



OPERATIONAL AMPLIFIER TESTER CIRCUIT



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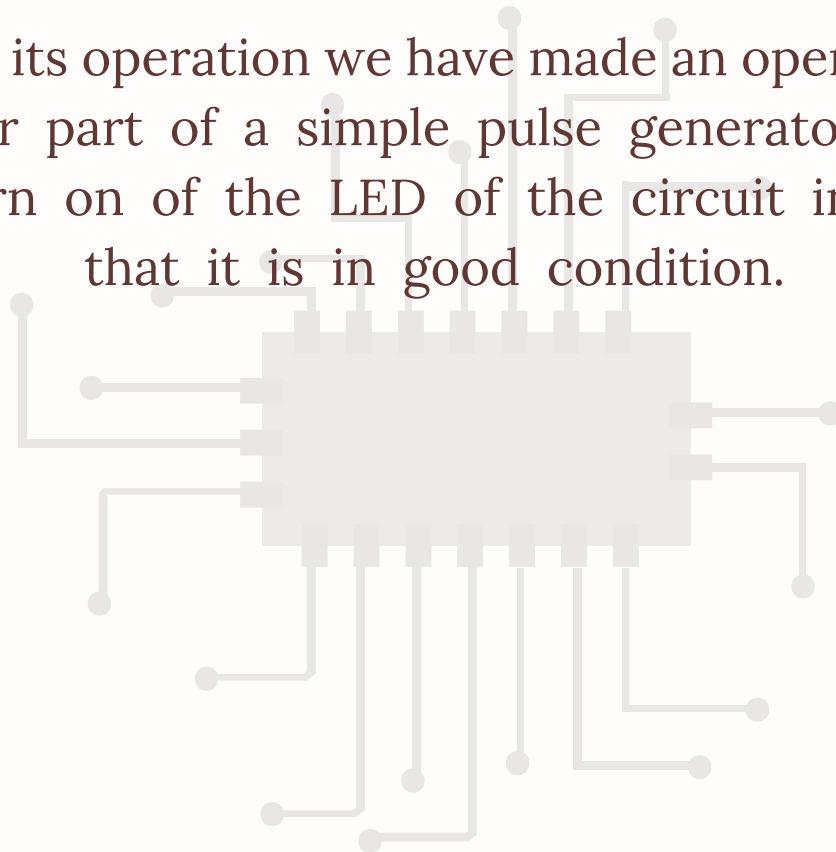
REFERENCES



INTRODUCTION

Many times we have an operational amplifier in our workshop or laboratory, and we do not know if it is in good or bad condition. This op amp tester circuit lets us get out of the doubt.

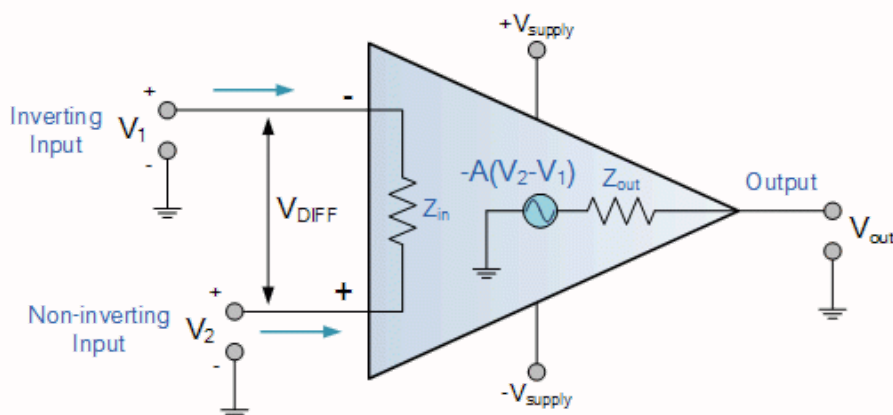
To test its operation we have made an operational amplifier part of a simple pulse generator circuit. The turn on of the LED of the circuit indicates that it is in good condition.



OPERATIONAL AMPLIFIER

An Operational Amplifier, or op-amp for short, is fundamentally a voltage amplifying device designed to be used with external feedback components such as resistors and capacitors between its output and input terminals. These feedback components determine the resulting function or “operation” of the amplifier and by virtue of the different feedback configurations whether resistive, capacitive or both, the amplifier can perform a variety of different operations, giving rise to its name of “Operational Amplifier”.

An Operational Amplifier is basically a three-terminal device which consists of two high impedance inputs. One of the inputs is called the Inverting Input, marked with a negative or “minus” sign, (-). The other input is called the Non-inverting Input, marked with a positive or “plus” sign (+).





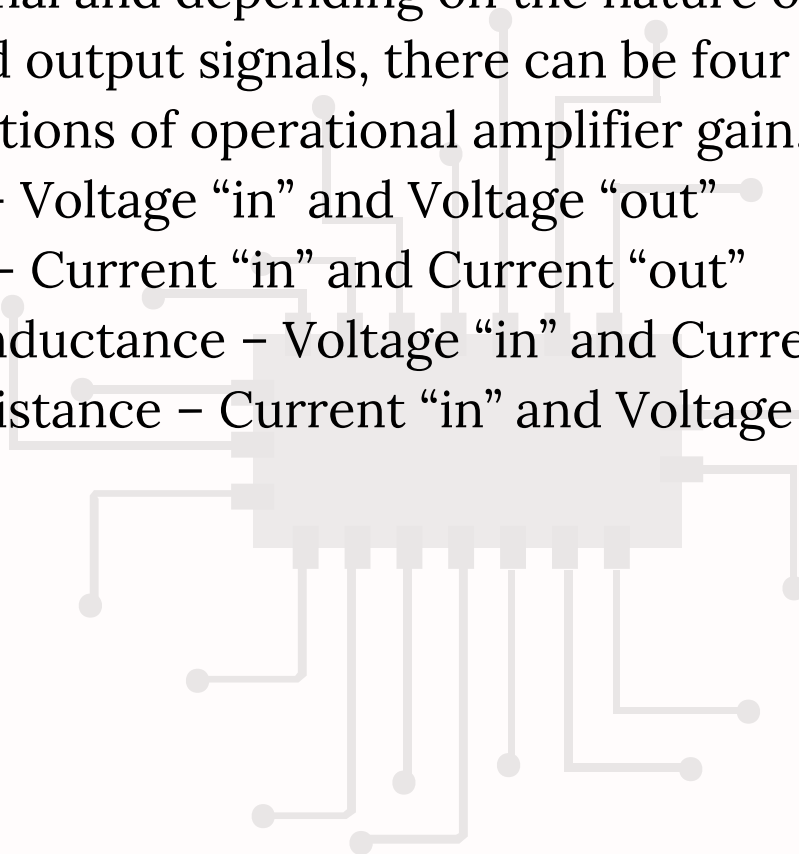
A third terminal represents the operational amplifiers output port which can both sink and source either a voltage or a current. In a linear operational amplifier, the output signal is the amplification factor, known as the amplifiers gain (A) multiplied by the value of the input signal and depending on the nature of these input and output signals, there can be four different classifications of operational amplifier gain.

Voltage – Voltage “in” and Voltage “out”

Current – Current “in” and Current “out”

Transconductance – Voltage “in” and Current “out”

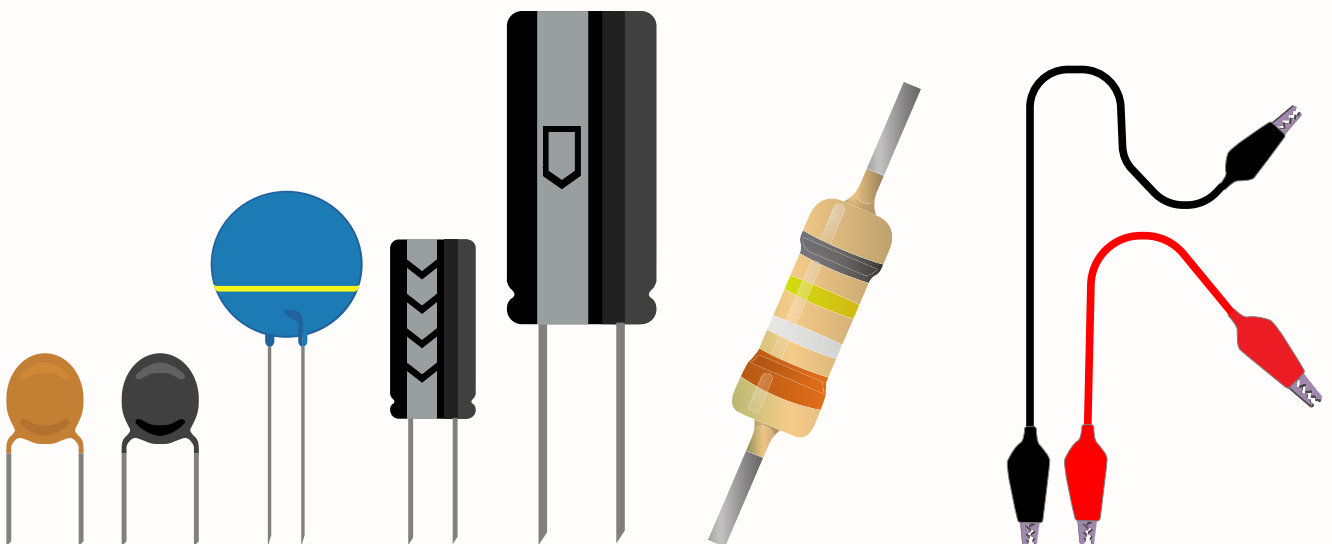
Transresistance – Current “in” and Voltage “out”



THE COMPONENTS USED ARE:

CA3130 Op-Amp : Operational amplifiers are linear devices that have all the properties required for nearly ideal DC amplification and are therefore used extensively in signal conditioning, filtering or to perform mathematical operations such as add, subtract, integration and differentiation. An Operational Amplifier, or op-amp for short, is fundamentally a voltage amplifying device designed to be used with external feedback components such as resistors and capacitors between its output and input terminals. It is of 741 configuration as it is the ic under test

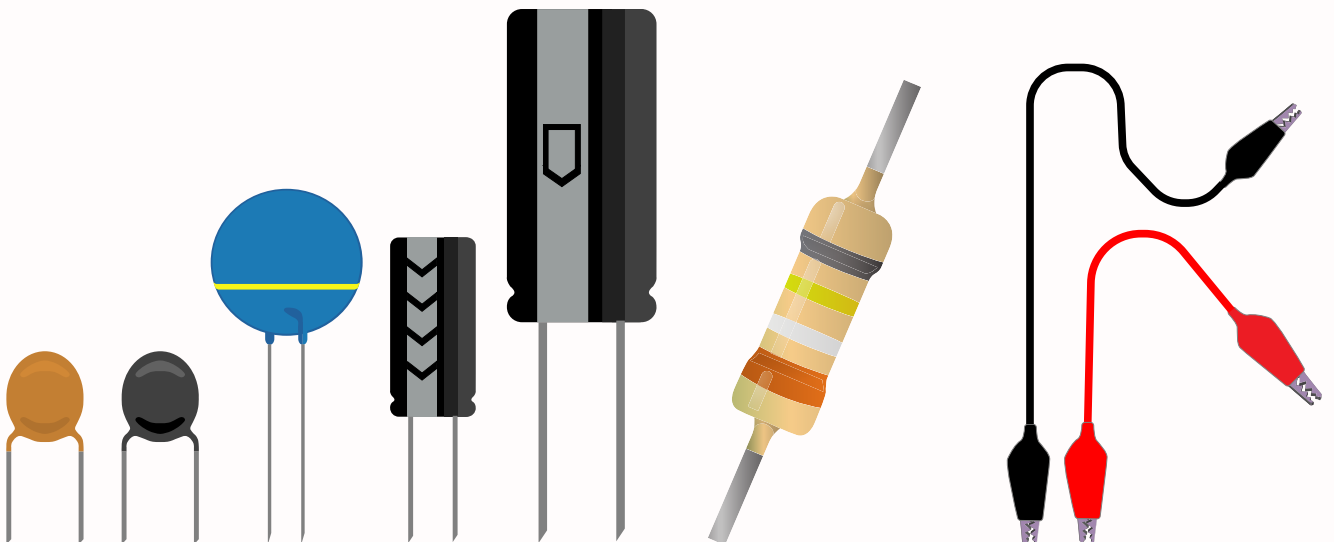
Resistors : Resistance is a measure of the opposition to current flow in an electrical circuit. Resistance is measured in ohms, symbolized by the Greek letter omega (Ω). Ohms are named after Georg Simon Ohm (1784-1854), a German physicist who studied the relationship between voltage, current and resistance. He is credited for formulating Ohm's Law.





Capacitors : capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit.

2N2222 NPN bipolar transistor : The 2N2222 is a common NPN bipolar junction transistor (BJT) used for general purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage, and can operate at moderately high speeds. The 2N2222 is considered a very common transistor, and is used as an exemplar of an NPN transistor. It is frequently used as a small-signal transistor, and it remains a small general purpose transistor of enduring popularity.



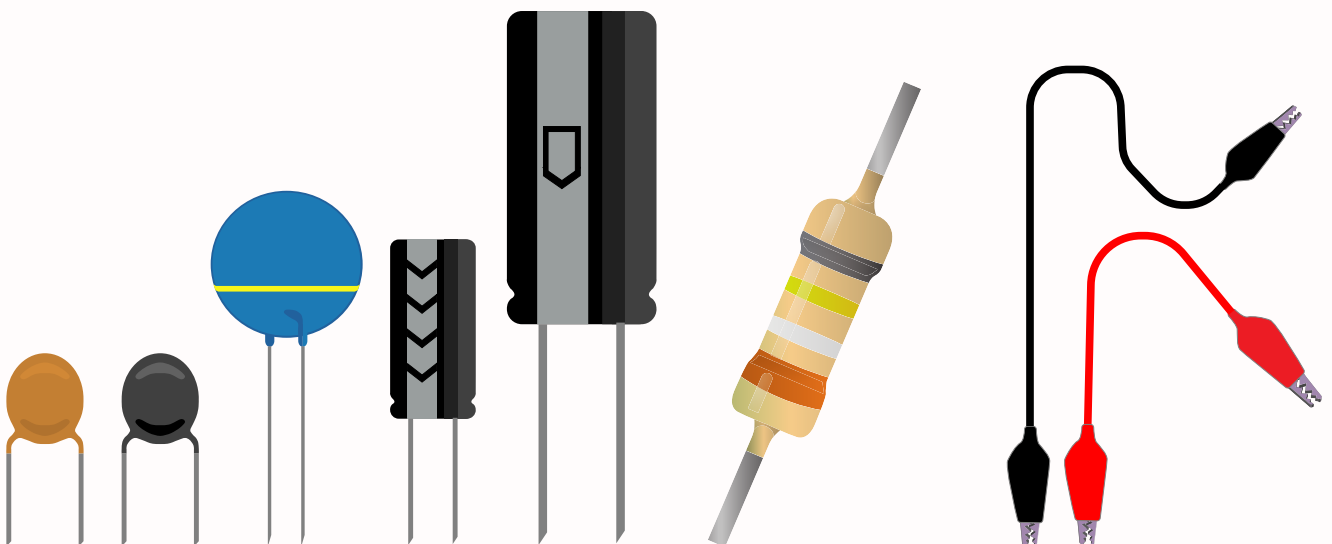


2N2905 PNP bipolar transistor : A PNP transistor is a bipolar junction transistor constructed by sandwiching an N-type semiconductor between two P-type semiconductors.

PNP Silicon Planar Switching Transistor. It is a fast switching devices exhibiting short turn-off and low saturation voltage characteristics
It is useful for Switching And Linear Application DC to VHF Amplifier Applications

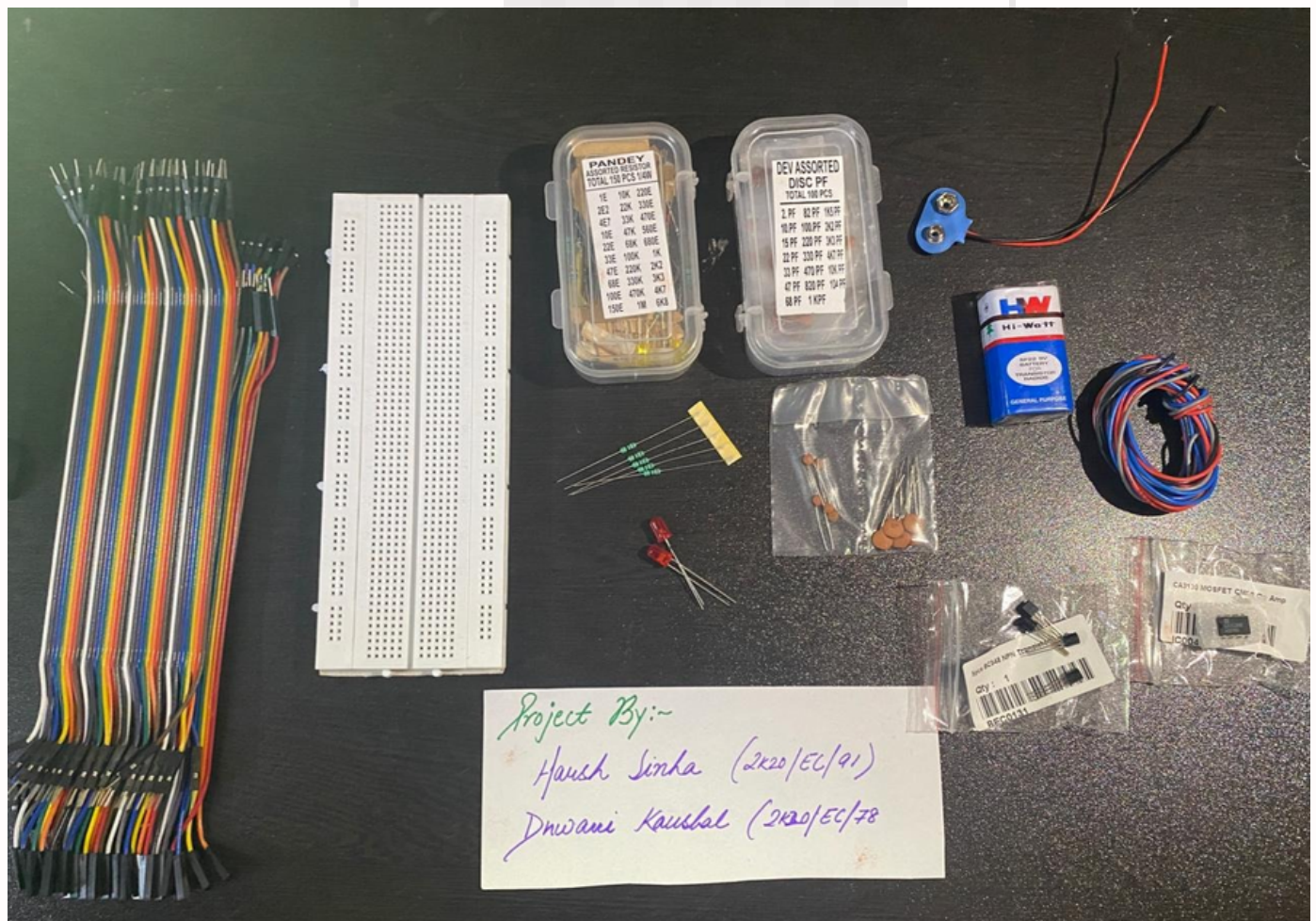
LED : A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

Connecting wires : Connecting wires allows an electrical current to travel from one point on a circuit to another because electricity needs a medium through which it can move. Most of the connecting wires are made up of copper or aluminum.



Breadboard : A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED (light-emitting diode).

Battery : A battery is a source of electric power consisting of one or more electrochemical cells with external connections[1] for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode.[2] The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal.



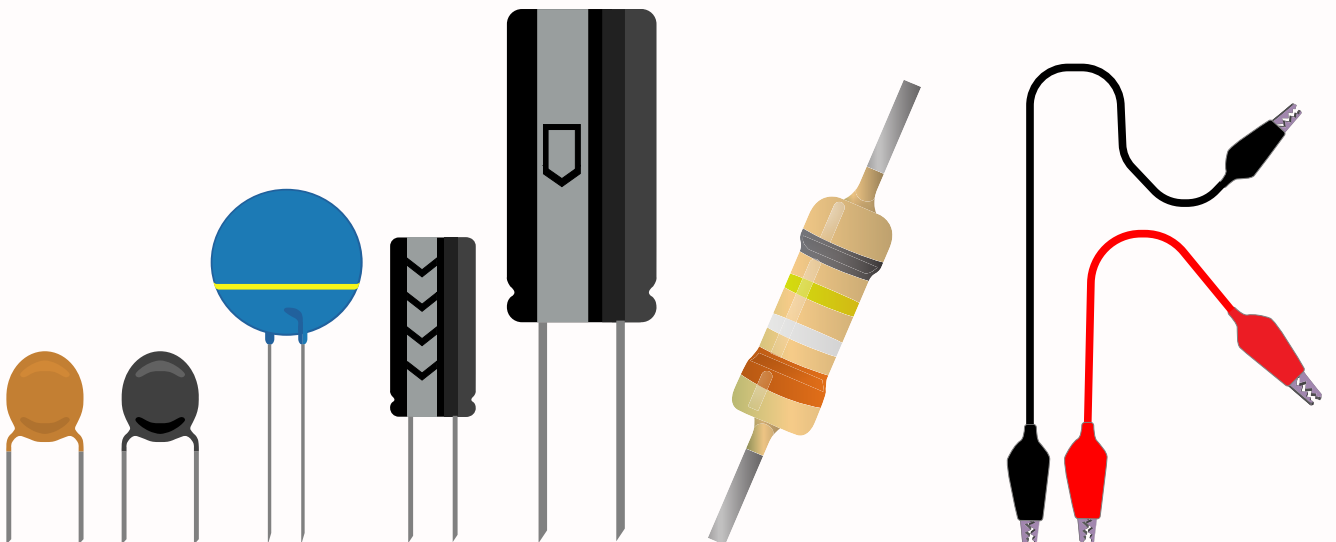
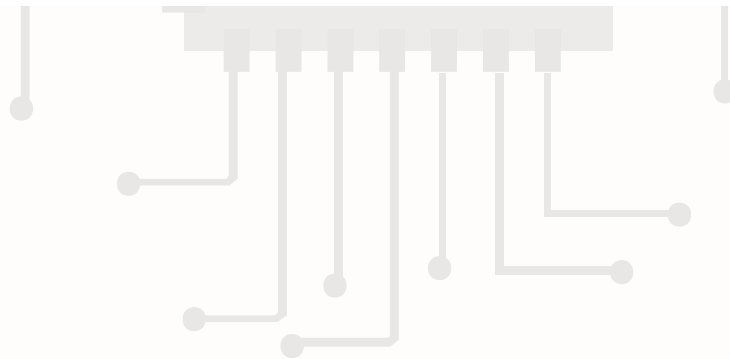
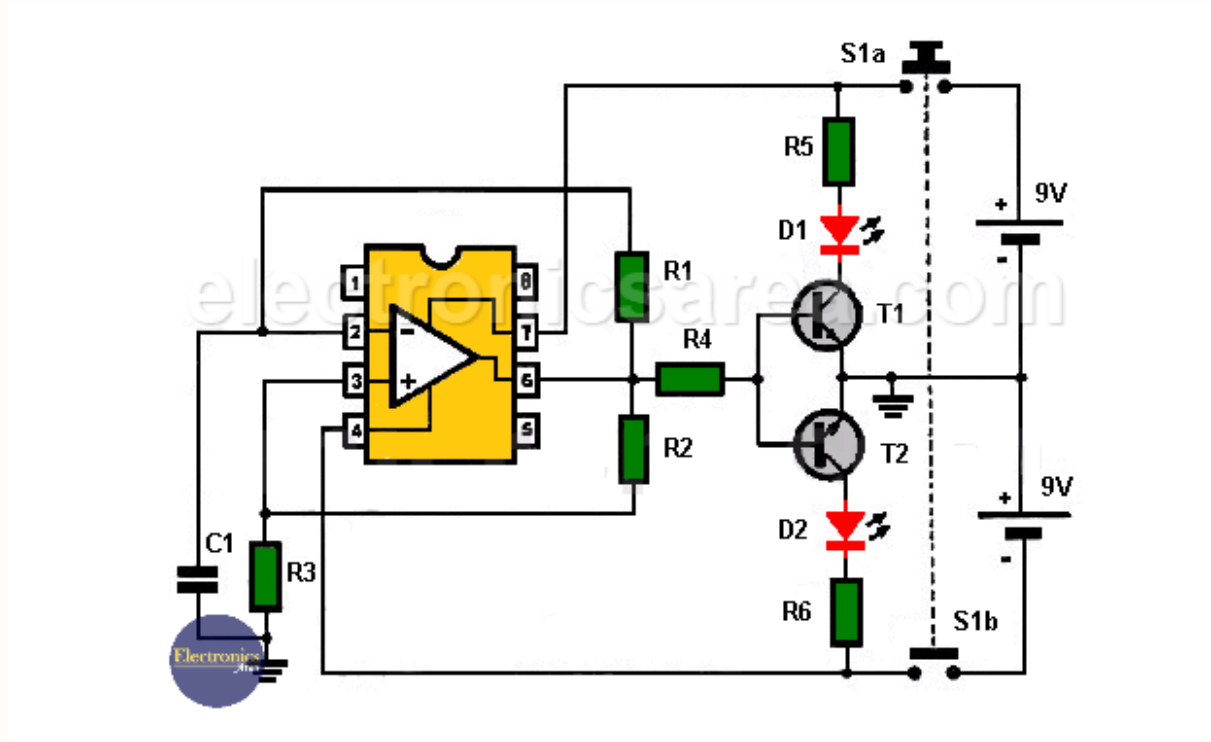


THE PURPOSE OF COMPONENTS

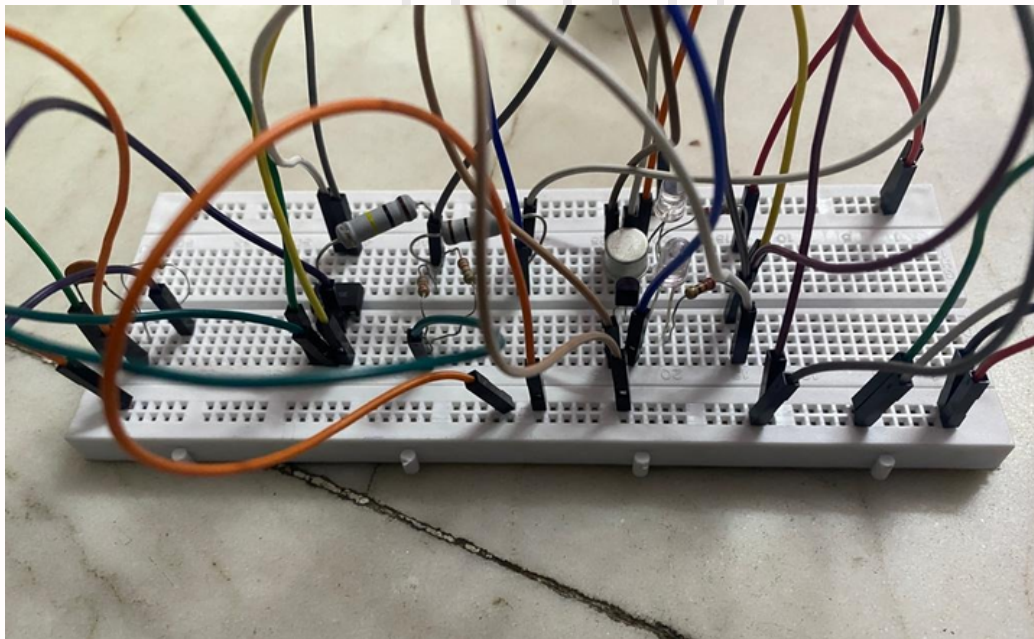
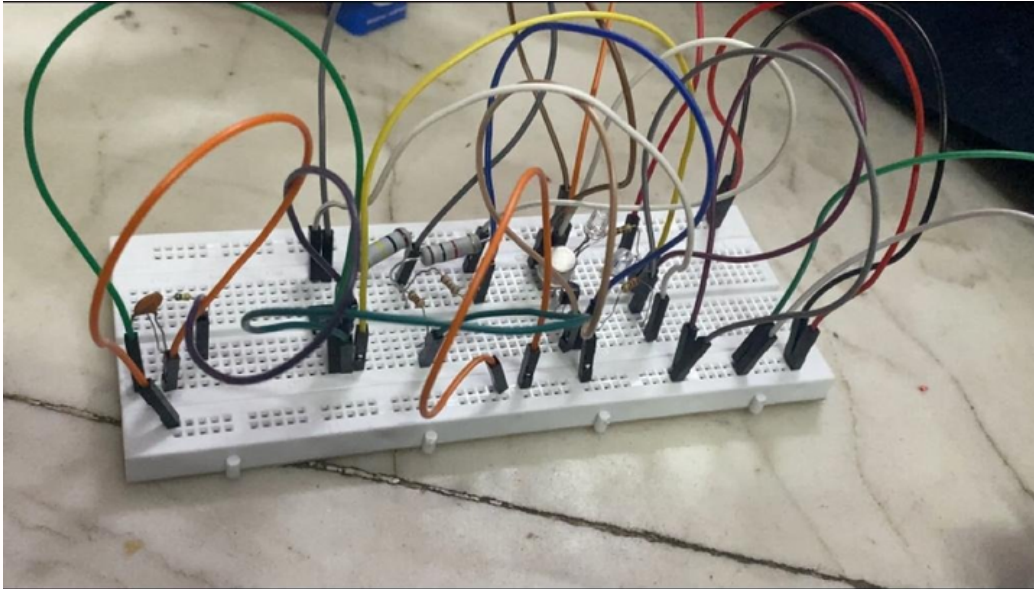
- The CA3130 IC is an op-amplifier under test
- Each resistor is used to control the current throughout the circuit.
- Each capacitor is used to store energy and provide the circuit with energy when it is necessary.
- Transistors are used to switch electronic signals and electrical power.
- Light-emitting diode is used to provide light for the final output.
- Power Supply is used to provide the circuit with a proper amount of voltage.
- The digital multimeter is used to set the power supply to the required voltage amount.
- Wires are used to connect each component within the circuit together.
- Breadboard is needed to construct the circuit.
- Anode is the positive end of the capacitor and transistor.
- Cathode is the negative end of the capacitor and transistor.
- The base of the transistor is the second terminal of the transistor.
- Anode, as well as, the collector is the first terminal of the transistor.
- Cathode, as well as, the emitter is the third terminal of the transistor.



CIRCUIT DIAGRAM



HARDWARE IMPLEMENTATION



WORKING OF THE TESTER

This op amp tester works well for 741 Integrated Circuits (IC) and others with the same pin configuration.

To test its operation we will make the operational amplifier part of a simple pulse generator circuit. The alternating turn on of the 2 LEDs of the circuit indicates that it is in good condition.

When the normally open (NO) button S1 is pressed the op amp is powered by the two 9 volt batteries. Immediately at the output of the integrated circuit (pin 6) there is a high voltage level.

This voltage is applied to a voltage divider made up of resistors R2 and R3, and a reference voltage is set at pin 3 (non-inverting input) of the op amp.

Simultaneously the capacitor C1 is charged through the resistor R1. The voltage across capacitor C1 eventually reaches the voltage set by the aforementioned voltage divider, with the op amp operating, at this time, as a comparator.

At this time, the op-amp output changes state from a positive to a negative output, also creating a reference voltage of opposite polarity at the non-inverting input (pin 3).

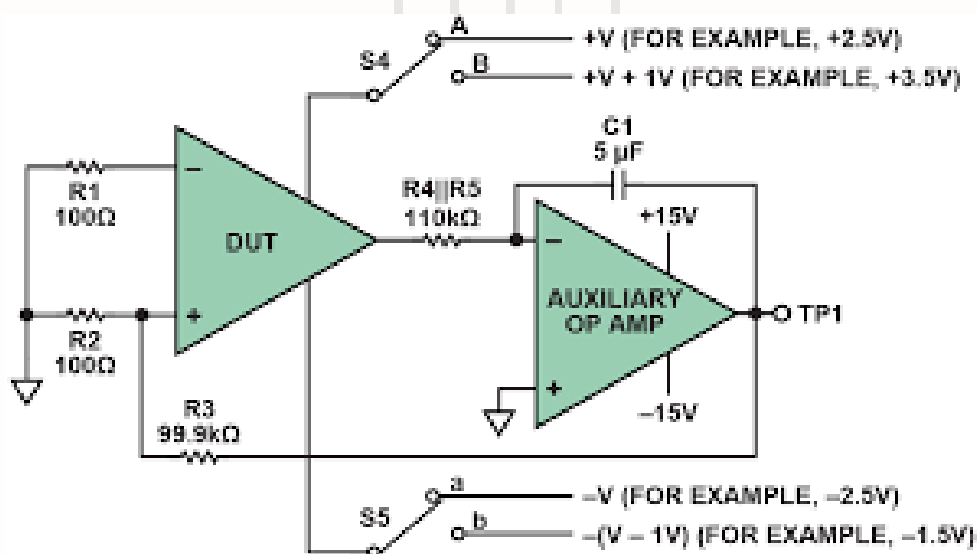


Capacitor C1 at that time begins to discharge and charge to a negative voltage, and the cycle repeats indefinitely.

When the output is high the transistor T1 conducts and will make the led D1 turn on. In the same way, when the output is low the transistor T2 conducts and will make the led D2 turn on.

The inclusion of transistors in the design is due to the possibility that some operational amplifier under test has a low output current capacity.

For the operation of the circuit, two 9V batteries or a voltage source with outputs of -9 and +9 volts are required.





APPLICATION AND USES

Op-amp 741 is a very well-known as well as very usable IC in many of the projects like amplifier circuits, voltage follower circuits, current to voltage changer or voltage to current changer and many more other applications. So for the proper working circuit it is highly necessary that your op-amp works correctly.

- IN EDUCATIONAL CENTERS

It can be used to detect faulty op-amp for the convenient and error free use of them in colleges

- IN INDUSTRIES

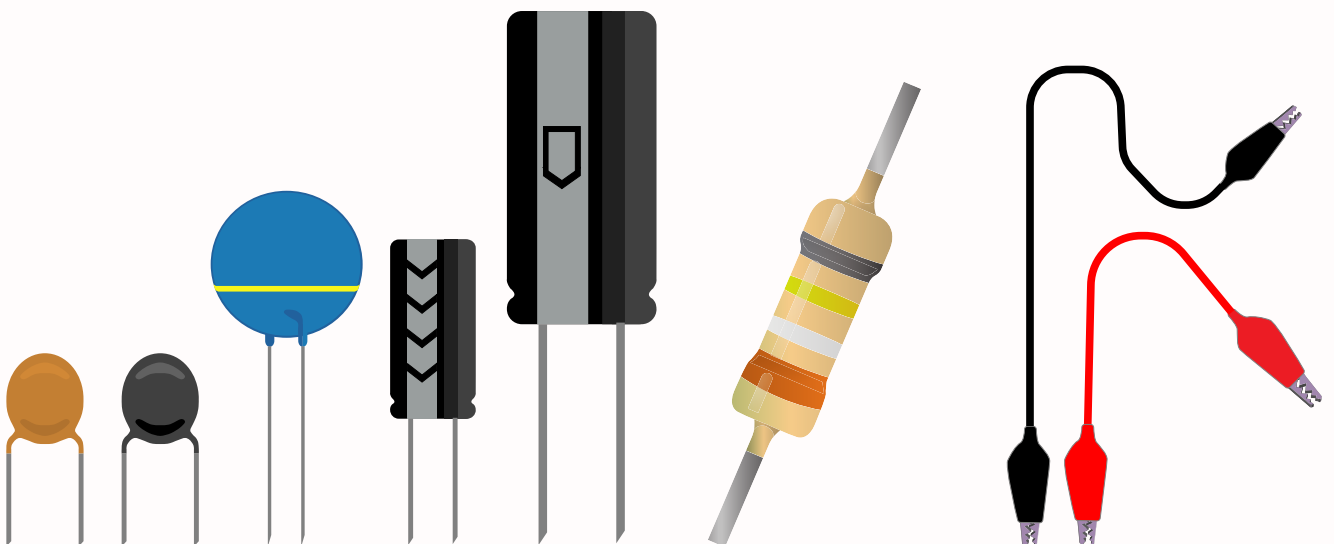
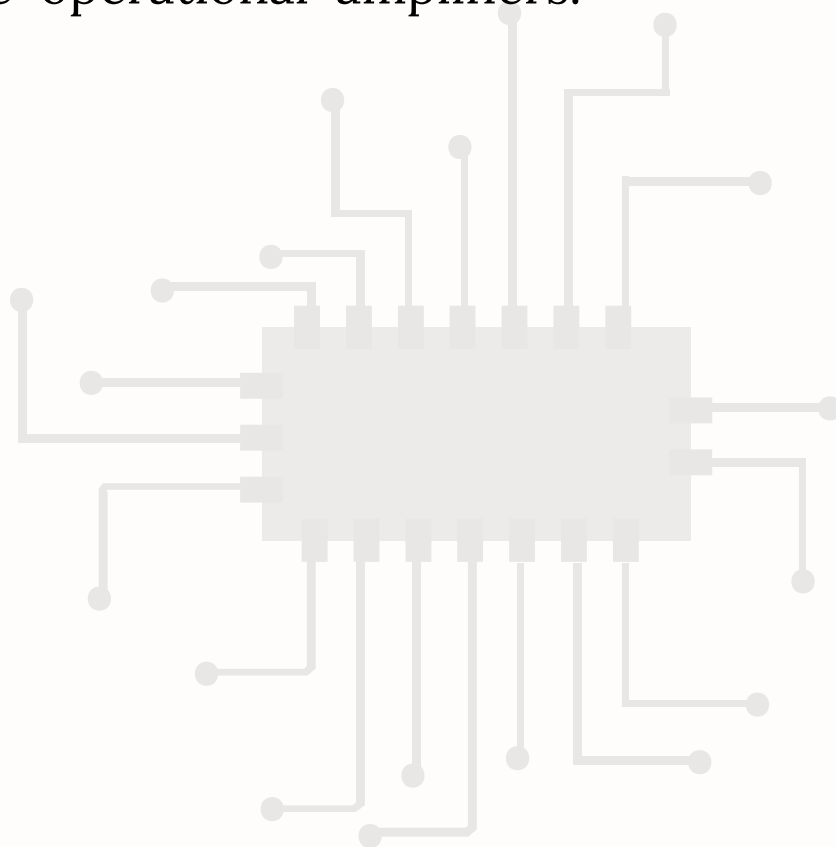
Op-Amp is widely used in electronics industry as current to voltage converter, active rectifiers, voltage followers etc. The ability to detect faulty op-amp will help enhance the productivity of the industries

- IN COMMUNICATION

When an operational amplifier is combined with an amplification circuit, it can amplify weak signals to strong signals. The ability to detect any faulty op-amp enables us to change to device so as to avoid any inconvenience or loss of sensitive information

CONCLUSION

An Operational Amplifier Tester check whether the given op amp is functionable or not. This will save us a lot of time and will thus increase efficiency. The op amp tester is designed to test simple, double and quadruple operational amplifiers.





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