AUTOMATIC RAILWAY GATE CONTROL SYSTEM

MOTIVATION

The motivation behind this project is to analyse all the concepts that we have learned in Embedded System Design and try to make and learn something new. One of the strong motivation was to amalgam-alize the theory and the practical aspects of the subject. Obviously the biggest motivation was to get good marks. If this project works then it would even affect our resume.

DESCRIPTION AND FINAL OUTCOME

Gates will be closed automatically on the arrival of the train and open when the train departs . The main purpose of the project is to avoid accidents and save time. We will add a timer which will show the duration for which the gate will remain close.

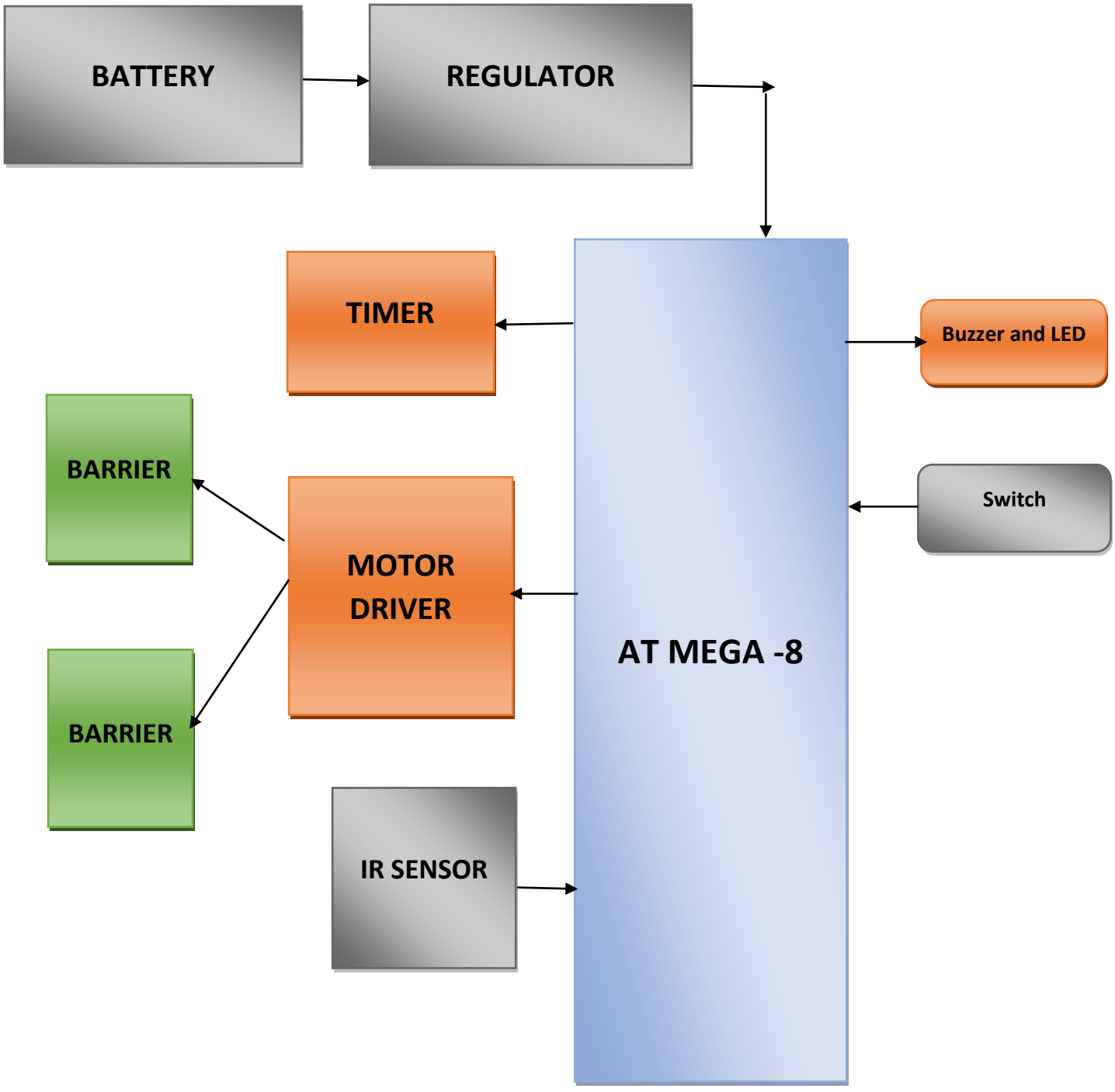
This project utilizes two IR Tx./Rx. Pair is placed at either side of the gate with some distance . When train crosses, first sensor light signal will toggle from Green to Red; a buzzer gets activated for 2 seconds and railway gate will be closed. When train crosses second sensor then a countdown timer starts then the light signal is again toggled from Red to Green. Timing for countdown timer is set in the controller according to the speed and length of the train. We can easily measure this timing for our toy train.

We are going to design the circuit using AVR ATmega8 microcontroller for our project.

We are designing this project so as to ensure the safety of people.

As a outcome, the railway gate will be controlled automatically by the sensors.

BLOCK DIAGRAM



COMPONENTS NEEDED

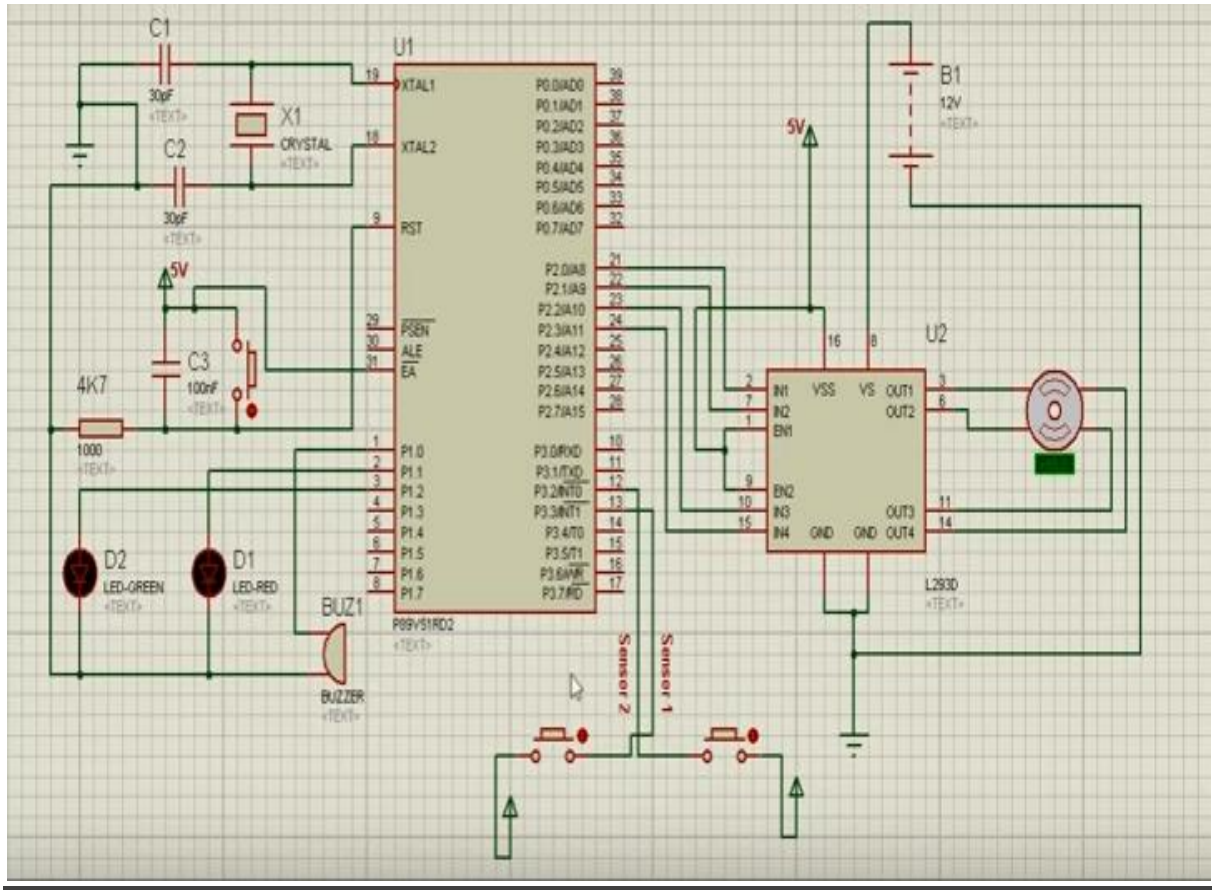
- DC Geared Motors RPM:30 - 2
- IR Tx./Rx. Pairs - 2
- MCU ATmega8 - 1
- IC-LM324 - 1
- IC-L293D - 1
- Resistors 470E - 10,10K-2,4.7K-1
- Capacitors : 1000uF.16volt -1 , 100nF-1
- Seven Segment CC - 1
- Some LED's : 2- Green, 2-Red, 3 others
- 7805 -1
- 6 Volt, 4.5 mAh Battery
- some wires, burg strips

SELECTION CRITERIA FOR COMPONENTS

- 30 RPM 12V DC Geared Motor is high quality low cost DC geared motor.
- Can be directly connect to a microcontroller, Arduino or Raspberry Pi with only a few current limiting resistors and require no complex circuit for making it work.
- The device features autonomous battery protection during charging and discharging, and supports very accurate accumulated current measurements using an 18-bit ADC with a resolution of 0.84V. It also supports up to 4 MIPS throughput at 4MHz. 1.8 - 9V operation.

- The LM324 series are low−cost, quad operational amplifiers with true differential inputs. They have several distinct advantages over standard operational amplifier types in single supply applications.
- L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction.
- IC 7805 provides +5 volts regulated power supply with provisions to add heat sink as well.

CIRCUIT DIAGRAM→

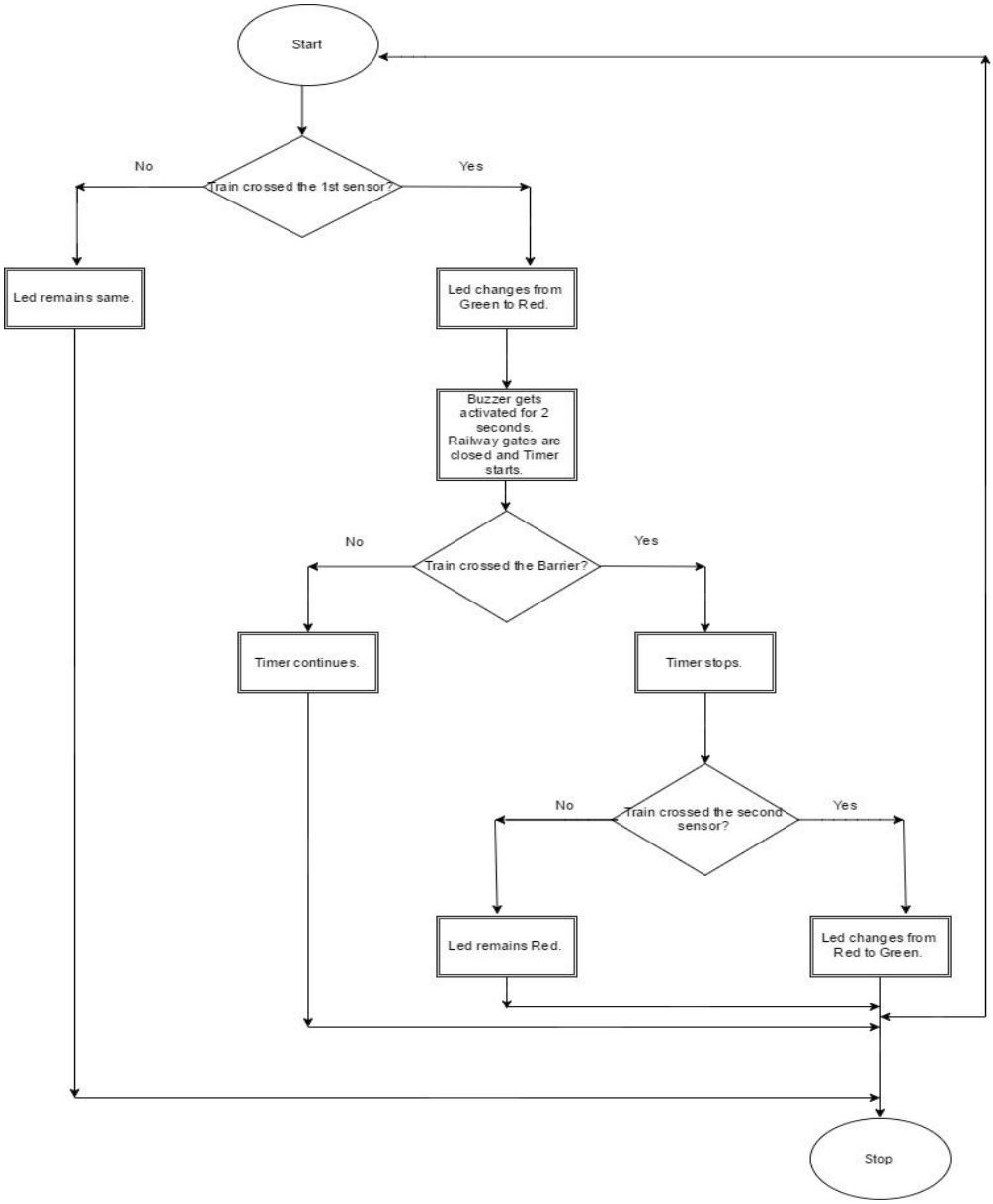


Description of the circuit diagram

The above circuit is the circuit diagram of our project. It uses ATmega8 as a microcontroller. It even uses some LEDs and Buzzers.
Some of the major components of our project are:

- DC Geared Motors RPM:30
- IR Tx./Rx. Pairs
- MCU ATmega8
- IC-LM324
- IC-L293D
- Seven Segment CC
- 7805
- 6 Volt, 4.5 mAh Battery

FLOWCHART



DATASHEET OF VARIOUS COMPONENTS USED →

1. **DC Geared Motors RPM:30**

DC Supply	RPM	No Load Current	Load Current	Torque	Total Length
4 to 12V	30 at 12V	50mA at 12V	300mA(max) at 12V	5kg-cm at 12V	46mm

Motor Diameter	Motor Length	Brush Type	Gear head diameter	Gear head length	Output shaft
36mm	25mm	Precious metal	37mm	21mm	Centred

Shaft diameter	Shaft length	Gear assembly	Motor weight
6mm	22mm	Spur	100gms

2. **IR Tx**

IR TX RX size	IR LED current rating	IR LED wavelength	Photodiode peak response wavelength
5mm diameter package	30mA nominal, 600mA pulse loading at 1% duty cycle	940nM	940nM

VISHAY

www.vishay.com

TSOP382.., TSOP384..

Vishay Semiconductors

IR Receiver Modules for Remote Control Systems

FEATURES

- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Insensitive to supply voltage ripple and noise
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

MECHANICAL DATA

Pinning for TSOP382.., TSOP384..:
1 = OUT, 2 = GND, 3 = V_S

DESCRIPTION

These products are miniaturized IR receiver modules for infrared remote control systems. A PIN diode and a preamplifier are assembled on a leadframe, the epoxy package contains an IR filter.

The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP384.. series devices are optimized to suppress almost all spurious pulses from energy saving lamps like CFLs. The AGC4 used in the TSOP384.. may suppress some data signals. The TSOP382.. series are provided primarily for compatibility with old AGC2 designs. New designs should prefer the TSOP384.. series containing the newer AGC4.

These components have not been qualified according to automotive specifications.

PARTS TABLE			
AGC		LEGACY, FOR LONG BURST REMOTE CONTROLS (AGC2)	RECOMMENDED FOR LONG BURST CODES (AGC4)
Carrier frequency	30 kHz	TSOP38230	TSOP38430
	33 kHz	TSOP38233	TSOP38433
	36 kHz	TSOP38236	TSOP38436 [1][2][3]
	38 kHz	TSOP38238	TSOP38438 [4][5]
	40 kHz	TSOP38240	TSOP38440
	56 kHz	TSOP38256	TSOP38456 [6][7]
Package		Minicast	
Pinning		1 = OUT, 2 = GND, 3 = V_S	
Dimensions (mm)		5.0 W x 6.95 H x 4.8 D	
Mounting		Leaded	
Application		Remote control	
Best remote control code		[1] RC-5 [2] RC-6 [3] Panasonic [4] NEC [5] Sharp [6] r-step [7] Thomson RCA	

3. **IR Rx**

IR TX RX size	IR LED current rating	IR LED wavelength	Photodiode peak response wavelength
5mm diameter package	30mA nominal, 600mA pulse loading at 1% duty cycle	940nM	940nM

EVERLIGHT

Technical Data Sheet

5mm Infrared LED , T-1 3/4

IR333-A

Features

- High reliability
- High radiant intensity
- Peak wavelength λ p=940nm
- 2.54mm Lead spacing
- Low forward voltage
- Pb free
- The product itself will remain within RoHS compliant version.

Descriptions

- EVERLIGHT'S Infrared Emitting Diode(IR333-A) is a high intensity diode , molded in a blue transparent plastic package.
- The device is spectrally matched with phototransistor , photodiode and infrared receiver module.

Applications

- Free air transmission system
- Infrared remote control units with high power requirement
- Smoke detector
- Infrared applied system

Device Selection Guide

LED Part No.	Chip Material	Lens Color
IR	GaAlAs	Blue

4. MCU ATmega8

EEPROM	Flash program memory	SRAM	General Purpose Working Registers	Timer/Counters	Operating Voltages	Speed Grades	Power Consumption
512Bytes	8Kbytes	1Kbyte	32 x 8	8 bit- timer0 and timer 2	4.5V - 5.5V	0 - 16MHz	0.5uA - 3.6mA
				16 bit - timer 1			

Atmel

8-bit AVR Microcontroller

ATmega8A

DATASHEET COMPLETE

Introduction

The Atmel® ATmega8A is a low-power CMOS 8-bit microcontroller based on the AVR® enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8A achieves throughputs close to 1MIPS per MHz. This empowers system designer to optimize the device for power consumption versus processing speed.

Features

- High-performance, Low-power Atmel AVR 8-bit Microcontroller
- Advanced RISC Architecture
  - 130 Powerful Instructions - Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16MIPS Throughput at 16MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 8KBytes of In-System Self-programmable Flash program memory
  - 512Bytes EEPROM
  - 1KByte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
  - Programming Lock for Software Security
- Atmel QTouch® library support
  - Capacitive touch buttons, sliders and wheels
  - Atmel QTouch and QMatrix acquisition
  - Up to 64 sense channels
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescaler, one Compare Mode

5. IC-LM324

Power Supply Voltages	Input Differential Voltage Range	Input Common Mode Voltage Range	Output Short Circuit Duration	Junction Temperature	Storage Temperature Range
32 Vdc	±32 Vdc	-0.3 to 32 Vdc	Continuous	150 °C	-65 to +150 °C

Single Supply Quad Operational Amplifiers

The LM324 series are low−cost, quad operational amplifiers with true differential inputs. They have several distinct advantages over standard operational amplifier types in single supply applications. The quad amplifier can operate at supply voltages as low as 3.0 V or as high as 32 V with quiescent currents about one−fifth of those associated with the MC1741 (on a per amplifier basis). 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
- Low Input Bias Currents: 100 nA Maximum (LM324A)
- Four Amplifiers Per Package
- Internally Compensated
- Common Mode Range Extends to Negative Supply
- Industry Standard Pinouts
- ESD Clamps on the Inputs Increase Ruggedness without Affecting Device Operation
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

ON Semiconductor®

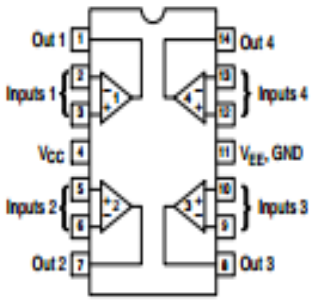
www.onsemi.com

PDIP−14
N SUFFIX
CASE 646

SOIC−14
D SUFFIX
CASE 751A

TSSOP−14
DTB SUFFIX
CASE 948G

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 11 of this data sheet.

6. IC-L293D

Wide Supply-Voltage Range	Output Current	Peak Output Current
4.5 V to 36 V	600 mA	1.2 A

1 Features

- Wide Supply-Voltage Range: 4.5 V to 36 V
- Separate Input-Logic Supply
- Internal ESD Protection
- High-Noise-Immunity Inputs
- Output Current 1 A Per Channel (600 mA for L293D)
- Peak Output Current 2 A Per Channel (1.2 A for L293D)
- Output Clamp Diodes for Inductive Transient Suppression (L293D)

2 Applications

- Stepper Motor Drivers
- DC Motor Drivers
- Latching Relay Drivers

3 Description

The L293 and L293D devices are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1.2EN and drivers 3 and 4 enabled by 3,4EN.

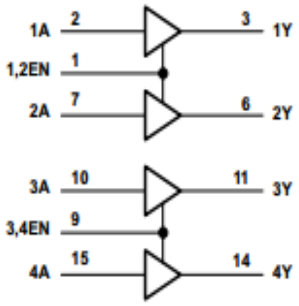
The L293 and L293D are characterized for operation from 0°C to 70°C.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
L293NE	PDIP (16)	19.80 mm × 6.35 mm
L293DNE	PDIP (16)	19.80 mm × 6.35 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Logic Diagram



7. 7805

Input voltage range	Current rating	Output voltage range	Thermal Resistance Junction-Cases	Storage Temperature Range
7V- 35V	1A	4.8V- 5.2V	5 °C/W	−65 to +150 °C

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage (for V_O = 5V to 18V) (for V_O = 24V)	V_I V_I	35 40	V V
Thermal Resistance Junction-Cases (TO-220)	$R_{\theta JC}$	5	°C/W
Thermal Resistance Junction-Air (TO-220)	$R_{\theta JA}$	65	°C/W
Operating Temperature Range	T_{OPR}	0 ~ +125	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Electrical Characteristics (MC7805/LM7805)

(Refer to test circuit ,0°C < T_J < 125°C, I_O = 500mA, V_I = 10V, C_I= 0.33µF, C_O= 0.1µF, unless otherwise specified)

Parameter	Symbol	Conditions		MC7805/LM7805 Min.	Typ.	Max.	Unit
Output Voltage	V_O	T_J =+25 °C		4.8	5.0	5.2	V
		5.0mA ≤ I_O ≤ 1.0A, P_O ≤ 15W V_I = 7V to 20V		4.75	5.0	5.25	
Line Regulation (Note1)	Regline	T_J=+25 °C	V_O = 7V to 25V	-	4.0	100	mV
			V_I = 8V to 12V	-	1.6	50	
Load Regulation (Note1)	Regload	T_J=+25 °C	I_O = 5.0mA to1.5A	-	9	100	mV
			I_O =250mA to 750mA	-	4	50	
Quiescent Current	I_Q	T_J =+25 °C		-	5.0	8.0	mA
Quiescent Current Change	ΔI_Q	I_O = 5mA to 1.0A		-	0.03	0.5	mA
		V_I= 7V to 25V		-	0.3	1.3	
Output Voltage Drift	$\Delta V_O/\Delta T$	I_O= 5mA		-	-0.8	-	mV/ °C
Output Noise Voltage	V_N	f = 10Hz to 100KHz, T_A=+25 °C		-	42	-	µV/Vo
Ripple Rejection	RR	f = 120Hz V_O = 8V to 18V		62	73	-	dB
Dropout Voltage	V_{Drop}	I_O = 1A, T_J =+25 °C		-	2	-	V
Output Resistance	r_O	f = 1KHz		-	15	-	mΩ
Short Circuit Current	I_{SC}	V_I = 35V, T_A =+25 °C		-	230	-	mA
Peak Current	I_{PK}	T_J =+25 °C		-	2.2	-	A

Note:

1. Load and line regulation are specified at constant junction temperature. Changes in V_o due to heating effects must be taken into account separately. Pulse testing with low duty is used.

SENSOR/ACTUATOR

1. IR SENSOR-

DESCRIPTION-

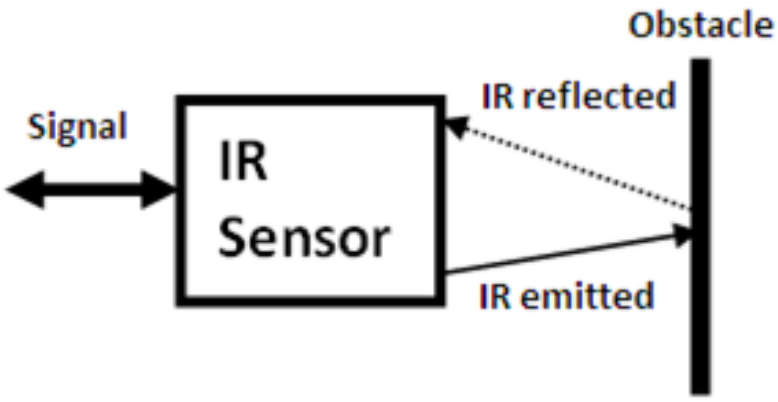
An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor .The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

IR TX RX size	IR LED current rating	IR LED wavelength	Photodiode peak response wavelength
5mm diameter package	30mA nominal, 600mA pulse loading at 1% duty cycle	940nM	940nM

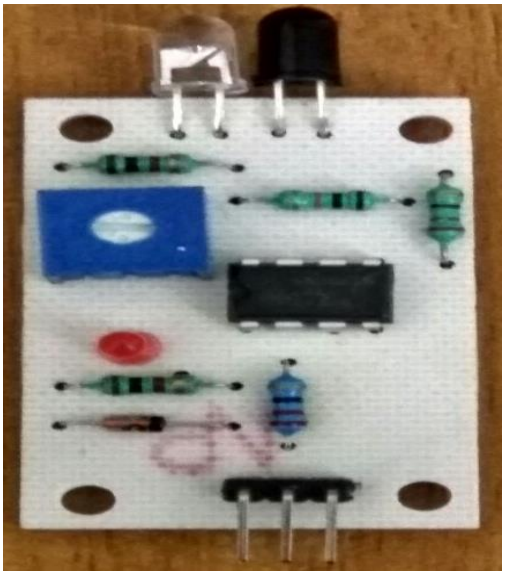
OPERATION PRINCIPLE-

The picture shown is a very simple black box model of the IR Sensor. The sensor emits IR light and gives a signal when it detects the reflected light.
An IR sensor consists of an emitter, detector and associated circuitry. The circuit required to make an IR sensor consists of two parts; the emitter circuit and the receiver circuit.

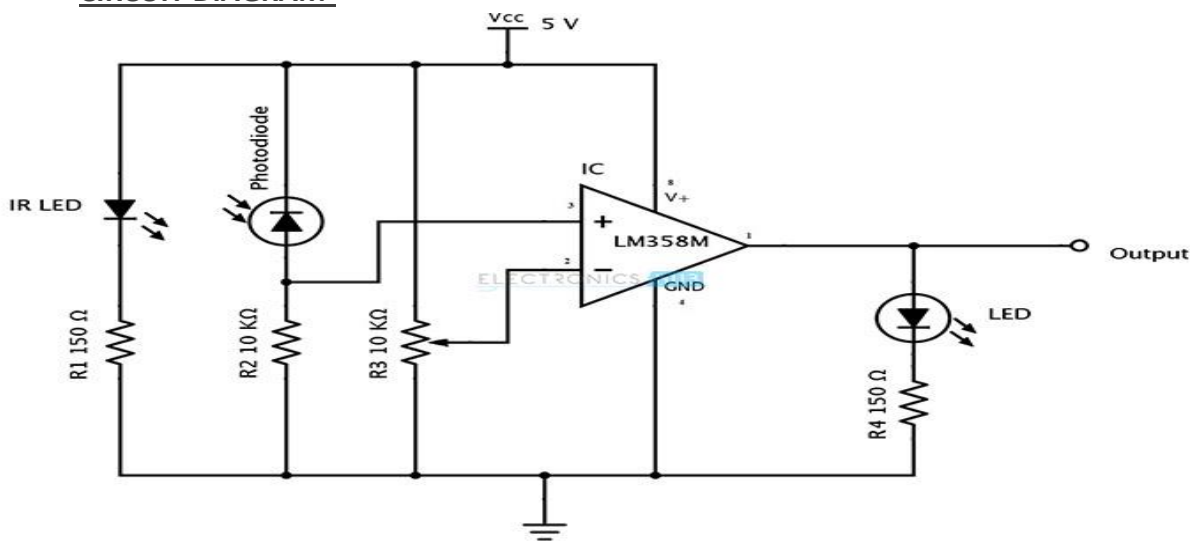
The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, its resistance and correspondingly, its output voltage, change in proportion to the magnitude of the IR light received. This is the underlying principle of working of the IR sensor.



COMPONENT



CIRCUIT DIAGRAM-



CODE-

```
void main()       // main function

{
while(1)                  //loop runs continuously
{
 DDRB = 0xFF;   //PORTB as output port
DDRA = 0x00;    //PORTA as input port
if(PINA.b0 ==1)  //if the 0th pin of portA is 1 then the 0th pin of PORTB should become 1
PORTB = 0x01;
else                //if the 0th pin of portA is 0 then the 0th pin of PORTB should become 0
PORTB = 0x00;
}
}
```

2. SEVEN SEGMENT LED-

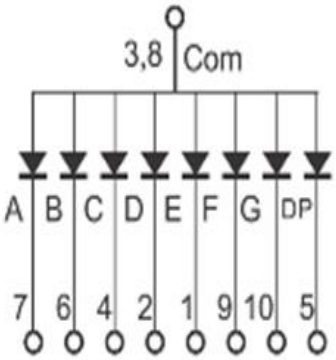
DESCRIPTION-

A seven segment display is the most basic electronic display device that can display digits from 0-9. They find wide application in devices that display numeric information like digital clocks, radio, microwave ovens, electronic meters etc. The most common configuration has an array of eight LEDs arranged in a special pattern to display these digits. They are laid out as a squared-off figure ‘8’. Every LED is assigned a name from 'a' to 'h' and is identified by its name. Seven LEDs 'a' to 'g' are used to display the numerals while eighth LED 'h' is used to display the dot/decimal.

OPERATION PRINCIPLE-

Seven segment display works, by glowing the required respective LEDS in the numeral. The display is controlled using pins that are left freely. Forward biasing of these pins in a sequence will display the particular numeral or alphabet. Depending on the type of seven segment the segment pins are applied with logic high or logic zero and in the similar way to the common pins also.

CIRCUIT DIAGRAM-



COMPONENT

CODE-

```
unsigned int display[]={0x01,0x4F,0x12,0x06,0x4C,0x24,0x20,0x0F,0x00,0x0C,
                        0x08 ,0x60, 0x31 ,0x42 ,0x30,0x38};
unsigned int i;                    //variable declaration

void main()            //main function
{
DDRA = 0xFF;           //PORTA as output


while(1)               //loop runs continuously
{
for(i=0;i<=15;i++)     //loop which displays the values from 0 to 15 in   //ascending order
   {
PORTA = display[i];  //PORTA is assigned the value stored in display array at location i
delay_ms(1000);      //Delay of 1 second is given
}
}

}
```

3. GEAR MOTOR

DESCRIPTION-

30 RPM Side Shaft 37mm Diameter Compact DC Gear Motor is suitable for small robots / automation systems. It has sturdy construction with gear box built to handle stall torque produced by the motor. Drive shaft is supported from both sides with metal bushes. Motor runs smoothly from 4V to 12V and gives 30 RPM at 12V. Motor has 6mm diameter, 22mm length drive shaft with D shape for excellent coupling.

DC Supply	RPM	No Load Current	Load Current	Torque	Total Length
4 to 12V	30 at 12V	50mA at 12V	300mA(max) at 12V	5kg-cm at 12V	46mm

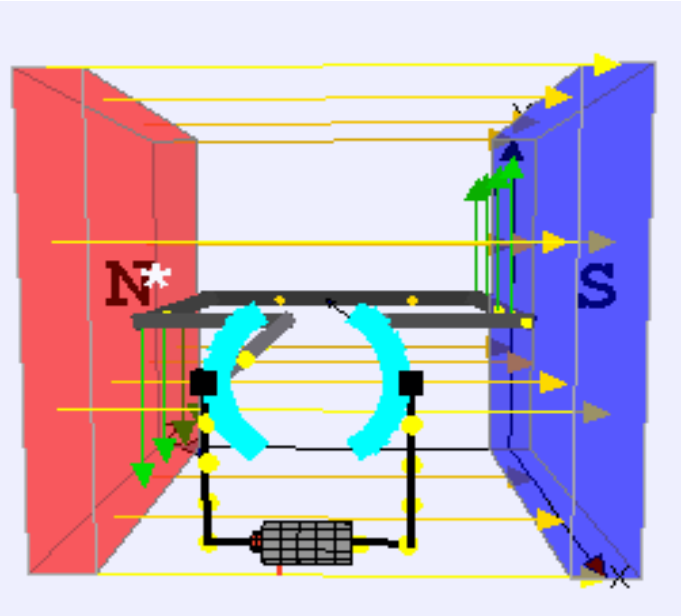
Motor Diameter	Motor Length	Brush Type	Gear head diameter	Gear head length	Output shaft
36mm	25mm	Precious metal	37mm	21mm	Centred

Shaft diameter	Shaft length	Gear assembly	Motor weight
6mm	22mm	Spur	100gms

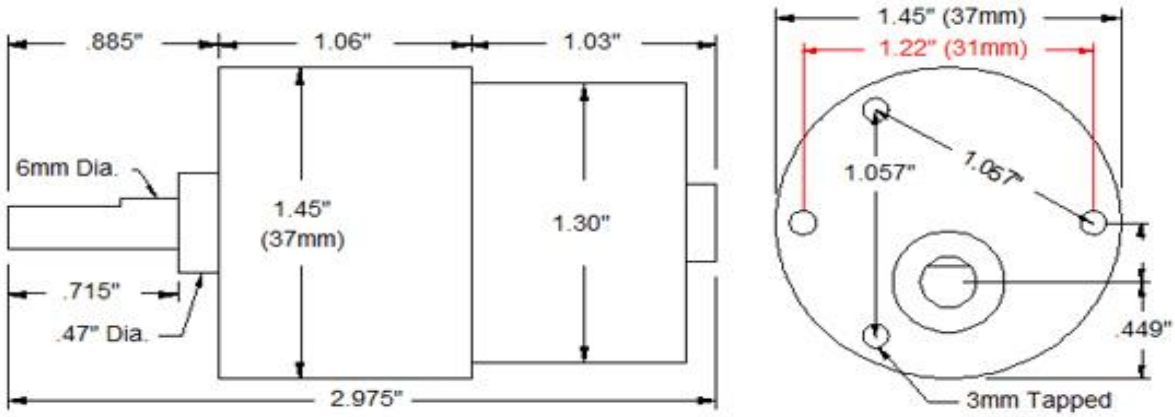
OPERATION PRINCIPLE-

A motor is an electrical machine which converts electrical energy into mechanical energy. The principle of working of a DC motor is that "*whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force".* The direction of this force is

given by Fleming's left hand rule and it's magnitude is given by F = BIL. Where, B = magnetic flux density, I = current and L = length of the conductor within the magnetic field.



CIRCUIT DIAGRAM-



COMPONENT

CODE-

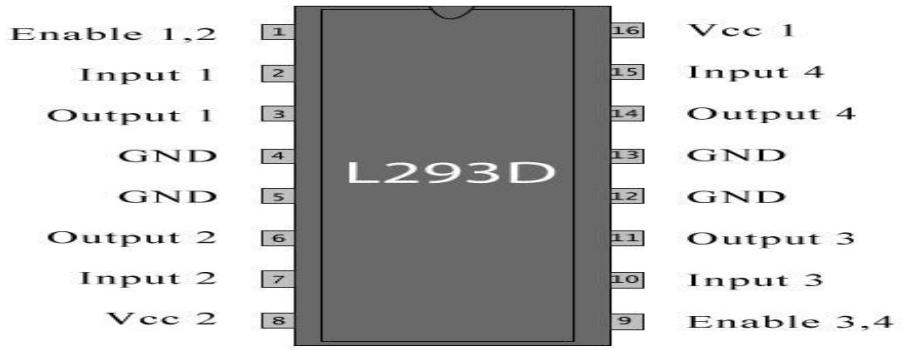
```
void main()                  // main function
{
while(1)                     //loop runs continuously
{
DDRC = 0x00;                 //PORTC as input port
DDRA = 0xFF;                 //PORTA as output port
if(PINC.b0 ==1)              //Sensor is connected to the 0th pin of PORTC PORTA = 0x0A;
                             //PORTA is connected to motor driver which drives the motors in
//clockwise direction when sensor is turned on (A i.e 1010 is for two motors)

else
PORTA = 0x00;                //When PORTA is assigned 0 it shows that the motor should stop

}
}
```

4. L293D

DESCRIPTION

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge *Motor Driver integrated circuit* (*IC*).The l293d can drive small and quiet big motors as well.

CIRCUIT DIAGRAM



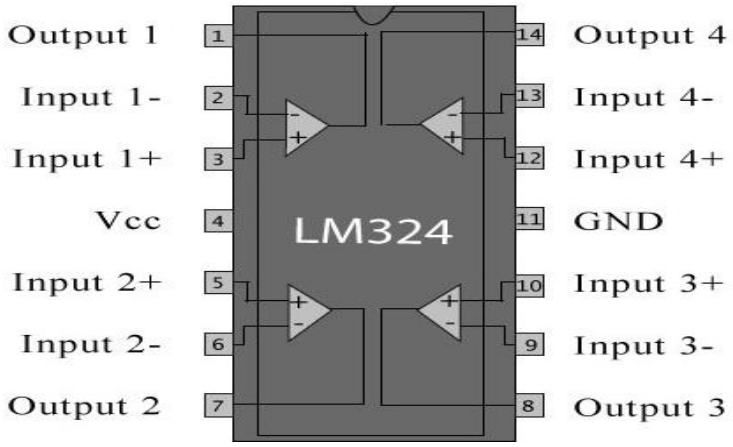
5. LM324

DESCRIPTION

LM324 is a 14pin IC consisting of four independent operational amplifiers (op-amps) compensated in a single package. Op-amps are high gain electronic voltage amplifier with differential input and, usually, a single-ended output. The output voltage is many times higher than the voltage difference between input terminals of an op-amp. These op-amps are operated by a single power supply LM324 and need for a dual supply is eliminated. They

can be used as amplifiers, comparators, oscillators, rectifiers etc. The conventional op-amp applications can be more easily implemented with LM324.

CIRCUIT DIAGRAM

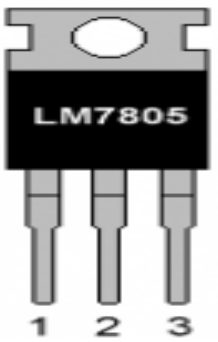


6. 7805

DESCRIPTION

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

CIRCUIT DIAGRAM



7. Buzzer

DESCRIPTION

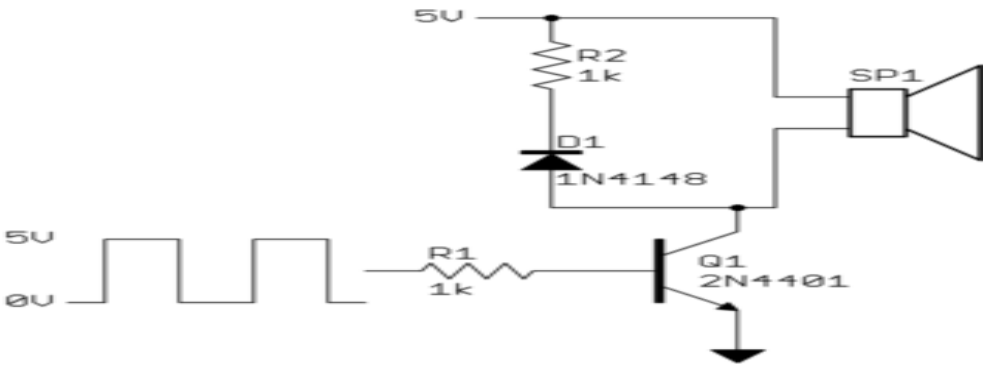
A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment,

telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play."

OPERATION PRINCIPLE

An electromagnetic buzzer is a "chattering relay" where current to the relay coil is interrupted each time the relay coil begins to pull in the armature, causing it to release the armature and reconnect current through the relay coil. This cycle repeats rapidly causing a buzzing sound. There are also electronic buzzers where a very low frequency oscillator drives a small speaker (usually a piezoelectric disk) causing a buzzing sound. One brand of these is Sonalert.

CIRCUIT DIAGRAM



COMPONENT

CODE

```
void main()       //main function
{
while(1)          //loop runs continuously
{
DDRC = 0xFF;      //PORTC as output port
DDRA = 0x00;      //PORTA as input port
if(PINA.b0)       //The sensor is connected to 0th pin of PORTA and if the sensor senses then
```

```
//the pin becomes 1 and hence the Buzzer which is connects to 0th pin of PORTB should
//become 1
{
PORTC = 0x01;   // The 0th pin of PORTC becomes 1
}
else
{
PORTC = 0x00;
}
}
}
```

8. LCD

DESCRIPTION

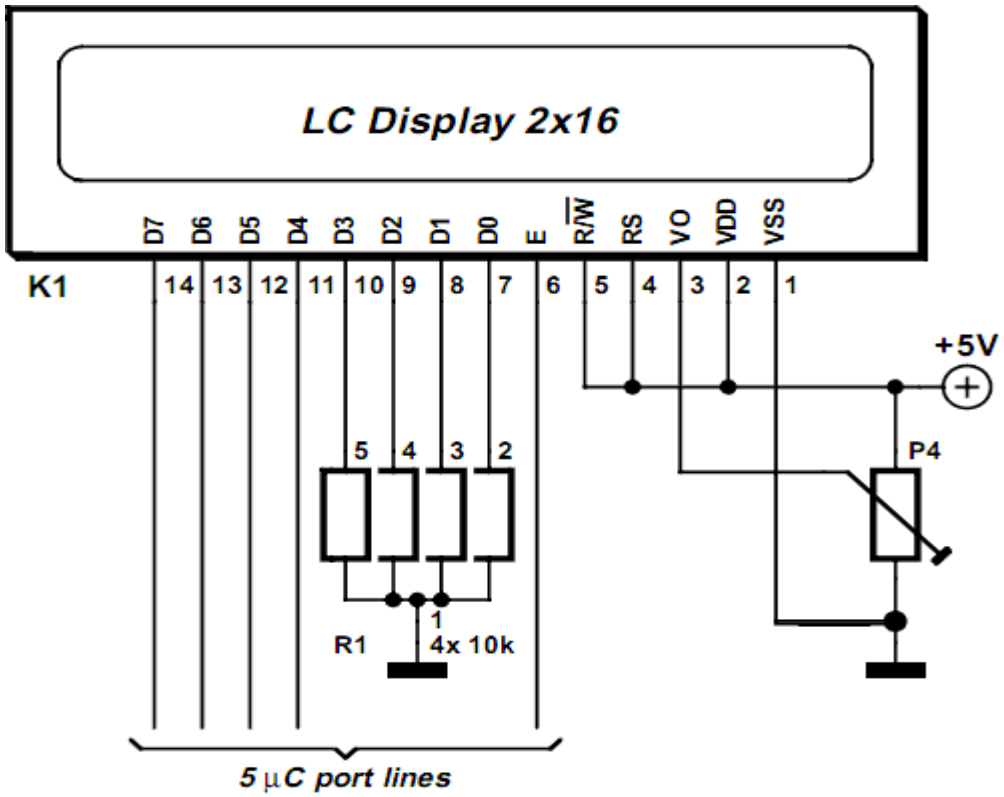
LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.

An LCD is made with either a passive matrix or an active matrix display display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time (your mouse will appear to move more smoothly across the screen, for example).

OPERATION PRINCIPLE

The principle behind the LCD's is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD's, a reflected mirror is arranged at the back. An electrode plane is made of indium-tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter.

CIRCUIT DIAGRAM



COMPONENT

CODE

```
#define F_CPU 8000000UL              /* Define CPU Frequency e.g. here its 8MHz*/
#define LCD_Dir DDRB                 /* Define LCD data port direction */
#define LCD_Port PORTB               /* Define LCD data port */
#define RS PORTB.b0          /* Define Register Select(data reg./command reg.) signal pin */
#define EN PORTB.b1                  /* Define Enable signal pin */
```

```
void LCD_Command( unsigned char cmnd )
{
LCD_Port = (LCD_Port & 0x0F) | (cmnd & 0xF0); /* sending upper nibble */
LCD_Port &= ~ (1<<RS);                          /* RS=0, command reg. */
LCD_Port |= (1<<EN);                           /* Enable pulse */
delay_us(1);
LCD_Port &= ~ (1<<EN);
delay_us(200);
LCD_Port = (LCD_Port & 0x0F) | (cmnd << 4);  /* sending lower nibble */
LCD_Port |= (1<<EN);
delay_us(1);
LCD_Port &= ~ (1<<EN);
delay_ms(2);
}

void LCD_Char( unsigned char data )
{
LCD_Port = (LCD_Port & 0x0F) | (data & 0xF0); /* sending upper nibble */
LCD_Port |= (1<<RS);                           /* RS=1, data reg. */
LCD_Port|= (1<<EN);
delay_us(1);
LCD_Port &= ~ (1<<EN);
delay_us(200);
LCD_Port = (LCD_Port & 0x0F) | (data << 4); /* sending lower nibble */
LCD_Port |= (1<<EN);
delay_us(1);
LCD_Port &= ~ (1<<EN);
delay_ms(2);
}

void LCD_Init (void)                    /* LCD Initialize function */
{
delay_ms(20);                           /* LCD Power ON delay always >15ms */
LCD_Dir = 0xFF;                         /* Make LCD command port direction as o/p */
LCD_Command(0x02);              /*send for 4 bit initialization of LCD */
LCD_Command(0x28);            /*use 2 line and initialize 5*7 matrix in (4-bit mode)*/
LCD_Command(0x0c);            /*display on cursor off*/
LCD_Command(0x06);            /*increment cursor (shift cursor to right)*/
LCD_Command(0x01);            /*clear display screen*/
}

void LCD_String (char *str)             /* Send string to LCD function */
{
int i;
for(i=0;str[i]!=0;i++)                  /* Send each char of string till the NULL */
{
LCD_Char (str[i]);
}
}
```

```
void LCD_String_xy (char row, char pos, char *str)    /* Send string to LCD with xy position *
{
if (row == 0 && pos<16)
LCD_Command((pos & 0x0F)|0x80);     /* Command of first row and required position<16 */
else if (row == 1 && pos<16)
LCD_Command((pos & 0x0F)|0xC0);     /* Command of first row and required position<16 *
LCD_String(str);                                    /* Call LCD string function */
}

void LCD_Clear()
{
LCD_Command (0x01);                                 /* clear display */
LCD_Command (0x80);                                 /* cursor at home position */
}

int main()
{
LCD_Init();                                  /* initialization of LCD*/
LCD_String("ElectronicWINGS");              /* write string on 1st line of LCD*/
LCD_Command(0xc0);                             /*go to 2nd line*/
LCD_String("Hello World");                  /*write string on 2nd line*/
DDRD=0xFF;
PORTD=0xFF;
return 0;
}
```