A PROJECT REPORT ON

ECO FRIENDLY RAILWAY STATION

Project Report submitted in partial fulfillment of the degree of

BACHELOR OF ENGINEERING

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ABSTRACT

One thing is certain; the railways are playing a more and more important role in the transfer of people and goods. All over the world measures are taken to improve railway traffic in respect to safety and flexibility. One step towards this goal is the implementation of interlocking. Misinterpretations of signal aspects by the locomotive driver and false reactions due to bad visibility because of rain, snow, fog or the smoke in the tunnel and the incapacity of the driver can lead to endanger human life and goods. Automatic Warning System, therefore, can be considered as an essential link within the chain of safety provision. And as Indian Railways has 7,500 stations which consume so much fossil fuel and electricity. So to reduce this consumption of fossil fuel and electricity we had taken one step towards it and implemented a small model. The Eco-Friendly Railway project consists of solar panel, piezoelectric plate, windmill, rotor and auxiliary warning system. In Eco-Friendly Railway project solar panel, windmill and rotor stores power in battery and use it later when it require.

In the project,

- PIEZO ELECTRIC ENERGY
- SOLAR
- WIND
- ROTOR
- AUXILIARY WARNING SYSTEM

The Eco-Friendly Railway project consist of four application which produce electricity by natural way, and a safety purpose application know as auxiliary warning system.

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CHAPTER 1

INTRODUCTION

*The Eco-Fr*iendly Railway project consist of three application which produce electricity by natural way and a safety purpose application know as auxiliary warning system.

1.1 PIEZOELECTRIC ENERGY HARVESTING.

The exponential growth of the "alternative energy" industry in the last few years shows great promise in regards to the energy independence of the United States. For awhile now, the energy responsible for our success has been provided by fossil fuels; petroleum, natural gas, coal, etc. But we all realize that these are finite resources and the energy source that will power our future success lies elsewhere. The future of sustainable, clean power lies in other, more abstract opportunities. Wind, of course, is a viable option. Solar, indeed, will also play a part. Tidal Wave is yet another viable method. Geothermal is particularly appealing due to its simplicity: basically stick a pipe in the ground, and you're done. Well, there's more to it but you get my drift. My favorite that I've been reading about lately is called piezoelectric energy harvesting.The Voltage of Piezoelectric Plate 6V and the Current rating 2.5mA.

Figure 1.1 Piezoelectric Plate.

1.1.1 SLIDEWALK POWERGENERATOR

So generally Piezoelectric Energy Harvesting is based upon the piezoelectric effect. Yeah, I know. Real ground breaking stuff. The essence of the piezoelectric effect works as follows: by applying a mechanical stress to a crystal, one can generate a voltage or potential energy difference, and thus a current. Also by applying a current to a piezoelectric one can stress or strain the material. The mechanical stress can be supplied by any source. But with so many people walking around from place to place, why not harness that kinetic energy to power stuff, right.

Figure 1.2:Light from Piezoelectric Plate.

1.1.2 HOW IS THIS ENERGY HARNESSED

So with the basic idea layed out, how can this phenomenon be but to use in generating electricity. A lot of ways. One highly viable option is to lay piezoelectric crystal arrays underneath sidewalks, stairwells, and pretty much any other high traffic area to power street lights or whatever else you care to plug in. The armed forces toyed with the idea of putting piezoelectric materials in soldier‟s boots to power radios and other portable electronic gear. This turned out to be not feasible with current technology at the present time due to the extra weight and discomfort of the setup, but it may be possible later on. Several nightclubs, mostly in Europe have already begun to power their strobes and stereos using the force of hundreds of people pounding on piezoelectric lined dance floors. Several gyms, notable in Portland and a few other places are powered by a combination of piezoelectric set ups and generators set up on stationary bikes. We're really just looking at the tip of the iceberg when it comes to the uses of human kinetic energy of people in motion to create energy.

1.2 SOLAR POWER

1.2.1 HOW SOLAR PANELS WORK

There are two main types of solar panels 1) solar electric panels and 2) solar water heating panels. We'll discuss water heating later. Right now, let's talk about solar photovoltaic (PV) panels, which provide electricity. The solar panel used is of 6V,5W.

1.2.2 HOW PV PANELS WORK

PV panels collect energy from the sun and convert it into electricity. PV systems convert sunlight directly into electricity. "Photo" refers to light and "voltaic" to electricity. A PV cell is made of a semiconductor material, usually crystalline silicon, which absorbs sunlight. You‟ve seen PV cells at work in simple mechanisms like watches and calculators. You‟ve probably even seen them for signs on the road. More complex PV systems produce solar electricity for houses and the utility grid. The utility grid is the power source available to your local electricity provider. PV cells are typically combined into modules, or panels, containing about 40 cells. Roughly ten modules constitute a PV array, or grouping of panels. Each Solar cell having a 5Volt.

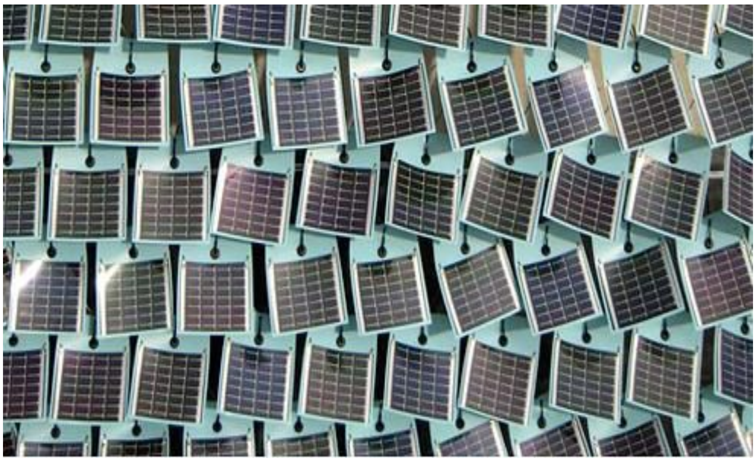


Figure 1.3:Solar Panels

1.2.3 DETALIS ON HOW PV PANELS WORK

Most PV panels contain a top protective layer, two specially treated layers of silicon with collecting circuitry attached to the top layer, and a polymer backing layer. The top layer of silicon is treated to make it electrically negative; the back layer is treated it make it electrically positive. When sunlight knocks electrons loose from the silicon, electrons move up from the bottom layer of silicon and crowd the electrons in the top layer. The electrons freed from the top layer are collected by electrical contacts on the surface of the top layer and routed through an external circuit, thus providing power to the electrical system attached to the panels. New technology, which we‟ll get to in a later section, uses different, less expensive materials than silicon in PV panels to capture sunlight more afforable.

1.3 ROTOR

All motors require two magnetic fields, one produced by the stationary part of the motor (the stator, or field), and one by the rotating part (the rotor, or armature). These are produced either by a winding of coils carrying a current, or by permanent magnets. If the field is a coil of wire, this may be connected in a variety of ways, which produces different motor characteristics.

The basic law of a motor, the reason why they rotate, is governed by Fleming"s left hand rule (see figure below). This tells you the direction of the force on a wire that is carrying current when it is in a magnetic field.

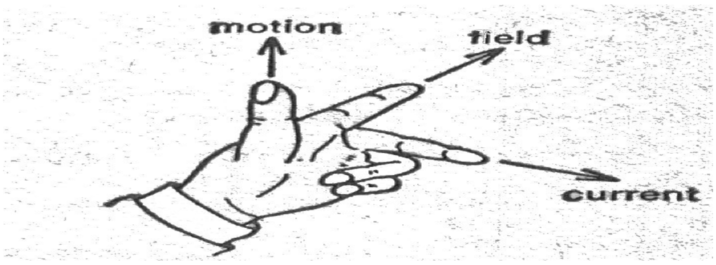


Figure 1.4: Left Hand Motor Rule

The next diagram shows the force acting on a wire carrying current,obeying the left hand rule.

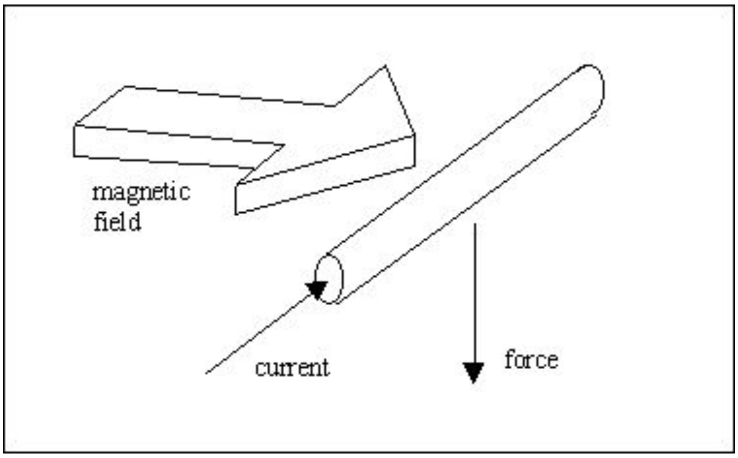


Figure 1.5: Force Acting On A Wire

If we now bend the wire round in a loop, and place it in a magnetic field caused by two permanent magnets, we have the situation shown in the diagram below. Here, both sides of the wire loop will have a force on them, trying to make the wire loop rotate. The current is applied to the loop through the commutator, which is shown as two pieces of metal formed into a ring in the figure. Current is applied to the commutator by stationary graphite blocks, called brushes, which rub against the commutator ring

If we now bend the wire round in a loop, and place it in a magnetic field caused by two permanent magnets, we have the situation shown in the diagram below. Here, both sides of the wire loop will have a force on them, trying to make the wire loop rotate. The current is applied to the loop through the commutator, which is shown as two pieces of metal formed into a ring in the figure. Current is applied to the commutator by stationary graphite blocks, called brushes, which rub against the commutator ring.

The loop will continue to rotate anticlockwise (as we see it in the figure) until it is vertical. At this point, the stationary brushes won't be applying current around the loop anymore because they will be contacting the gap between the commutator segments, but the inertia of the loop keeps it going a little more, until the DC supply reconnects to the commutator segments, and the current then goes around the loop in the opposite direction. The force though is still in the same direction, and the loop continues to rotate.

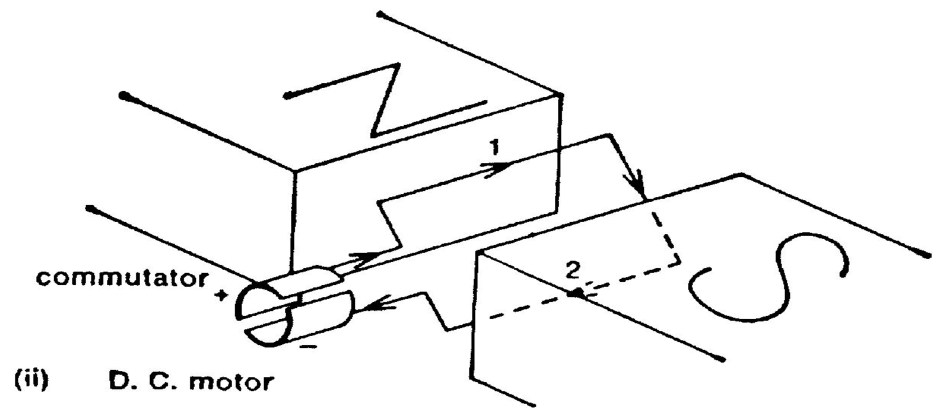


Figure 1.6:DC Motor

This is how DC motors work. In a real motor, there are many wire loops (windings*)* all at varying angles around a solid iron core. Each loop has its own pair of commutator segments. This block of core and wire loops is called the rotor because it rotates, or the armature.

The fixed magnets in the diagram above generating the field may be replaced by electromagnets which are generally more powerful. The electromagnets are supplied by the same power supply as the armature winding, either in series (series connected) or in parallel (shunt connected) as shown in the diagram below.

If permanent magnets are used, the motor is said to be a permanent magnet (PM) motor. DC motors can also have permanent magnets in the armature, and electromagnets for the stator coils.

In this case, the stator windings must be switched in some way to make the permanent magnets in the rotor follow them to cause rotation. This connection is less common for small motors.

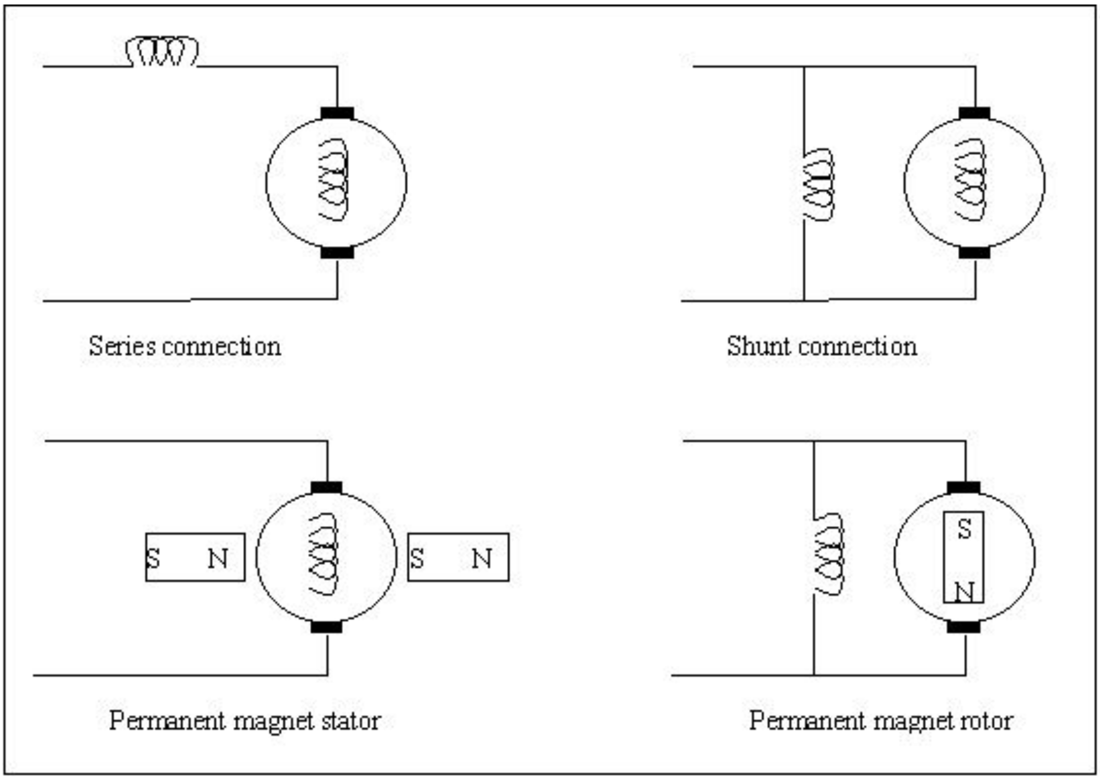


figure1.7: Series And Parallel Connection.

There may be more than just the two fixed magnets, called poles. In some motors there may be four poles (imagine one more coming from above and one more from below in the figure). There will always be an even number of poles, since there is an N pole for every S pole, and in the equations governing the motor, the number of poles is often quoted as p, the number of pole pairs. These magnets are called the stator because they are stationary, and the electromagnet coils are called the field windings because they generate the magnetic field.

The supply is connected to the commutator segments through graphite brushes. These are held in little sockets with a spring behind them, so the brush is pushed onto the segments. This guarantees a good electrical connection (although there will be a fraction of an Ohm resistance across them). Eventually, these brushes wear down completely. If you get the motors from a scrap yard, the brushes may need replacing. New brushes should be available from automotive spares shops.

A four pole motor is shown in the diagram below. This shows how the magnetic field is generated by the poles and flows through the rotor:

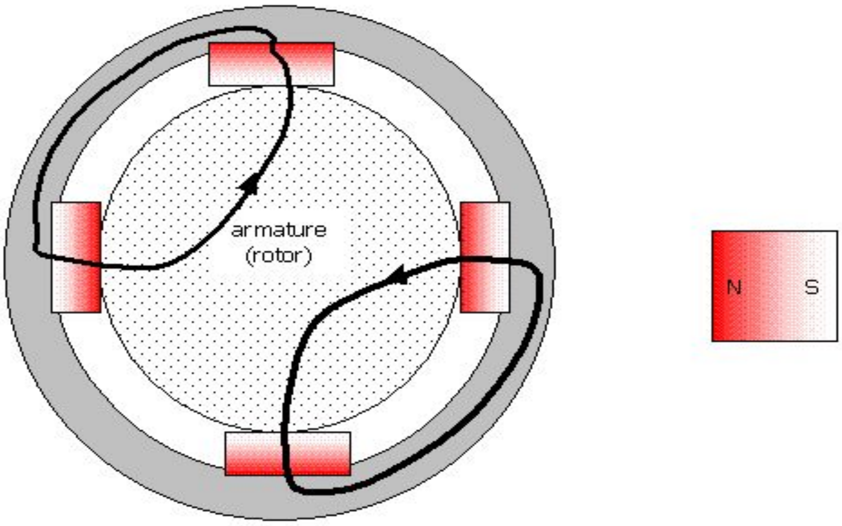


Figure 1.8:A Four Pole Motor

1.4 WIND

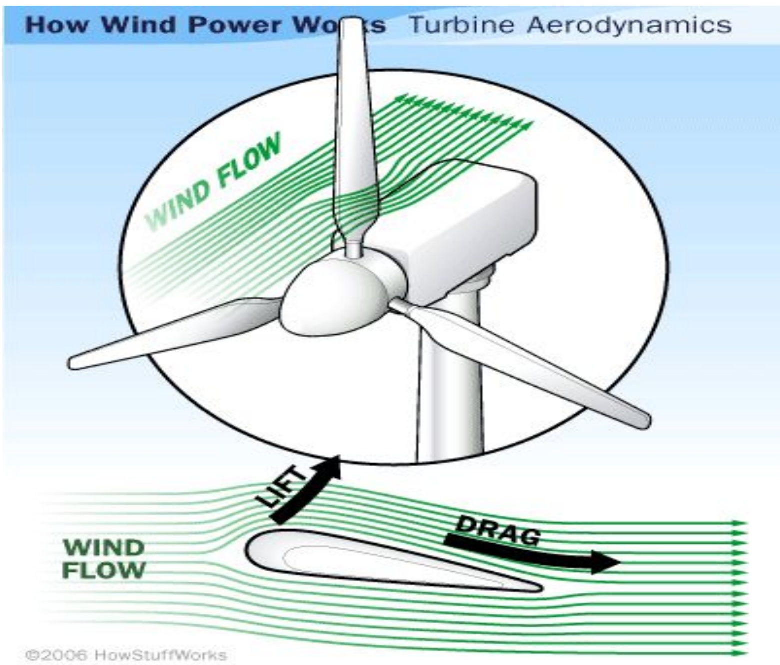


Figure 1.9: A Wind Rotor.

Large wind farms consist of hundreds of Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships, individual wind turbines which are connected to the electric power transmission network. For new constructions, onshore wind is an inexpensive source of electricity, competitive with or in many places cheaper than fossil fuel plants. India has the fifth largest installed wind power capacity in the world. In 2010, wind power accounted for 6% of India's total installed power capacity, and 1.6% of the country's power output.Dynamo rating having a 6V and rotating speed is 500rpm.

CHAPTER 2

2.1 BLOCK DIAGRAM

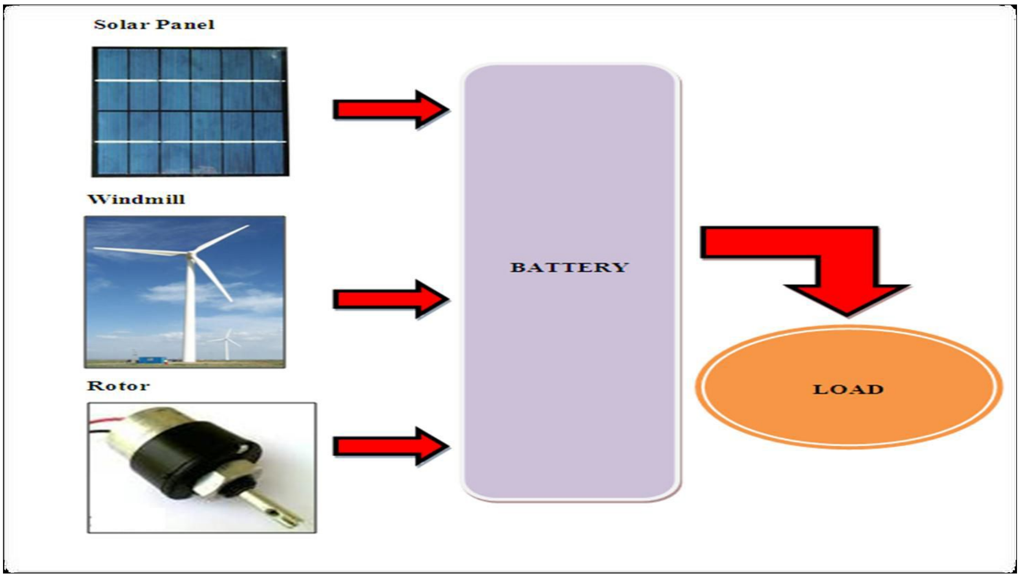


Figure 2.1: Eco Friendly Railway System.

The above given diagram is the block diagram showing the solar panel windmill and piezoplate.The energy generated by these three source is connected to the maintenance free lead acid battery.Dependind upon the load this energy is given to the load.

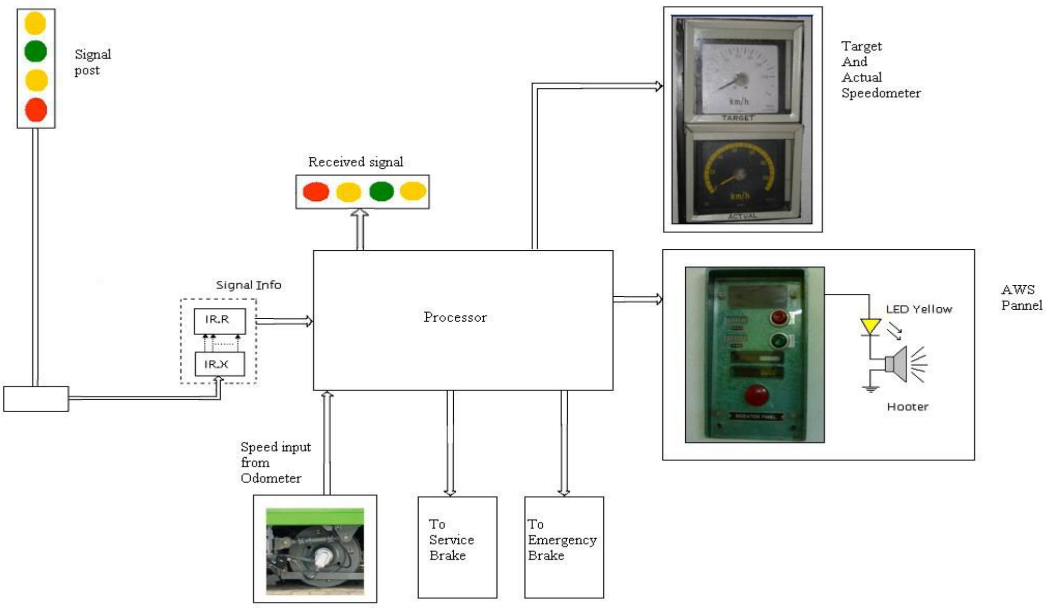


Figure 2.2: AWS Section.

2.2 CIRCUIT DIAGRAM

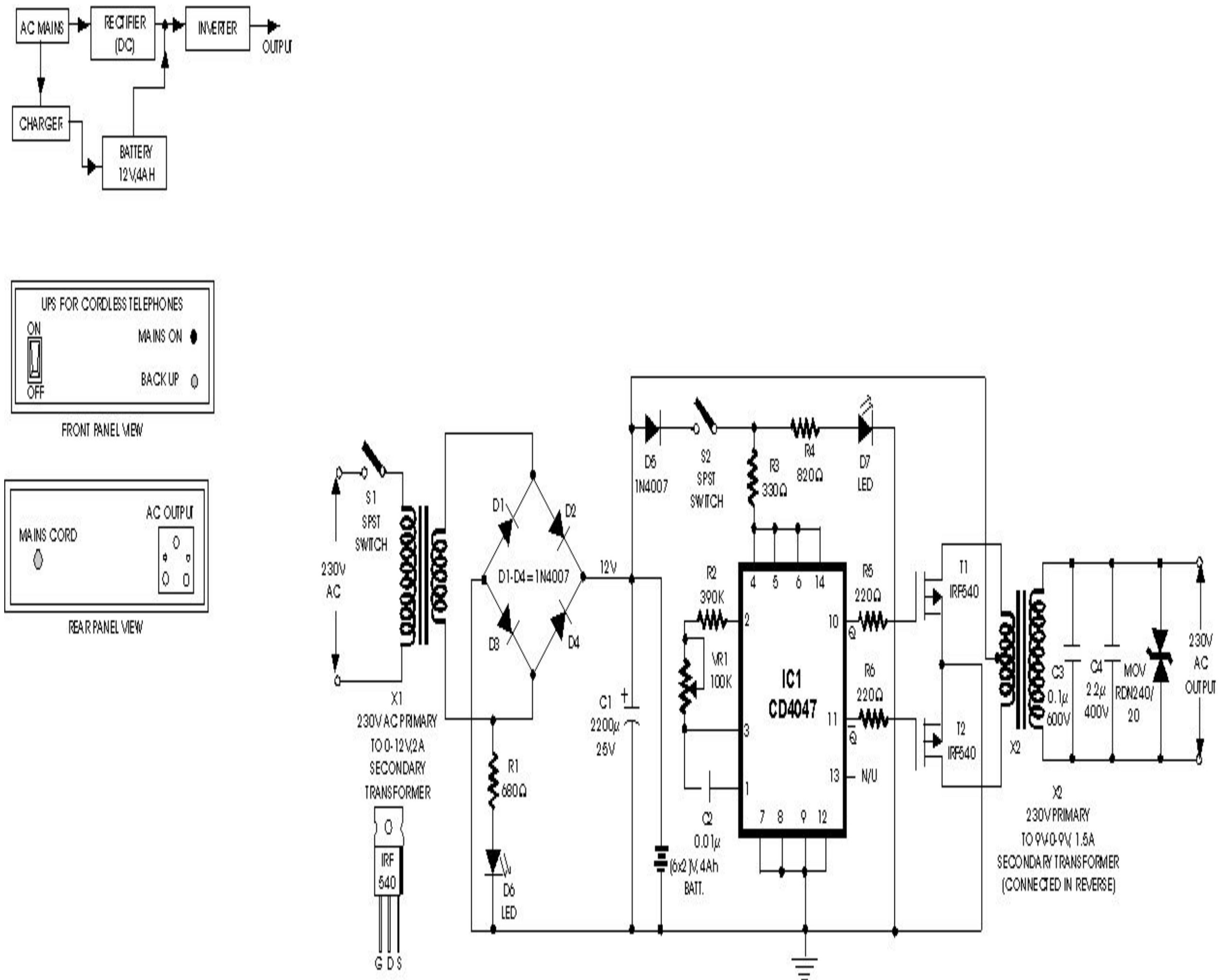


Figure 2.3: Circiut Diagram

2.2.1 DIODES

Diodes are components that allow current to flow in only one direction. They have a positive side (leg) and a negative side. When the voltage on the positive leg is higher than on the negative leg then current flows through the diode (the resistance is very low). When the voltage is lower on the positive leg than on the negative leg then the current does not flow (the resistance is very high). The negative leg of a diode is the one with the line closest to it. It is called the cathode. The postive end is called the anode.

2.2.2 LED

Light Emitting Diodes are great for projects because they provide visual entertainment. LEDs use a special material which emits light when current flows through it. Unlike light bulbs, LEDs never burn out unless their current limit is passed. A current of 0.02 Amps (20 mA) to 0.04 Amps (40 mA) is a good range for LEDs. They have a positive leg and a negative leg just like regular diodes. To find the positive side of an LED, look for a line in the metal inside the LED. It may be difficult to see the line. This line is closest to the positive side of the LED. Another way of finding the positive side is to find a flat spot on the edge of the LED. This flat spot is on the negative side.

When current is flowing through an LED the voltage on the positive leg is about 1.4 volts higher than the voltage on the negative side. Remember that there is no resistance to limit the current so a resistor must be used in series with the LED to avoid destroying it.

2.2.3 RESISTORS

Resistors are components that have a predetermined resistance. Resistance determines how much current will flow through a component. Resistors are used to control voltages and currents. A very high resistance allows very little current to flow. Air has very high resistance. Current almost never flows through air. (Sparks and lightning are brief displays of current flow through air. The light is created as the current burns parts of the air.) A low resistance allows a large amount of current to flow. Metals have very low resistance. That is why wires are made of metal. They allow current to flow from one point to another point without any resistance. Wires are usually covered with rubber or plastic. This keeps the wires from coming in contact with other wires and creating short circuits. High voltage power lines are covered with thick layers of plastic to make them safe, but they become very dangerous when the line breaks and the wire is exposed and is no longer separated from other things by insulation.

Resistance is given in units of ohms. (Ohms are named after Mho Ohms who played with electricity as a young boy in Germany.) Common resistor values are from 100 ohms to 100,000 ohms. Each resistor is marked with colored stripes to indicate it’s resistance. To learn how to calculate the value of a resistor by looking at the stripes on the resistor, go to Resistor Values which includes more information about resistors.

2.2.4 VARIABLE RESISTORS

Variable resistors are also common components. They have a dial or a knob that allows you to change the resistance. This is very useful for many situations. Volume controls are variable resistors. When you change the volume You are changing the resistance which changes the current. Resistance is given in units of ohms.Making the resistance higher will let less current flow so the volume goes down. Making the resistance lower will let more current flow so the volume goes up. The value of a variable resistor is given as it's highest resistance value. For example, a 500 ohm variable resistor can have a resistance of anywhere between 0 ohms and 500 ohms. A variable resistor may also be called a potentiometer (pot for short).

2.2.5 SWITCHES

Switches are devices that create a short circuit or an open circuit depending on the position of the switch. For a light switch, ON means short circuit (current flows through the switch, lights light up and people dance.) When the switch is OFF, that means there is an open circuit (no current flows, lights go out and people settle down. This effect on people is used by some teachers to gain control of loud classes.)

When the switch is ON it looks and acts like a wire. When the switch is OFF there is no connection.

2.2.6 USING A BREAD BOARD

To build our projects, we will use a breadboard like the one shown below.

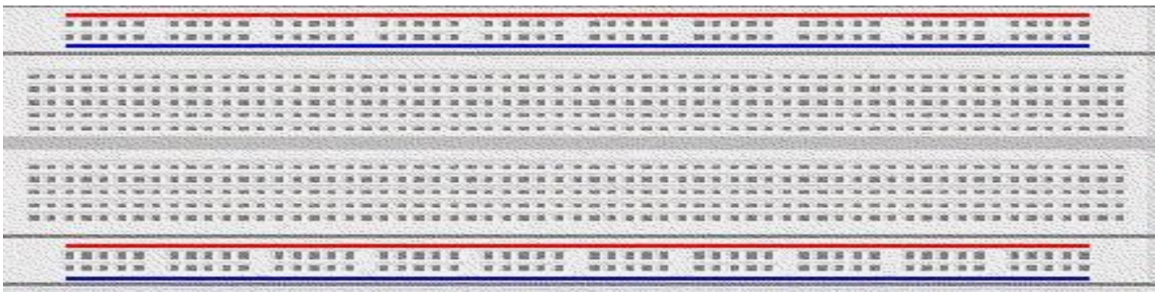


Figure 2.4: Breadboard

The bread board has many strips of metal (copper usually) which run underneath the board. The metal strips are laid out as shown below.

These strips connect the holes on the top of the board. This makes it easy to connect components together to build circuits. To use the bread board, the legs of components are placed in the holes. The holes are made so that they will hold the component in place. Each hole is connected to one of the metal strips running underneath the hole.

Each strip forms a node. A node is a point in a circuit where two components are connected. Connections between different components are formed by putting their legs in a common node. On the bread board, a node is the row of holes that are connected by the strip of metal underneath.INDEX.

The long top and bottom row of holes are usually used for power supply connections. The row with the blue strip beside it is used for the negative voltage (usually ground) and the row with the red strip beside it is used for the positive voltage.

The circuit is built by placing components and connecting them together with jumper wires. Then when a path is formed from the positive supply node to the negative supply node through wires and components, we can turn on the power and current flows through the path and the circuit comes alive.A series connection of 2 resistors on a breadboard looks like the picture below on the left and a parallel connection of 2 resistors looks like the picture below on the right.

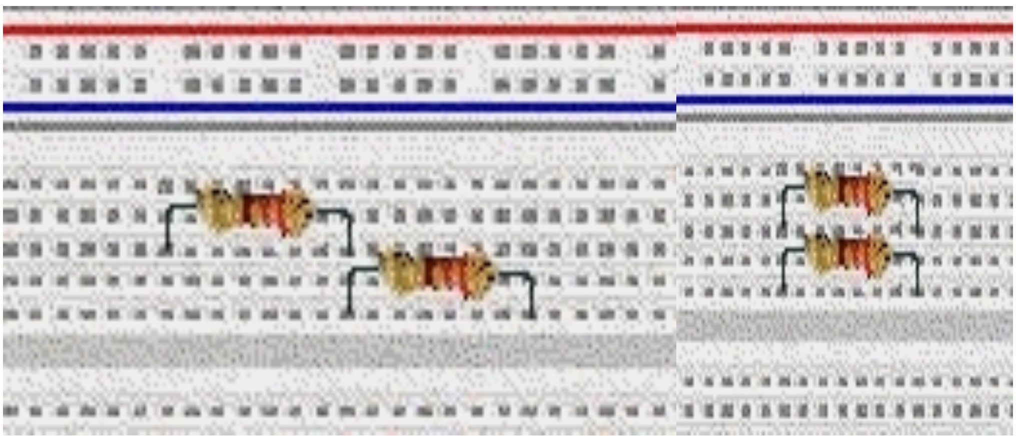


Figure 2.5: Coloured Breadboard

For chips with many legs (ICs), place them in the middle of the board (across the middle dividing line) so that half of the legs are on one side of the middle line and half are on the other side.

A completed circuit might look like the following. This circuit uses two small breadboards.

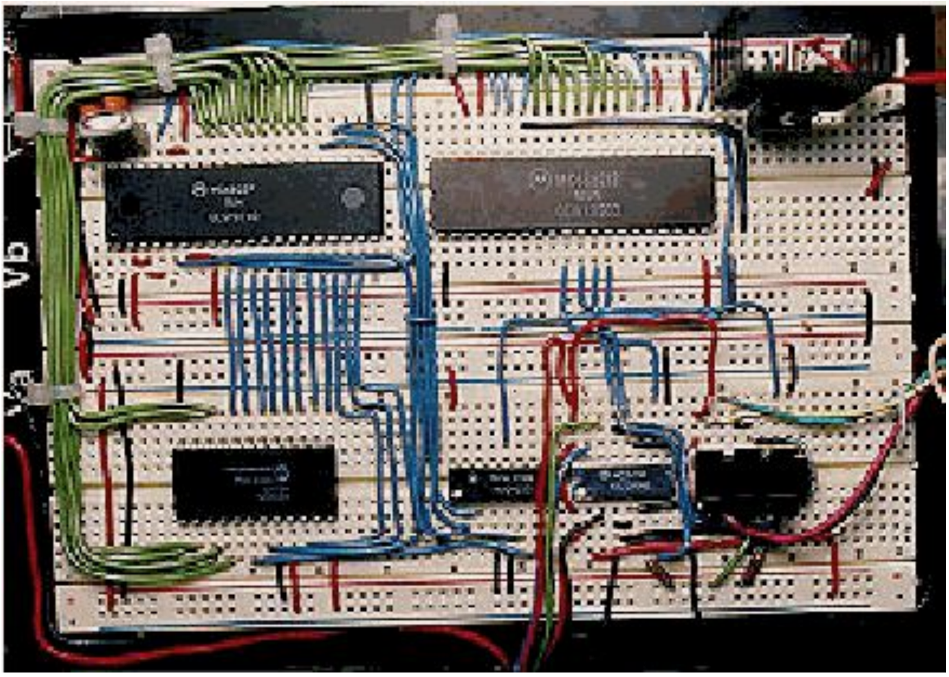


Figure 2.6:*Mounting on breadboard*

2.2.7 TRANSISTORS AND LED

Now we know enough that we can start to build circuits. But first we will look a little closer at a component that was introduced in Section 1.2.

2.2.8 THE LED

An LED is the device shown above. Besides red, they can also be yellow, green and blue. The letters LED stand for Light Emitting Diode. If you are unfamiliar with diodes, take a moment to review the components in Basic Components, Section 1.2. The important thing to remember about diodes (including LEDs) is that current can only flow in one direction.

To make an LED work, you need a voltage supply and a resistor. If you try to use an LED without a resistor, you will probably burn out the LED. The LED has very little resistance so large amounts of current will try to flow through it unless you limit the current with a resistor. If you try to use an LED without a power supply, you will be highly disappointed.So first of all we will make our LED light up by setting up the circuit below.

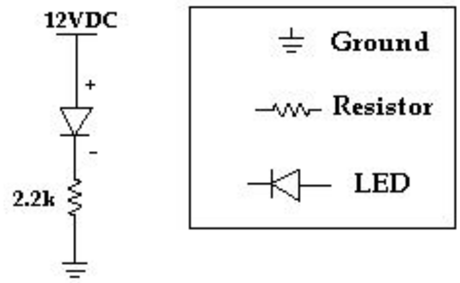


Figure 2.7: Symbols

Step 1.) First you have to find the positive leg of the LED. The easiest way to do this is to look for the leg that is longer.

Step 2.) Once you know which side is positive, put the LED on your breadboard so the positive leg is in one row and the negative leg is in another row. (In the picture below the rows are vertical.)

Step 3.) Place one leg of a 2.2k ohm resistor (does not matter which leg) in the same row as the negative leg of the LED. Then place the other leg of the resistor in an empty row.

Step 4.) Unplug the power supply adapter from the power supply. Next, put the ground (black wire) end of the power supply adapter in the sideways row with the blue stripe beside it. Then put the positive (red wire) end of the power supply adapter in the sideways row with the red stripe beside it.

Step 5.) Use a short jumper wire (use red since it will be connected to the positive voltage) to go from the positive power row (the one with the red stripe beside it) to the positive leg of the LED (not in the same hole, but in the same row). Use another short jumper wire (use black) to go from the ground row to the resistor (the leg that is not connected to the LED). Refer to the picture below if necessary.

The breadboard should look like the picture shown below.

Now plug the power supply into the wall and then plug the other end into the power supply adapter and the LED should light up. Current is flowing from the positive leg of the LED through the LED to the negative leg. Try turning the LED around. It should not light up. No current can flow from the negative leg of the LED to the positive leg.

People often think that the resistor must come first in the path from positive to negative, to limit the amount of current flowing through the LED. But, the current is limited by the resistor no matter where the resistor is. Even when you first turn on the power, the current will be limited to a certain amount, and can be found using ohm's law.

2.2.9 REVISITING OHMS LAW

Ohm's Law can be used with resistors to find the current flowing through a circuit. The law is I = VD/R (where I = current, VD = voltage across resistor, and R = resistance). For the circuit above we can only use Ohm's law for the resistor so we must use the fact that when the LED is on, there is a 1.4 voltage drop across it. This means that if the positive leg is connected to 12 volts, the negative leg will be at 10.6 volts. Now we know the voltage on both sides of the resistor and can use Ohm's law to calculate the current. The current is (10.6 - 0) / 2200 = 0.0048 Amperes = 4.8 mA

This is the current flowing through the path from 12V to GND. This means that 4.8 mA is flowing through the LED and the resistor. If we want to change the current flowing through the LED (changing the brightness) we can change the resistor. A smaller resistor will let more current flow and a larger resistor will let less current flow. Be careful when using smaller resistors because they will get hot.

Next, we want to be able to turn the LED on and off without changing the circuit. To do this we will learn to use another electronic component, the transistor.

2.2.10 THE TRANSISTORS

Transistors are basic components in all of today's electronics. They are just simple switches that we can use to turn things on and off. Even though they are simple, they are the most important electrical component. For example, transistors are almost the only components used to build a Pentium processor. A single Pentium chip has about 3.5 million transistors. The ones in the Pentium are smaller than the ones we will use but they work the same way.

Transistors that we will use in projects look like this:

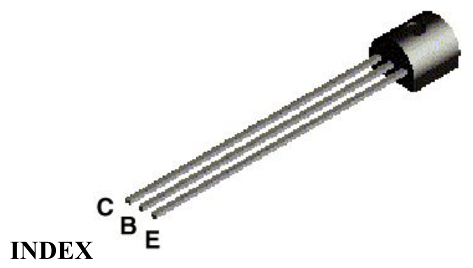


figure 2.8: Transistor

The transistor has three legs, the Collector (C), Base (B), and Emitter (E). Sometimes they are labeled on the flat side of the transistor. Transistors always have one round side and one flat side. If the round side is facing you, the Collector leg is on the left, the Base leg is in the middle, and the Emitter leg is on the right.

The following symbol is used in circuit drawings (schematics) to represent a transistor.

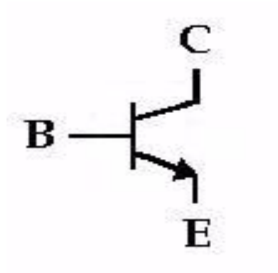


figure 2.9: Configuration

BASIC CIRCUIT

The Base (B) is the On/Off switch for the transistor. If a current is flowing to the Base, there will be a path from the Collector (C) to the Emitter (E) where current can flow (The Switch is On.) If there is no current flowing to the Base, then no current can flow from the Collector to the Emitter. (The Switch is Off.)

Below is the basic circuit we will use for all of our transistors.

Input	Switch
12V	ON
0V	OFF

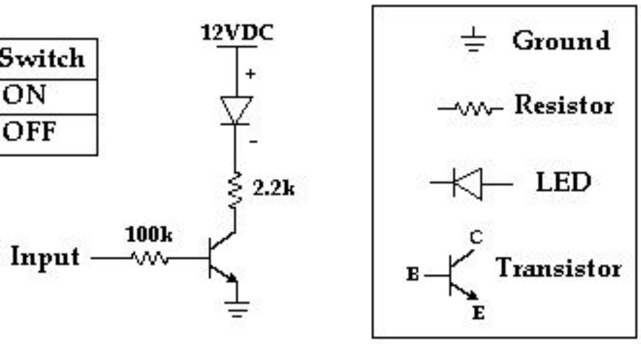


Figure 2.10: Input To Transistor

To build this circuit we only need to add the transistor and another resistor to the circuit we built above for the LED. Unplug the power supply from the power supply adapter before making any changes on the breadboard. To put the transistor in the breadboard, seperate the legs slightly and place it on the breadboard so each leg is in a different row. The collector leg should be in the same row as the leg of the resistor that is connected to ground (with the black jumper wire). Next move the jumper wire going from ground to the2.2k ohm resistor to the Emitter of the transistor.Next place one leg of the 100k ohm resistor in the row with the Base of the transistor and the other leg in an empty row and your breadboard should look like the picture below.

Now put one end of a yellow jumper wire in the positive row (beside the red line) and the other end in the row with the leg of the 100k ohm resistor (the end not connected to the Base). Reconnect the power supply and the transistor will come on and the LED will light up. Now move the one end of the yellow jumper wire from the positive row to the ground row (beside the blue line). As soon as you remove the yellow jumper wire from the positive power supply, there is no current flowing to the base. This makes the transistor turn off and current can not flow through the LED. As we will see later, there is very little current flowing through the 100k resistor. This is very important because it means we can control a large current in one part of the circuit (the current flowing through the LED) with only a small current from the input.

2.2.11 BACK TO OHMS LAW

We want to use Ohm's law to find the current in the path from the Input to the Base of the transistor and the current flowing through the LED. To do this we need to use two basic facts about the transistor.

1.) If the transistor is on, then the Base voltage is 0.6 volts higher than the Emitter voltage.

2.) If the transistor is on, the Collector voltage is 0.2 volts higher than the Emitter voltage.

So when the 100k resistor is connected to 1power supply, there is no current flowing to the base. This makes the 2VDC, the circuit will look like this:

So the current flowing through the 100k resistor is (12 - 0.6) / 100000 = 0.000114 A = 0.114 mA.

The current flowing through the 2.2k ohm resistor is (10.6 - 0.2) / 2200 = 0.0047 A = 4.7 mA.

If we want more current flowing through the LED, we can use a smaller resistor (instead of 2200) and we will get more current through the LED without changing the amount of current that comes from the Input line. This means we can control things that use a lot of power (like electric motors) with cheap, low power circuits. Soon you will learn how to use a microcontroller (a simple computer). Even though the microcontroller can not supply enough current to turn lights and motors on and off, the microcontroller can turn transistors on and off and the transistors can control lots of current for lights and motors.

CHAPTER 3

3.1 INTRODUCTION TO DIGITAL DEVICES-THE INVERTER

In digital devices there are only two values, usually referred to as 0 and 1. 1 means there is a voltage (usually 5 volts) and 0 means the voltage is 0 volts.

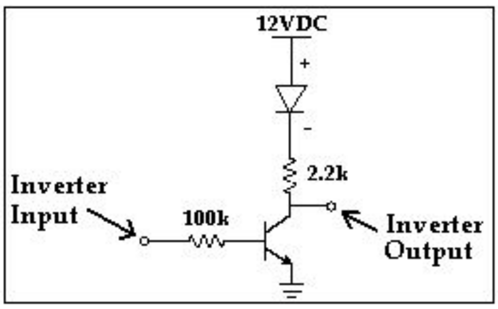
An inverter (also called a NOT gate) is a basic digital device found in all modern electronics. So for an inverter, as the name suggests, it's output is the opposite of the input (Output is NOT the Input). If the input is 0 then the output is 1 and if the input is 1 then the output is 0. We can summarize the operation of this device in a table

Input	Output
1	0
0	1

Figure 3.1: Truth table

To help us practice with transistors we will build an inverter. Actually we have already built an inverter. The transistor circuit we just built is an inverter circuit. To help see the inverter working, we will build a circuit with two inverters. The circuit we will use is shown below.

First Inverter (already built) **Second Inverter**



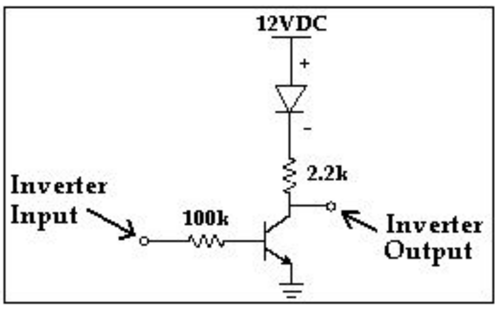


Figure 3.2: Type Of Inverter

To build the circuit, use the transistor circuit we just built as the first inverter. The first inverter input is the end of the 100k ohm resistor connected to the yellow jumper wire. Build another circuit identical to the first (the basic transistor circuit from Section 1.6.1) except leave out the yellow jumper wire connected to the 100k ohm resistor (the inverter input). This circuit is the second inverter.

Connect the output of the first inverter to the input of the second inverter by putting one end of a jumper wire in the same row of holes as the 2.2k ohm resistor and the Collector of the transistor (the output of the first inverter) and putting the other end in the same row of holes as the leg of the 100k ohm resistor of the second inverter (the input to the second inverter).

Here is how to check if you built it correctly. Connect the first inverter input (the yellow jumper wire) to 12V (the positive row). The LED in the first inverter should come on and the LED in the second inverter should stay off. Then connect the first inverter input to 0V (the ground row). (You are turning off the switch of the first inverter.) The first LED should go off and the second LED should come on. If this does not happen, check to make sure no metal parts are touching. Check to make sure all the parts are connected correctly.

The input can either be connected to 12V or 0V. When the Inverter Input is 12V, the transistor in the first inverter will turn on and the LED will come on and the Inverter Output voltage will be 0.2V. The first Inverter Output is connected to the input of the second inverter. The 0.2V at the input of the second inverter is small enough that the second transistor is turned off. The circuit voltages are shown in the diagram below.

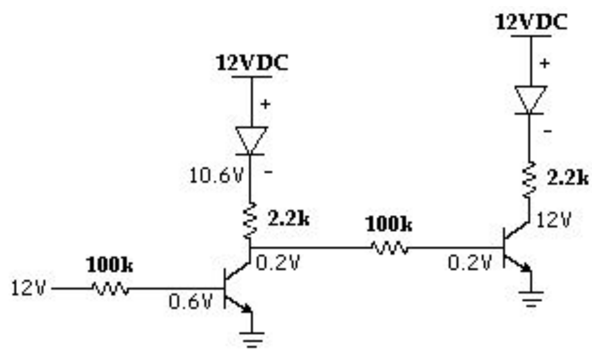


Figure 3.3: Two Transistor Connected Each Other

When the Inverter Input is connected to 0V, the transistor in the first inverter is turned off and the LED will get very dim. There is a small amount of current still flowing through the LED to the second inverter. The voltage at the first Inverter Output will go up, forcing the second inverter transistor to come on. When the second inverter transistor comes on, the second inverter LED will come on. To find the voltage at the output of the first inverter (10.4V), use Ohm's law. There is no current flowing through the transistor in the first inverter so the path of the current is through the first LED, through the 2.2k resistor, through the 100k resistor, through the second transistor to ground. The voltage at the negative side of the first LED is fixed at 10.6V by the LED. The voltage at the second transistor base is fixed at 0.6V by the transistor. Then given those two voltages, you should be able to find the voltage at the point in the middle (10.4V) using Ohm's law. (Hint: First find the current and then work through Form 1 of ohm's law to find the voltage at the point between the 2.2k resistor and the 100k resistor.)

Switch the input back and forth from 0V to 12V and you can see that when the first stage is on, the second stage is off. This demonstrates the inverting action of the Inverter.

3.2 OSCILLATORS,PULSE GENERATOR,CLOCKS...CAPACITORS AND THE 555 TIMER IC

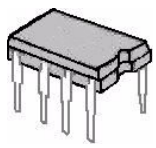


Figure 3.4: Timer IC555

3.2.1 INTRODUCTION

As electronic designs get bigger, it becomes difficult to build the complete circuit. So we will use prebuilt circuits that come in packages like the one shown above. This prebuilt circuit is called an IC. IC stands for Integrated Circuit. An IC has many transistors inside it that are connected together to form a circuit. Metal pins are connected to the circuit and the circuit is stuck into a piece of plastic or ceramic so that the metal pins are sticking out of the side. These pins allow you to connect other devices to the circuit inside. We can buy simple ICs that have several inverter circuits like the one we built in the LED and Transistor section or we can buy complex ICs like a Pentium Processor.

3.2.2 THE PULSE-MORE THAN JUST AN ON/OFF SWITCH

So far the circuits we have built have been stable, meaning that the output voltage stays the same. If you change the input voltage, the output voltage changes and once it changes it will stay at the same voltage level. The 555 integrated circuit (IC) is designed so that when the input changes, the output goes from 0 volts to Vcc (where Vcc is the voltage of the power supply). Then the output stays at Vcc for a certain length of time and then it goes back to 0 volts. This is a pulse. A graph of the output voltage is shown below.

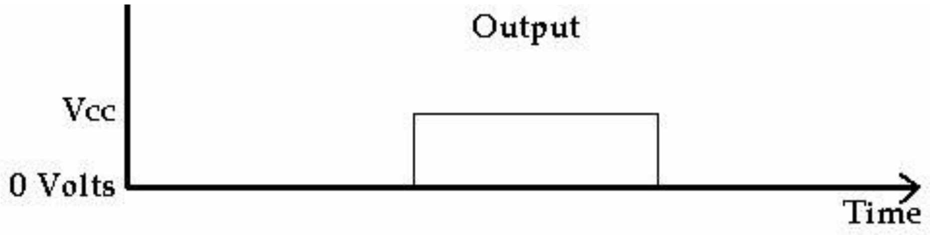


Figure 3.5: Output Voltage

3.2.3 THE OSCILLATOR(A CLOCK)-MORE THAN JUST A PULSE

The pulse is nice but it only happens one time. If you want something that does something interesting forever rather than just once, you need an oscillator. An oscillator puts out an endless series of pulses. The output constantly goes from 0 volts to Vcc and back to 0 volts again. Almost all digital circuits have some type of oscillator. This stream of output pulses is often called a clock. You can count the number of pulses to tell how much time has gone by. We will see how the 555 timer can be used to generate this clock. A graph of a clock signal is shown below.

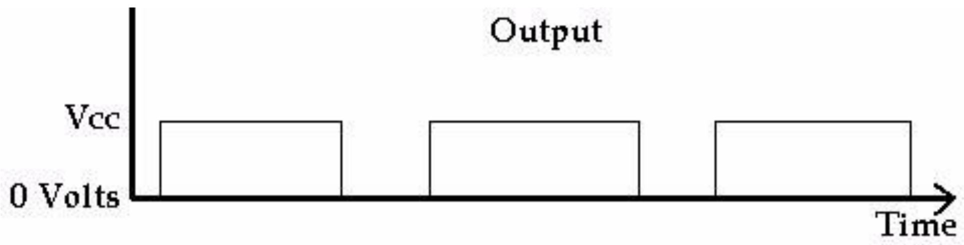


Figure 3.6: Output Voltage For Multiple Pulse

3.2.4 THE CAPACITOR

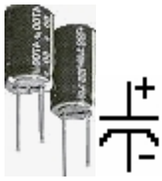


Figure 3.7: Capacitor

The picture above on the left shows two typical capacitors. Capacitors usually have two legs. One leg is the positive leg and the other is the negative leg. The positive leg is the one that is longer. The picture on the right is the symbol used for capacitors in circuit drawings (schematics). When you put one in a circuit, you must make sure the positive leg and the negative leg go in the right place. Capacitors do not always have a positive leg and a negative leg. The smallest capacitors in this kit do not. It does not matter which way you put them in a circuit.

A capacitor is similar to a rechargable battery in the way it works. The difference is that a capacitor can only hold a small fraction of the energy that a battery can. (Except for really big capacitors like the ones found in old TVs. These can hold a lot of charge. Even if a TV has been disconnected from the wall for a long time, these capacitors can still make lots of sparks and hurt people.) As with a rechargable battery, it takes a while for the capacitor to charge. So if we have a 12 volt supply and start charging the capacitor, it will start with 0 volts and go from 0 volts to 12 volts. Below is a graph of the voltage in the capacitor while it is charging.

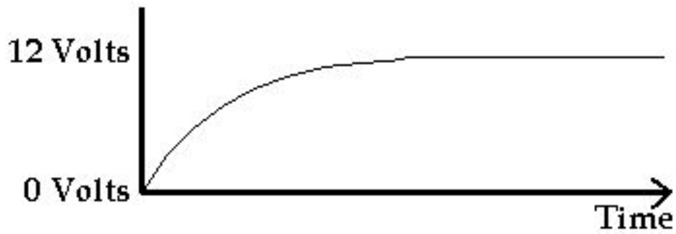


Figure 3.8: Voltage vs time curve during charging

The same idea is true when the capacitor is discharging. If the capacitor has been charged to 12 volts and then we connect both legs to ground, the capacitor will start discharging but it will take some time for the voltage to go to 0 volts. Below is a graph of what the voltage is in the capacitor while it is discharging.

Figure 3.9: Voltage vs time curve during discharging

We can control the speed of the capacitor's charging and discharging using resistors.

Capacitors are given values based on how much electricity they can store. Larger capacitors can store more energy and take more time to charge and discharge. The values are given in Farads but a Farad is a really large unit of measure for common capacitors. In this kit we have 2 33pf capacitors, 2 10uf capacitors and 2 220uF capacitors. Pf means picofarad and uf means microfarad. A picofarad is 0.000000000001 Farads. So the 33pf capacitor has a value of 33 picofarads or 0.000000000033 Farads. A microfarad is 0.000001 Farads. So the 10uf capacitor is 0.00001 Farads and the 220uF capacitor is 0.000220 Farads. If you do any calculations using the value of the capacitor you have to use the Farad value rather than the picofarad or microfarad value.

Capacitors are also rated by the maximum voltage they can take. This value is always written on the larger can shaped capacitors. For example, the 220uF capacitors in this kit have a maximum voltage rating of 25 volts. If you apply more than 25 volts to them they will die. We don’t have to worry about that with this kit because our power supply can only put out 12 volts.

3.2.5 THE 555 TIMER

3.2.5.1 CREATING A PULSE

The 555 is made out of simple transistors that are about the same as on / off switches. They do not have any sense of time. When you apply a voltage they turn on and when you take away the voltage they turn off. So by itself, the 555 can not create a pulse. The way the pulse is created is by using some components in a circuit attached to the 555 (see the circuit below). This circuit is made of a capacitor and a resistor. We can flip a switch and start charging the capacitor. The resistor is used to control how fast the capacitor charges. The bigger the resistance, the longer it takes to charge the capacitor. The voltage in the capacitor can then be used as an input to another switch. Since the voltage starts at 0, nothing happens to the second switch. But eventually the capacitor will charge up to some point where the second switch comes on.

The way the 555 timer works is that when you flip the first switch, the **Output** pin goes to Vcc (the positive power supply voltage) and starts charging the capacitor. When the capacitor voltage gets to 2/3 Vcc (that is Vcc * 2/3) the second switch turns on which makes the output go to 0 volts.

The pinout for the 555 timer is shown below

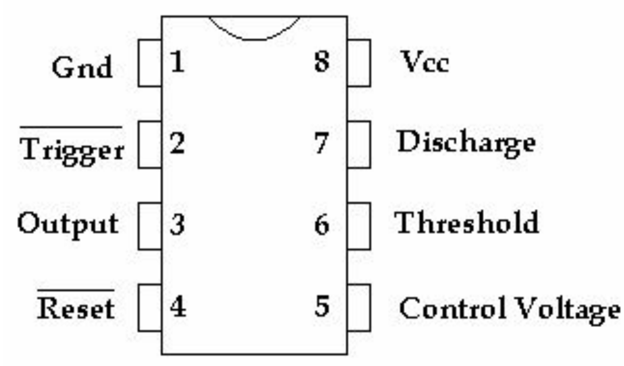


Figure 3.10: IC555

3.2.5.2 DEEP DETAILS

Pin 2 (Trigger) is the 'on' switch for the pulse. The line over the word Trigger tells us that the voltage levels are the opposite of what you would normally expect. To turn the switch on you apply 0 volts to pin 2. The technical term for this opposite behavior is 'Active Low'. It is common to see this 'Active Low' behavior for IC inputs because of the inverting nature of transistor circuits like we saw in the LED and Transistor Tutorial.

Pin 6 is the off switch for the pulse. We connect the positive side of the capacitor to this pin and the negative side of the capacitor to ground. When Pin 2 (Trigger) is at Vcc, the 555 holds Pin 7 at 0 volts (Note the inverted voltage). When Pin 2 goes to 0 volts, the 555 stops holding Pin 7 at 0 volts. Then the capacitor starts charging. The capacitor is charged through a resistor connected to Vcc. The current starts flowing into the capacitor, and the voltage in the capacitor starts to increase.

Pin 3 is the output (where the actual pulse comes out). The voltage on this pin starts at 0 volts. When 0 volts is applied to the trigger (Pin 2), the 555 puts out Vcc on Pin 3 and holds it at Vcc until Pin 6 reaches 2/3 of Vcc (that is Vcc * 2/3). Then the 555 pulls the voltage at Pin 3 to ground and you have created a pulse. (Again notice the inverting action.) The voltage on Pin 7 is also pulled to ground, connecting the capacitor to ground and discharging it.

3.2.5.3 SEEING THE PULSE

To see the pulse we will use an LED connected to the 555 output, Pin 3. When the output is 0 volts the LED will be off. When the output is Vcc the LED will be on.

3.2.5.4 BUILDING THE CIRCUIT

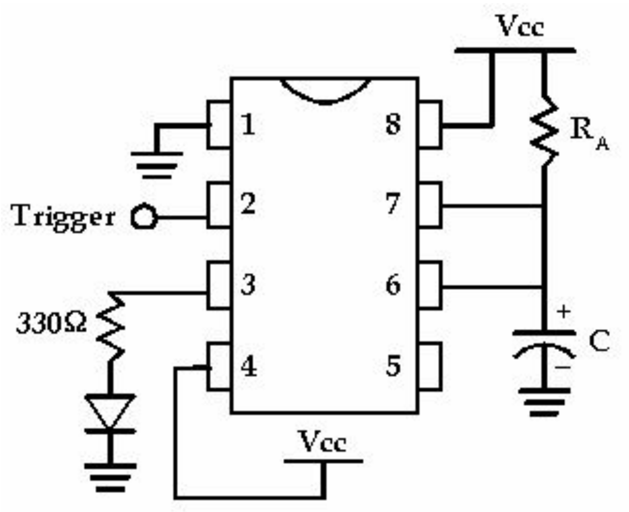


Figure 3.11: Pin Diagram

Place the 555 across the middle line of the breadboard so that 4 pins are on one side and 4 pins are on the other side. (You may need to bend the pins in a little so they will go in the holes.) Leave the power disconnected until you finish building the circuit. The diagram above shows how the pins on the 555 are numbered. You can find pin 1 by looking for the half circle in the end of the chip. Sometimes instead of a half circle, there will be a dot or shallow hole by pin 1.

Before you start building the circuit, use jumper wires to connect the red and blue power rows to the red and blue power rows on the other side of the board. Then you will be able to easily reach Vcc and Ground lines from both sides of the board. (If the wires are too short, use two wires joined together in a row of holes for the positive power (Vcc) and two wires joined together in a different row of holes for the ground.)

Connect Pin 1 to ground.

Connect Pin 8 to Vcc.

Connect Pin 4 to Vcc.

Connect the positive leg of the LED to a 330 ohm resistor and connect the negative end of the LED to ground. Connect the other leg of the 330 ohm resistor to the output, Pin 3.

Connect Pin 7 to Vcc with a 10k resistor (R_A = 10K).

Connect Pin 7 to Pin 6 with a jumper wire.

Connect Pin 6 to the positive leg of the 220uF Capacitor (C = 220uF). (You will need to bend the positive (long leg) up and out some so that the negative leg can go in the breadboard.

Connect the negative leg of the capacitor to ground.

Connect a wire to Pin 2 to use as the trigger. Start with Pin 2 connected to Vcc.

Now connect the power. The LED will come on and stay on for about 2 seconds. Remove the wire connected to Pin 2 from Vcc. You should be able to trigger the 555 again by touching the wire connected to pin 2 with your finger or by connecting it to ground and removing it. (It should be about a 2 second pulse.)

3.2.5.4 MAKING IT OSCILLATE

Next we will make the LED flash continually without having to trigger it. We will hook up the 555 so that it triggers itself. The way this works is that we add in a resistor between the capacitor and the discharge pin, Pin 7. Now, the capacitor will charge up (through R_A and R_B) and when it reaches 2/3 Vcc, Pin 3 and Pin 7 will go to ground. But the capacitor can not discharge immediately because of R_B. It takes some time for the charge to drain through R_B. The more resistance R_B has, the longer it takes to discharge. The time it takes to discharge the capacitor will be the time the LED is off.

To trigger the 555 again, we connect Pin 6 to the trigger (Pin 2). As the capacitor is discharging, the voltage in the capacitor gets lower and lower. When it gets down to 1/3 Vcc this triggers Pin 2 causing Pin 3 to go to Vcc and the LED to come on. The 555 disconnects Pin 7 from ground, and the capacitor starts to charge up again through R_A and R_B.

To build this circuit from the previous circuit, do the following.

Disconnect the power.

Take out the jumper wire between Pin 6 and Pin 7 and replace it with a 2.2k resistor (R_B = 2.2K).

Use the jumper wire at pin 2 to connect Pin 2 to Pin 6.

Now reconnect the power and the LED should flash forever (as long as you pay your electricity bill).

Experiment with different resistor values of R_A and R_B to see how it changes the length of time that the LED flashes. (You are changing the amount of time that it takes for the Capacitor to charge and discharge.)

3.2.5.5 FORMULAS

These are the formulas we use for the 555 to control the length of the pulses.

t1 = charge time (how long the LED is on) = $0.693 * (R_A + R_B) * C$

t2 = discharge time (how long the LED is off) = $0.693 * R_B * C$

T = period = t1 + t2 = $0.693 * (R_A + 2*R_B) * C$

Frequency = 1 / T = $1.44 / ((R_A + 2 * R_B) * C)$

t1 and t2 are the time in seconds. C is the capacitor value in Farads. 220uF = 0.000220 F. So for our circuit we have:

t1 = 0.693 * (10000 + 2200) * 0.000220 = 1.86 seconds

t2 = 0.693 * 2200 * 0.000220 = 0.335 seconds

T = 1.86 + 0.335 = 2.195 seconds

Frequency = 0.456 (cycles per second)

3.3 BUILDING A 5V POWER SUPPLY

Most digital logic circuits and processors need a 5 volt power supply. To use these parts we need to build a regulated 5 volt source. Usually you start with an unregulated power supply ranging from 9 volts to 24 volts DC. To make a 5 volt power supply, we use a LM7805 voltage regulator IC (Integrated Circuit). The IC is shown below.

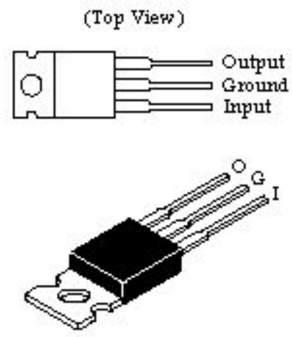


Figure 3.12:IC7805

The LM7805 is simple to use. You simply connect the positive lead of your unregulated DC power supply (anything from 9VDC to 24VDC) to the Input pin, connect the negative lead to the Ground pin and then when you turn on the power, you get a 5 volt supply from the Output pin. This 5 volt output will be used as Vcc in the following projects.

Connect the red wire from the power supply adapter to the input of the 7805. Connect the black wire from the power supply adapter to the ground row (with the blue line beside it). Run a black jumper wire from the ground row to the ground of the 7805. Then use a yellow jumper to connect the 5 volt output to the row of holes with the red stripe beside it. The breadboarded circuit is shown below.

Sometimes the input supply line (the 12VDC above) may be noisy. To help smooth out this noise and get a better 5 volt output, a capacitor is usually added to the circuit, going between the input and ground (GND). Find the 220 uF capacitor and put the long leg (positive leg) in the row of holes with the 12VDC line and put the short leg (negative leg) in ground (the row of holes next to the blue line).

CHAPTER 4

WORKING OF CIRCUIT

4.1 WORKING PRINCIPLE OF WIND MILLS

A wind turbine is a machine that coverts wind energy into electricity. The generators are connected to battery charging circuits and finally to large utility grids. In windmills the wind passes through the airfoil section of the blades and the lift produced generates a torque which is then transformed to electricity in the generator. It is basically the conversion of the wind energy into the mechanical energy of the turbine and then finally to electricity. As the output of the wind turbine is dependent on the availability of the winds it is intermittent and undependable. They can however be used along with conventional generators in a large grid and can reduce the loads of these generators when they are generating. The other option is to use storage devices like batteries and then discharge the electricity uniformly.

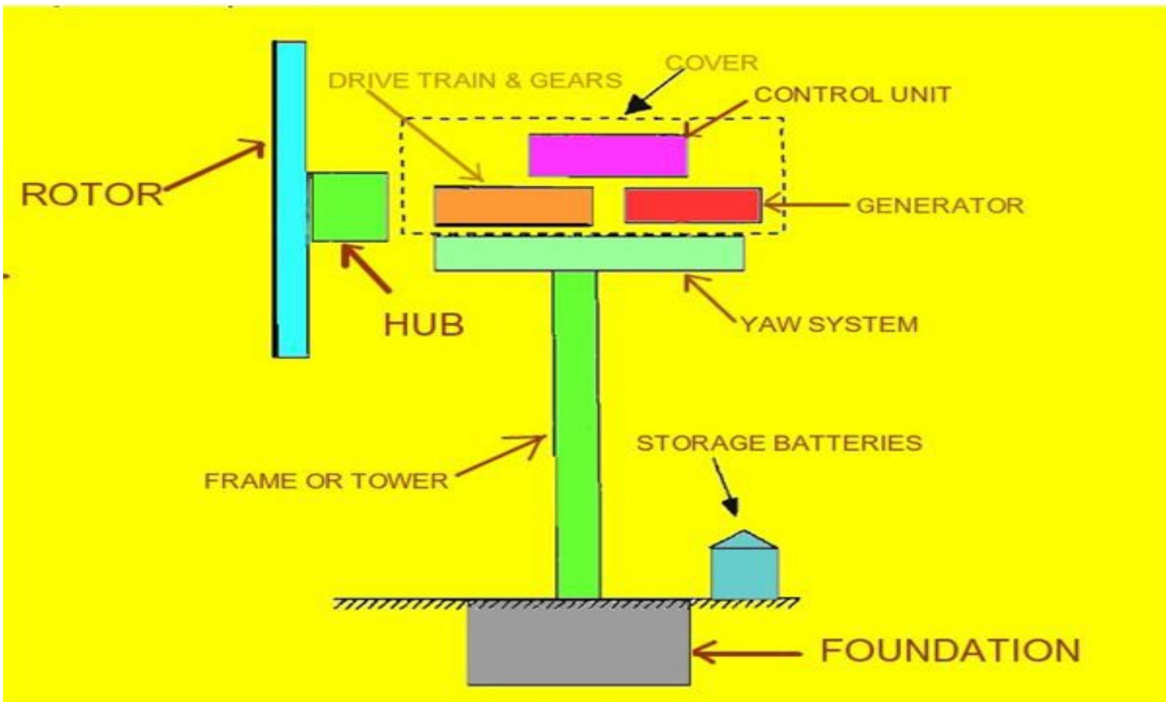


Figure 4.1: Wind Mill

The main parts of the windmills are as follows:The rotors consisting of the blades and the hub.

The drive train and gears along with the mechanical brakes. The brakes are used in the maintenance work and when a storm is coming.

The generator which generates electricity.

The yaw system which rotates the housing toward the direction of the wind.

Tower and foundation.

Battery and the electrical system to transmit to the grid.

The working principle is that when the wind passes through the blades, the blades experience a lift due to the aerodynamic airfoil shape. Due to the lift produced, the blades move and start rotating. The yaw unit aligns it towards the incoming wind direction when the winds change. The rotation of the blades is transmitted through the gear train and couplings to the generator that generates electricity. The electricity is then transmitted through the wires to the storage batteries or directly to the grid.

4.2 WORKING PRINCIPLE OF PIEZOPLATE

Squeeze certain crystals (such as quartz) and you can make electricity flow through them. The reverse is usually true as well: if you pass electricity through the same crystals, they "squeeze themselves" by vibrating back and forth. That's pretty much piezoelectricity in a nutshell but, for the sake of science, let's have a formal definition:

Piezoelectricity (also called the piezoelectric effect) is the appearance of an electrical potential (a voltage, in other words) across the sides of a crystal when you subject it to mechanical stress (by squeezing it).

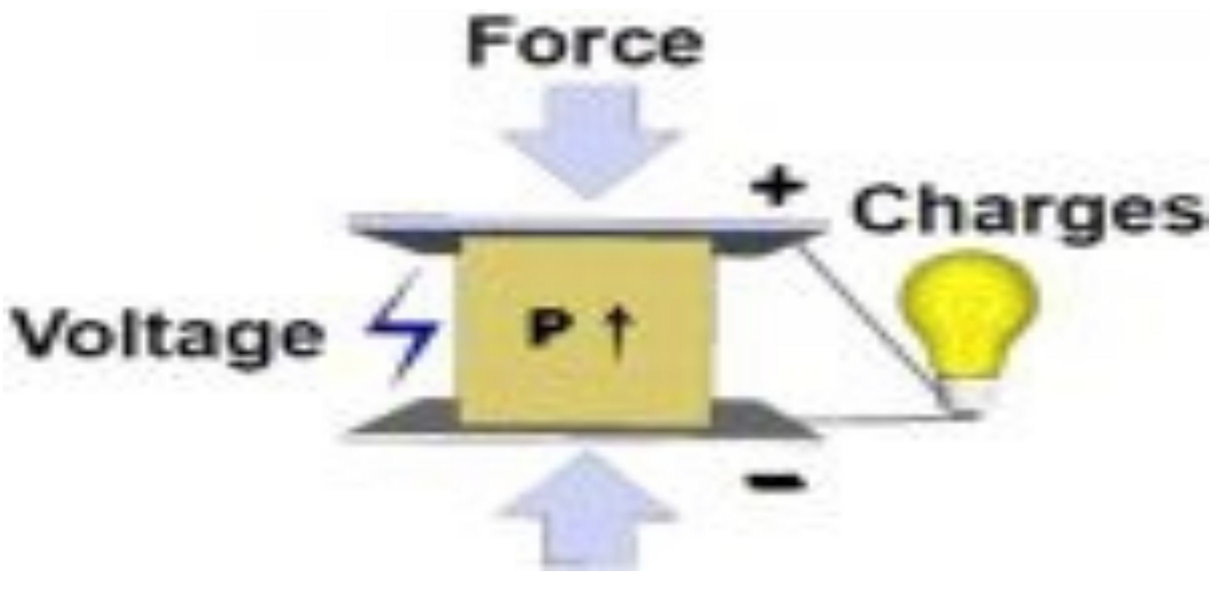


Figure 4.2: Understanding Piezo Effect

In practice, the crystal becomes a kind of tiny battery with a positive charge on one face and a negative charge on the opposite face; current flows if we connect the two faces together to make a circuit. In the reverse piezoelectric effect, a crystal becomes mechanically stressed (deformed in shape) when a voltage is applied across its opposite faces.

Diagram showing the regular arrangement of atoms in a crystalline solid.

Think of a crystal and you probably picture balls (atoms) mounted on bars (the bonds that hold them together), a bit like a climbing frame. Now, by crystals, scientists don't necessarily mean intriguing bits of rock you find in gift shops: a crystal is the scientific name for any solid whose atoms or molecules are arranged in a very orderly way based on endless repetitions of the same basic atomic building block (called the unit cell). So a lump of iron is just as much of a crystal as a piece of quartz. In a crystal, what we have is actually less like a climbing frame (which doesn't necessarily have an orderly, repeating structure) and more like three-dimensional, patterned wallpaper.

Artwork: What scientists mean by a crystal: the regular, repeating arrangement of atoms in a solid. The atoms are essentially fixed in place but can vibrate slightly.

In most crystals (such as metals), the unit cell (the basic repeating unit) is symmetrical; in piezoelectric crystals, it isn't. Normally, piezoelectric crystals are electrically neutral: the atoms inside them may not be symmetrically arranged, but their electrical charges are perfectly balanced: a positive charge in one place cancels out a negative charge nearby. However, if you squeeze or stretch a piezoelectric crystal, you deform the structure, pushing some of the atoms closer together or further apart, upsetting the balance of positive and negative, and causing net electrical charges to appear. This effect carries through the whole structure so net positive and negative charges appear on opposite, outer faces of the crystal.

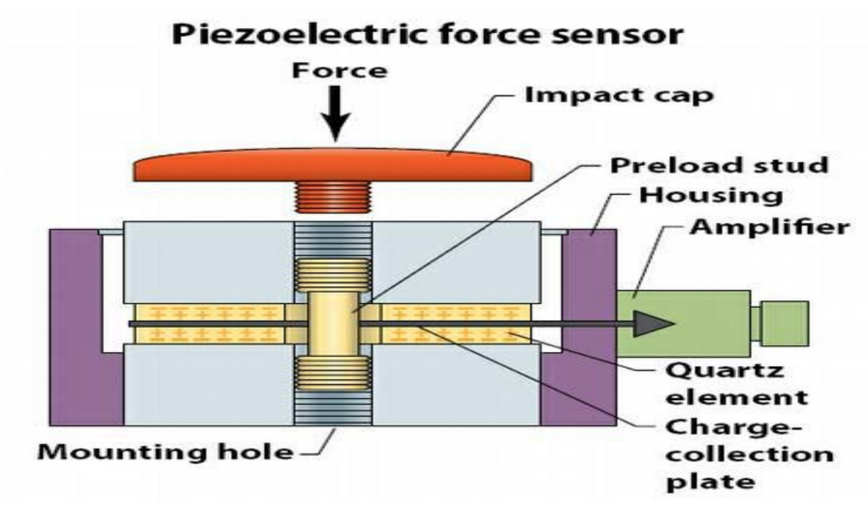


Figure 4.3: Piezoeectric force sensor

The reverse-piezoelectric effect occurs in the opposite way. Put a voltage across a piezoelectric crystal and you're subjecting the atoms inside it to "electrical pressure." They have to move to rebalance themselves—and that's what causes piezoelectric crystals to deform (slightly change shape) when you put a voltage across them.

4.3 HOW PIEZOELECTRICITY WORKS

Here's a quick animation showing how piezoelectricity occurs. It's somewhat simplified, but it gives you the basic idea:

Animation showing how piezoelectric charges appear when you press a crystal.

Normally, the charges in a piezoelectric crystal are exactly balanced, even if they're not symmetrically arranged.

The effects of the charges exactly cancel out, leaving no net charge on the crystal faces. (More specifically, the electric dipole moments—vector lines separating opposite charges—exactly cancel one another out.)

If you squeeze the crystal (massively exaggerated in this picture!), you force the charges out of balance.

Now the effects of the charges (their dipole moments) no longer cancel one another out and net positive and negative charges appear on opposite crystal faces. By squeezing the crystal, you've produced a voltage across its opposite faces—and that's piezoelectricity!

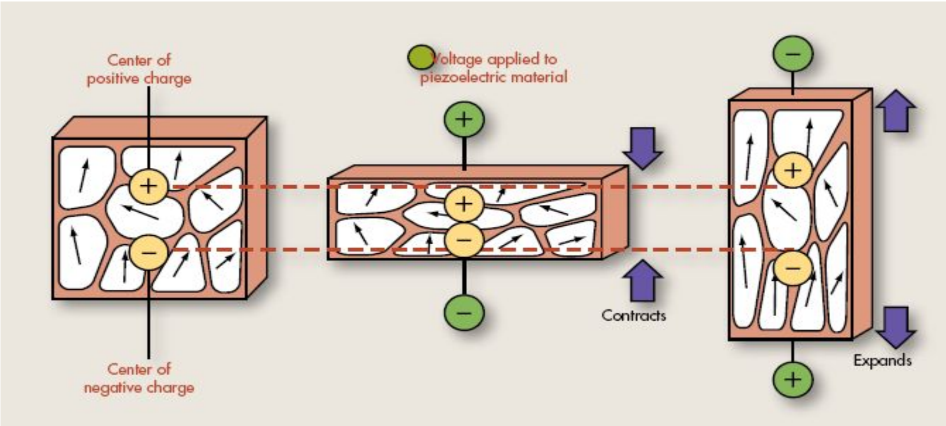
4.4 WHAT IS PIEZOELECTRICITY USED FOR

Photo: A typical piezoelectric transducer.

There are all kinds of situations where we need to convert mechanical energy (pressure or movement of some kind) into electrical signals or vice-versa. Often we can do that with a piezoelectric transducer. A transducer is simply a device that converts small amounts of energy from one kind into another (for example, converting light, sound, or mechanical pressure into electrical signals).

Photo: A typical piezoelectric transducer.

In ultrasound equipment, a piezoelectric transducer converts electrical energy into extremely rapid mechanical vibrations—so fast, in fact, that it makes sounds, but ones too high-pitched for our ears to hear. These ultrasound vibrations can be used for scanning, cleaning, and all kinds of other things.



1. The piezoelectric effect causes crystal materials like quartz to generate an electric charge when the crystal material is compressed, twisted, or pulled. The reverse also is true, as the crystal material compresses or expands when an electric voltage is applied.

Figure 4.4: Piezoelectric effect

In a microphone, we need to convert sound energy (waves of pressure traveling through the air) into electrical energy—and that's something piezoelectric crystals can help us with. Simply stick the vibrating part of the microphone to a crystal and, as pressure waves from your voice arrive, they'll make the crystal move back and forth, generating corresponding electrical signals. The "needle" in a gramophone (sometimes called a record player) works in the opposite way. As the diamond-tipped needle rides along the spiral groove in your LP, it bumps up and down. These vibrations push and pull on a lightweight piezoelectric crystal, producing electrical signals that your stereo then converts back into audible sounds.

LP record player stylus seen from underneath.

In a quartz clock or watch, the reverse-piezoelectric effect is used to keep time very precisely. Electrical energy from a battery is fed into a crystal to make it oscillate thousands of times a second. The watch then uses an electronic circuit to turn that into slower, once-per-second beats that a tiny motor and some precision gears use to drive the second, minute, and hour hands around the clock-face.

Piezoelectricity is also used, much more crudely, in spark lighters for gas stoves and barbecues. Press a lighter switch and you'll hear a clicking sound and see sparks appear. What you're doing, when you press the switch, is squeezing a piezoelectric crystal, generating a voltage, and making a spark fly across a small gap.

Photo: Record-player stylus (photographed from underneath): If you're still playing LP records, you'll use a stylus like this to convert the mechanical bumps on the record into sounds you can hear. The stylus (silver horizontal bar) contains a tiny diamond crystal (the little dot on the end at the right) that bounces up and down in the record groove.

CHAPTER 5

FABRICATION OF PCB

5.1 P.C.B. MAKING

+ P.C.B. is printed circuit board which is of insulating base with layer of thin copper-foil.
+ The circuit diagram is then drawn on the P. C. B. with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the P.C.B., thus leaving components interconnection on the board.
+ The specification of the base material is not important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip.
+ The resistance of copper foil will have an affect on the circuit operation.
+ Base material is made of lamination layer of suitable insulating material such as treated paper, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed paper bonded with epoxy resin.
+ It is possible to obtain a range of thickness between 0.5 mm to 3 mm.
+ Thickness is the important factor in determining mechanical strength particularly when the commonly used base material is "**Formea"** from paper assembly.
+ Physical properties should be self supportingthese are surface resistivity, heat dissipation, dielectric, constant, dielectric strength.
+ Another important factor is the ability to wishstand high temperature.

5.2 DESIGNING THE LAYOUT :

+ While designing a layout, it must be noted that size of the board should be as small as possible.
+ Before starting, all components should be placed properly so that an accurate measurement of space can be made.
+ The component should not be mounted very close to each other or far away from one another and neither one should ignore the fact that some component reed ventilation, which considerely the dimension of the relay and transformer in view of arrangement, the bolting arrangement is also considered.

- The layout is first drawn on paper then traced on copper plate which is finalized with the pen or permanent marker which is efficient and clean with etching.
- The resistivity also depends on the purity of copper, which is highest for low purity of copper. The high resistance path are always undesired for soldered connections.
- The most difficult part of making an original printed circuit is the conversion from, theretical circuit diagram into wiring layout. without introducing cross over and undesirable effect.
- Although it is difficult operation, it provides greatent amount of satisfaction because it is carried out with more care and skill.
- The board used for project has copper foil thickness in the range of 25 40 75 microns.
- The soldering quality requires 99.99% efficiency.
- It is necessary to design copper path extra large. There are two main reasons for this,
  - i) The copper may be required to carry an extra large overall current:-
  - ii) It acts like a kind of screen or ground plane to minimize the effect of interaction.
- The first function is to connect the components together in their right sequence with minimum need for interlinking i.e. the jumpers with wire connections.
- It must be noted, that when layout is done, on the next day it should be dipped in the solution and board is move continuously right and left after etching perfectly the board is cleaned with water and is drilled.
- After that holes are drilled with 1 mm or 0.8 mm drill. Now the marker on the P. C. B. is removed.
- The Printed Circuit Board is now ready for mounting the components on it.

5.3 SOLDERING :

- For soldering of any joints first the terminal to be soldered are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered.
- Now the joint to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly.
- The joint and the soldering iron is held such that molten solder should flow smoothly over the joint.
- When joint is completely covered with molten solder, the soldering iron is removed.
- The joint is allowed to cool, without any movement.

- + The bright shining solder indicates good soldering.
- + In case of dry solder joint, a air gap remains in between the solder matenal and the joint. It means that soldering is improper. This is removed and again soldering is done.

5.4 COMPONENT LIST

Sr.no	Description	Qty.	Price
1	Transformer 12-0-12V,750mA	1	35
2	Diode 1N4007	4	4
3	Capacitor1000uF,25V	1	5
4	Voltage regulator IC 7805	1	10
5	Capacitor 1Uf	1	1
6	LED	1	1
7	Resistors	15	5
8	Disc capacitors	5	5
9	IC Base	5	10
10	PCB	1	250
11	Wires	2	25
12	Solder wire	1	25
13	Cabinet	1	150
14	Mains cord	1	10
15	Transistor BC548	5	15
16	Photovoltaic cell 5V,5W	16	50
17	Piezo plate 6V,2.5mA	3	75
18	Wind mill 6V,500rpm	1	350

CHAPTER 6

6.1 ADVANTAGES

1. Using fiber optic lightning we save so much power which use for lightning in day time.The use of thin flexible thin fibre of glass or others transparent solids to transmit light signals chiefly for telecommunications or for internal inspection of the body.
2. In this project we use Nonconventional materials so system is become eco-friendly.Those energy sources which are renewable ecologically safe. Non Conventional energy are solar energy,wind energy,geothermal etc.
3. This system is not producing any kind of chemical waste material.Types of chemical waste such as toxic waste,industrial waste,radioactive waste can be prevented.
4. Windmill doesn't produce any poisonous gases smoke etc as it doesn't involve any burning process so it is clean.
5. Windmills have very low maintenance costs as compared to those of other power generation plants.
6. In long term there can be high return on investment due to amount of free energy a solar panel can produce it is estimated that the average house hold will see 50% of their energy coming in from solar panels.
7. Useful for maintaining high frequency railway traffic.
8. Decreased probability of accidents.

6.2 DISADVANTAGES

1. System initialize implementation cost will be high.
2. Solar power is used to charge batteries so that solar powered devices can be used at night.The batteries can often be large and heavy taking up space and needing to be replaced from time to time.
3. Electricity generation depends entirely on a countries exposure to sunlight,this could be limited by a countries climate.
4. At rainy season will affect to fiber optic lightning and Solar panel**.**
5. False signal reception due to noise.
6. Fails when track coupling coil is damaged.
7. The main disadvantage regarding wind power is down to the winds unreliabilty factor.In many areas the winds strength is not enough to support a wind turbine.

8.Wind turbine generally produce less electricity than the average fossil fuelled power stations which means that multiple wind turbine are needed to make an impact.

6.3 APPLICATION

1.Mainly use for underground Railway stations.

2.All type railway station.

3.Bus Stop, Metro Train, Monorail etc.

4.This system also we can use for School, college, Government offices, shopping malls, Theaters, office building, Restaurants, hotels even at Temples.

5.Need to consider use and benefits in multiple environments and oriented these to an eco-friendly goal

- charging the business model
- recycling devices and components
- manufacture using eco-friendly materials

6.Need to consider all of the device cycle

- need to go beyond recycling by also considering demanufacturing and re-manufacturing.

7.Proximity to railway station and bus stops.

8.Strong financial credibility with financial institution.

6.4 DATASHEET

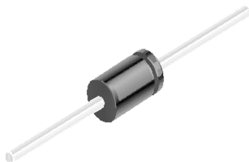
FAIRCHILD
SEMICONDUCTOR®

1N4001-1N4007

1N4001 - 1N4007

Features

- Low forward voltage drop.
- High surge current capability.



DO-41
COLOR BAND DENOTES CATHODE

General Purpose Rectifiers

Absolute Maximum Ratings* T_A = 25°C unless otherwise noted

Symbol	Parameter	Value							Units
		4001	4002	4003	4004	4005	4006	4007	
V_{RRM}	Peak Repetitive Reverse Voltage	50	100	200	400	600	800	1000	V
$I_{F(AV)}$	Average Rectified Forward Current, .375 " lead length @ T_A = 75°C	1.0							A
I_{FSM}	Non-repetitive Peak Forward Surge Current 8.3 ms Single Half-Sine-Wave	30							A
T_{stg}	Storage Temperature Range	-55 to +175							°C
T_J	Operating Junction Temperature	-55 to +175							°C

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

Thermal Characteristics

Symbol	Parameter	Value	Units
P_D	Power Dissipation	3.0	W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	50	°C/W

Electrical Characteristics T_A = 25°C unless otherwise noted

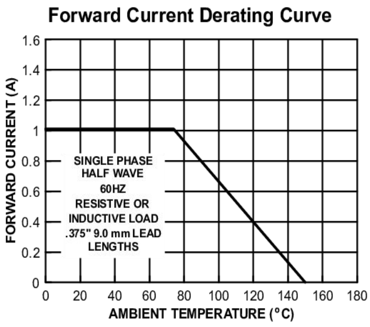
Symbol	Parameter	Device							Units
		4001	4002	4003	4004	4005	4006	4007	
V_F	Forward Voltage @ 1.0 A	1.1							V
I_{rr}	Maximum Full Load Reverse Current, Full Cycle T_A = 75°C	30							µA
I_R	Reverse Current @ rated V_R T_A = 25°C T_A = 100°C	5.0 500							µA µA
C_T	Total Capacitance V_R = 4.0 V, f = 1.0 MHz	15							pF

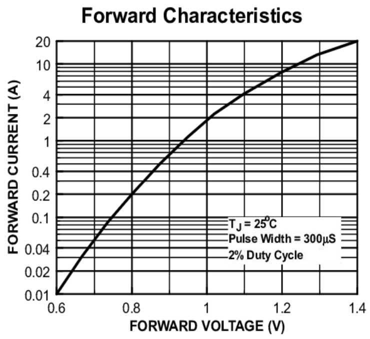
 1N4001-1N4007, Rev. C1

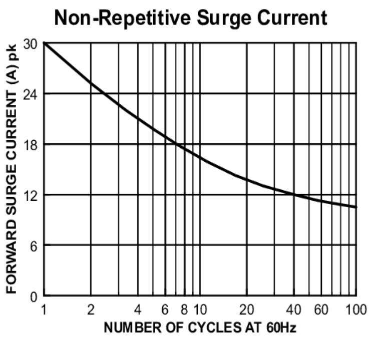
General Purpose Rectifiers
(continued)

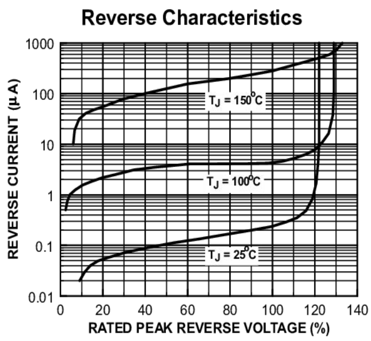
1N4001-1N4007

Typical Characteristics









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Bottomless™	FAST®	LittleFET™	Power247™	SuperSOT™-3
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CROSSVOLT™	FRFET™	MicroPak™	QFET™	SuperSOT™-8
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Programmable Active Droop™		OPTOPLANAR™	SMART START™	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. I2

FAIRCHILD
SEMICONDUCTOR™

October 1987
Revised March 2002

CD4047BC Low Power Monostable/Astable Multivibrator

CD4047BC
Low Power Monostable/Astable Multivibrator

General Description

The CD4047B is capable of operating in either the monostable or astable mode. It requires an external capacitor (between pins 1 and 3) and an external resistor (between pins 2 and 3) to determine the output pulse width in the monostable mode, and the output frequency in the astable mode.

Astable operation is enabled by a high level on the astable input or low level on the $\overline{\text{astable}}$ input. The output frequency (at 50% duty cycle) at Q and $\overline{Q}$ outputs is determined by the timing components. A frequency twice that of Q is available at the Oscillator Output; a 50% duty cycle is not guaranteed.

Monostable operation is obtained when the device is triggered by LOW-to-HIGH transition at + trigger input or HIGH-to-LOW transition at − trigger input. The device can be retriggered by applying a simultaneous LOW-to-HIGH transition to both the + trigger and retrigger inputs.

A high level on Reset input resets the outputs Q to LOW, $\overline{Q}$ to HIGH.

Features

- Wide supply voltage range: 3.0V to 15V
- High noise immunity: 0.45 V_{DD} (typ.)
- Low power TTL compatibility: Fan out of 2 driving 74L or 1 driving 74LS

Special Features

- Low power consumption: special CMOS oscillator configuration
- Monostable (one-shot) or astable (free-running) operation
- True and complemented buffered outputs
- Only one external R and C required

Monostable Multivibrator Features

- Positive- or negative-edge trigger
- Output pulse width independent of trigger pulse duration
- Retriggerable option for pulse width expansion
- Long pulse widths possible using small RC components by means of external counter provision
- Fast recovery time essentially independent of pulse width
- Pulse-width accuracy maintained at duty cycles approaching 100%

Astable Multivibrator Features

- Free-running or gatable operating modes
- 50% duty cycle
- Oscillator output available
- Good astable frequency stability
  typical= ±2% + 0.03%/°C @ 100 kHz
  frequency= ±0.5% + 0.015%/°C @ 10 kHz
  deviation (circuits trimmed to frequency V_{DD} = 10V ±10%)

Applications

- Frequency discriminators
- Timing circuits
- Time-delay applications
- Envelope detection
- Frequency multiplication
- Frequency division

Ordering Code:

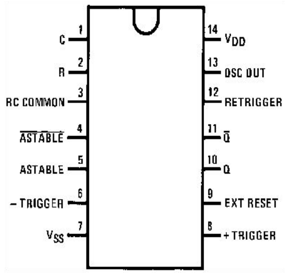
Order Number	Package Number	Package Description
CD4047BCM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
CD4047BCN	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

 DS005969 www.fairchildsemi.com

Connection Diagram

Pin Assignments for SOIC and DIP



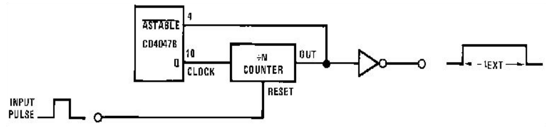
Top View

Function Table

Function	Terminal Connections			Output Pulse	Typical Output
	To V_{DD}	To V_{SS}	Input Pulse To	From	Period or Pulse Width
Astable Multivibrator					
Free-Running	4, 5, 6, 14	7, 8, 9, 12		10, 11, 13	t_A(10, 11) = 4.40 RC
True Gating	4, 6, 14	7, 8, 9, 12	5	10, 11, 13	t_A (13) = 2.20 RC
Complement Gating	6, 14	5, 7, 8, 9, 12	4	10, 11, 13	
Monostable Multivibrator					
Positive-Edge Trigger	4, 14	5, 6, 7, 9, 12	8	10, 11	
Negative-Edge Trigger	4, 8, 14	5, 7, 9, 12	6	10, 11	t_M (10, 11) = 2.48 RC
Retriggerable	4, 14	5, 6, 7, 9	8, 12	10, 11	
External Countdown (Note 1)	14	5, 6, 7, 8, 9, 12	Figure 1	Figure 1	Figure 1

Note 1: External resistor between terminals 2 and 3. External capacitor between terminals 1 and 3.

Typical Implementation of External Countdown Option



$t_{EXT} = (N - 1)\ t_A + (t_M + t_A/2)$

FIGURE 1.

N-channel enhancement mode TrenchMOS™ transistor — IRFZ44N

STATIC CHARACTERISTICS

T_j= 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.25 mA;	55	-	-	V
		T_j = -55˚C	50	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	V_{DS} = V_{GS}; I_D = 1 mA	2.0	3.0	4.0	V
		T_j = 175˚C	1.0	-	-	V
		T_j = -55˚C	-	-	4.4	
I_{DSS}	Zero gate voltage drain current	V_{DS} = 55 V; V_{GS} = 0 V;	-	0.05	10	µA
		T_j = 175˚C	-	-	500	µA
I_{GSS}	Gate source leakage current	V_{GS} = ±10 V; V_{DS} = 0 V	-	0.04	1	µA
		T_j = 175˚C	-	-	20	µA
$\pm V_{(BR)GSS}$	Gate source breakdown voltage	I_G = ±1 mA;	16	-	-	V
$R_{DS(ON)}$	Drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A	-	15	22	mΩ
		T_j = 175˚C	-	-	42	mΩ

DYNAMIC CHARACTERISTICS

T_{mb} = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	V_{DS} = 25 V; I_D = 25 A	6	-	-	S
C_{iss}	Input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz	-	1350	1800	pF
C_{oss}	Output capacitance		-	330	400	pF
C_{rss}	Feedback capacitance		-	155	215	pF
Q_g	Total gate charge	V_{DD} = 44 V; I_D = 50 A; V_{GS} = 10 V	-	-	62	nC
Q_{gs}	Gate-cource charge		-	-	15	nC
Q_{gd}	Gate-drain (miller) charge		-	-	26	nC
$t_{d\ on}$	Turn-on delay time	V_{DD} = 30 V; I_D = 25 A;	-	18	26	ns
t_r	Turn-on rise time	V_{GS} = 10 V; R_G = 10 Ω	-	50	75	ns
$t_{d\ off}$	Turn-off delay time	Resistive load	-	40	50	ns
t_f	Turn-off fall time		-	30	40	ns
L_d	Internal drain inductance	Measured from contact screw on tab to centre of die	-	3.5	-	nH
L_d	Internal drain inductance	Measured from drain lead 6 mm from package to centre of die	-	4.5	-	nH
L_s	Internal source inductance	Measured from source lead 6 mm from package to source bond pad	-	7.5	-	nH

REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

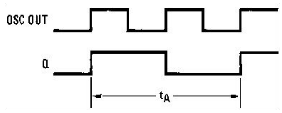
T_j = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current		-	-	49	A
I_{DRM}	Pulsed reverse drain current		-	-	160	A
V_{SD}	Diode forward voltage	I_F = 25 A; V_{GS} = 0 V	-	0.95	1.2	V
		I_F = 40 A; V_{GS} = 0 V	-	1.0	-	
t_{rr}	Reverse recovery time	I_F = 40 A; $-dI_F/dt$ = 100 A/µs;	-	47	-	ns
Q_{rr}	Reverse recovery charge	V_{GS} = -10 V; V_R = 30 V	-	0.15	-	µC

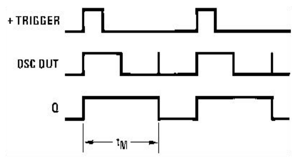
Typical Performance Characteristics (Continued)

Timing Diagrams

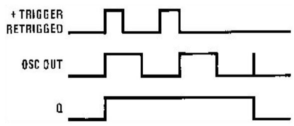
Astable Mode



Monostable Mode



Retrigger Mode



N-channel enhancement mode TrenchMOS^{TM} transistor — IRFZ44N

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	
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