminals biased so that terminals 6 potential is +7.5V above terminal 4.
2. Total supply voltage (for indicated voltage gains) = 15V with output terminal driven to either supply rail.

SECOND STAGE

Most of the voltage gain in the CA3130 is provided by the second amplifier stage, consisting of bipolar transistor Q_{11} and its cascade-connected load resistance provided by PMOS transistors is subsequently described. Miller Effect compensation (roll-off) is accompanied by simply connecting a small capacitor between terminals 1 and 8. A 47pF capacitor provides sufficient compensation for stable unity-gain operation in most applications.

Bias-source circuit

At total supply voltages, somewhat above 8.3V resistor R_2 and zener diode Z_1 serve to establish a voltage of 8.3V across the series-connected circuit, consisting of resistor R_1, diodes D_1 through D_4 and PMOS transistor Q_1. A tap at the junction of resistor R_1 and diode D_4 provides a gate-bias potential of about 4.5V for PMOS transistors Q_4 and Q_5 with respect to terminal 7. A potential of about 2.2V is developed across diode connected PMOS transistor Q_1 with respect to terminal 7 to provide gate-bias for PMOS transistors Q_2 and Q_3.

It should be noted that Q1 is "mirror-connected" to both Q_2 and Q3. Since transistors Q_1,Q_2,Q_3 are designed to be identical, approximately 220µA current in Q_1 establishes a similar current in Q_2 and Q_3 as constant current sources for both the first and second amplifier stages, respectively.

At total supply voltages somewhat less than 8.3V, zener diode Z_1 becomes non conductive and the potential, developed across series connected R_1, D_1-D_4 and Q_1, varies directly with the variations in supply voltage. Consequently, the gate bias for Q_4, Q_5 and Q_2, Q_3 varies in accordance with supply voltage variations. These variations results in deterioration of the power-supply-rejection ratio (PSRR) at total supply voltages below 8.3V. Operation at total supply voltages below about 4.5V results in seriously degraded performance.

OUTPUT STAGE

The output stage consists of drain loaded inverting amplifier using CMOS transistors operating in the Class A mode. When operating into very high resistance loads, the output can be swung within milli volts of either supply rail. Because the output stage is the drain loaded amplifier, its gain is dependent upon the load impedance. The transfer characteristics of the output stage for the load returned to the negative supply rail are shown in the below figure. Typical op amp loads are readily driven by the output stage.

Because large signal excursions are non linear, requiring feedback for good waveform reproduction, transient delays may be encountered. As the voltage follower, the amplifier can achieve 0.01% accuracy levels, including the negative supply rail.

NOTE

For general information on the characteristics of CMOS transistor pairs in linear circuit applications.

POWER-SUPPLY CONSIDERATIONS

Because the CA3130 is very useful in single-supply applications, it is pertinent to review some considerations relating to power-supply current consumption under both single-and dual-supply service. Figure 6A and 6B show the CA3130 connected for both dual-and single-supply operation.

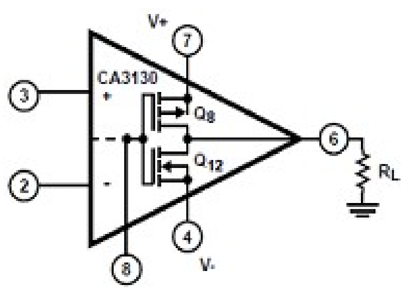


FIGURE 6A. DUAL POWER SUPPLY OPERATION

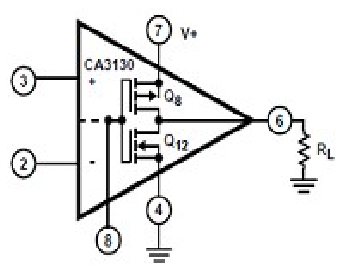


FIGURE 6B. SINGLE POWER SUPPLY OPERATION

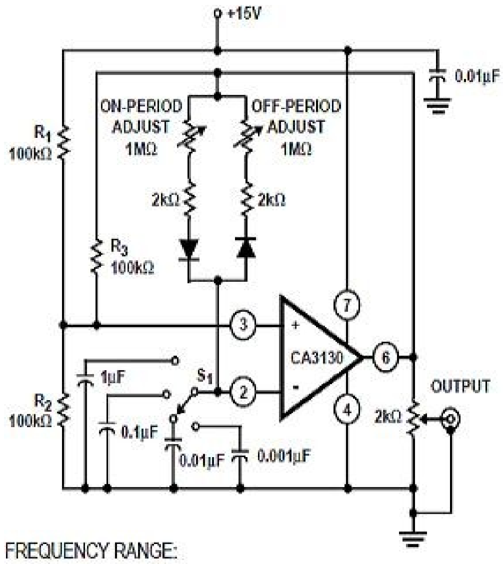
Dual-supply Operation: when the output voltage at terminal 6 is 0V, the currents supplied by the two power supplies are equal. When the gate terminals of Q_8 and Q_{12} are driven increasingly positive with respect to ground, current flow through Q_{12} (from the negative supply) to the load is increased and current flow through Q_8 (from the positive supply) decreases correspondingly. When the gate terminals of Q_8 and Q12 are driven increasingly negative with respect to ground, current flow through Q_8 is increased and current Q_{12} is decreased accordingly.

Single-supply Operation: initially, let it be assumed that the value of R_L is very high (or disconnected), and that the input-terminal bias (terminals 2 and 3) is such that the output terminal 6 voltage is at V+/2, i.e. The voltage drops across Q_8 and Q12 are of equal magnitude. Figure 20 shows typical quiescent supply-current v/s supply-voltage for the CA3130 operated under these considerations. Since the output stage is operating as a Class A amplifier, the supply-current will remain constant under dynamic operating conditions as long as the transistors are operated in the linear portion of their voltage-transfer characteristics. If either Q_8 or Q_{12} are swung out of their linear regions toward cut=off (a non-linear region), there will be a corresponding reduction in supply-current. In the extreme case, e.g., with terminal 8 swung down to ground potential (or tied to ground). NMOS transistor Q_{12} is completely cut off and the supply-current to series-connected transistors Q_{12} is completely cut off and the supply-current transistors Q_8. Q_{12} goes essentially to zero. The two preceding stages in the CA3130, however, continue to draw modest supply-current even though the output stage is stroked off. Figure 6A shows a dual-supply arrangement for the output stage that can also be stroked off, assuming $R_L = \infty$ by pulling the potential of terminal 8 down to that of terminal 4.

Let it now be assumed that a load resistance of nominal value (e.g. 2kΩ) is connected between terminal 6 and ground in the circuit of figure 6B. Let it be assumed again that the input terminal bias (terminals 2 and 3) is such that the output terminal Q_8 must now supply quiescent current to both R_L and transistor Q_{12}, it should be apparent that under these conditions the supply-current must increase as an inverse function of the R_L magnitude. Figure 22 shows the voltage drop across PMOS transistor Q_8 as a function of load current at several supply voltages. Figure 2 shows the voltage-transfer characteristics of the output stage for several values of load resistance.

MULTIVIBRATORS

The exceptionally high input resistance presented by the CA3130 is an attractive feature for multivibrators circuit design because it permits the use of timing circuits with high R/C ratios. The circuit diagram of a pulse generator (astable multivibrator), with provisions for independent control of the “on” and “off” periods, is shown in figure 15. Resistors R_1 and R_2 are used to bias the CA3130 to the mid-point of the supply-voltage and R_3 are the feedback resistor. The pulse repetition rate is selected by positioning S_1 to the desired position and the rate remains essentially constant when the resistors which determine “on-period” and “off-period” are adjusted.



FREQUENCY RANGE:

POSITION OF S_1	PULSE PERIOD
0.001µF	4µs to 1ms
0.01µF	40µs to 10ms
0.1µF	0.4ms to 100ms
1µF	4ms to 1s

FIGURE 15. PULSE GENERATOR (ASTABLE MULTIVIBRATOR) WITH PROVISIONS FOR INDEPENDENT CONTROL OF "ON" AND "OFF" PERIODS

FEATURES

Turn-off time less than 2µs
Max. operating frequency greater than 500kHz
Timing from microseconds to hours
Operates in both astable and monostable models
High output current
Adjustable duty cycle
TTL compatible
Temperature stability of 0.005% per ^{0}C

APPLICATIONS

Precision timing
Pulse generation
Sequential timing
Time delay generation
Pulse width modulation

FUNCTION GENERATOR

Figure 16 contains a schematic diagram of a function generator using the CA3130 in the integrator and threshold detector functions. The circuit generates a triangular or square- wave output that can be swept over a 1,000,000:1 range (0.1Hz to 100Hz) by means of a single control, R_1. A voltage-control input is also available for remote sweep-control

The heart of frequency-determining system is an operational-transconductance- amplifier (OTA) IC_1, operated as a voltage-controlled current-source. The output, I_O, is a current applied directly to the integrating capacitor, C_1, in the feedback loop of the integrator IC_2, using a CA3130, to provide the triangular-wave output. Potentiometer R_2 is used to adjust the circuit for slope symmetry of positive-going and negative-going signal excursions.

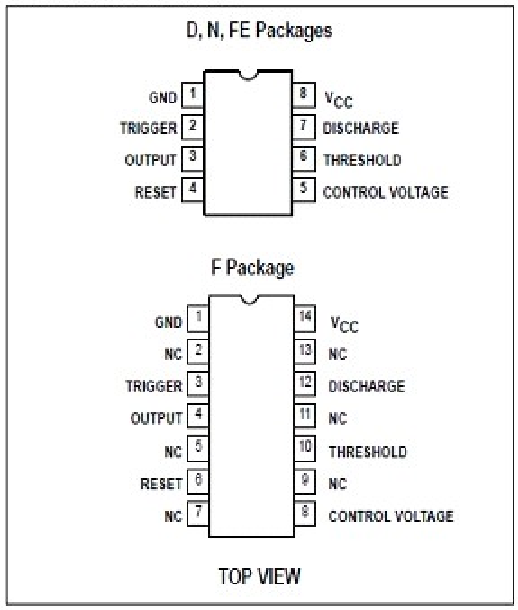
Another CA3130, IC_3, is used as a controlled switch to set the excursion limits of the triangular output from the integrator circuit. Capacitor $C_{2\ is}$ a “peaking adjustment” to optimize the high-frequency square-wave performance of the circuit.

Potentiometer $R_{3\ is}$ adjustable to perfect the “amplitude symmetry” of the square- wave output signals. Output from the threshold detector is fed back via resistor R_4 to the input of $IC_{1\ so}$ as to toggle the current source from plus to minus in generating the linear triangular wave.

IC NE555 TIMER Description

The 555 monolithic timing circuits is a highly stable controller capable of producing accurate time delays, or oscillation. In the time delay mode of operation, the time is preciously controlled by one external resistor and capacitor. For a stable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA.

PIN CONFIGURATIONS



BLOCK DIAGRAM