FIRE ALARM WITH SIREN SOUND

A PROJECT REPORT SUBMITTED TO

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SAVITRIBAI PHULE PUNE UNIVERSITY

BONAFIDE CERTIFICATE

This is to certify that the work incorporated in the project report entitled **“Fire Alarm with Siren Sound”** submitted to Savitribai Phule Pune University, Pune, is benefited work of **Miss. Gunjal Sunil Ashok** of M.Sc.-II (Physics) during the academic year 2020-21, who carried out the project work under my supervision.

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Chapter 1

Introduction

Fire Alarm with Siren Sound

In order to undertake the process of designing a fire system for a building it is necessary to have a sound understanding of the relevant design standards, the legal framework surrounding building safety legislation and a sound working knowledge of product application theory. The following system design process is intended to give a reasonable overview of all the areas of knowledge required for the successful design of a fire alarm system. Due to the complex nature of legislation and design standards relating to fire alarm system design, this course is not intended to be a comprehensive to all aspects of fire alarm design but rather a very useful source of background information to which further application specific detailed information can be added from other sources as required.

1.1WHY HAVE A FIRE ALARM SYSTEM?

The answer to this question depends on the premises in question and the legal requirements. Your local fire marshal may require a fire alarm system based upon the occupancy of the building. Generally the legal requirement for a fire alarm system relates to the protection of life. In general fire alarm systems are installed to:

1) To provide for the safety of occupants in buildings, and to make provision for their evacuation or refuge during a fire or other emergency.

2) To provide fire department with early notification of a fire in a building and to direct them to the area of risk

3) To reduce loss of property; the property may have considerable intrinsic value and the insurers either require a fire detection system or may incentives its use.

4) To reduce building damage; the building may be unoccupied for periods where equipment is still powered and the owner wishes to ensure that if anything goes wrong fire department is called to the scene in a timely manner. Sometimes fire detection and alarm systems are used to compensate for structural fire protection shortcomings or to give special cover for items of high value.

5) To reduce the amount of business lost

6) Minimize risk to the public who attend unfamiliar properties. It is often a mandatory requirement by the Building Codes. Whatever the reason, an automatic fire detection and alarm system generally provides a network of manual call points, heat and smoke detectors, alarm warning devices over the area covered. Once activated, the devices send signals to the fire alarm panel which in turn activates audio and visual devices including lights and sounders. The system may also send its signal to an off-site monitoring station.

Abstract

This circuit alerts us when there is a fire accident at home by ringing a siren sound. You might have seen fire alarms earlier but this is quite different as it generates a siren sound instead of a buzzer and also it uses basic components to generate that siren sound.

We are aware that there are many integrated circuits which can be used to generate the siren effect but we preferred to use basic electronics components like resistors, capacitors and transistors to generate it so that you will clearly understand the internal working of it and it will be much useful for you as you will gain more knowledge by analyzing it instead of simply going for pre designed integrated circuits

Chapter 2

Resistor

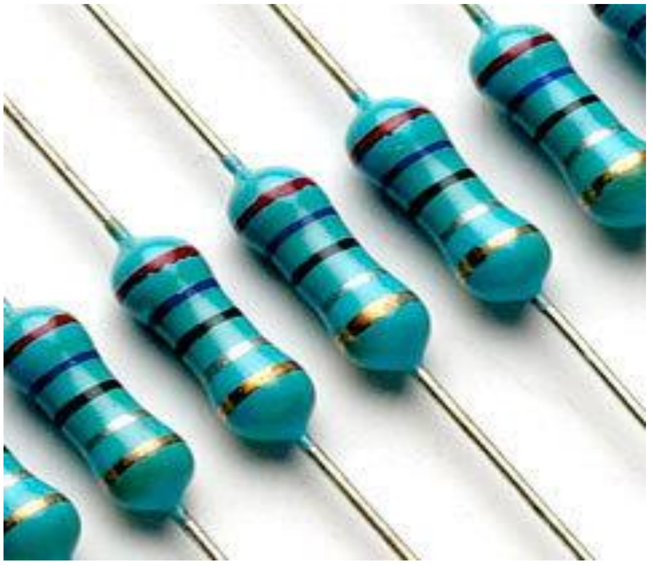


Fig 2.1 resistor

2.1 Introduction

Resistors are the most commonly used component in electronics and their purpose is to create specified values of current and voltage in a circuit. The resistors are on millimeter paper, with 1cm spacing to give some idea of the dimensions.

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits, resistors are used to limit current flow, to adjust signal levels, bias active elements, and terminate transmission lines among other uses. High-power resistors, that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance will fall within a manufacturing tolerance.

2.2 Ohm's law

The behavior of an ideal resistor is dictated by the relationship specified by Ohm's law: $V = I \cdot R.$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I), where the constant of proportionality is the resistance (R). For example, if a 300 ohm resistor is attached across the terminals of a 12 volt battery, then a current of 12 / 300 = 0.04 amperes flows through that resistor. Practical resistors also have some inductance and capacitance which will also affect the relation between voltage and current in alternating current circuits.

The ohm (symbol: Ω) is the SI unit of electrical resistance, named after Georg Simon Ohm. An ohm is equivalent to a volt per ampere. Since resistors are specified and manufactured over a very large range of values, the derived units of milliohm (1 mΩ = 10^{-3} Ω), kilohm (1 kΩ = 10^{3} Ω).

2.3 Types of Resistors

The first major categories into which the different types of resistor can be fitted is into whether they are fixed or variable. These different resistor types are used for different applications:

- ***Fixed resistors:*** Fixed resistors are by far the most widely used type of resistor. They are used in electronics circuits to set the right conditions in a circuit. Their values are determined during the design phase of the circuit, and they should never need to be changed to "adjust" the circuit. There are many different types of resistor which can be used in different circumstances and these different types of resistor are described in further detail below.
- ***Variable resistors:*** These resistors consist of a fixed resistor element and a slider which taps onto the main resistor element. This gives three connections to the component: two connected to the fixed element, and the third is the slider. In this way the component acts as a variable potential divider if all three connections are used. It is possible to connect to the slider and one end to provide a resistor with variable resistance.

Fixed resistor types

There are a number of different types of fixed resistor:

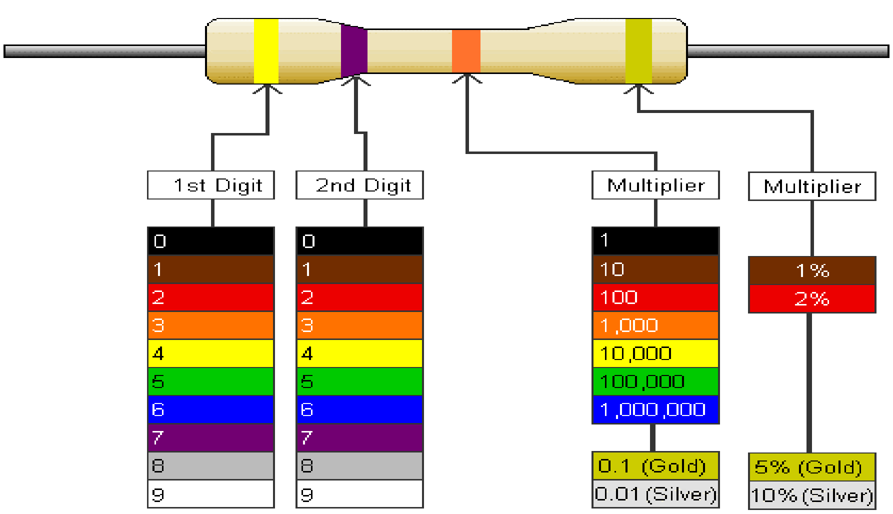
- ***Carbon composition:***
- ***Carbon film:***
- ***Metal oxide film***:
- ***Metal film:***
- ***Thin film:***

2.4 Resistor Colour Codes

Components and wires are coded are with colors to identify their value and function.

Color	Digit	Multiplier	Tolerance (%)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20

Table 2.1



2.5 symbols of resistor

The colors brown, red, green, blue, and violet are used as tolerance codes on 5-band resistors only. All 5-band resistors use a colored tolerance band. The blank (20%) "Band" is only used with the "4-band" code (3 colored bands + a blank "band").

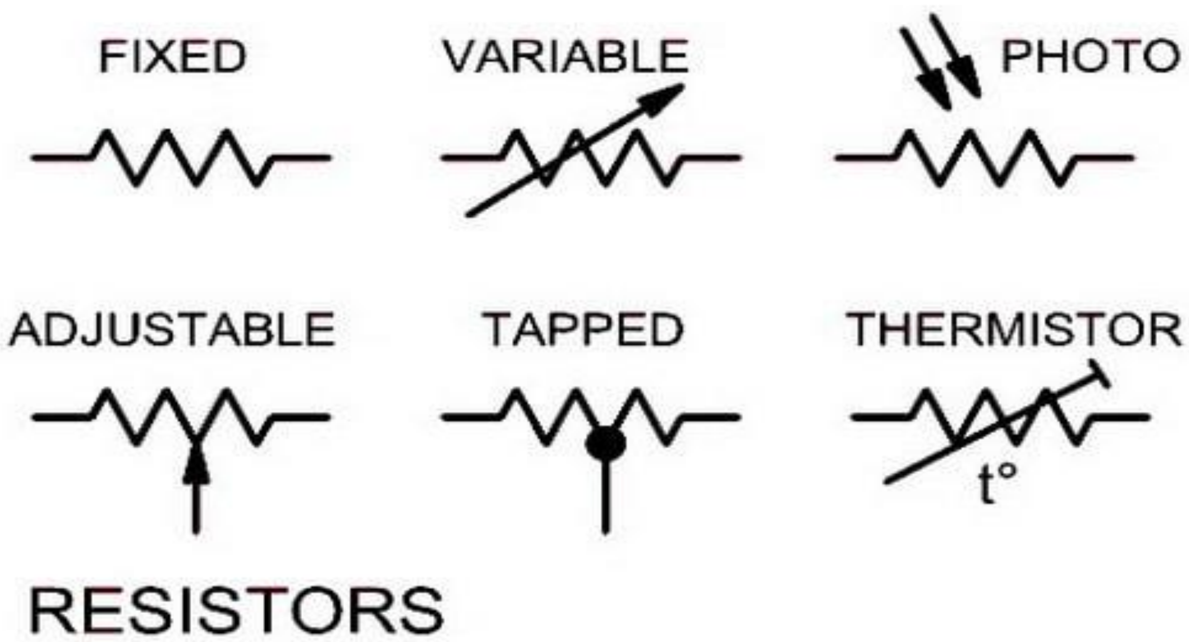


Fig2.2 Symbol of the resister

Chapter 3

Transistor

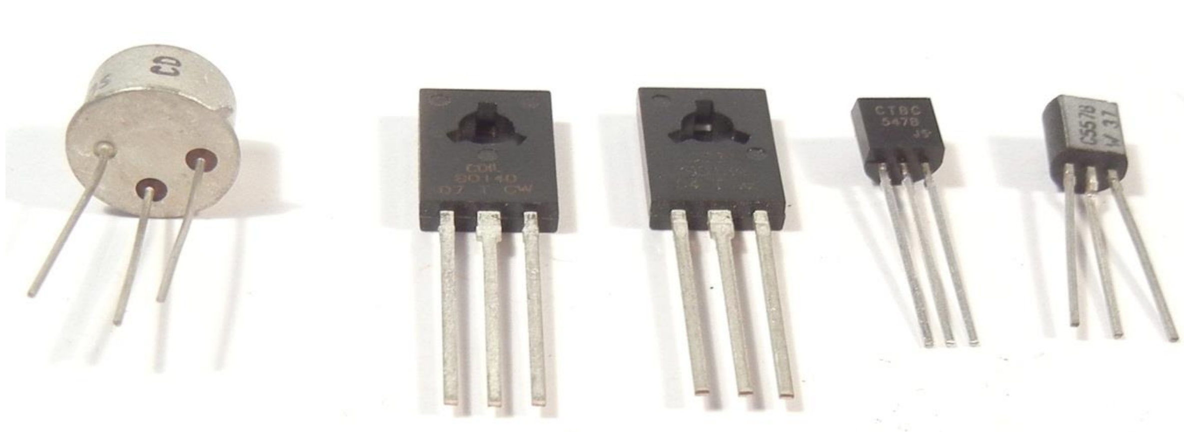


Fig3.1 transistors

3.1 Introduction

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

3.2 Transistor Basics

A transistor is a three terminal device. Namely,

Base: This is responsible for activating the transistor.

Collector: This is the positive lead.

Emitter: This is the negative lead.

The basic idea behind a transistor is that it lets you control the flow of current through one channel by varying the intensity of a much smaller current that's flowing through a second channel.

3.3 Transistor symbol

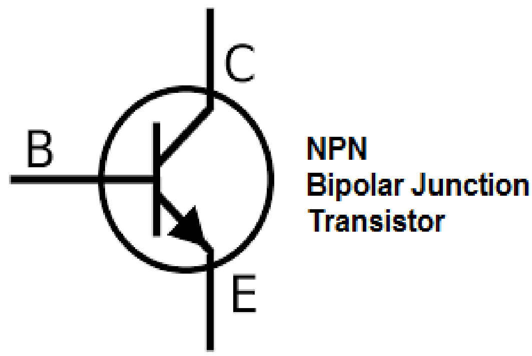


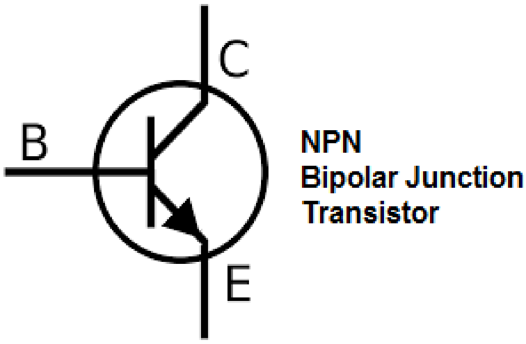
Fig.3.2 npn transistor

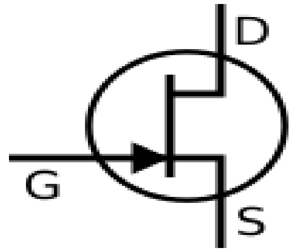
Pin No	Pin name	Description
1.	Collector	Current flow in through
2.	Base	Control the biasing
3.	Emitter	Current through out

Table 3.1pin configuration

3.4 Types of Transistors

There are two types of transistors in present; they are bipolar junction transistor (BJT), field effect transistors (FET). A small current is flowing between the base and the emitter; base terminal can control a larger current flow between the collector and the emitter terminals. For a field-effect transistor, it also has the three terminals, they are gate, source, and drain, and a voltage at the gate can control a current between source and drain. The simple diagrams of BJT and FET are shown in figure below:





(a) BJT (b) FET

Fig 3.3 types of transistor

3.5 Applications of Transistors

The transistor as an amplifier,

1. A transistor can be used to amplify current. This is because a small change in base current causes a large change in collector current.
2. Example is a microphone.
3. Sound waves that are fed into the microphone cause the diaphragm in the microphone to vibrate.
4. The electrical output of the microphone changes according to the sound wave
5. As a result, the base current is varying because of the small alternating voltage produced by the microphone.
6. A small change in the base current causes a large change in the collector current.
7. The varying collector current flows into the loudspeaker.

3.6 Advantages of Transistor

i. Smaller mechanical sensitivity.
ii. Lower cost and smaller in size, especially in small-signal circuits.

iii. Low operating voltages for greater safety, lower costs and tighter clearances.
iv. Extremely long life.
v. No power consumption by a cathode heater.
vi. Fast switching.

3.7 Disadvantages of a Transistor

1. When they blow, they need to be replaced but they are so small (that an advantage) it can be difficult to find the offending transistor.
2. Manufacturing techniques are complex.
3. Manufacturing techniques require clean rooms.
4. They can be put into the circuit board the wrong way and therefore not work.
5. Removing them from a circuit board involves unsoldering whereas valves were plugged.
6. If they are on an integrated circuit and blow, the ENTIRE integrated circuit must be replaced.

3.8 Transistor bc547

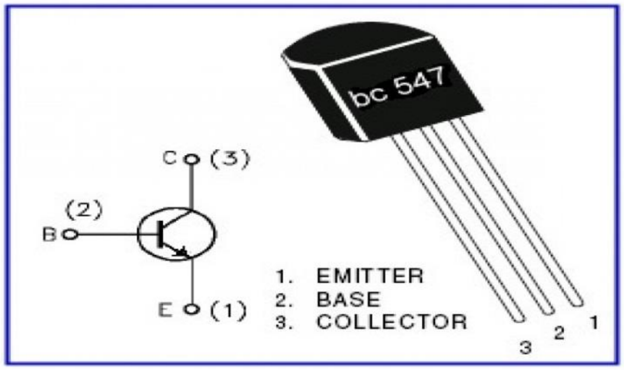


Fig: 3.4 transistor bc547

It is a NPN transistor hence the collector and emitter will be left open (reverse biased) .when the base pin is held at ground and will be closed (forward biased). when a signal is provided base pin the maximum amount of current that flow through the collector pin is 100 mA to biased a transistor we have supply current to base pin this current (IB) should be limited to 5mA .

3.9 Application

1. Transistor as an Amplifier.
2. Transistor as a Switch.
3. Transistor as a constant-current Source.

Chapter 4

Capacitors

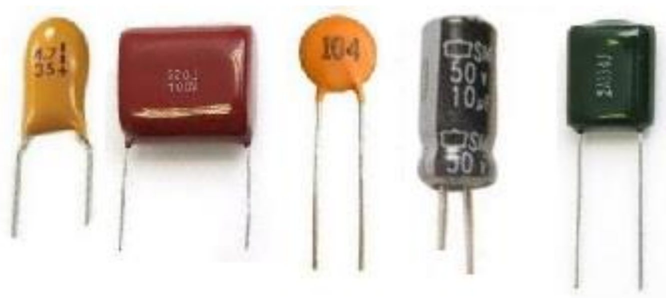


Fig 4.1 capacitor

4.1 Introduction

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store electrical energy temporarily in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e. an insulator that can store energy by becoming polarized). The conductors can be thin films, foils or sintered beads of metal or conductive electrolyte, etc. The non-conducting dielectric acts to increase the capacitor's charge capacity. Unlike a resistor, an ideal capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

4.2 Definition

Capacitance is defined as the ratio of the electric charge *Q* on each conductor to the potential difference *V* between them. The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V).

4.3 Types of Capacitors

Practical capacitors are available commercially in many different forms. The type of internal dielectric, the structure of the plates and the device packaging all strongly affect the characteristics of the capacitor, and its applications.

4.3.1 Dielectric materials

Most types of capacitor include a dielectric spacer, which increases their capacitance. These dielectrics are most often insulators. However, low capacitance devices are available with a vacuum between their plates, which allows extremely high voltage operation and low losses.

4.3.2Polymer capacitors

(OS-CON, OC-CON, KO, AO) use solid conductive polymer (or polymerized organic semiconductor) as electrolyte and offer longer life and lower ESR at higher cost than standard electrolytic capacitors.

4.3.3 Voltage Dependent Capacitors

The dielectric constant for a number of very useful dielectrics changes as a function of the applied electrical field, for example ferroelectric materials, so the capacitance for these devices is more complex.

4.3.4 Frequency-dependent capacitors

If a capacitor is driven with a time-varying voltage that changes rapidly enough, at some frequency the polarization of the dielectric cannot follow the voltage.

Capacitor colour code table

Band Colour	**Digit A**	**Digit B**	**Multiplier D**	**Tolerance (T) > 10pf**	**Tolerance (T) < 10pf**	**Temperature Coefficient (TC)**
Black	0	0	x1	± 20%	± 2.0pF	
Brown	1	1	x10	± 1%	± 0.1pF	-33×10^{-6}
Red	2	2	x100	± 2%	± 0.25pF	-75×10^{-6}
Orange	3	3	x1,000	± 3%		-150×10^{-6}
Yellow	4	4	x10,000	± 4%		-220×10^{-6}
Green	5	5	x100,000	± 5%	± 0.5pF	-330×10^{-6}
Blue	6	6	x1,000,000			-470×10^{-6}
Violet	7	7				-750×10^{-6}
Grey	8	8	x0.01	+80%,-20%		
White	9	9	x0.1	± 10%	± 1.0pF	
Gold			x0.1	± 5%		
Silver			x0.01	± 10%		

Table4.1 Capacitor colour code table

4.4 Ceramic Disc capacitor

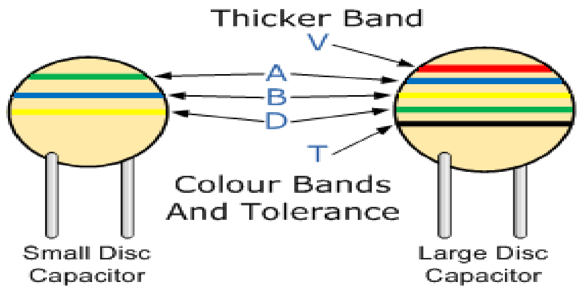


Fig.4.2ceramic disc capacitor

The Capacitor Colour Code system was used for many years on unpolarised polyester and mica moulded capacitors. This system of colour coding is now obsolete but there are still many "old" capacitors around. Nowadays, small capacitors such as film or disk types conform to the BS1852 Standard and its new replacement, BS EN 60062, were the colours have been replaced by a letter or number coded.

4.5 Advantages

- Low maintenance.
- Easily available.
- No gas or pollutant produces.
- We can use this circuit to jam the remote signals so that the other people cannot change the channel while watching on favourite program on TV.
- It will not affect the signal receiving capacity of the TV.
- Fully Automatic.

4.6 Disadvantages

- The circuit should be tuned correctly to 38 KHZ frequency to get accurate result.
- Not always produce constant Electricity.
- Very costly for individual purpose.

4.7 Electrolytic capacitor

4.7.1What is electrolytic capacitors?

Fig 4.3 electrolytic capacitor

An electrolytic capacitor is a type of capacitor that uses an electrolyte to achieve a larger capacitance than other capacitor types. An electrolyte is a liquid or gel containing a high concentration of ions. Almost all electrolytic capacitors are polarized, which means that the voltage on the positive terminal must always be greater than the voltage on the negative terminal. The benefit of large capacitance in electrolytic capacitors comes with several drawbacks as well. Among these drawbacks are large leakage currents, value tolerances, equivalent series resistance and a limited lifetime. Electrolytic capacitors can be either wet-electrolyte or solid polymer. They are commonly made of tantalum or aluminum, although other materials may be used. Super capacitors are a special subtype of electrolytic capacitors, also called double-layer electrolytic capacitors, with capacitances of hundreds and thousands of farads. This article will be based on aluminum electrolytic capacitors. These have a typical capacitance between 1µF to 47mF and an operating voltage of up to a few hundred volts DC. Aluminum electrolytic capacitors are found in many applications such as power supplies, computer motherboards and many domestic appliances. Since they are polarized, they may be used only in DC circuits

4.7.2 Electrolytic capacitor definition

"An electrolytic capacitor is a polarized capacitor which uses an electrolyte to achieve a larger capacitance than other capacitor types".

Reading the capacitance value

In the case of through-hole capacitors, the capacitance value as well as the maximum rated voltage is printed on the enclosure. A capacitor that has "4.7µF 25V" printed on it has a nominal capacitance value of 4.7µF and a maximum voltage rating of 25 volts, which is never to be exceeded.

In the case of SMD (surface mounted) electrolytic capacitors, there are two basic marking types. The first one clearly states the value in microfarads and the operating voltage. For example, using this approach, a 4.7 µF capacitor with an operating voltage of 25 volts would bear the marking "4.7 25V". In the other marking system, a letter is followed by three numbers. The letter represents the voltage rating according to the table below. The first two numbers represent the value in Pico farads, while the third number is the number of zeroes to be added to the first two. For example, a 4.7 µF capacitor with a voltage rating of 25 volts would bear the marking E476. This translates to 47000000 pF = 47000 nF = 47 µF.

4.7.3Characteristics

- **Capacitance drift**

The capacitance of electrolytic capacitors drifts from the nominal value as time passes, and they have large tolerances, typically 20%. This means that an aluminum electrolytic capacitor with a nominal capacitance of 47μF is expected to have a measured value of anywhere between 37.6μF and 56.4μF. Tantalum electrolytic capacitors can be made with tighter tolerances, but their maximum operating voltage is lower so they cannot be always used as a direct replacement

4.7.4Construction and properties of electrolytic capacitors

Aluminum electrolytic capacitors are made of two aluminum foils and a paper spacer soaked in electrolyte. One of the two aluminum foils is covered with an oxide layer, and that foil acts as the anode, while the uncoated one acts as a cathode. During normal operation, the anode must be at a positive voltage in relation to the cathode, which is why the cathode is most commonly marked with a minus sign along the body of the capacitor. The anode, electrolyte-soaked paper and cathode are stacked. The stack is rolled, placed into a cylindrical enclosure and connected to the circuit using pins. There are two common geometries: axial and radial. Axial capacitors have one pin on each end of the cylinder, while in the radial geometry, both pins are located on the same end of the cylinder.

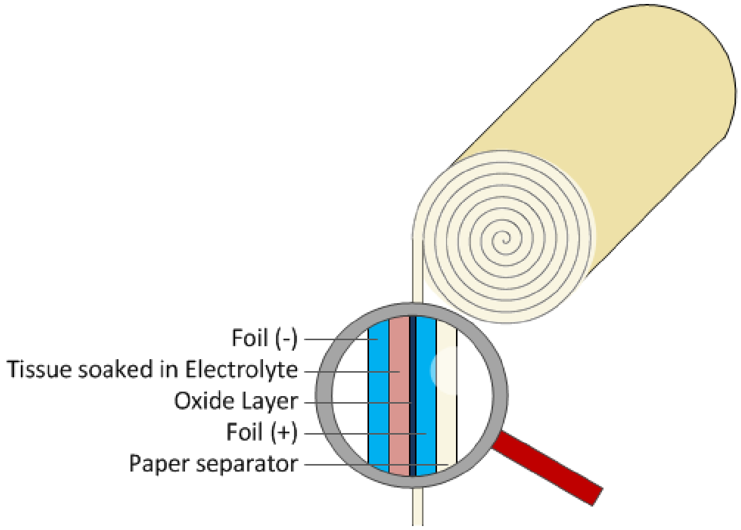


Fig4.4 construction of electrolytic capacitor

Electrolytic capacitors have a larger capacitance than most other capacitor types, typically 1μF to 47mF. There is a special type of electrolytic capacitor, called a double-layer capacitor or a super capacitor, whose capacitance can reach thousands of farads. The capacitance of an aluminum electrolytic capacitor is determined by several factors, such as the plate area and the thickness of the electrolyte. This means that a large capacitance capacitor is bulky and large in size. It is worth mentioning that electrolytic capacitors made using old technology didn't have a very long shelf life, typically only a few months. If left unused, the oxide layer deteriorates and has to be rebuilt in a process called capacitor reforming. This can be performed by connecting the capacitor to a voltage source through a resistor and slowly increasing the voltage until the oxide layer has been fully rebuilt. Modern electrolytic capacitors have a shelf life of 2 years or more. If the capacitor is left unpolarized for longer periods, they must be reformed prior to use.

4.7.4 Applications for electrolytic capacitors

There are many applications which do not need tight tolerances and AC polarization, but require large capacitance values. They are commonly used as filtering devices in various power supplies to reduce the voltage ripple. When used in switching power supplies, they are often the critical component limiting the usable life of the power supply, so high quality capacitors are used in this application.

They may also be used in input and output smoothing as a low pass filter if the signal is a DC signal with a weak AC component. However, electrolytic capacitors do not work well with large amplitude and high frequency signals due to the power dissipated at the parasitic internal resistance called equivalent series resistance (ESR). In such applications, low-ESR capacitors must be used to reduce losses and avoid overheating.

A practical example is the use of electrolytic capacitors as filters in audio amplifiers whose main goal is to reduce mains hum. Mains hum is a 50Hz or 60Hz electrical noise induced from the mains supply which would be audible if amplified

Chapter 5

Thermistor

Fig 5.1 thermistor

5.1Introduction

We are all known that a resistor is an electrical component that limits the amount of current flows through a circuit. Thermistor is special type of resistor, whose resistance varies more significantly with temperature than in standard resistors. Generally, the resistance increases with the temperature for most of the metals but the thermistors respond negatively i.e. the resistance of the thermistors decrease with the increase in temperature. This is the main principle behind thermistor. As the resistance of thermistors depends on the temperature, they can be connected in the electrical circuit to measure the temperature of the body. Thermistors are mainly used as temperature sensors, inrush current limiters, self-resetting over-current protectors and self-regulating heating elements. A thermistor is made from a semiconductor material. It is shaped into a disc, a rod or a bead. Bead thermistors may be only a few millimeters in diameter. Some bead thermistors have the bead enclosed in a glass capsule. The symbol of Thermistors can be represented as follows:

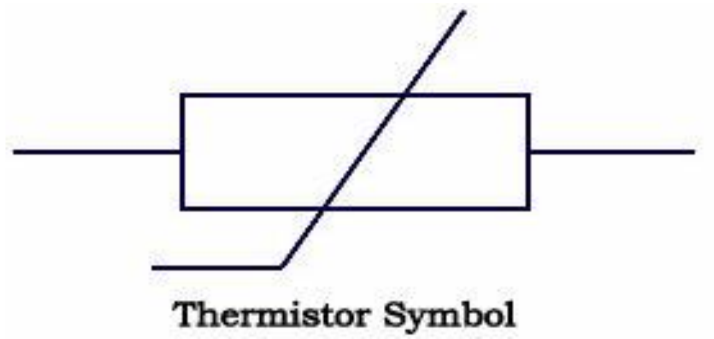


Fig 5.2 symbol of thermistor

5.2 Types of Thermistors:

There are mainly two types of thermistors namely Positive-temperature coefficient (PTC) and Negative-temperature coefficient (NTC).

5.2.1Positive Temperature Coefficient (PTC):

PTC thermistors increase their resistance as the temperature rises. The relationship between resistance and temperature is linear, as expressed in the following equation: delta R = k (delta T) where delta R is the change in resistance, delta T is the change in temperature and k is the temperature coefficient. When k is positive, it causes a linear increase in resistance as the temperature rises.

5.2.2 PTC Uses:

PTC thermistors can be used in place of fuses for circuit protection. As the circuit heats up, resistance increases to prevent overload. They are also used as timing devices in televisions. When the unit is switched on, the degaussing coil is activated to eliminate the magnetic field; the thermistor automatically switches it off when the temperature reaches a certain point.

5.2.3 Negative Temperature Coefficient (NTC):

Many NTC thermistors are made from a pressed disc or cast chip of a semiconductor such as a sintered metal oxide. They work because raising the temperature of a semiconductor increases the number of electrons able to move about and carry charge – it promotes them into the conduction band. The more charge carriers that are available, the more current a material can conduct. This is described in the formula:

I = n.A.v.e

Where I = electric current (amperes)

n = density of charge carriers (count/m^3)

A = cross-sectional area of the material (m^2)

v = velocity of charge carriers (m/s)

e = charge of an electron (e=1.602 \times 10^ {-19} coulomb)

The current is measured using an ammeter. Over large changes in temperature, calibration is necessary. Over small changes in temperature, if the right semiconductor is used, the resistance of the material is linearly proportional to the temperature. There are many different semiconducting thermistors with a range from about 0.01 kelvins to 2,000 kelvins (- 273.14 °C to 1,700 °C)

5.2.4 NTC Uses:

NTC thermistors, on the other hand, are used as current-limiters and temperature monitors in digital thermostats and automobiles.

5.3 Testing of a Thermistor:

This is just a sample and rough test for basic understand about how to test a thermistor. The analog multimeter has to be kept in resistance mode. The multimeter terminals are to be connected to the thermistor leads. We need not concentrate on polarity here. Now, heat the thermistor by moving the heated soldering iron tip to it. Now you can observe that the multimeter reading increases or decreases smoothly depending o whether the thermistor under test is PTC or NTC. Of course, it happens only for a healthy thermistor.

For faulty thermistors, we may observe the following things.

- The change in reading will never be smooth or there will not be any change at all.

- For a short thermistor, the meter reading will be always zero whereas for an open thermistor the meter reading will be always infinity. As I mentioned earlier, it is just a rough test. For perfect confirmation, we need to follow some process of measuring the temperature and corresponding resistance reading and that has to be compared with the thermistor's temperature resistance characteristics provided by the manufacturer.

5.4 Thermistor characteristics:

As just mentioned above, resistance increase with increase in temperature for PTC and resistance decrease with increase in temperature for NTC. The thermistor exhibits a highly non-linear characteristic of resistance vs. temperature.

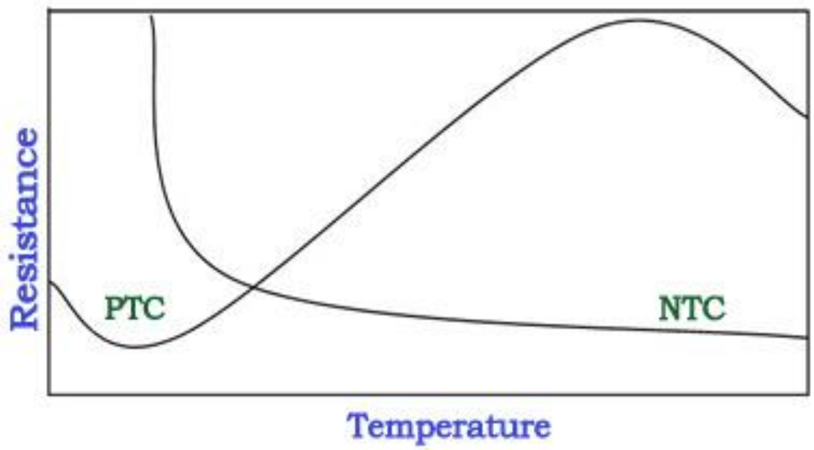


Fig 5.3 characteristic of resistance vs. temperature

PTC thermistors can be used as heating elements in small temperature controlled ovens. NTC thermistors can be used as inrush current limiting devices in power supply circuits. Inrush current refers to maximum, instantaneous input current drawn by an electrical device when first turned on. Thermistors are available in variety of sizes and shapes; smallest in size are the beads with a diameter of 0.15mm to 1.25mm.

There are two fundamental ways to change the temperature of thermistor internally or externally. The temperature of thermistor can be changed externally by changing the temperature of surrounding media and internally by self-heating resulting from a current flowing through the device.

The dependence of the resistance on temperature can be approximated by following equation,

$$R = R_0 e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)} \quad \text{-----------------------------------} \; (1)$$

Where,

R is the resistance of thermistor at the temperature T (in K)

R0 is the resistance at given temperature T0 (in K)

β is the material specific-constant

The material specific-constant of a NTC thermistor is a measure of its resistance at one temperature compared to its resistance at a different temperature. Its value may be calculated by the formula shown below and is expressed in degrees Kelvin (°K).

5.5 Thermistor Applications:

- PTC thermistors were used as timers in the degaussing coil circuit of most CRT displays. A degaussing circuit using a PTC thermistor is simple, reliable (for its simplicity), and inexpensive

. • We can also use PTC thermistors as heater in automotive industry to provide additional heat inside cabin with diesel engine or to heat diesel in cold climatic conditions before engine injection.

- We can use PTC thermistors as current-limiting devices for circuit protection, as replacements for fuses.

- We can also use NTC thermistors to monitor the temperature of an incubator.

- Thermistors are also commonly used in modern digital thermostats and to monitor the temperature of battery packs while charging.

- We regularly use NTC thermistors in automotive applications.

- NTC thermistors are used in the Food Handling and Processing industry, especially for food storage systems and food preparation. Maintaining the correct temperature is critical to prevent food borne illness.

- NTC thermistors are used throughout the Consumer Appliance industry for measuring temperature. Toasters, coffee makers, refrigerators, freezers, hair dryers, etc. all rely on thermistors for proper temperature control.

- We can regularly use the Thermistors in the hot ends of 3D printers; they monitor the heat produced and allow the printer's control circuitry to keep a constant temperature for melting the plastic filament. • NTC thermistors are used as resistance thermometers in low-temperature measurements of the order of 10 K.

- NTC thermistors can be used as inrush-current limiting devices in power supply circuits

5.6 Potentiometer

Fig 5.4 potentiometer

It is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. It is also called as variable resistor or rheostat.

Potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometer operated by a mechanism can be used as position transducers it rarely used as to directly control significant power since the power dissipated in the potentiometer would be comparable to the power in the controlled load. It is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. It is also called as variable resistor or rheostat.

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such as volume controls on audio equipment. Potentiometer operated by a mechanism can be used as position transducers it rarely used as to directly control significant power since the power dissipated In the potentiometer would be comparable to the power in the controlled load .Potentiometers consist of a resistive element, a sliding contact (wiper) that moves along the element, making good electrical contact with one part of it, electrical terminals at each end of the element, a mechanism that moves the wiper from one end to the other, and a housing containing the element and wiper.

See drawing. Many inexpensive potentiometers are constructed with a resistive element (B) formed into an arc of a circle usually a little less than a full turn and a wiper (C) sliding on this element when rotated, making electrical contact. The resistive element can be flat or angled. Each end of the resistive element is connected to a terminal (E, G) on the case. The wiper is connected to a third terminal (F), usually between the other two. On panel potentiometers, the wiper is usually the center terminal of three. For single-turn potentiometers, this wiper typically travels just under one revolution around the contact. The only point of ingress for contamination is the narrow space between the shaft and the housing it rotates in.

Another type is the linear slider potentiometer, which has a wiper which slides along a linear element instead of rotating. Contamination can potentially enter anywhere along the slot the slider moves in, making effective sealing more difficult and compromising long-term reliability. An advantage of the slider potentiometer is that the slider position gives a visual indication of its setting. While the setting of a rotary potentiometer can be seen by the position of a marking on the knob, an array of sliders can give a visual impression of, for example, the effect of a multi-band equalizer (hence the term "graphic equalizer").

The resistive element of inexpensive potentiometers is often made of graphite. Other materials used include resistance wire, carbon particles in plastic, and a ceramic/metal mixture called cermet. Conductive track potentiometers use conductive polymer resistor pastes that contain hard-wearing resins and polymers, solvents, and lubricant, in addition to the carbon that provides the conductive properties.

5.6.1 Application of Potentiometer: -

1) Potentiometers are rarely used to directly control significant amounts of power (more than a watt or so).

2) They are used to adjust the level of analog signals (for example volume controls on audio equipment), and as control inputs for electronic circuits. For example, a light dimmer uses a potentiometer to control the switching of a TRIAC and so indirectly to control the

Chapter6

Battery

Fig 6.1 battery

The nine-volt battery, or 9-volt battery, is a common size of battery that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors.

The nine-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron disulfide, and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium-ion. Mercury-oxide batteries of this format, once common, have not been manufactured in many years due to their mercury content. Designations for this format include NEDA 1604 and IEC 6F22 (for zinc-carbon) or MN1604 6LR61 (for alkaline). The size, regardless of chemistry, is commonly designated PP3 - a designation originally reserved solely for carbon-zinc [1] - or in some countries, E or E-block

Chapter 7

Buzzer

Fig 7.1 buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufacturers and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of cooperative efforts by Japanese manufacturing companies. In 1951, they established the Barium Titanite Application Research Committee, which allowed the companies to be "competitively cooperative" and bring about several piezoelectric innovations and inventions.

Chapter 8

Printed circuit board (PCB)

Fig 8.1 copper clad board

8.1 INTRODUCTION

It is an electronic circuit mounted on a base material. The circuit made of copper foil, is so thin that it need a base a support it. The name printed on the base. The unwanted copper can be etching process.

8.2 Layout work

While drawing layout, the size and shape of components, IC's, pin number, transistor etc. should be kept in mind. The power supply lines should not touch and cross each other. Each line must have minimum thickness. The distance between two holes must be 2.5 mm.

8.3 Etching process

Various solutions can be used for this purpose namely chromic acid, ferric chloride. The most commonly used in industries are $FeCl_3$. It includes tray rocking, tank etching, spray etching. The tray rocking is simple one. In the process put copper clad in FeCl3 solution for 3 to 4 hours. The wanted copper once completely removed then wash clad by alcohol solution to remove the printed color which save the copper behind it. Hence PCB readay for mounting.

8.4 Cleaning of PCB

The cleaning of PCB can be done by using organic solvents. Chemicals mostly used in

- Acetone
- Aromatic hydrocarbon
- Fluorinated hydrocarbon
- Alcohol

8.5 Mounting and soldering

Now the components by drilling holes at proper place on copper clad. It is necessary to components to increase the show of designing. By using proper soldering material and gun solder the components. Solder is an alloy of tin for fusing metals at relatively low temperature. The reason for soldering connection is that it makes a good bound between the joined metal, covering joint completely to the oxidation.

Chapter 9

Circuit diagram and working

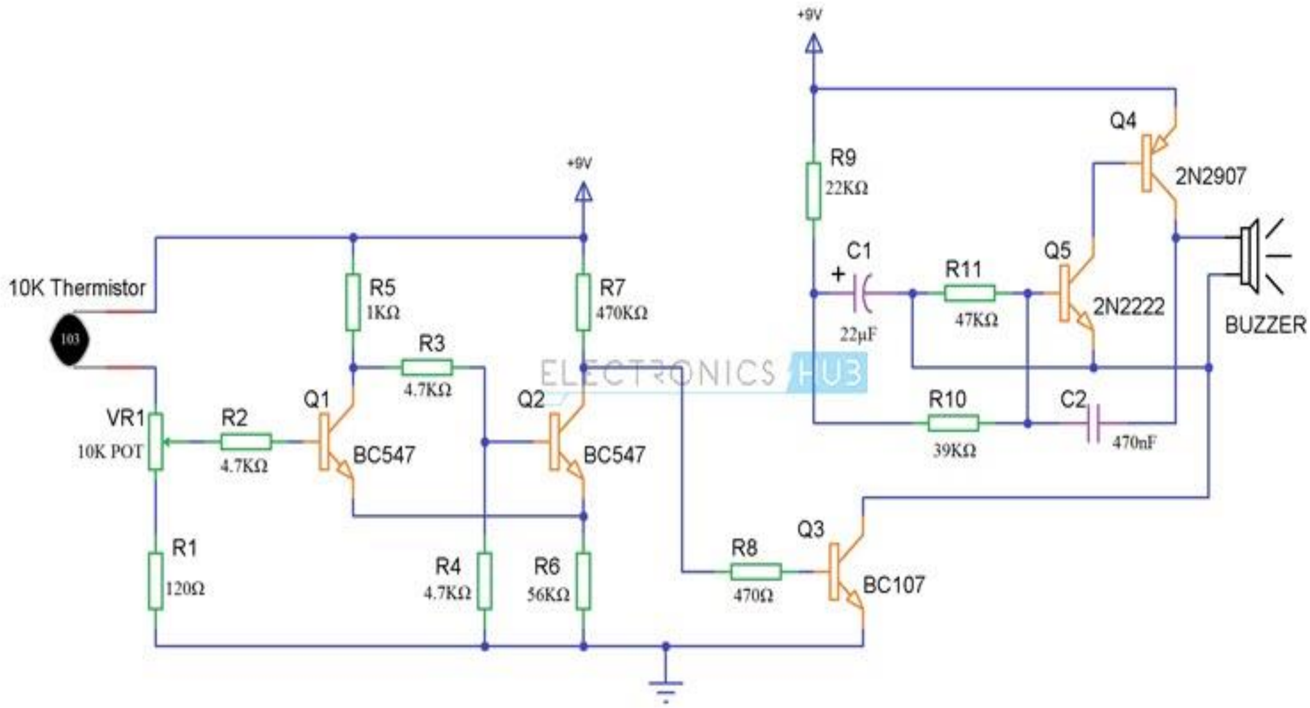

Fig 9.1circuit diagram

9.1 Component list

- 1 x 10K Thermistor
- 2 x BC547 NPN Transistor
- 1 x BC107 NPN Transistor
- 1 x 2N2222 NPN Transistor
- 1 x 2N2907 PNP Transistor
- 3 x 4.7KΩ Resistor (1/4 Watt)
- 1 x 470KΩ Resistor (1/4 Watt)
- 1 x 56KΩ Resistor (1/4 Watt)
- 1 x 47KΩ Resistor (1/4 Watt)
- 1 x 39KΩ Resistor (1/4 Watt)

- 1 x 22KΩ Resistor (1/4 Watt)
- 1 x 1KΩ Resistor (1/4 Watt)
- 1 x 470Ω Resistor (1/4 Watt)
- 1 x 120Ω Resistor (1/4 Watt)
- 1 x 10KΩ Potentiometer
- 1 x 22μF Capacitor (Polarized)
- 1 x 470nF (0.47μF) Ceramic Capacitor
- 1 x Buzzer
- 1 x printed circuit board(PCB)
- 1 x 9V battery

9.2 working

This circuit uses a thermistor to sense the temperature. When it senses that the temperature of the environment is increasing above a given threshold, then it gives a signal. The temperature at which the circuit detects fire can be adjusted by using the potentiometer arrangement at VR1.

When the temperature increases above the set value, the potentiometer arrangement produces a high voltage. This voltage is then given to BC547 transistor in common emitter mode. It is an NPN general purpose transistor. When the base is given a high input, it gets turned on. When the transistor is turned on, its collector voltage is reduced to low as the collector to emitter voltage decreases. The collector output voltage of the first transistor is given to the base as an input to the second BC 547 NPN transistor. This transistor too is in common emitter mode and as the input is low when the temperature threshold is reached, the output at the collector will rise high. In this state, it will turn on the next transistor, i.e. BC107. This transistor will now act as a switch for the siren circuit. This transistor can bear power quite larger than the BC547 and it is also equipped with a heat sink for that purpose.

When the BC107 transistor turns on, it allows current to pass from power supply to ground through collector thereby acting as an electronically controlled switch. When the current is passing, the siren circuit which is assembled as the load to the circuit is turned ON. Then you can hear the siren sound through the buzzer. The capacitors used in the circuit are the main components in producing the siren effect. The principle involved in generating the siren effect is to make an oscillator with an envelope which periodically increases and decreases so as to generate that effect.

9.3 Application

1) It is a low cost and simple project.

2) It is useful for home, industry, hospitals, schools, colleges.

Chapter 10

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