EXP 1. PCB FABRICATION ON POWER SUPPLY GENERATION WITH BRIDGE RECTIFIER IC

OBJECTIVE

To design and fabricate regulated dual power supply with both positive and negative 5V and 12V using 7805, 7905, 7812and 7912 with bridge rectifier IC(PCB+box).

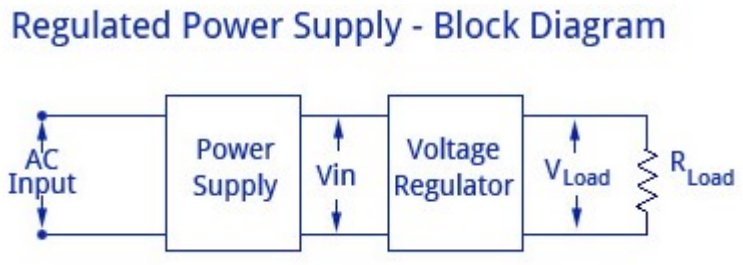
COMPONENTS REQUIRED

S.No	Name of the component	Specification	Quantity
1	Center tapped transformer	Input Voltage: 220V AC at 50Hz Output Voltage: 24V, 12V or 0V Output Current: 1A Low cost and small package	1 nos.
2	Bridge Rectifier IC	DB104	1 no.
3	Voltage Regulator	7805: +5V 7905: -5V 7812: +12V 7912: -12V	1 no. each
4	Capacitors	Electrolytic: 1000uF/25V 100uF/16V	2 no. 4 no.
5	Connecting Wires	Single Strand	As much required
6	**PCB Wizard** Software	For PCB Layout Design	

THEORY

A **regulated power supply** is an embedded circuit; it converts unregulated AC (Alternating Current) into a constant DC. With the help of a rectifier it converts AC supply into pulsating DC. Its function is to supply a stable voltage (or less often current), to a circuit or device that must be operated within certain power supply limits. The output from the regulated power supply is a constant DC.

The DC power supply is practically converted to each and every stage in an electronic system. Thus a common requirement for all these phases will be the DC power supply. All low power system can be run with a battery. But, for a long time operating devices, batteries could prove to be costly and complicated. The best method used is in the form of a regulated power supply is combination of a transformer, rectifier, voltage regulator and a filter. The diagram is shown below.



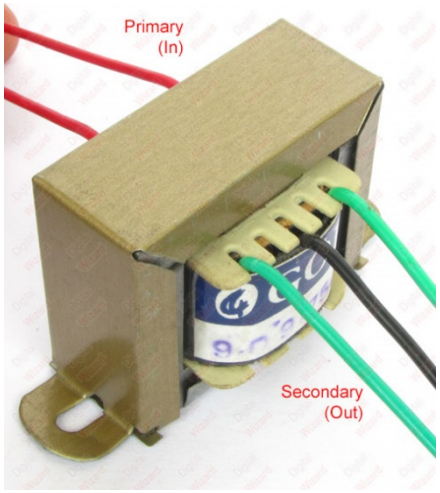
A regulated power supply essentially consists of an ordinary power supply and a voltage regulating device, as illustrated in the figure. The output from an ordinary power supply is fed to the voltage regulating device that provides the final output. The output voltage remains constant irrespective of variations in the ac input voltage or variations in output (or load) current.

The general block diagram for this project is given below. It is very simple. It has the following four main sub-blocks.

- The Transformer
- The Rectifier Circuit
- The Filter
- The Regulator

Transformer

A step down transformer is used to step down the voltage from the input AC to the required voltage of the electronic device. This output voltage of the transformer is customized by changing the turns ratio of the transformer according the electronic device specs. The input of the transformer being 230 Volts AC mains, the output is 24V, 12V or 0V, output current 1A. It is a low cost and small package transformer.



Full Wave Rectifier Circuit

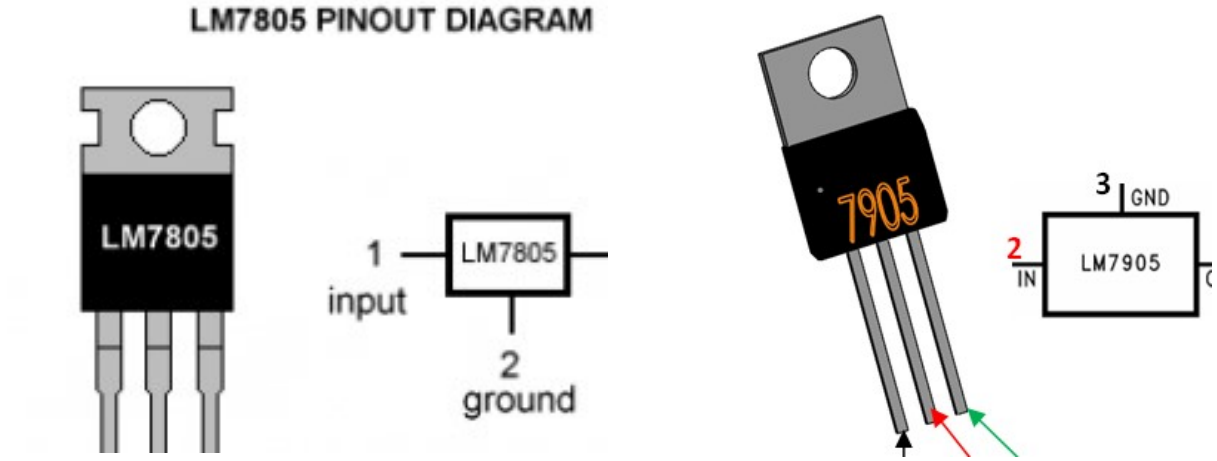
The FWR consists of 4 diodes which rectifies the output AC voltage or current from the transistor to its equivalent DC quantity. As the name implies the FWR rectifies both half's of the AC input. The rectified DC output is given as input to the filter circuit.

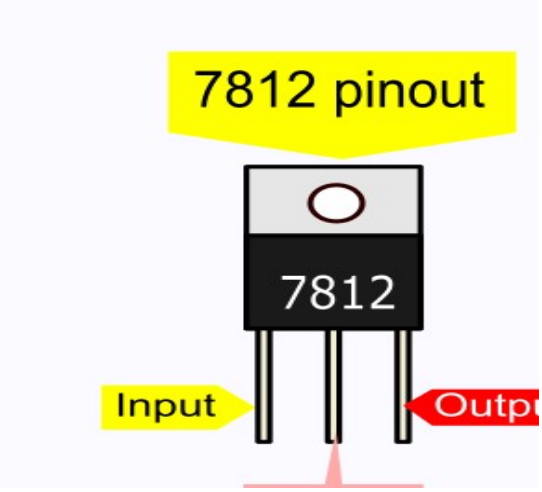
- The full wave bridge rectifier is designed to convert an AC sine wave to an full wave pulsating DC signal
- The bridge is normally connected to the secondary terminals of the transformer
- Here, we have considered a bridge rectifier IC BD104.

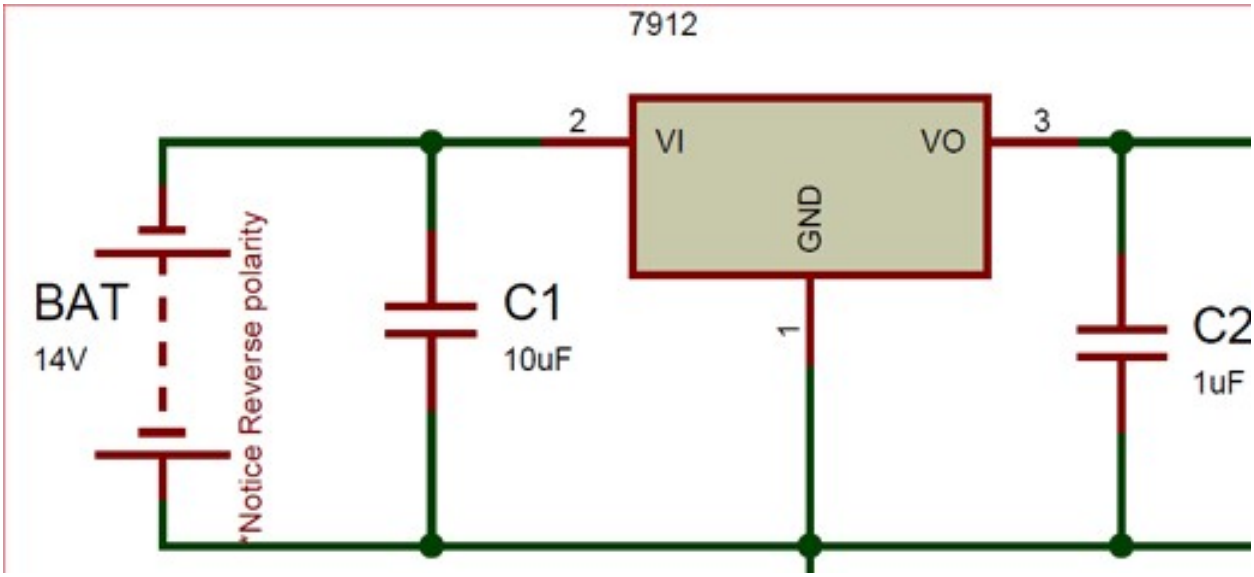
Bridge rectifier IC.

Voltage Regulators

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink. Similarly, 7905 provides -5 volts, 7812 provides +12 volts and 7912 provides -12 volts.







An example illustrating regulated power supply connection.

PRECAUTIONS

- ✓ Before making the connection keep the SPST switch in OFF position.
- ✓ Before switch ON the RPS, check the voltage setting knob of RPS at minimum position and current setting knob of RPS at maximum position.
- ✓ After completing the experiment disconnect the circuit carefully.
- ✓ During PCB fabrication be careful with the chemical and other hazardous substances.
- ✓ Be careful with drilling machine during PCB drilling.

PROCEDURE

- Make the connections as per the circuit diagram.
- Choose the electrolytic capacitors as per the specification and connect them as per the polarity indicated.
- Check the ground connection precisely before switching on the power supply.
- Power on the main supply
- Observe the output signal from multimeter.
- Design the PCB layout using PCB wizard software.
- Fabricate the PCB and follow each step carefully.

CIRCUIT DESCRIPTION

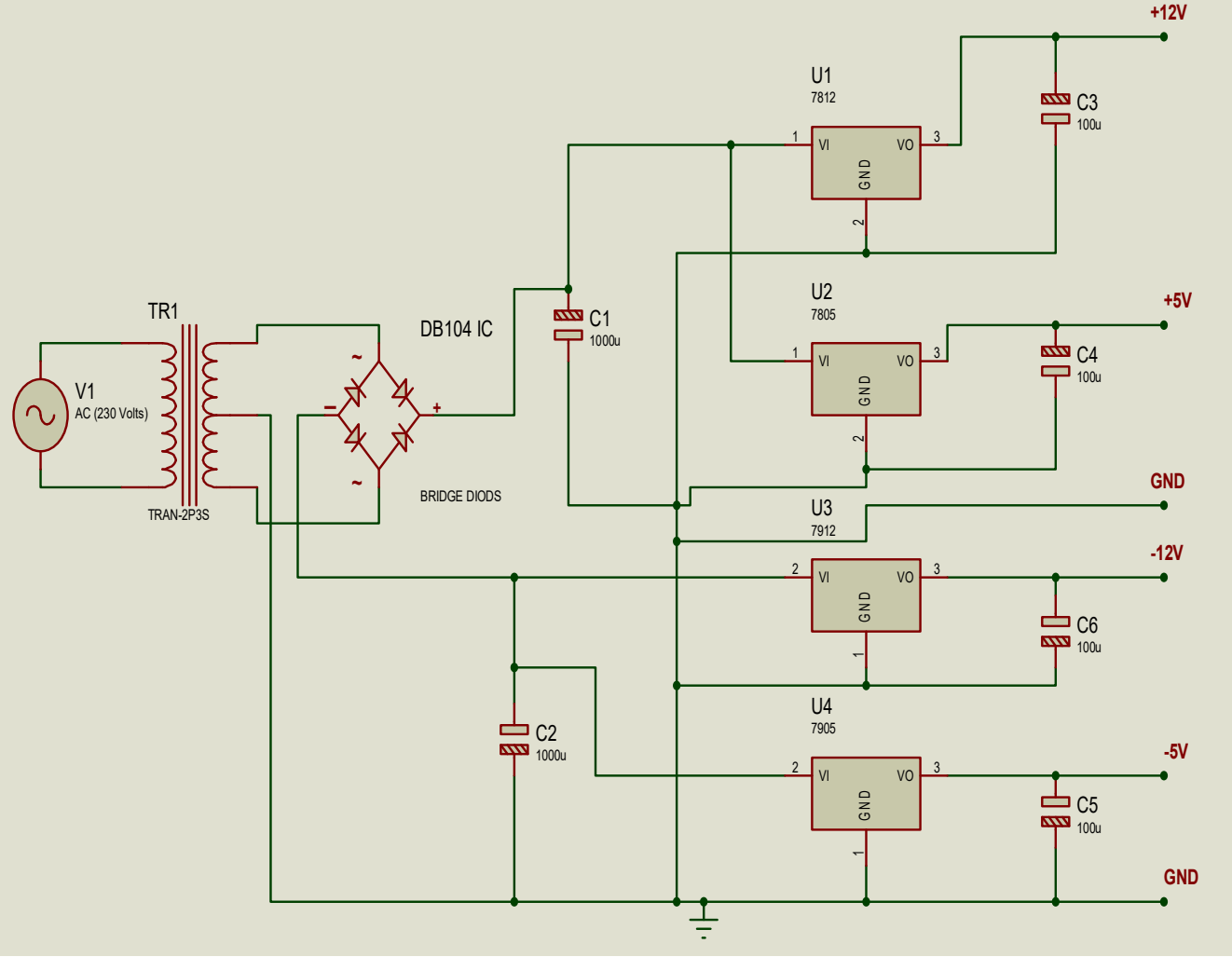
The AC power supply from mains first gets converted into and unregulated DC and then into a constant regulated DC with the help of this circuit. The circuit is made up of transformer, bridge rectifier made up from diodes, linear voltage regulator 7805, 7905, 7812 and 7912 and capacitors.

If you observe, the working of the circuit can be divided into two parts. In the first part, the AC Mains is converted into unregulated DC and in the second part, this unregulated DC is converted into regulated 5V DC. So, let us start discussing the working with this in mind.

Initially, a 230V to 12V Step down transformer is taken and its primary is connected to mains supply. The secondary of the transformer is connected to Bridge rectifier (either a dedicated IC or a combination of 4 1N4007 Diodes can be used).

A 1A fuse is placed between the transformer and the bridge rectifier. This will limit the current drawn by the circuit to 1A. The rectified DC from the bridge rectifier is smoothened out with the help of 1000μF Capacitor.

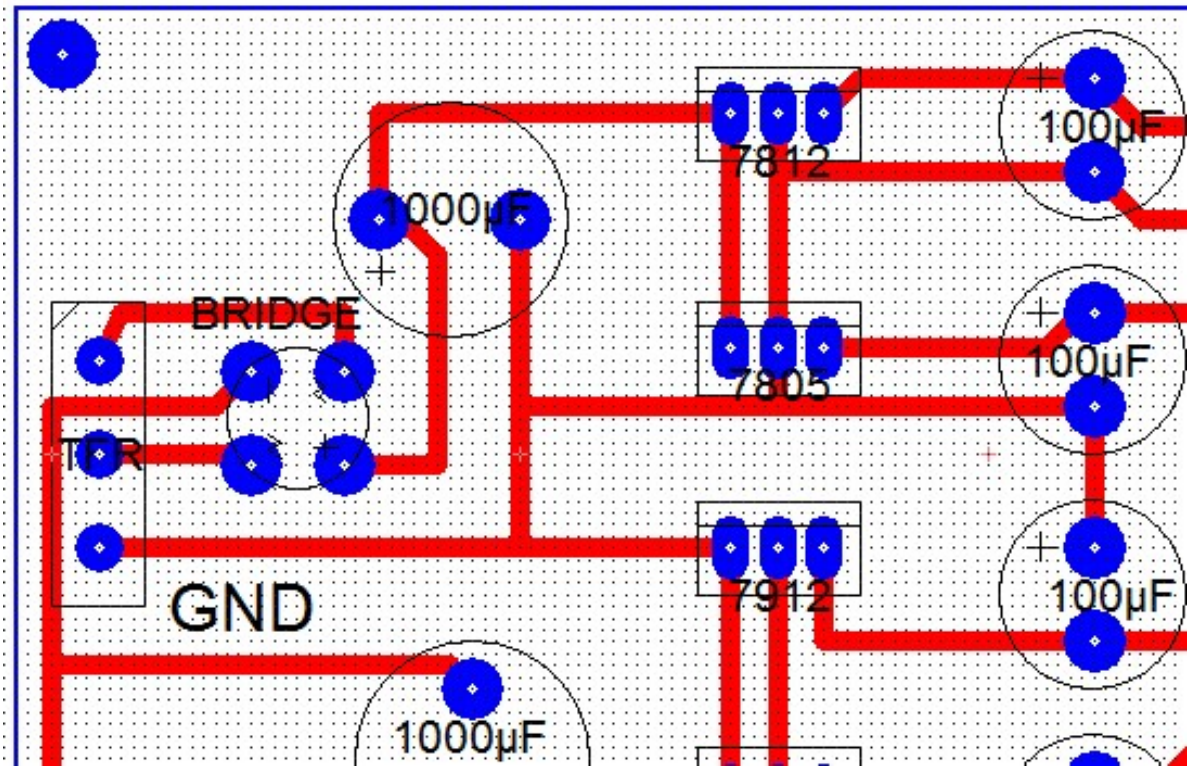
So, the output across the 1000µF Capacitor is unregulated 12V DC. This is given as an input to the 7805, 7905, 7812 and 7912 Voltage Regulator IC. 7805, 7905, 7812, 7912 IC then converts this to a regulated +5V, -5V, +12V and -12V DC and the output can be obtained at its output terminals, as indicated in the circuit below.



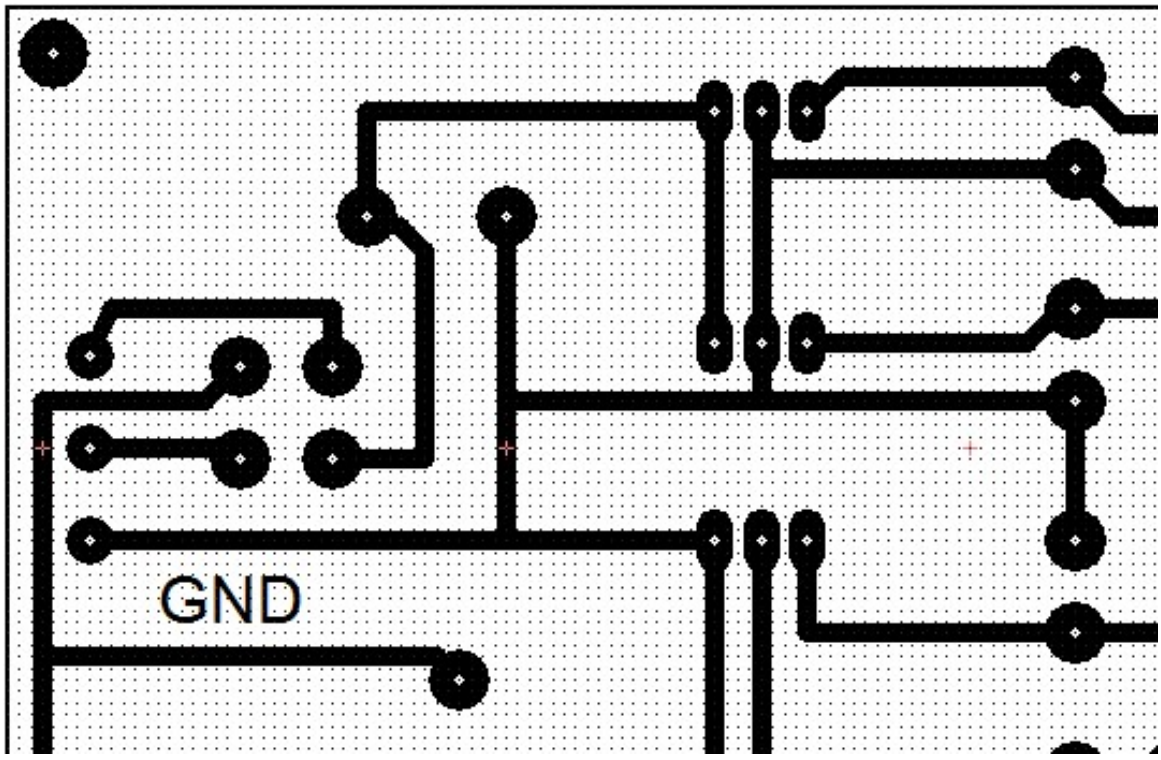
Full Circuit diagram of regulated power supply with four different power output.

PCB Fabricated Circuit

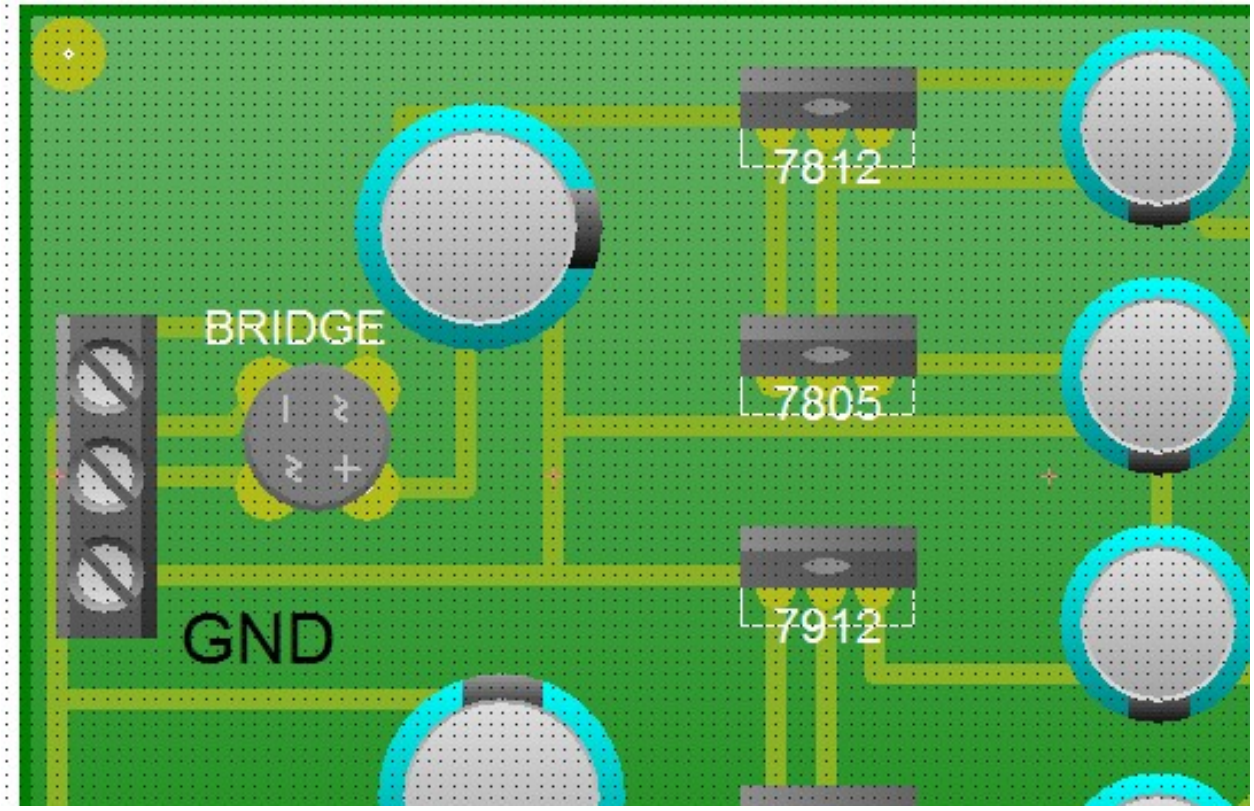
The PCB fabrication circuit can be done using PCB wizard. The wiring or the connection between the IC pins must be done carefully with minimum space and with optimum gap between two terminals so that no wiring gets short circuited. An example of PCB art work is shown in the figure below.



The PCB artwork connections using PCB wizard software.



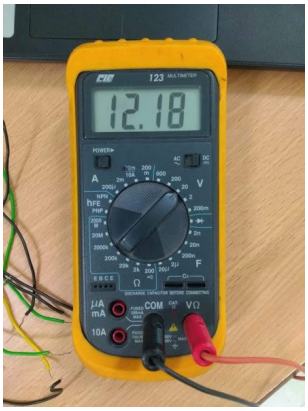
Panel Layout illustrating each component in to be placed in the PCB board.

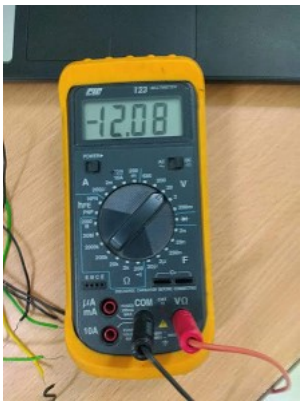


Layout Reference.

RESULT

Here, we have successfully implemented the regulated power supply for generating both positive and negative voltages with four different voltage regulators and instead of diodes we have considered bridge rectifier IC (with is compact in size) for power supply. The following outputs are obtained and validated from the multimeter.





RESULT

In this experiment, we have connected and fabricated regulated dual power supply with both positive and negative 5V and 12V using 7805, 7905, 7812 and 7912 with bridge rectifier IC(PCB+box).

EXP 2. PCB FABRICATION AND PACKAGING OF CLOCK SIGNAL GENERATOR USING IC 555 BASED CIRCUITS AND VARIABLE DATA GENERATOR PRESET BY SWITCHES USING 4051

OBJECTIVE

To design and fabricate clock signal generator using IC 555 based circuit and variable data generator preset by switches using 4051(PCB+box).

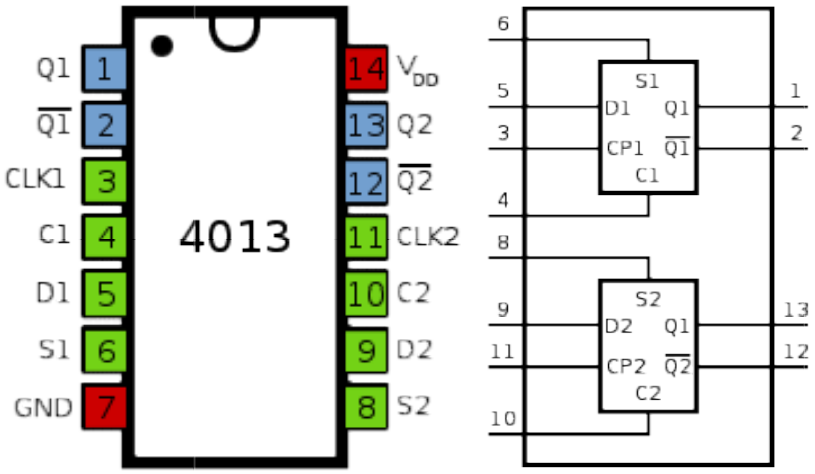
COMPONENTS REQUIRED

S.No	Name of the component	Specification	Quantity
1	IC 555	Timer IC	1 no.
2	Capacitors	0.01uF	2 nos.
3	Resistors	1kΩ 100kΩ	1 no. 1 no.
5	SPST switches		8 no.
6	IC 4051	8:1 MUX	1 no.
7	IC 4013	D Flipflop	3 nos
8	IC 4027	JK Flipflop	3 nos
8	Connecting Wires	Single Strain	As much required
9	PCB Wizard Software	For PCB Layout Design	

THEORY

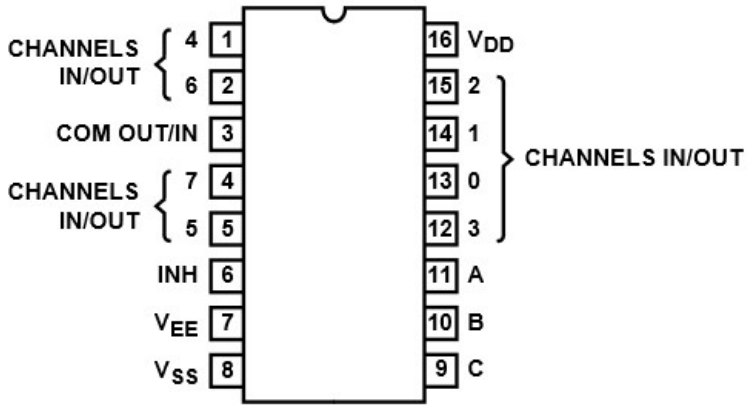
CMOS D FLIP FLOP (4013)

The 4013 contains two independent D-type flip-flops with asynchronous set/reset inputs. When the set is ONE, then the Q is ONE and when the reset is ONE, then the Q is ZERO. When set and reset are low, they are in “don’t care condition”. Q shifts the data at D during low-to-high clock transition. This is then held until the next low-to-high clock transition.



CMOS ANALOG MULTIPLEXER (4051)

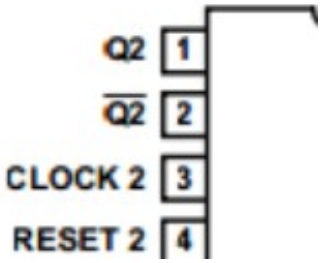
The CD4051B is a single 8-Channel multiplexer having three binary control inputs, A, B, and C, and an inhibit input. The three binary signals select 1 of 8 channels to be turned on, and connect one of the 8 inputs to the output.



CMOS JK FLIP FLOP (4027)

The CD4027BC dual J-K flip-flops are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. Each flip-flop has independent J, K, set, reset, and clock inputs and buffered Q and Q outputs. These flip-flops are edge sensitive to the clock input and change state on the positive-going transition of the clock pulses. Set or reset is independent of the clock and is accomplished by a high level on the respective input. All inputs are protected against damage due to static discharge by diode clamps to VDD and VSS.

e IC pin configuration.



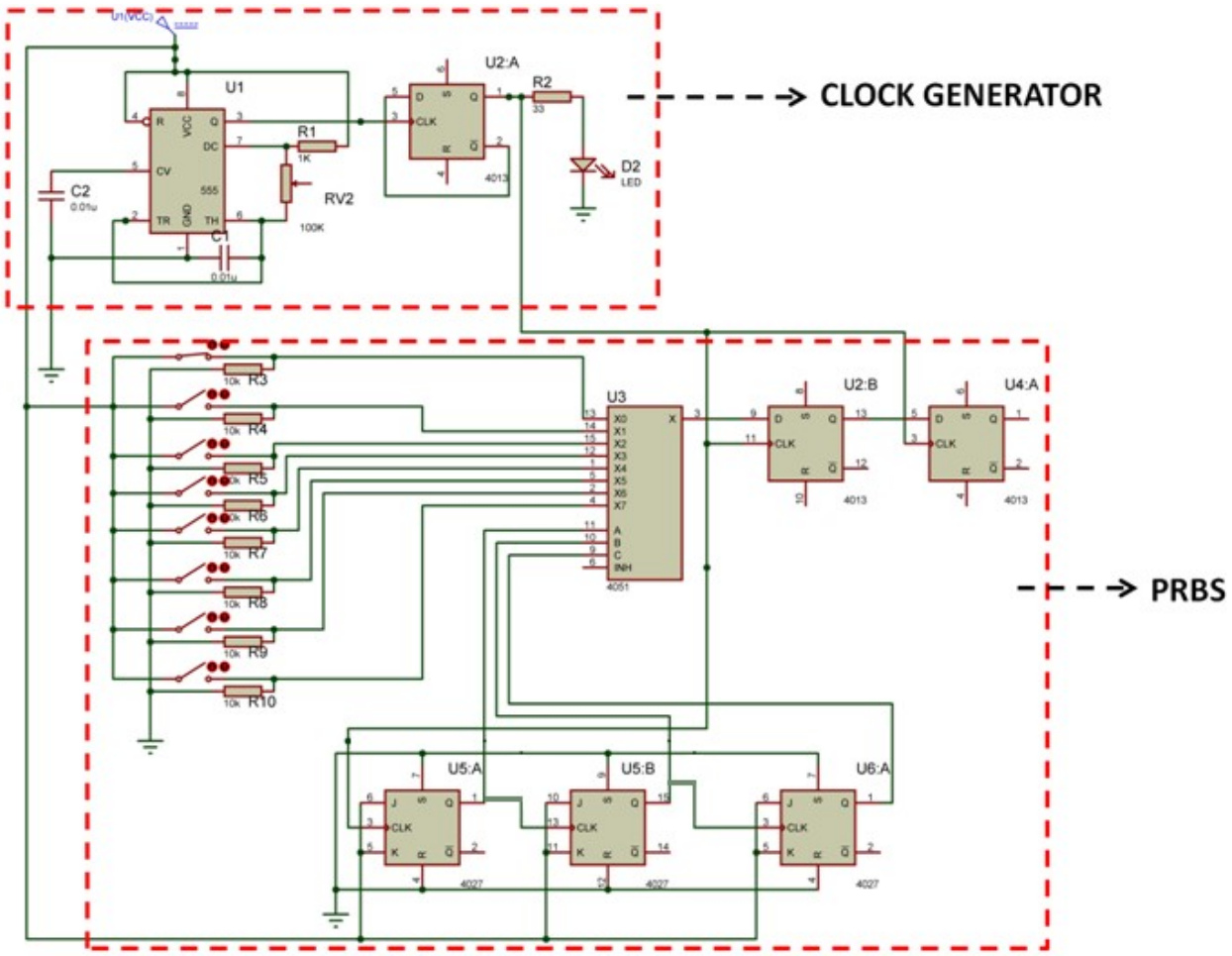
PRECAUTIONS

- ✓ Before making the connection keep the SPST switch in OFF position.
- ✓ Before switch ON the RPS, check the voltage setting knob of RPS at minimum position and current setting knob of RPS at maximum position.
- ✓ After completing the experiment disconnect the circuit carefully.
- ✓ During PCB fabrication be careful with the chemical and other hazardous substances.
- ✓ Be careful with drilling machine during PCB drilling.

PROCEDURE

- ➢ Make the connections as per the circuit diagram.
- ➢ Choose the electrolytic capacitors as per the specification and connect them as per the polarity indicated.
- ➢ Check the ground connection precisely before switching on the power supply.
- ➢ Power on the main supply
- ➢ Observe the output signal from multimeter.
- ➢ Design the PCB layout using PCB wizard software.
- ➢ Fabricate the PCB and follow each step carefully.

CIRCUIT DESCRIPTION



Full Circuit diagram of regulated Clock cum Variable data generator

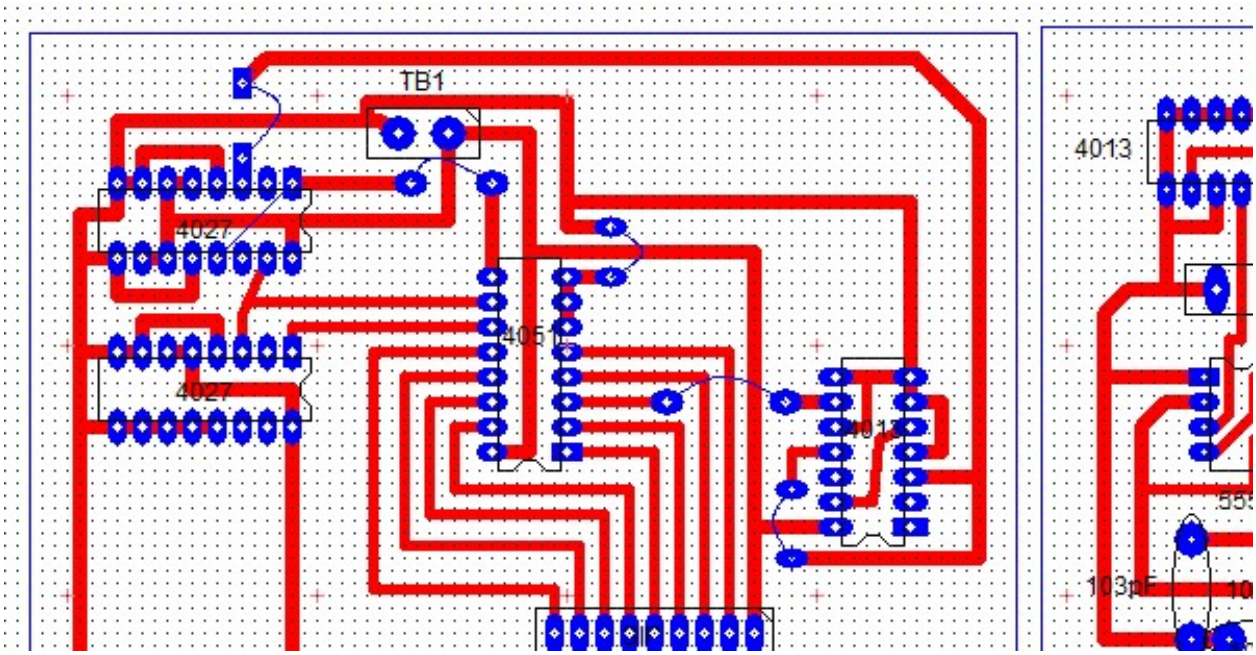
1. The circuit can be divided into two main sections namely clock generator and the PRBS generator.
2. The clock signal is generated using IC 555, D flip flop and LED.
3. In the 555 Oscillator above, pin 2 and pin 6 are connected together allowing the circuit to retrigger itself on each and every cycle allowing it to operate as a free running oscillator. During each cycle capacitor, C charges up through both timing resistors, R1 and R2 but discharges itself only through resistor, R2 as the other side of R2 is connected to the discharge terminal, pin 7. Then the capacitor charges up to 2/3Vcc which is determined by the 0.693(R1+R2)C combination and discharges itself down to 1/3Vcc determined by

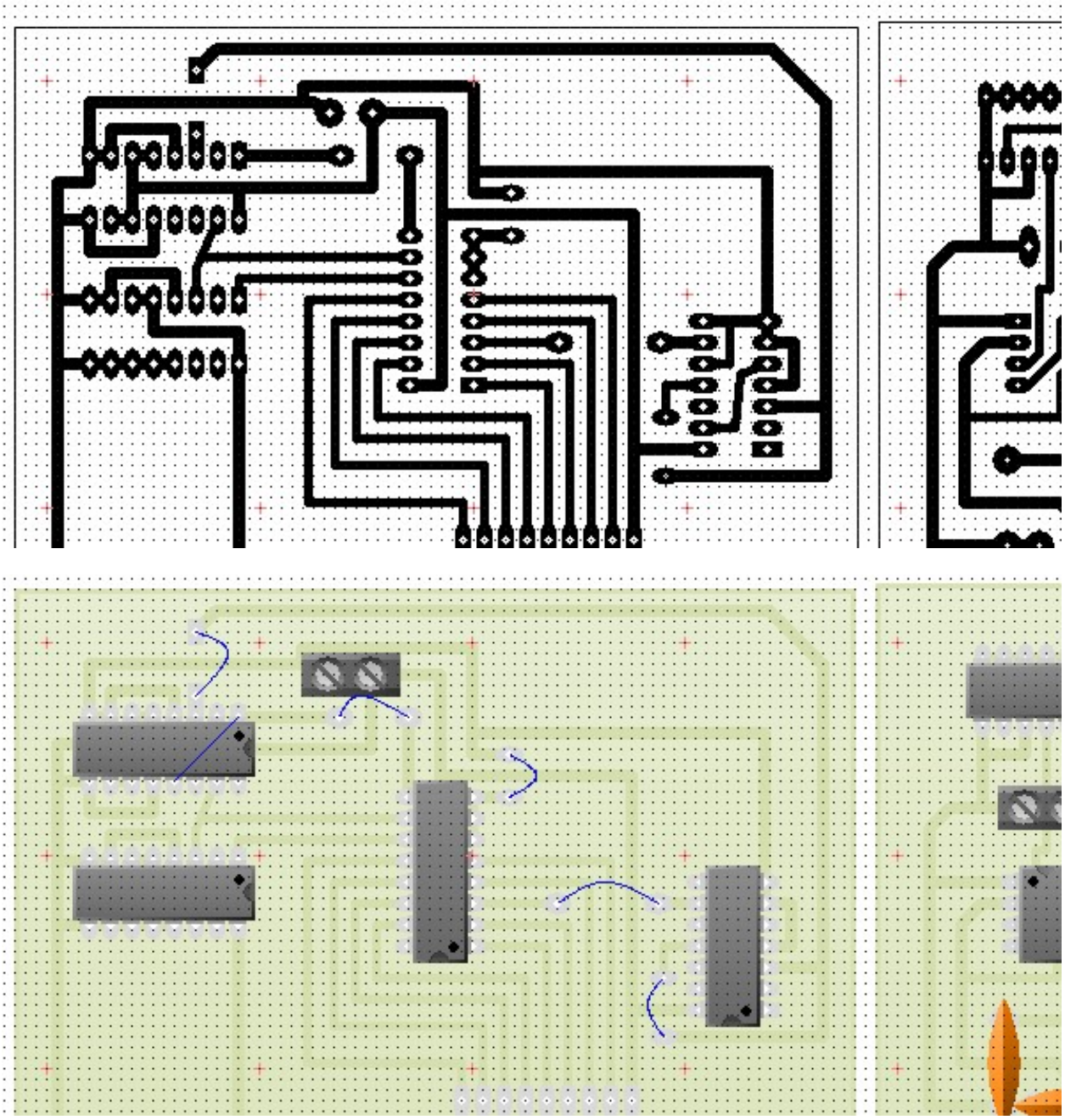
the 0.693(R2.C) combination. This results in an output waveform whose voltage level is approximately equal to Vcc - 1.5V and whose output "ON" and "OFF" time periods are determined by the capacitor and resistors combinations.

4. The individual times required completing one charge and discharge cycle of the output is therefore given as:
   t1 = 0.693 (R1+R2)C, t2 = 0.693 R2C, T = t1 + t2
5. The Pseuso random sequence is generated using a set of 8 SPST switches, 8:1 MUX and Johnson counter output is given to the 3 select lines

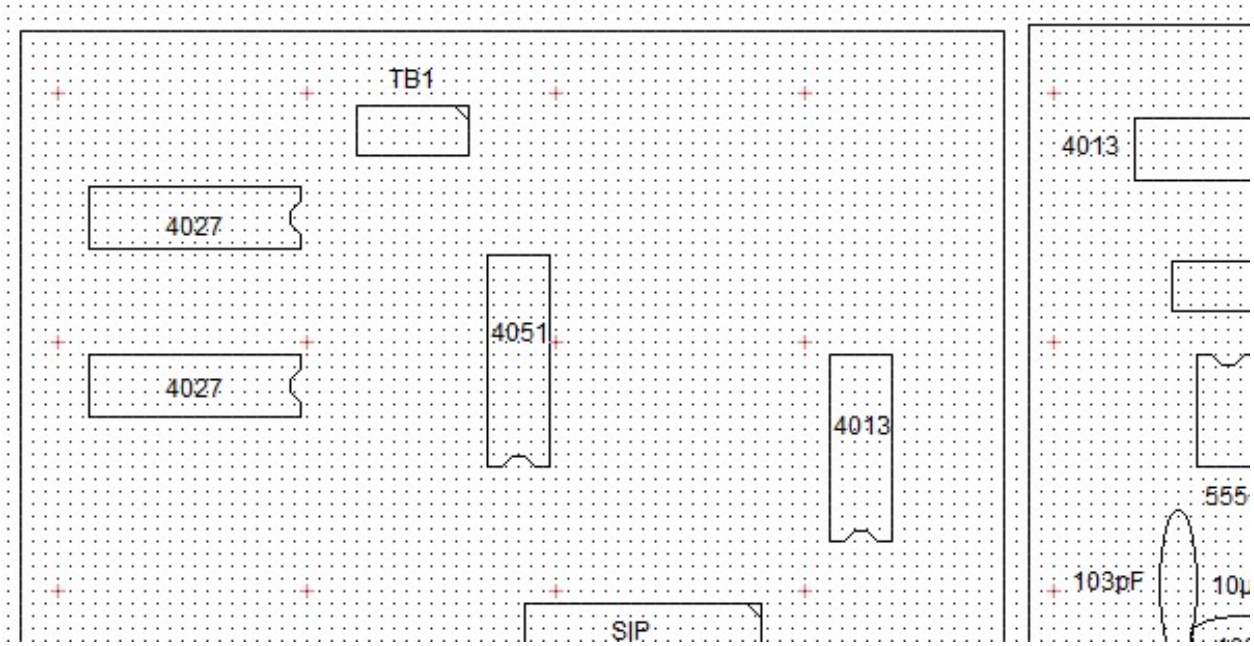
PCB Fabricated Circuit

The PCB fabrication circuit can be done using PCB wizard. The wiring or the connection between the IC pins must be done carefully with minimum space and with optimum gap between two terminals so that no wiring gets short circuited. An example of PCB art work is shown in the figure below.





The PCB artwork connections using PCB wizard software.



Silk Screen

RESULT

Here, we have successfully generated the clock signal and pseudo random sequence using the circuit above.

EXP 3. 4-LEVEL, 2-PHASE, 8-BIT QUADRATURE AMPLITUDE MODULATION

OBJECTIVE

To design and implement 4-level, 2 Phase, 8-bit Quadrature Amplitude Modulation Signal using LM324 and IC 4051

COMPONENTS REQUIRED

S.No	Name of the component	Specification	Quantity
1	Quad Op-Amp	LM324	2 nos.
2	CMOS MULTIPLEXER (8:1)	IC 4051	1 no.
3	Clock Generator module using IC 555	1 KHZ	1 no.
4	PRBS Data Generator	1 KHZ	1 no.
5	Function Generator	(0-5)MHZ	1 no.
6	Resistors	1kΩ,10kΩ 8 kΩ 22 kΩ 33 kΩ 47kΩ	Each 16 nos. 4 nos. 3 nos. 1 no. 1 no.
7	Capacitors	0.01uf, 1 uf	Each 1 no.
8	Regulated Power Supply (RPS)	+5V, -5V, +12V and -12V	1 no.
9	Soldering Iron	25W	1 no.
10	Soldering Lead and Flux	-	1 no.
11	Copper Clad	Glass Epoxy	1 no.
12	Connecting Wires	Multi Strand	As Required

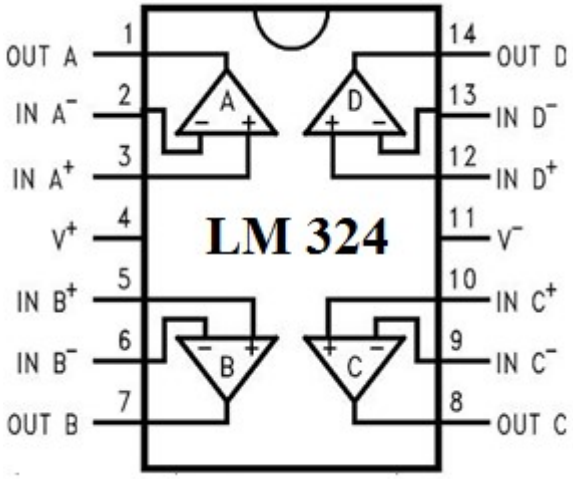
THEORY

QUAD OP AMP (LM324)

The LM324 series has quad op-amps with true differential inputs. The quad amplifier can operate at supply voltages as low as 3.0 V or as high as 32 V. The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage.

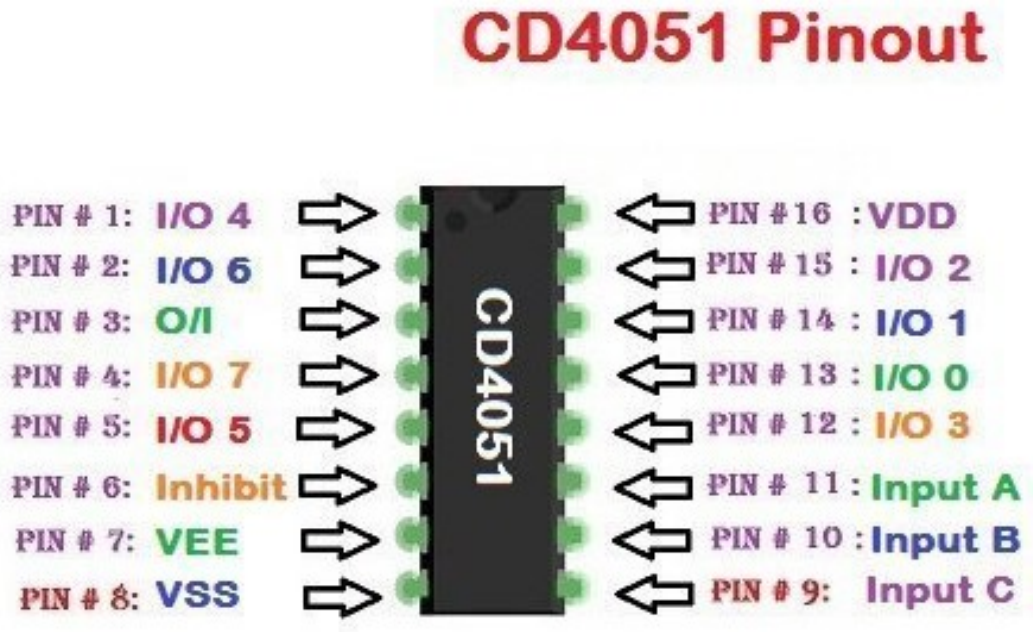
FEATURES

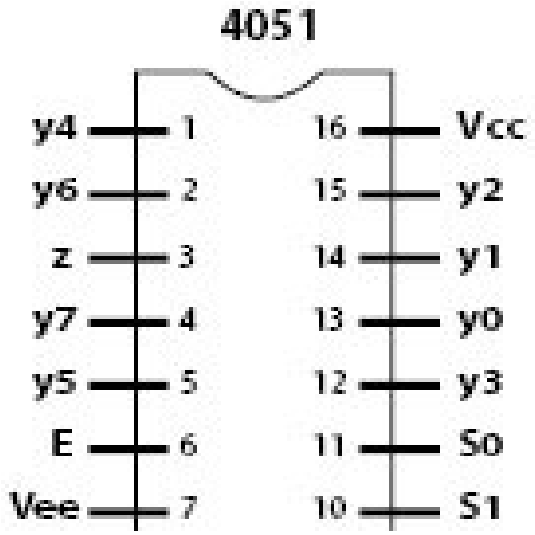
- Short Circuited Protected Outputs
- True Differential Input Stage
- Single Supply Operation: 3.0 V to 32 V (LM224, LM324, LM324A)
- Four Amplifiers Per Package

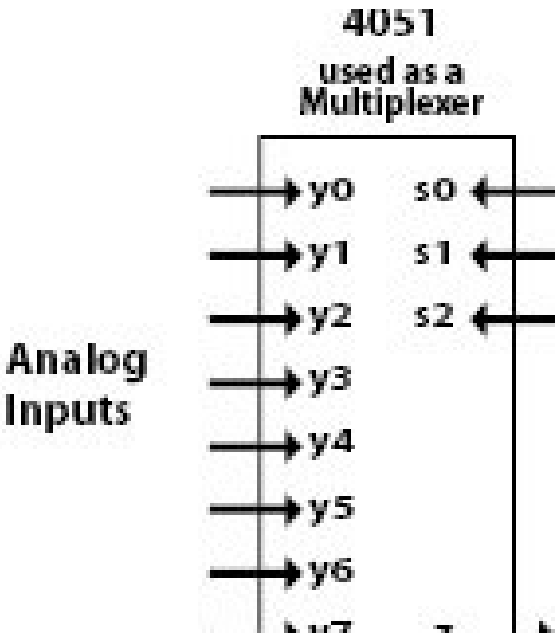


CMOS 8:1 MULTIPLEXER (4051)

CD 4051 is basically an analog multiplexer and demultiplexer. It is analog controlled switch. CD-4051 is an eight (8) channel multiplexer and has three control input named as **A, B** and **C.** These inputs connect only 1 out of 8 channels to the output in order to obtain the desired output. Channel I/O terminals became outputs and common O/I become input terminals when CD 4051 is used as a demultiplexer. CD-4051 has a lot of amazing features e.g. binary address decoding on chip, break before make switching eliminates channel overlapping, wide ranges of analog signals as well digital signal levels. CD-4051 can be used in signal gating, analog to digital converter, digital to analog converter, analog and digital multiplexing and demultiplexing.







PRECAUTIONS

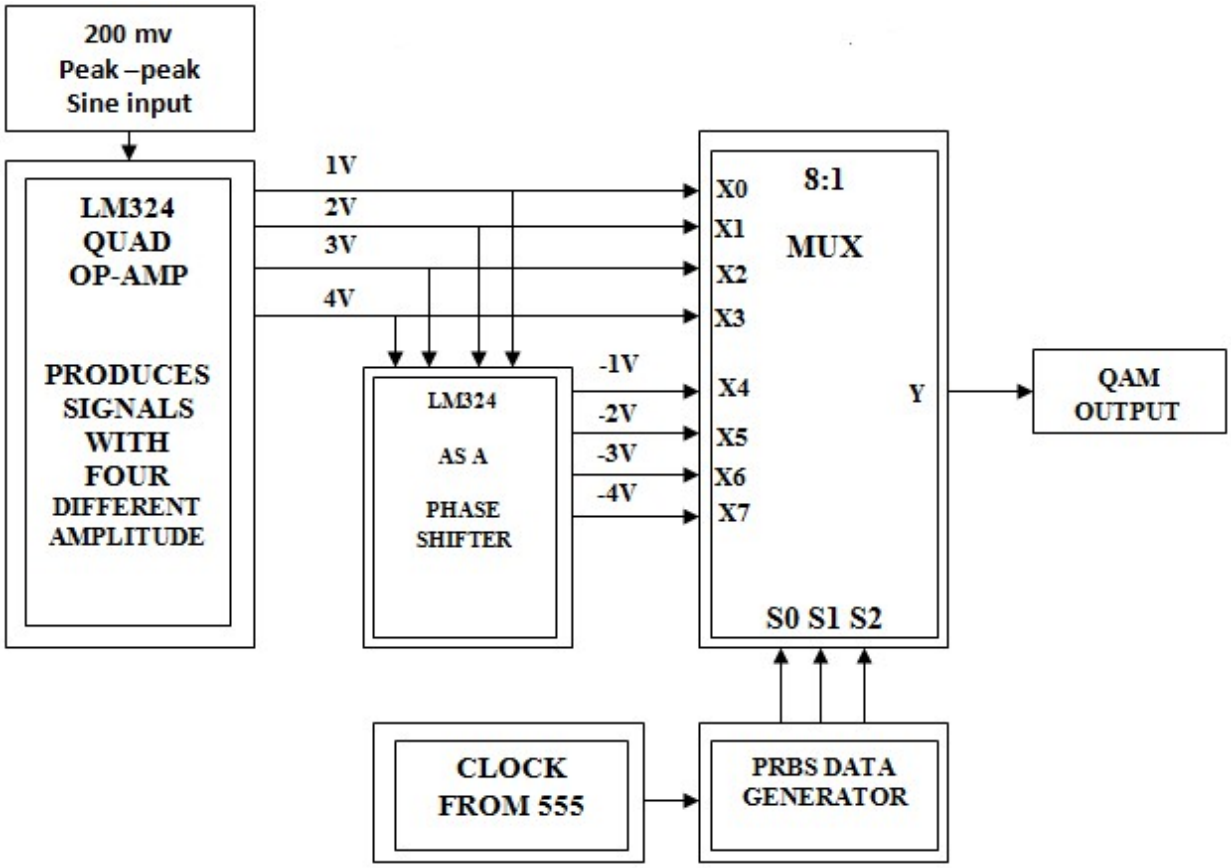
- ✓ Before making the connection keep the SPST switch in OFF position.
- ✓ Before switch ON the RPS, check the voltage setting knob of RPS at minimum position and current setting knob of RPS at maximum position.
- ✓ After completing the experiment disconnect the circuit carefully.

PROCEDURE

- ➢ Make the connections as per the circuit diagram.
- ➢ Set the voltage in RPS, to give the biasing voltage Vcc, Vee and Gnd to IC 4051 (MUX) and LM 324 (Quad op amp).
- ➢ Set the voltage in RPS for IC 4013, IC 4030 (PRBS Data Generator) and IC 555(Clock signal Generator).
- ➢ Apply 200 mv Peak to peak voltage to the input of op amp.
- ➢ **Connect all the unused input pins of CMOS IC to the ground.**
- ➢ Observe the output signal from CRO.

HARDWARE IMPLEMENTATION

Refer the Block diagram. First of all, we have to obtain four different amplitude levels of sine signal by applying the same input signal to the 4 op amps with different gain output. The op amps provides signal with four different amplitude levels and the same is applied to op amps in next stage to get 90 degree phase shift of those 4 signals. All the 8 signals are applied to the 8:1 multiplexer. The select lines are connected with PRBS data generator for selecting the inputs randomly. The clock signal for the PRBS is generated by 555 timer, operating in Astable mode. Finally we will get the output as 4 different amplitudes as well as 2 different phase shifts.

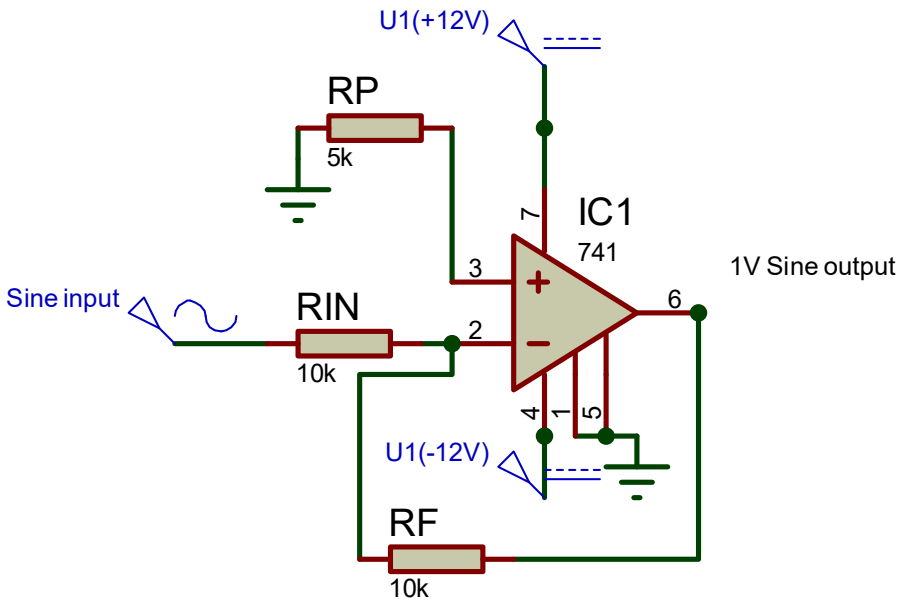


S2	S1	S0	Y
0	0	0	X0
0	0	1	X1
0	1	0	X2
0	1	1	X3
1	0	0	X4
1	0	1	X5
1	1	0	X6
1	1	1	X7

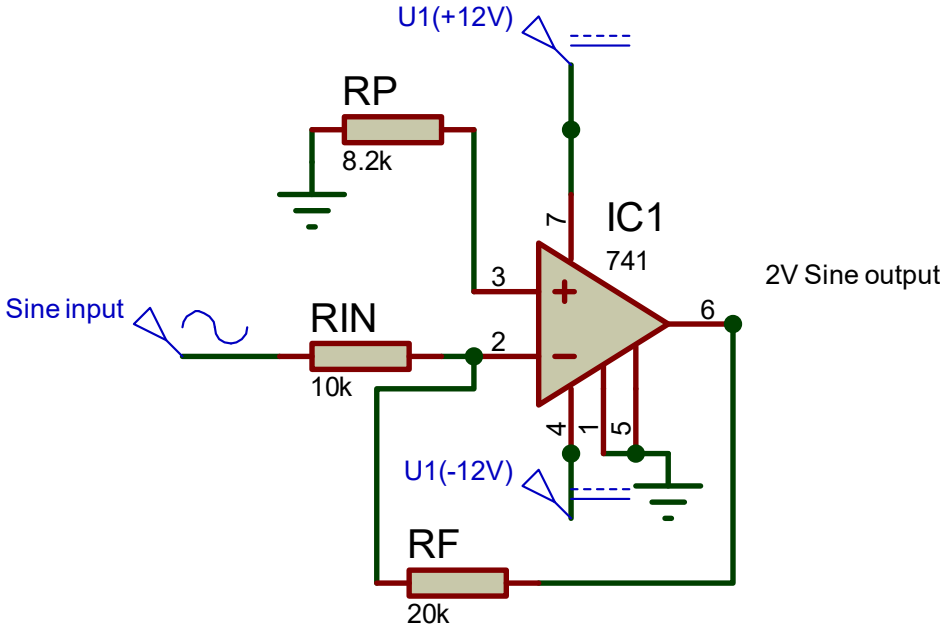
To generate the sine wave with four different amplitudes, we have to use four op-amps with different gains. The gain of an op-amp can be adjusted by varying the feedback resistance RF.

GAIN = RF / RIN and RP = RIN // RF

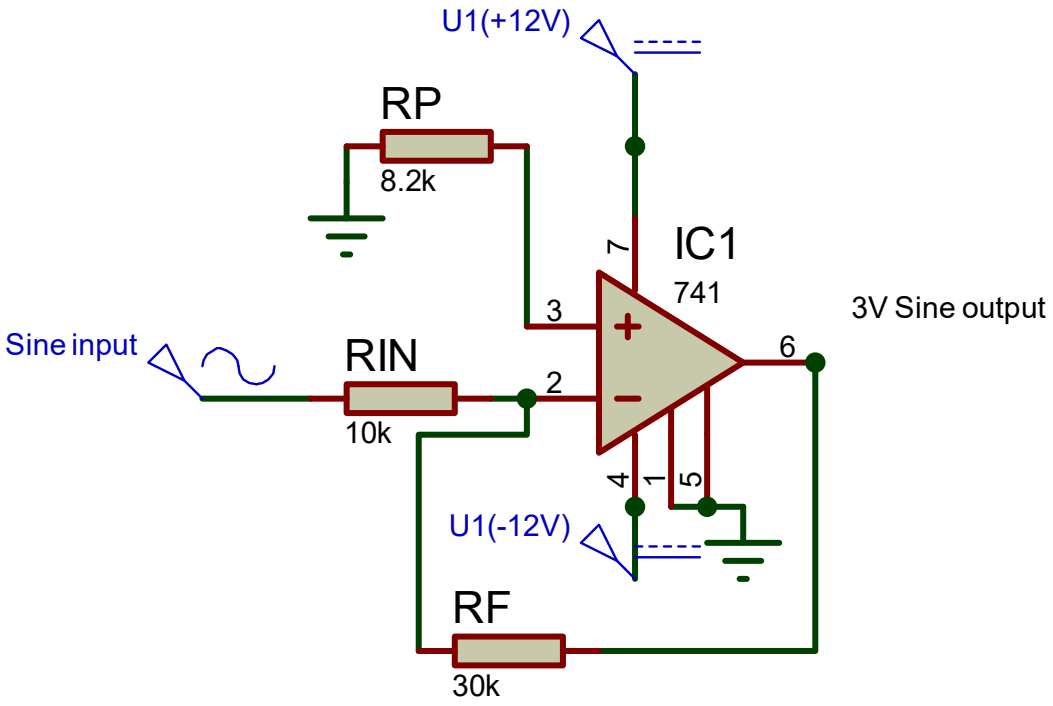
OP AMP WITH GAIN =1



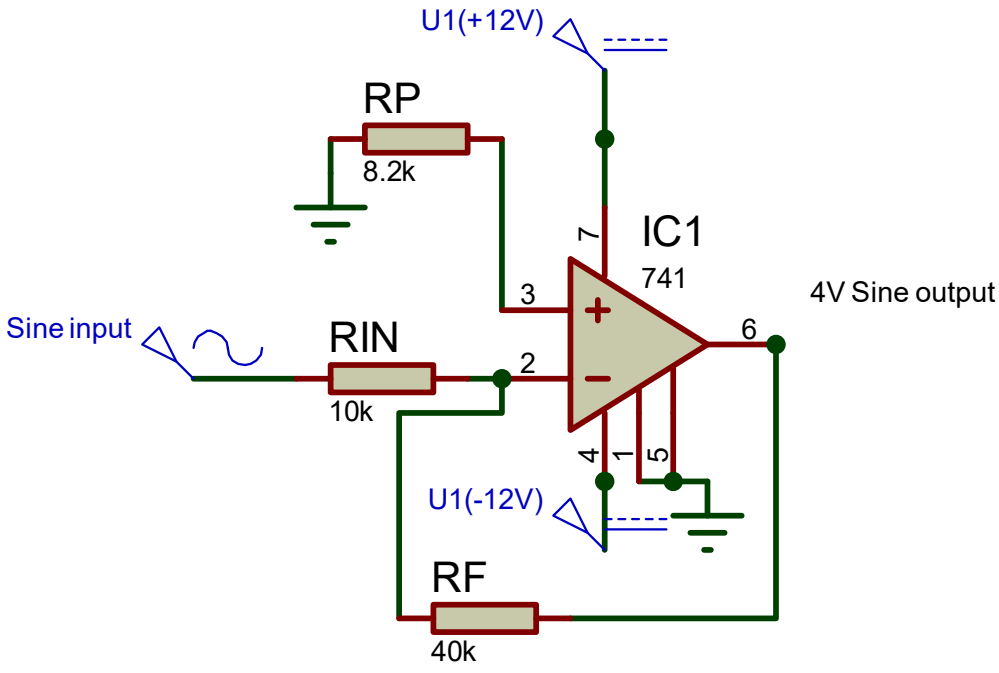
OP AMP WITH GAIN =2



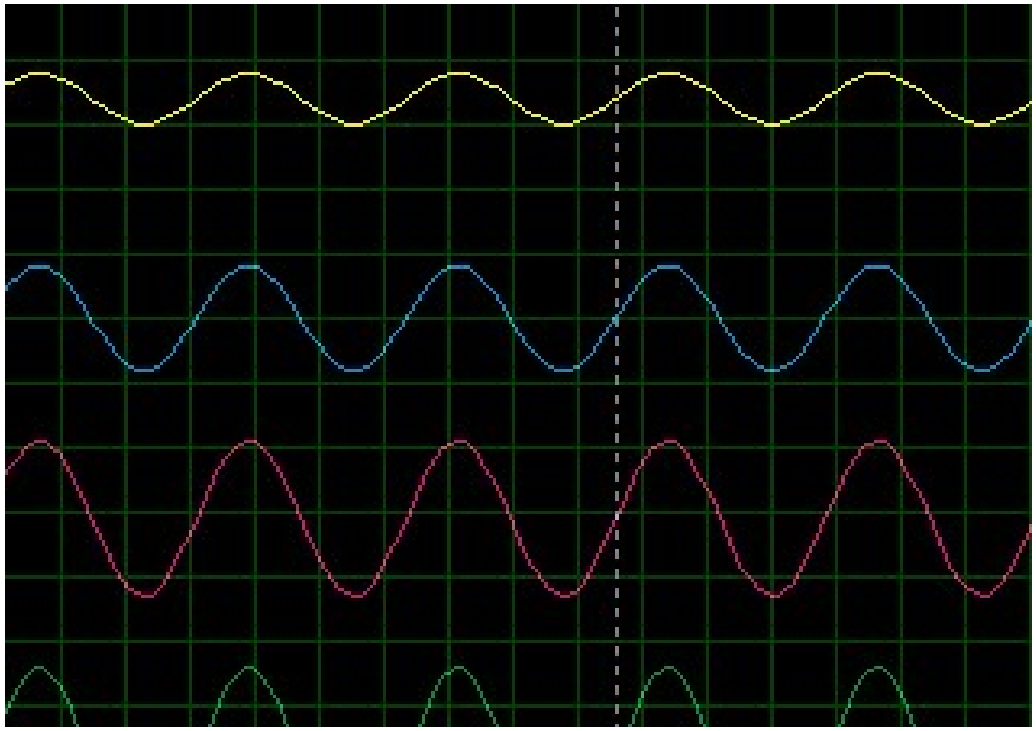
OP AMP WITH GAIN =3



OP AMP WITH GAIN =4

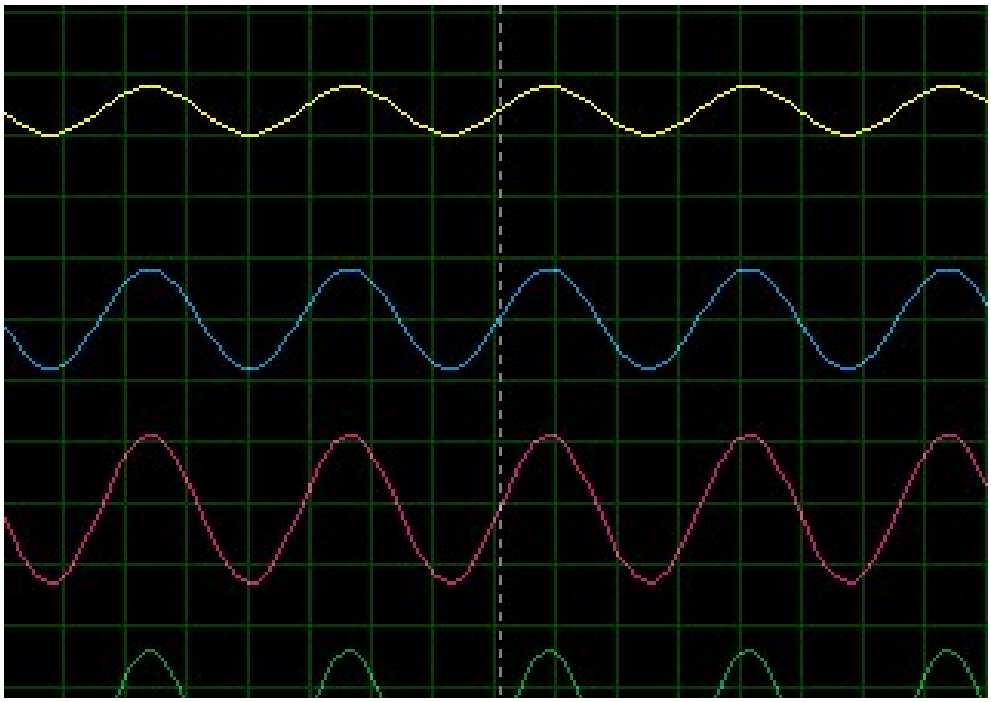


OUTPUT WAVEFORMS OF FOUR OP-AMPS

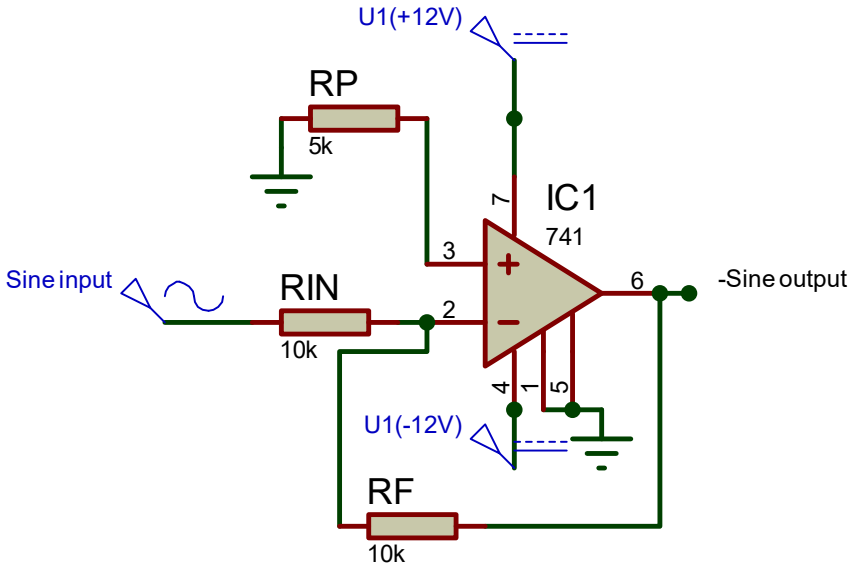


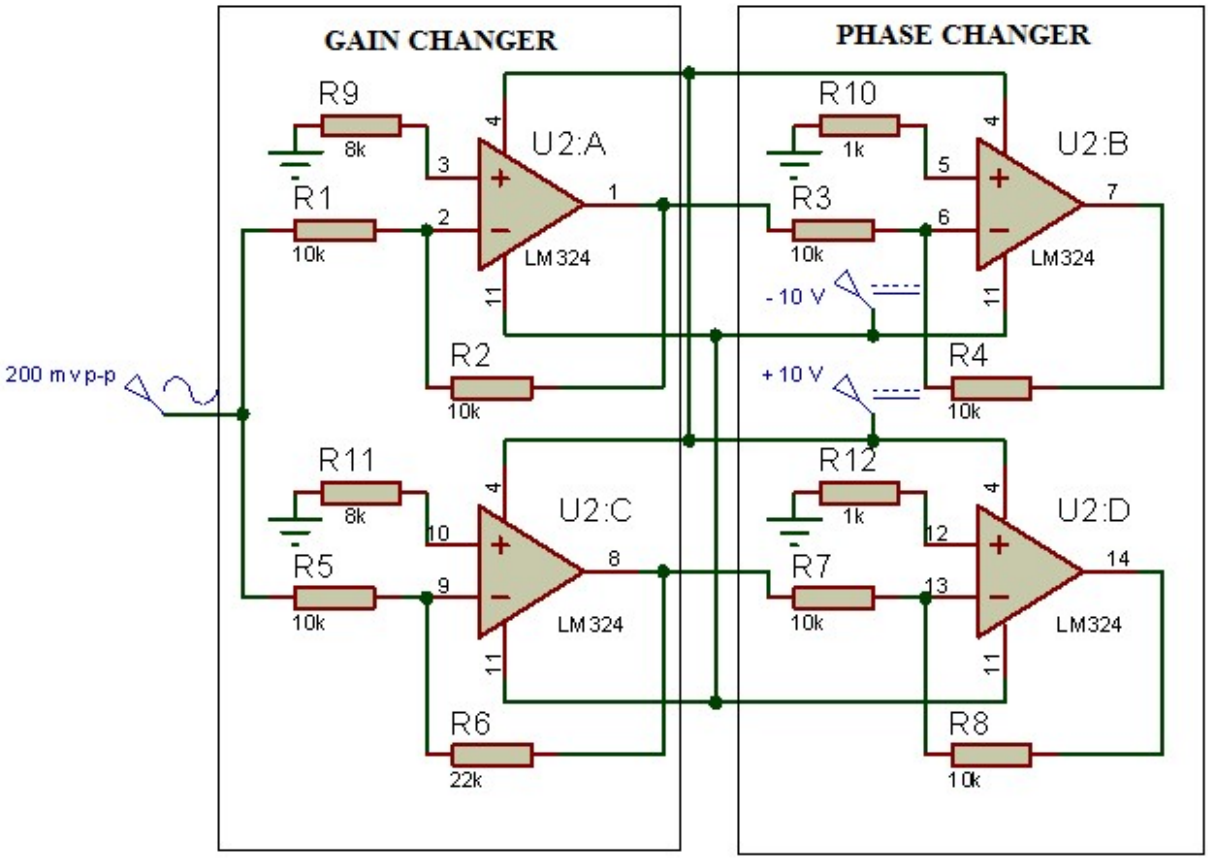
Instead of using four number of IC 741, we can use LM 324, which is having four op-amps in one single chip. So that we can reduce number of IC pins as well as component occupying space.

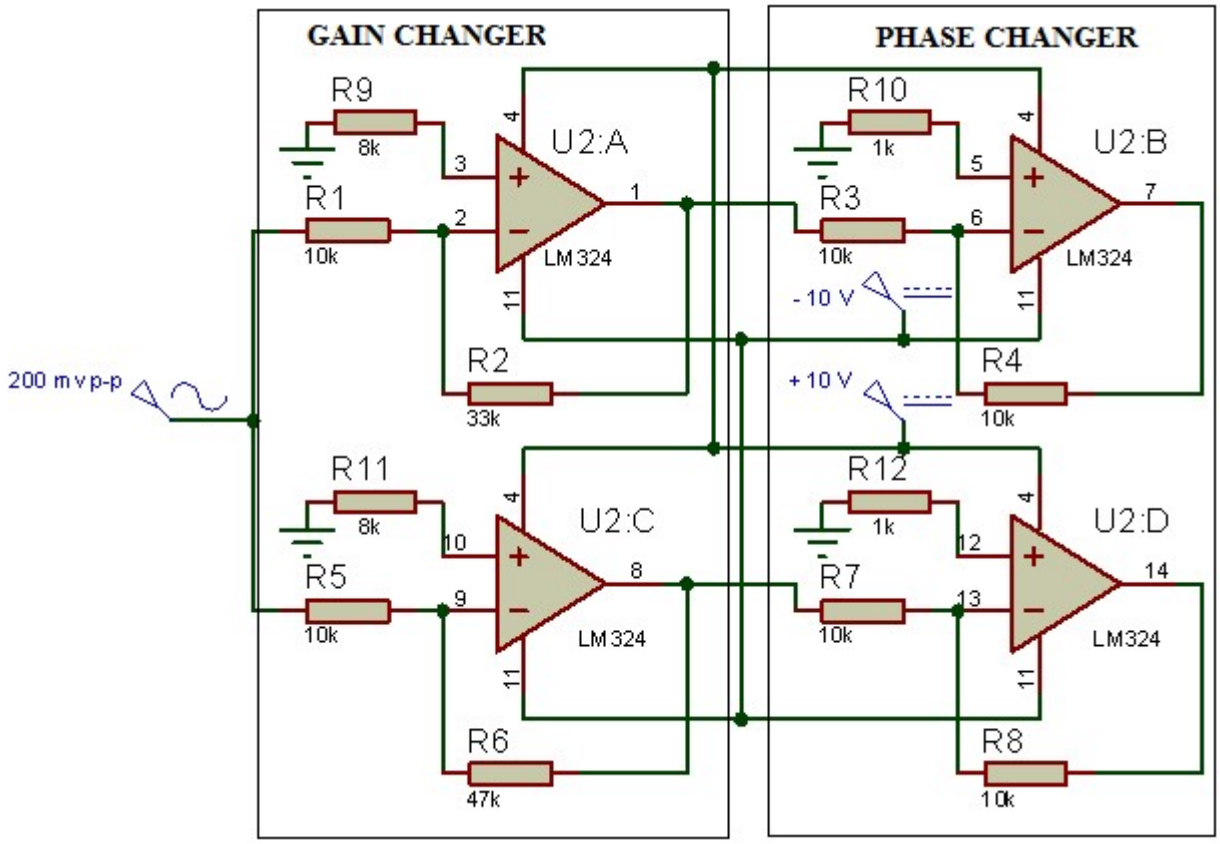
OUTPUT WAVEFORMS OF FOUR OP-AMPS OPERATED AS PHASE SHIFTER



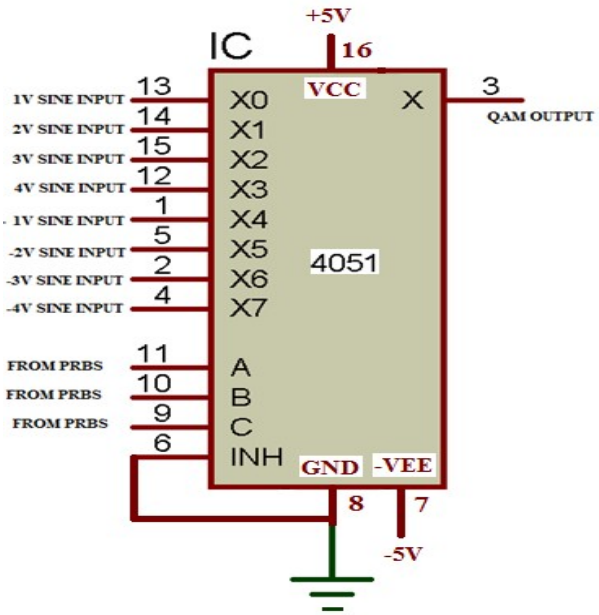
OP AMP AS PHASE SHIFTER



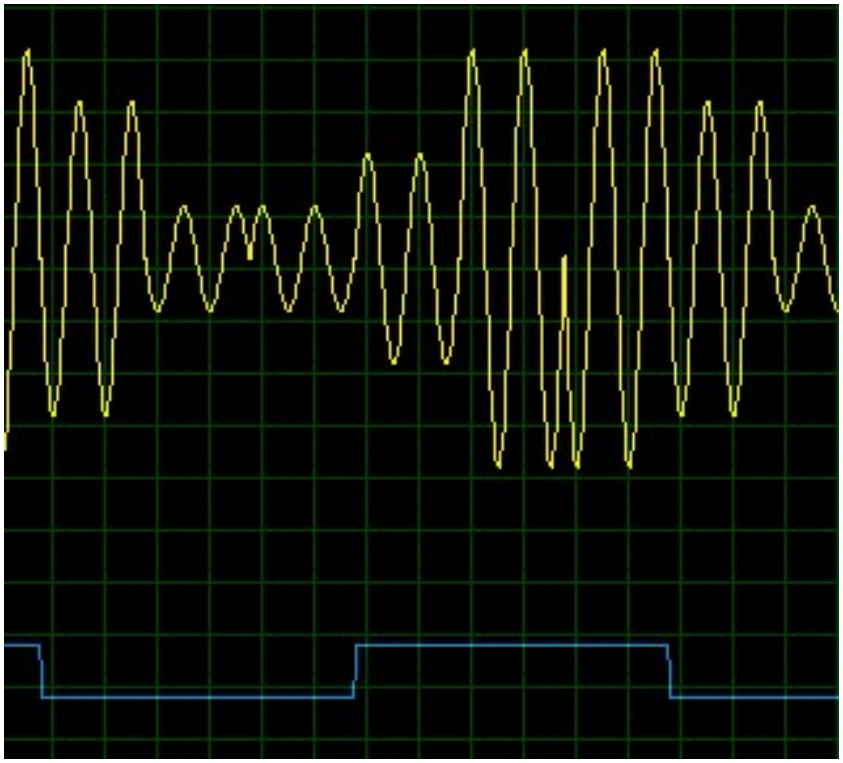


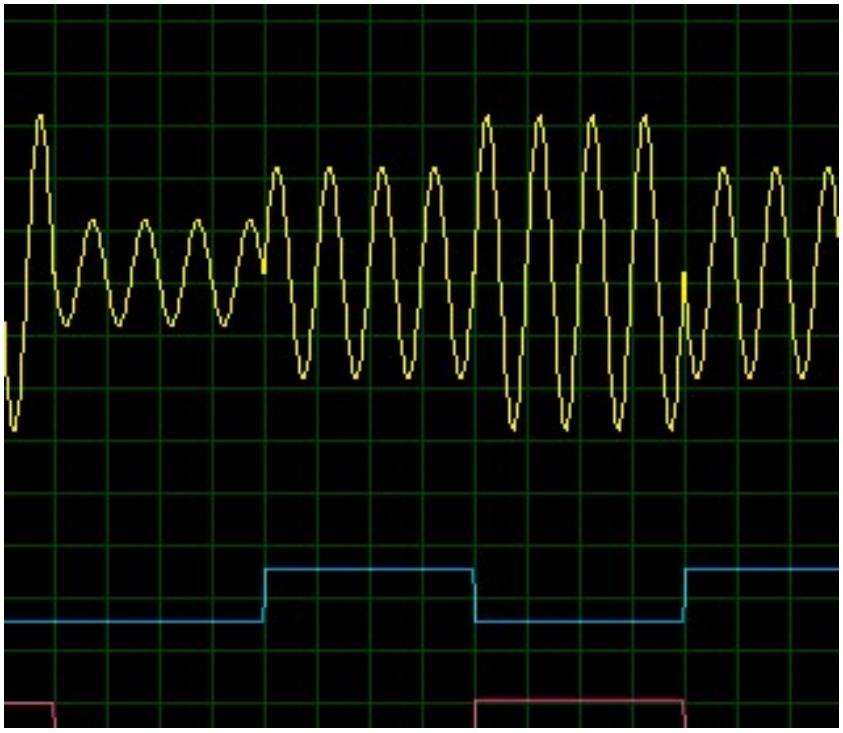


Finally, all the 8 sine signals are applied to the 8:1 multiplexer(IC 4051), and select lines are connected from PRBS to achieve QAM output.

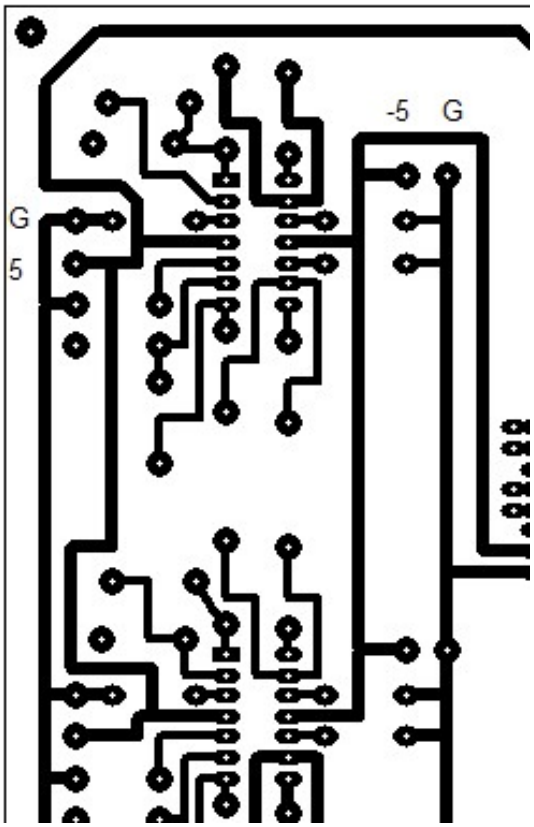


QAM WAVEFORM

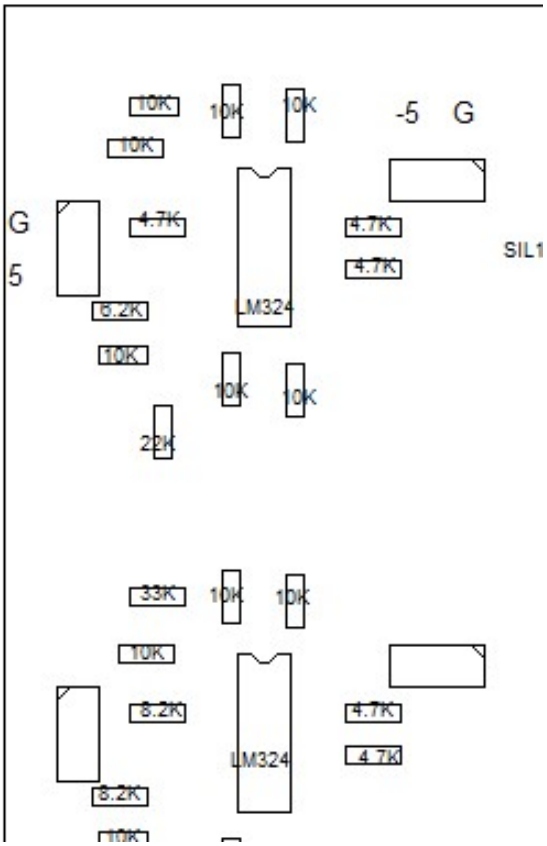


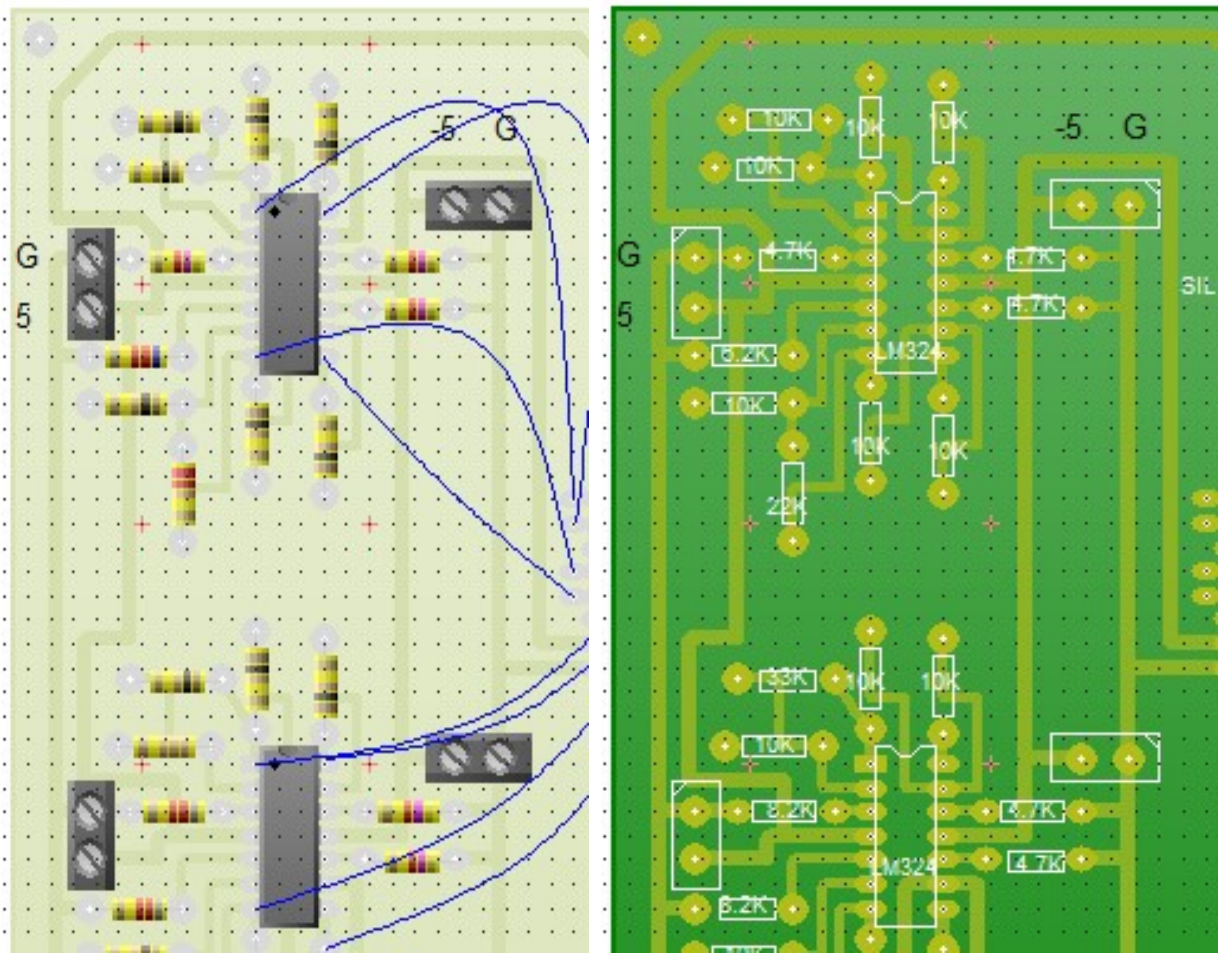


PCB ART WORK



SILK SCREEN ARTWORK





PROCEDURE

1. Draw the PCB artwork with the help of PCB wizard software.
2. Take a PCB raw material (Copper Clad) and cut the material as per the required dimensions.
3. Prepare the master layout using silk screen to copy the layout to the copper clad and print the same in copper clad using legend printing.
4. Do the process of etching (Removing the unwanted copper from copper clad).
5. Perform drilling (Process of making holes for component placement) in the copper clad.
6. Perform tinning (Process of applying lead at soldering points) in the copper clad.
7. Place the components in the copper clad and solder the same as per the silk screen layout and verify the output.

RESULT

Thus, the 4-level, 2 Phase, 8-bit Quadrature Amplitude Modulation Signal using LM324 and IC 4051 is designed, implemented and its output is verified.

EXP 4. ALTERNATE MARK INVERSION CODER

OBJECTIVE

To generate AMI signal using IC 4013 (D-FF) and IC 4016 (Quad Bilateral Switch)

COMPONENTS REQUIRED

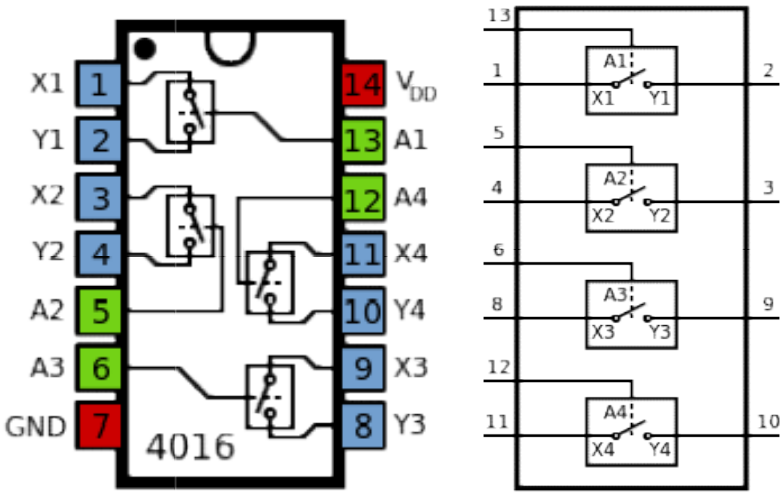
S.No	Name of the component	Specification	Quantity
1	Quad Bilateral Switch	IC 4016	1 no.
2	CMOS D-FLIP FLOP	IC 4013	1 no.
3	CMOS AND GATE	IC 4081	1 no.
4	Clock Generator module using IC 555	1 KHZ	1 no.
5	Regulated Power supply (RPS)	+5V, -5V, +12V and -12V	1 no.
6	PRBS Data Generator	100 HZ	1 no.
7	Resistors	1kΩ,10kΩ	Each 2 nos.
8	Soldering Iron	25W	1 no.
9	Soldering Lead and Flux	-	1 no.
10	Copper Clad	Glass Epoxy	1 no.
11	Connecting Wires	Multi Strand	As Required

THEORY

QUAD BILATERAL SWITCH (4016)

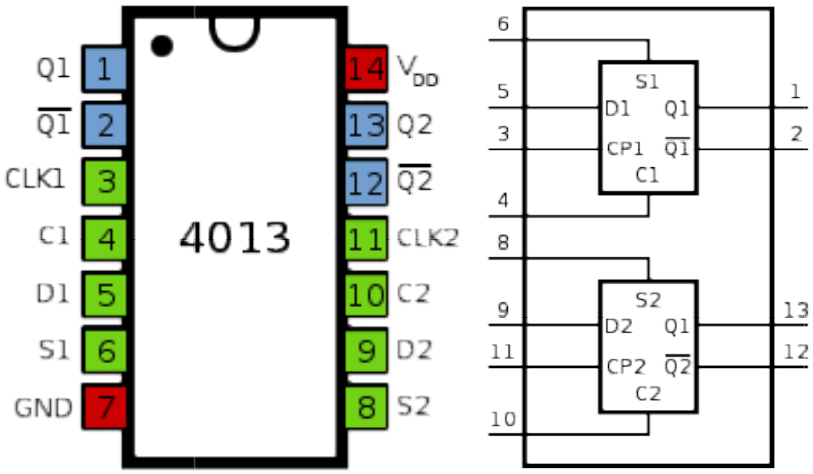
The 4016 contains 4 analog bilateral switches, each with an active-high enable input (A) and two input/outputs (X and Y). When the enable input is HIGH, the X and Y terminals are shorted. This is the ON condition. When the enable is low, the X and Y terminals are open, and the switch is off. This IC can be used as an analog switch.

The 4066 is pin-compatible with the 4016, but has a significantly lower on impedance and more constant on resistance over the full range of input voltage. Therefore, the 4066 is preferable to the 4016 in most cases.



CMOS D FLIP FLOP (4013)

The 4013 contains two independent D-type flip-flops with asynchronous set/reset inputs. When the set is ONE, then the Q is ONE and when the reset is ONE, then the Q is ZERO. When set and reset are low, they are in "don't care condition". Q shifts the data at D during low-to-high clock transition. This is then held until the next low-to-high clock transition.

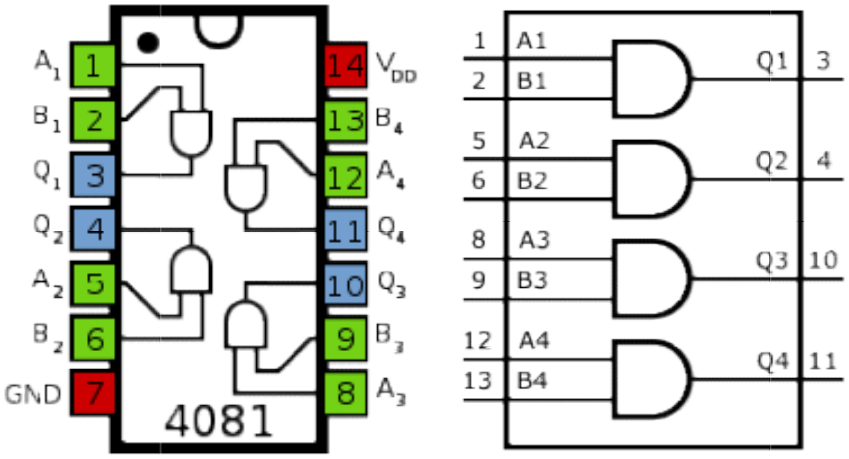


CMOS AND GATE (4081)

The 4081 is a member of the 4000 Series CMOS range, and contains four independent CMOS AND gates, each with two inputs. The pinout diagram, given on the right, is the standard two-input logic gate IC layout:

- Pin 7 is the negative supply
- Pin 14 is the positive supply
- Pins 1&2, 5&6, 8&9, 12&13 are gate inputs

- Pins 3, 4, 10, 11 are gate outputs



This chip is widely available, and usually comes in a DIL-14 or SOIC-14 package.

This chip is different in pinout to the TTL 7408 and 7409.

PRECAUTIONS

- ✓ Before making the connection keep the SPST switch in OFF position.
- ✓ Before switch ON the RPS, check the voltage setting knob of RPS at minimum position and current setting knob of RPS at maximum position.
- ✓ After completing the experiment disconnect the circuit carefully.

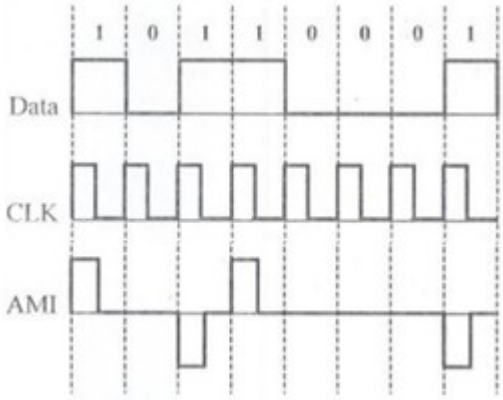
PROCEDURE

- ➢ Make the connections as per the circuit diagram.
- ➢ Set the voltage in power supply, to give the biasing voltage to IC 4013 (D-FF) and IC 4030 (EX-OR Gate).
- ➢ Set the voltage in power supply for V_1 and V_2 as +5V and -5V.
- ➢ Also, Connect +12V to the pin no.14 of IC 4016 and -5V to the pin no.7 of IC 4016.
- ➢ **Connect all the unused input pins of CMOS IC to the ground.**
- ➢ Observe the output signal from CRO.

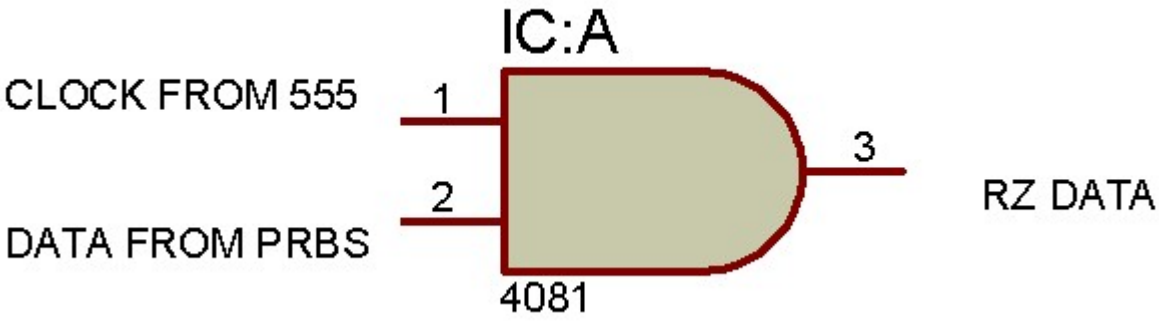
CIRCUIT DESCRIPTION

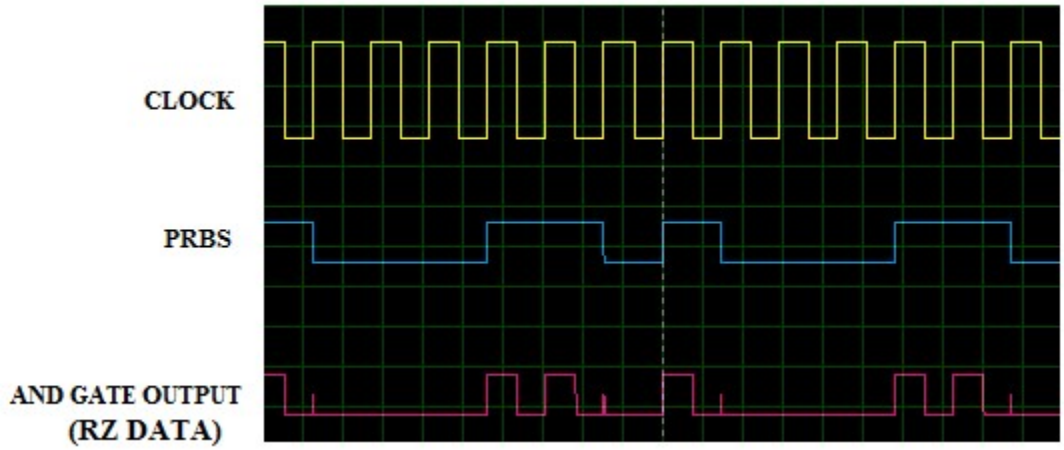
Alternate mark inversion (AMI) is a bipolar signal. If the input to a AMI coder is zero, the output is also zero. If the input contains ones, alternate ones are inverted at the output as +V and –V bipolar signals. The waveforms in the figure illustrate this. The data stream of AMI signal is shown in figure. when the data bit is "1", the first signal amplitude at 1/2 bit time is positive voltage level and the other 1/2 bit time is 0 V; then the second signal amplitude at 1/2 bit time is negative voltage level and the other 1/2 bit time is 0 V, therefore, the only different between AMI and RZ is the alternate "1" are inverted. When the data bit is "0", the signal amplitude is 0

V. this type of encode is common used by telephone industry which is pulse coding modulation (PCM).

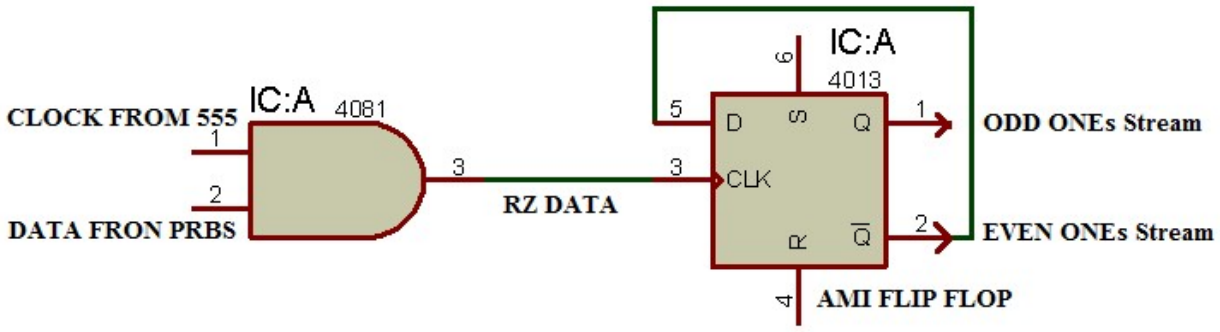


HARDWARE IMPLEMENTATION

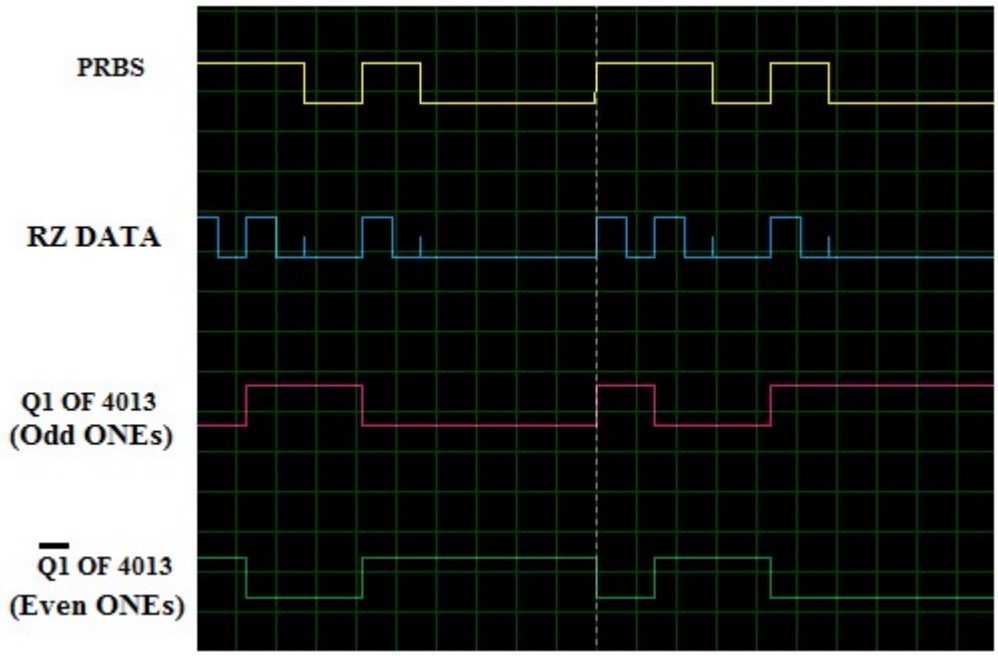


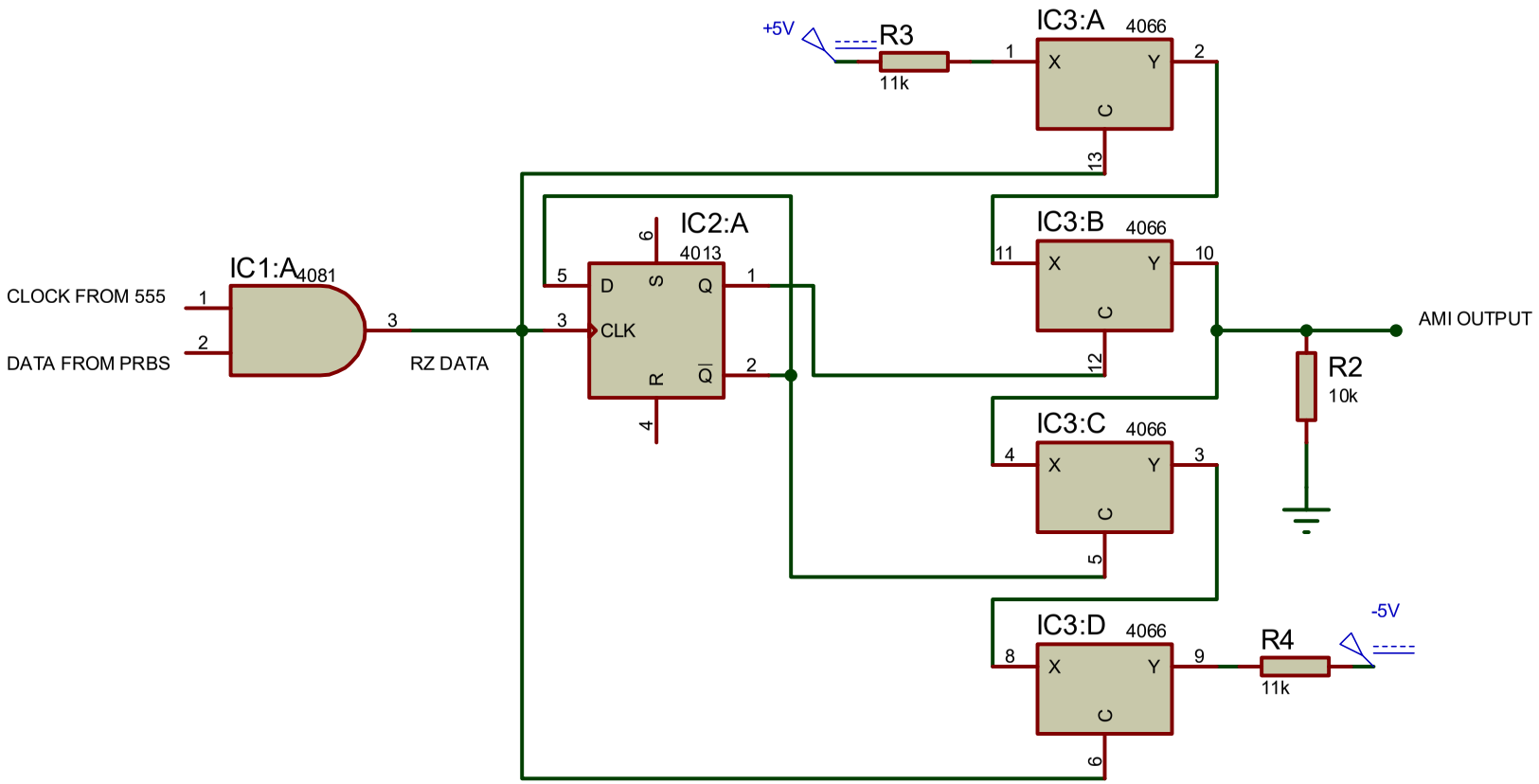


The RZ data output from AND gate is fed to a AMI flip flop. The successive ONEs at the clock toggle the flip flop. The zeros will not toggle the flip flop.

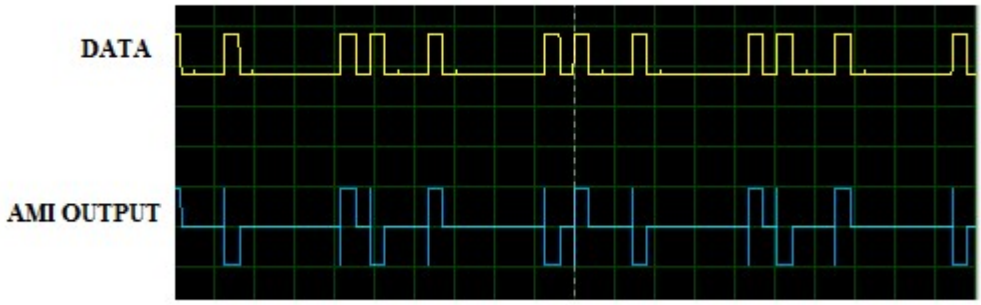


It is obvious, for all odd ones (1, 3, 5, etc) Q will be ONE and for all even ones (2, 4, 6, etc) $\overline{Q}$ will be ONE. Thus odd ONEs stream and even ONEs streams are separated.

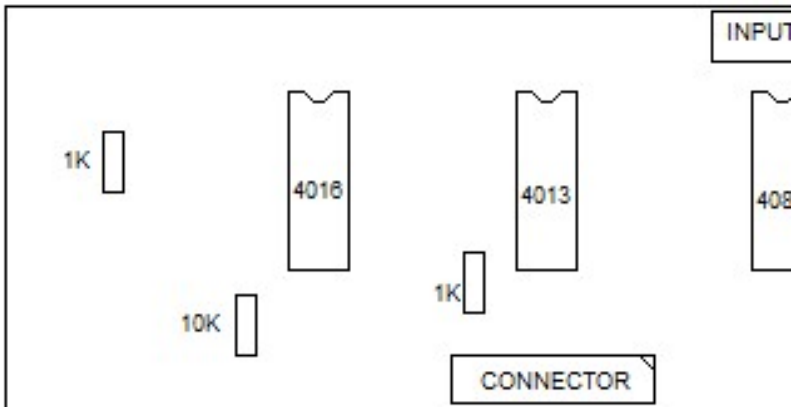


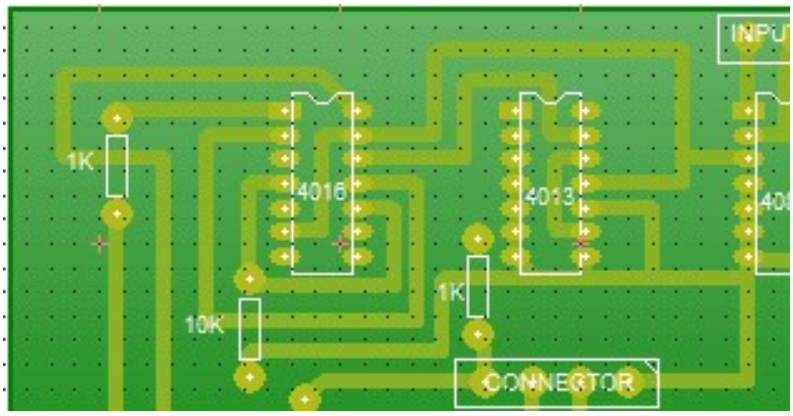

+5V
R3
11k
IC3:A
4066
1
2
X
Y
C
13
IC2:A
4013
6
5
D
S
Q
1
3
CLK
R
Q
2
4
IC3:B
4066
11
10
12
IC1:A
4081
CLOCK FROM 555
1
2
DATA FROM PRBS
3
RZ DATA
AMI OUTPUT
R2
10k
IC3:C
4066
4
3
5
IC3:D
4066
8
9
6
R4
11k
-5V

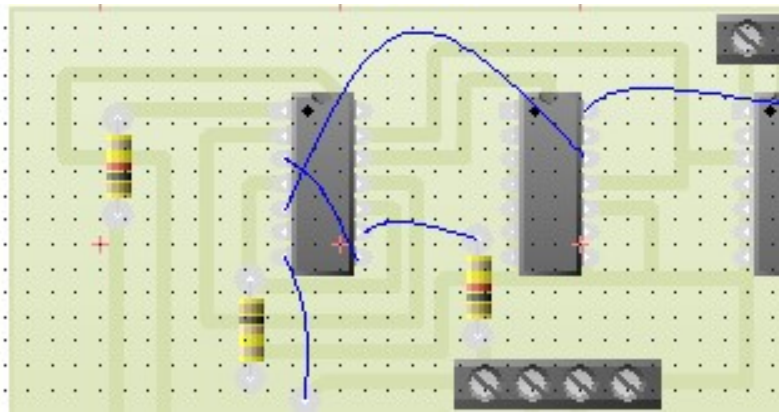
Switches IC3-A and IC3-B are deal with “Odd ONEs” Stream. Switches IC3-C and IC3-D are deal with “Even ONEs” Stream. IC3 –A and IC3-B form an AND gate and IC3-C and IC3-D form another AND gate. The output will be a +5V pulse if the RZ data AND “Odd ONEs” stream is ONE. The output will be -5V pulse if the RZ data AND “Even ONEs” stream is ONE.



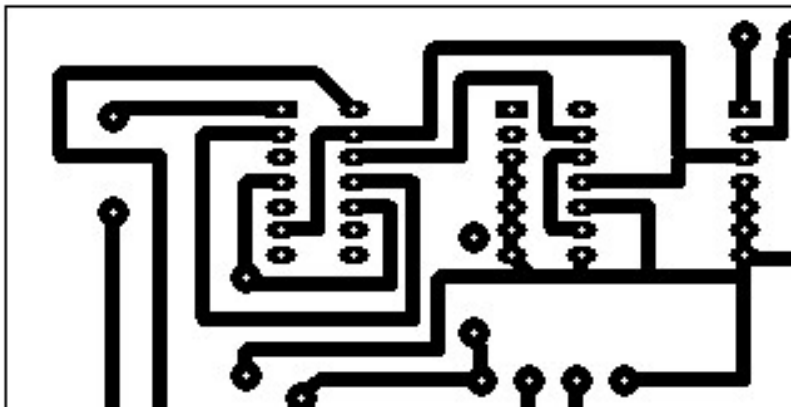
SILK SCREEN ARTWORK







PCB ARTWORK



PROCEDURE

8. Draw the PCB artwork with the help of PCB wizard software.
9. Take a PCB raw material (Copper Clad) and cut the material as per the required dimensions.
10. Prepare the master layout using silk screen to copy the layout to the copper clad and print the same in copper clad using legend printing.
11. Do the process of etching (Removing the unwanted copper from copper clad).
12. Perform drilling (Process of making holes for component placement) in the copper clad.
13. Perform tinning (Process of applying lead at soldering points) in the copper clad.
14. Place the components in the copper clad and solder the same as per the silk screen layout and verify the output.

RESULT

Thus, the AMI signal using IC 4013 (D-FF) and IC 4016 (Quad Bilateral Switch) is designed, generated and its output is verified.

EXP 5. Industrial Automation using AT89S52 with Bluetooth

Objective:

Bluetooth Controlled Electronic Industrial Automation is a project, where we can control different electrical appliances and electronic devices using an Android device with the help of Bluetooth Technology.

Components Required:

- 8051 Microcontroller (AT89C52)
- 8051 Development Board
- 8051 Programmer (Programming Board)
- Programming Cable
- 16 × 2 LCD Display
- 10KΩ Potentiometer
- Bluetooth Module (HC – 05)
- 4 – Channel Relay Module
- Loads (like Light Bulb, Fan, etc.)
- Power Supply
- Connecting wires

  Relay Module Circuit (for 1 load) using the following
  - 5V or 12V Relay
  - BC547 NPN Transistor
  - 1N4007 PN Junction Diode
  - 1 KΩ Resistor (1/4 Watt)

Theory:

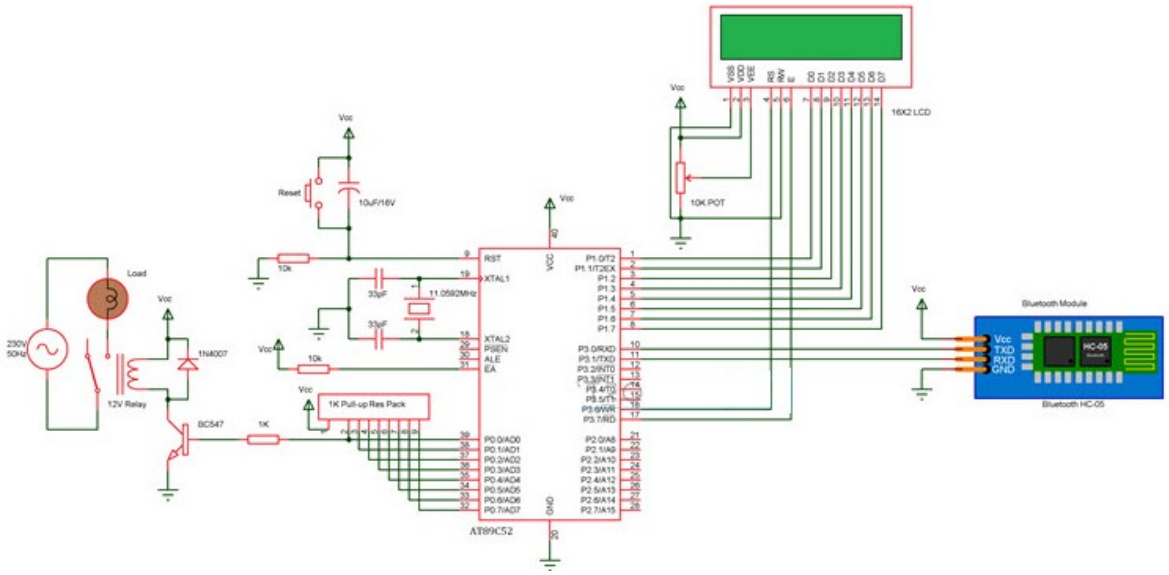
In this project, a Bluetooth module is interfaced to 8051 based AT89S52 Microcontroller. This Bluetooth Module receives the commands from the Android application that is installed on the Android device, using wireless communication (Bluetooth Technology). The program which is written to the 8051 microcontroller communicates with Bluetooth module serially to receive the commands. Microcontroller switches the electrical loads automatically based on the commands received from the Bluetooth.

Principle

In this project, a Bluetooth module is interfaced to 8051 Microcontroller. This Bluetooth Module receives the commands from the Android application that is installed on the Android

device, using wireless communication (Bluetooth Technology). The program which is written to the 8051 microcontroller communicates with Bluetooth module serially to receive the commands. Microcontroller switches the electrical loads automatically based on the commands received from the Bluetooth.

Circuit Diagram



Software Requirements

- Keil µVision IDE
- Willar Software
- Proteus (for Circuit Diagram and Simulation)
- Android Application installed on Android Device
- "Android Controlled Bluetooth " Android App

Procedure

- Make the connections as per the circuit diagram.
- Check the ground connection precisely before switching on the power supply.
- Power on the main supply
- Write Embedded C code using Keil Software
- Copy the HEX File to AT89S52 by Using Software
- Open Android App In your mobile to Control Industrial Loads

Embedded C Code:

```
#include <reg51.h>
#include "UART_H_file.h"              /* include UART library */
sbit LED=P1^0;
void main()
{
charData_in;
UART_Init();                          /* initialize UART */
P1 = 0;                          /* clear port initially */
LED = 0;                              /* initially LED turn OFF */
while(1)
{
Data_in = UART_RxChar();              /* receive char serially */
if(Data_in == '1')
{
LED = 1;                              /* turn ON LED */
UART_SendString("LED_ON");        /* send status of LED*/
}
else if(Data_in == '2')
{
LED=0;                                    /* turn OFF LED */
UART_SendString("LED_OFF");               /* send status of LED*/

}
else
UART_SendString("Select proper option");  /* send msg to select proper option */

}
}
```

RESULT

Here, we have successfully implemented the Industrial Automation using AT89S52 with Bluetooth

EXP 5. Visitor counter using AT89S52 with 16 x 2 LCD display

Objective:

This Project describes the design and working of a Bidirectional Visitor Counter using 8051 based AT89S52 Microcontroller

Components Required:

- AT89C52 (8051 based Microcontroller)
- 8051 Programmer
- Push Button
- 10µF Electrolytic Capacitor
- 2 x 10KΩ Resistors (1/4 Watt)
- 11.0592 MHz Crystal
- 2 x 33pF Ceramic Capacitors
- 16 x 2 LCD Display
- 10KΩ Potentiometer
- 2 x IR Sensors (Reflective Type)
- Connecting Wires
- Power Supply

Theory

. The main intention is to design a system wherein the number of persons entering or leaving a room is kept track of and displayed on a screen when a person enters the room, count would be increased, whereas on leaving, the count would decrease. IR sensing mechanism is used to sense the presence of visitors and the whole counting operation is done by a microcontroller.The sensor circuit is designed by selecting appropriate value of resistors for both the LED and the Photo Diode. A 150Ω current limiting resistor is placed in series with the IR LED.

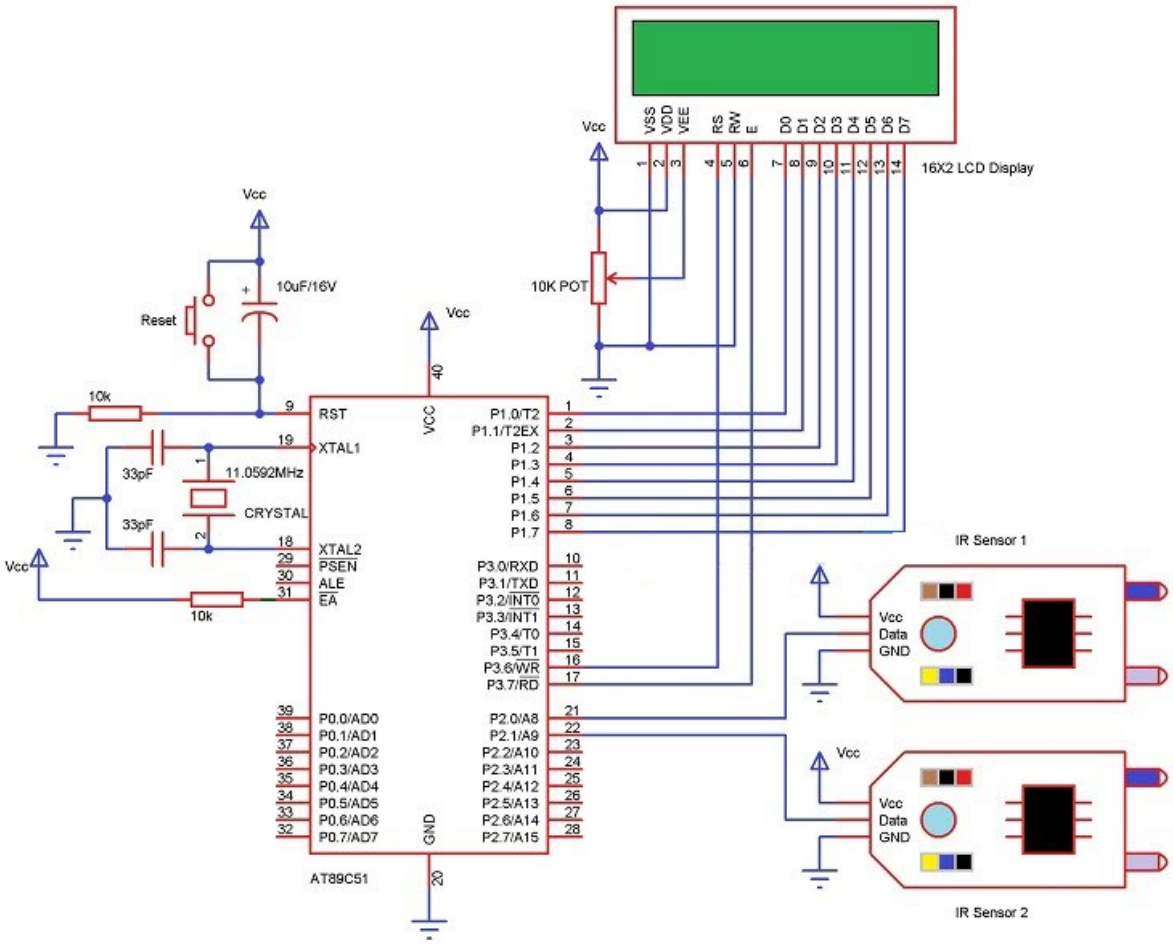
Photo Diode is connected in reverse bias with a series resistor of 10KΩ. Photo Diode and 10KΩ Resistor form a potential divider and the output is given to the non – inverting input of the Operational Amplifier (Op – Amp).

A 10KΩ POT is connected at the inverting input. This POT can be adjust in order to change the sensitivity of the IR Sensor. A 16 x 2 LCD Display is used to display the count values. The data line of the LCD are connected to PORT1 Pins of the Microcontroller.

Principle

The circuit works on the principle of IR sensing. Infrared or simply IR Sensors are devices that work with Infrared Light Source and a Photo Detector like a Photo Diode or a Photo Transistor that act as a Transmitter and Receiver respectively. In this project, we have used an IR LED as the IR Transmitter and a Photo Diode as the IR Receiver. Two sets of IR sensors consisting of an IR LED and Photo Diode are placed at two ends of the entrance of a room. Output from each sensor is fed to the microcontroller. In normal operation, IR light from the LED would not fall on the Photo Diode as it is a Reflective type IR Sensor. The output from the sensor would be a logic LOW signal in this case. In case of any interruption (due to any person crossing the path), the Photo Diode would start receiving the IR Light and start conducting. As a result, the output from the sensor would be a logic HIGH signal. The transition from low to high, for each sensor pair is detected by the microcontroller and accordingly the count would be increased or decreased.

Circuit Diagram



Software Requirements

- Keil µVision IDE
- Willar Software
- Proteus (for Circuit Diagram and Simulation)

Procedure

- Make the connections as per the circuit diagram.
- Check the ground connection precisely before switching on the power supply.
- Power on the main supply
- Write Embedded C code using Keil Software
- Copy the HEX File to AT89S52 by Using Software

Embedded C Code

```
#include<reg51.h>

#include<functions.h>

#include<stdio.h>

longint VisitorsCount,VisitorsCount1;

sbit Income=P1^0;

sbitOutGoing=P1^1;

void main()

{

IP=0xc5;

IE=0x80;

VisitorsCount=0;

VisitorsCount1=0;

InitialiseVFD();
```

```
ClearDisplay();
DisplayStringOnVFD("Total :",0x80,10);
DisplayStringOnVFD("Visitors:",0xc0,10);
while(1)
{
if(Income==0){SendDataToVFD(0xcf,0,10);
SendDataToVFD('+',1,10);
do{}
while(Income==0);VisitorsCount++;
VisitorsCount1++;
SendDataToVFD(0xcf,0,10);
SendDataToVFD(0x20,1,10);}
if(OutGoing==0){SendDataToVFD(0xcf,0,10);
SendDataToVFD('-',1,10);do{}while(OutGoing==0);
if(VisitorsCount>0)
{VisitorsCount--
;}SendDataToVFD(0xcf,0,10);
SendDataToVFD(0x20,1,10);
}
ShowData(VisitorsCount);
ShowData1(VisitorsCount1);
}
}
```

```
voidShowData(long int Temp)
{
char word[8];
inti;
for(i=1;i<=6;i++)
{
word[i]=(Temp%10)|0x30;
Temp=Temp/10;
}
SendDataToVFD(0xc9,0,10);
for(i=6;i>0;i--)
{
SendDataToVFD(word[i],1,10);
}
}
void ShowData1(long int Temp)
{
char word[8];
inti;
for(i=1;i<=6;i++)
{
word[i]=(Temp%10)|0x30;
```

```
Temp=Temp/10;
}
SendDataToVFD(0x89,0,10);
for(i=6;i>0;i--)
{
SendDataToVFD(word[i],1,10);
}
}
```

Visitor function display:

```
#include<reg51.h>
#include<functions.h>
sbit VFD=P3^7;
sbitVFDregsel=P3^6;
voidSendDataToVFD(char DataWord, bit CmdOrData,int Delay)
{
Delay=200;
P0=DataWord;
VFDregsel=CmdOrData;
VFD=1;
while(Delay>0)
{Delay--;}
VFD=0;
}
```

```
voidClearDisplay()
{
SendDataToVFD(0x01,0,10);
}
voidInitialiseVFD(void)
{
SendDataToVFD(0x38,0,100);
SendDataToVFD(0x0c,0,100);
SendDataToVFD(0x01,0,100);
SendDataToVFD(0x06,0,100);
}
voidDisplayStringOnVFD(char *String,char Address, int Delay)
{
SendDataToVFD(Address,0,100);
while(*String)
{
SendDataToVFD(*String++,1,Delay);
}
}
```

Result

Here, we have successfully implemented Visitor counter using AT89S52 with 16 x 2 LCD display

EXP 7. Temperature and Humidity measurement using Arduino with DHT11 sensor

Objective

This Project covers the basic low cost DHT11 Humidity and Temperature sensors inbuilt. The chip inside the DHT11 perform all the heavy task and only output a digital signal with humidity and temperature, compatible with any MCUs. To learn how to set up the DHT11 Humidity and Temperature sensor on your Arduino UNO. And learn about how the Humidity sensor works, and how to check output readings from the Serial monitor.

Components Required

- 1 x DHT11
- 1 x Arduino Uno
- Power Supply
- USB Cable
- 1 x 10KΩ Resistor
- Jumper Wires

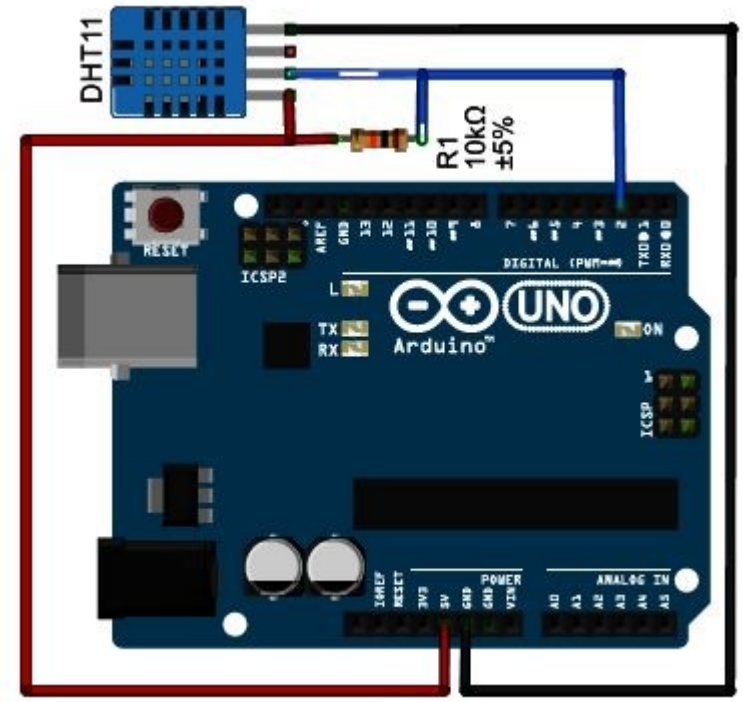
Theory

The DHT11 detects water vapour by measuring the electrical resistance between two electrodes. The humidity sensing component is a moisture holding substrate with electrodes applied to the surface. When water vapour is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes

Principle

. DHT11 sensor measures and provides humidity and temperature values serially over a single wire. It can measure relative humidity in percentage (20 to 90% RH) and temperature in degree Celsius in the range of 0 to 50°C.It has 4 pins; one of which is used for data communication in serial form. Pulses of different TON and TOFF are decoded as logic 1 or logic 0 or start pulse or end of a frame. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes, while lower relative humidity increases the resistance between the electrodes.

Circuit Diagram:



Software Requirements

- Arduino IDE
- Windows 7 or 8 or 10

Procedure

- Make the connections as per the circuit diagram.
- Check the ground connection precisely before switching on the power supply.
- Power on the main supply
- Write & Compile Embedded C code using Arduino IDE
- Copy the code to Arduino by Using Arduino IDE Software

Code :

```
#include "DHT.h"

DHT dht;

void setup()
{
Serial.begin(9600);
Serial.println();
Serial.println("Status\tHumidity (%)\tTemperature (C)\t(F)");

dht.setup(2); // data pin 2
}

void loop()
{
delay(dht.getMinimumSamplingPeriod());

float humidity = dht.getHumidity();
float temperature = dht.getTemperature();

Serial.print(dht.getStatusString());
Serial.print("\t");
Serial.print(humidity, 1);
Serial.print("\t\t");
Serial.print(temperature, 1);
Serial.print("\t\t");
Serial.println(dht.toFahrenheit(temperature), 1);
}
```

Result

Here, we have successfully implemented the Temperature and Humidity measurement using Arduino with DHT11 sensor

EXP 8. Home security system using Arduino with magnetic sensor and PIR sensor

Objective:

In this project we are going to build an Arduino home security system. One can install this Arduino security system project on his home main door. This security system checks two things. First it checks if someone approached the door? Second it checks if door is opened by the person? When the former two conditions meet a Buzzer will trigger.

Components Required

- 1 x PIR Sensor
- 1 x Arduino Uno
- USB Cable
- Power Supply
- 1 x Magnetic Sensor
- Jumper Wires
- Buzzer

Theory:

PIR

We will use popular hcsr501 passive infrared motion detection sensor in the project. It can detect motion at a max distance of 7 meters. Sensitivity range of hcsr501 PIR motion detector can be set by rotating the variable resistor/potentiometer mounted on the circuit board of hcsr501 PIR motion sensor. It also has a second variable resistor/potentiometer which is used to set the delay time i will talk about it later (With Out pin of Hcsr501). Hcsr501 PIR sensor has 3 pin. Two are power pins. Vcc is connected to +ve lead of power supply and Gnd is connected to -ve of power supply. The third pin is out pin. It normally remains low. When PIR sensor detects presence of infrared emitting body in its range it sets the out pin high. Now the question is for how long does PIR out pin remains high once the presence of person is detected? For this purpose the second variable resistor/potentiometer is present on hcsr501 PCB board you can set the delay time or out pin high time using the second variable resistor.

Door contact switch/Reed switch:

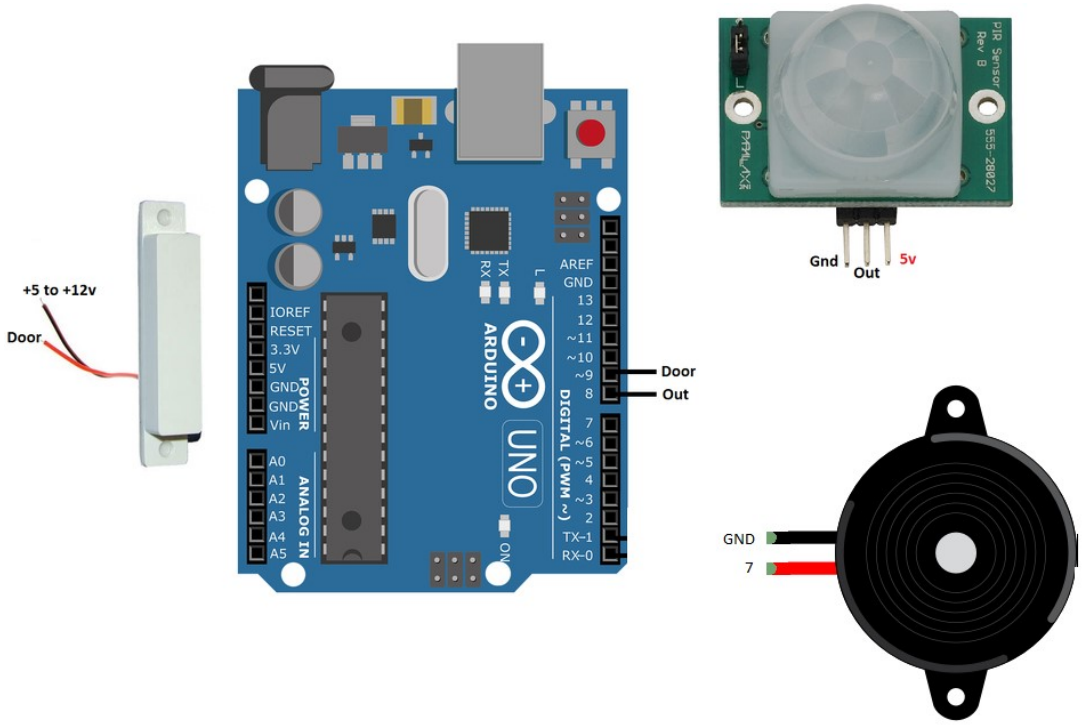
A reed switch is an electrical device operated using a magnet in place. It consists of two half's. One half contains actual switch and the other half contains just a magnet in it. When the magnetic half is brought near the switch half it starts conducting electricity. So how it all does happens? Actually the switch half contains a pair of magnetic rods. Normally when there is no magnetic field present near switch the rods are a part from each other (Open circuit - No electric

path). When we bring the magnetic half near the switch half the magnetic field brings the rods close and when the strength of magnetic field reaches the threshold limit the rods attach with each other (Making a physical contact - Path for electricity flow).

Principle:

Coming to the project circuit diagram. Only Three I/O pins of arduino uno are used in the project. The two pins are Pin 7, 8 and 9. Pin7 of arduino uno is connected to Buzzer, Pin#8 of arduino uno is connected to PIR motion sensor out pin and pin#9 of arduino uno is connected to door contact sensor. PIR motion detector and door contact sensor can be powered through the arduino +5 volt output. But i prefer to use an external power supply for powering the PIR and doorsensor. Door contact switch can be powered from +5v to +12v. I powered it with 5v power supply. If you input +12 volt to reed switch then you might need to insert a resistor in series with the reed switch because arduino pins are 5 volt tolerant and +12v(when contact is made) can destroy the input pin of arduino. When contact is made by reed switch the input voltage appears on the arduino digital pin. In our case on **Door(Pin#9)** pin. If the voltage is above 5 v it might destroy the input pin of arduino. So be careful before powering the reed switch.

Circuit Diagram



Software Requirements

- Arduino IDE
- Windows 7 or 8 or 10

Procedure

- Make the connections as per the circuit diagram.
- Check the ground connection precisely before switching on the power supply.
- Power on the main supply
- Write & Compile Embedded C code using Arduino IDE
- Copy the code to Arduino by Using Arduino IDE Software

Code:

```
int Door=9:

int Out =8:

Int Buzzer =7:



void setup(){

pinMode(Door,INPUT);

pinMode(Out,INPUT);

pinMode(Buzzer,OUTPUT);

}

voidlopp(){

int s1=0.s2=0;
```

```
s1=digitalRead(Door);

s2=digitalRead(Out);

if(s1==HIGH&&s2=HIGH){

digitalWrite(Buzzer, HIGH);

}

else{

digitalWrite(Buzzer, LOW);

}
```

Result:

Here, we have successfully implemented Home security system using Arduino with magnetic sensor and PIR sensor