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## *RFID BASED LIBRARY MANAGEMENT SYSTEM*



### *About project*

RFID technology is being implemented in a number of industries. Supply chain implementation is perhaps one of the most frequently mentioned applications of RFID tags and equipment. Retailers such as “Wal-Mart” and grocery stores such as “Albertson’s” have begun to make it mandatory for their suppliers to tag merchandise destined for their stores. There is, however, a key difference to the library’s inventory as compared to that of a warehouse or a retail outlet. In the warehouse and retail supply chain, goods come in and leave. Only occasionally are they returned. The retail sector is looking at RFID as a “throwaway” technology that hands an item to a customer which

gets discarded. Yet the item wise unit cost of including an RFID tag is much more than the cost of printing a barcode on a package. In libraries, items are taken out and returned many times. Thus the same RFID tag is re-used many times. The libraries across the globe started to use RFID to speed up the self check in/out processes, to control the theft and to ease the inventory control in library. The barcode technology is slowly getting replaced by the RFID technology. The RFID tag does not have to be visible for detection. It can be read even when it is embedded in an item, such as in the cardboard cover of a book or in the packaging of a product. It can also store data such as stack number, accession number, book number, author information etc., but barcode is limited to just an identification number.

## *RFID in Library*

A library is a collection of information, sources, resources, books, and services, and the structure in which it is housed. Apart from books many libraries are now also repositories and access points for maps, prints, or other documents on various storage media such as microform (microfilm/microfiche), audio tapes, CDs, LPs, cassettes, video tapes, and DVDs. Libraries have materials arranged in a specified order according to a library classification system, so that items may be located quickly and collections may be browsed efficiently. Reference stacks are different which has only reference books and only selected members.

Our College Library is a large one having 17,000 books and staffed by both paraprofessionals and professional librarians. The following are the tasks to be performed in the library.

- Circulation: handling user accounts and issuing/returning and shelving of materials.
- Collection, development, order materials, maintain materials' budgets.
- Technical Services work behind the scenes cataloguing and processing new materials and de accessioning weeded materials.

Basic tasks in library management include the planning of acquisitions of materials, arranging the acquired materials according to the library classification, preservation of materials the de accessioning of materials, patron borrowing of materials, and developing and administering library computer systems. Among these, the proposed system will automate the following tasks using RFID technology,

- Accessing number of books at a time
- Searching a particular book to check its presence in the library
- Locating the physical location of the book
- Accounting/Stock verification of the materials

The RFID based LMS facilitates the fast issuing, reissuing and returning of books with the help of RFID enabled modules. It directly provides the book information and library member information to the library management system and does not need the manual typing. It also provides monitoring and searching system. The monitoring module will continuously monitor the movement of books across the gates, so that the books taken out

without prior issuing will be traced out easily and will alarm the librarians. The searching module provides the fast searching of books using RFID handheld reader. The physical location of the books can be easily located using this module.

Utmost care has been taken to provide following features to the Library using RFID technology:

- To remove manual book keeping of records
- Traceability of books and library members as they move
- Improved utilization of resources like manpower, infrastructure etc.
- Less time consumption as line of sight and manual interaction are not needed for RFID-tag reading.
- To provide 2 meters read range antennas
- To minimize the manual intervention
- To minimize the manual errors
- To provide the long lasting labels
- To provide fast searching of books

## *THE PROCESS*

- Whenever a new book is acquired by the library, an RFID tag is attached into
- the book with the relevant information like, call number, accession number, book number, etc.
- The detailed information regarding the book is also captured in the computer database.
- The computer database also stores all information for individual users (patrons) of the library.
- Each patron is supplied with a smart card. These smart cards carry identification data for each patron.
- The efficacy of the above smart system is best utilized while searching for a book or while issuing or returning a book:
- When a patron needs to get a book issued, he can get it done without any manual intervention. He walks to the issue kiosk, flashes his smart card and the system automatically opens his login account page.
- He then places the selected books, one by one on the RFID scanner.
- The computer records all these data against his name.
- When a patron wants to return books, he simply places the books in the book drop counter and the books automatically are adjusted for return against the patron's name.
- Such a system is very useful for searching - any patron is able to search for a book from any networked computer. He/she is also able to get all information regarding how many copies of a book are presently available and when the book will be again available for circulation.

## INTRODUCTION TO RFID

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. The technology requires some extent of cooperation of an RFID reader and an RFID tag.

An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

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### What is RFID?

A basic RFID system consists of three components:

- a) An antenna or coil
- b) A transceiver (with decoder)
- c) A transponder (RF tag)

Electronically programmed with unique information. There are many different types of RFID systems out in the market. They are categorized according to their frequency ranges. Some of the most commonly used RFID kits are as follows:

- 1) Low-frequency (30 KHz to 500 KHz)
- 2) Mid-Frequency (900KHz to 1500MHz)
- 3) High Frequency (2.4GHz to 2.5GHz)

These frequency ranges mostly tell the RF ranges of the tags from low frequency tag ranging from 3m to 5m, mid-frequency ranging from 5m to 17m and high frequency ranging from 5ft to 90ft. The cost of the system is based according to these ranges with low-frequency system ranging from a few hundred dollars to a high-frequency system ranging somewhere near 5000 dollars.

## COMPONENTS OF RFID

A basic RFID system consists of three components:

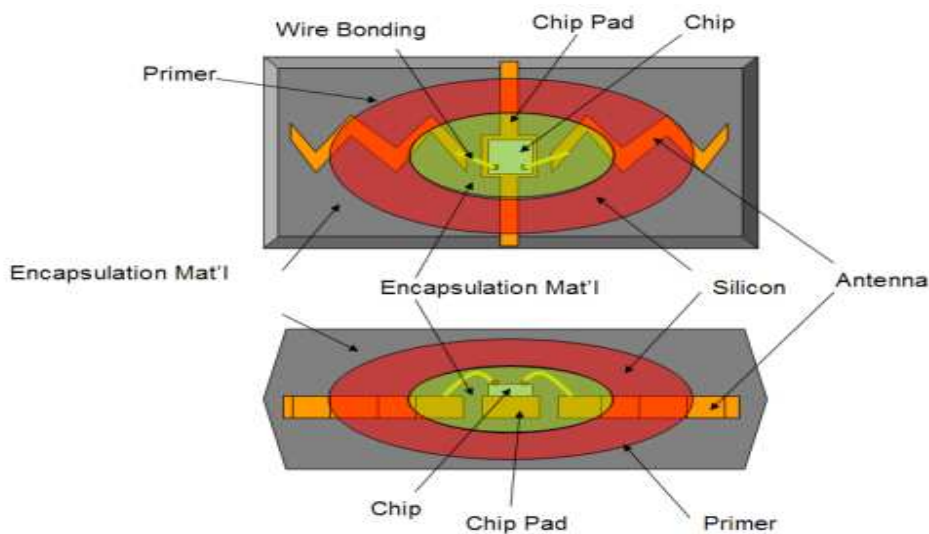
- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag) electronically programmed with unique information

These are described below:

## 1. ANTENNA

The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or things passing through the door, or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, a sensor device can activate the field.

Often the antenna is packaged with the transceiver and decoder to become a reader (a.k.a. interrogator), which can be configured either as a handheld or a fixed-mount device. The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.



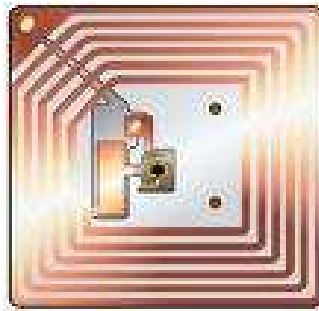
## 2. TAGS (Transponders)

An RFID tag is comprised of a microchip containing identifying information and an antenna that transmits this data wirelessly to a reader. At its most basic, the chip will contain a serialized identifier, or license plate number, that uniquely identifies that item, similar to the way many bar codes are used today. A key difference, however is that RFID tags have a higher data capacity than their bar code counterparts. This increases the options for the type of information that can be encoded on the tag, including the manufacturer, batch or lot number, weight, ownership, destination and history (such as

the temperature range to which an item has been exposed). In fact, an unlimited list of other types of information can be stored on RFID tags, depending on application needs. An RFID tag can be placed on individual items, cases or pallets for identification purposes, as well as on fixed assets such as trailers, containers, totes, etc.

**Tags come in a variety of types, with a variety of capabilities. Key variables include: "Read-only" versus "read-write"**

There are three options in terms of how data can be encoded on tags: (1) Read-only tags contain data such as a serialized tracking number, which is pre-written onto them by the tag manufacturer or distributor. These are generally the least expensive tags because they cannot have any additional information included as they move throughout the supply chain. Any updates to that information would have to be maintained in the application software that tracks SKU movement and activity. (2) "Write once" tags enable a user to write data to the tag one time in production or distribution processes. Again, this may include a serial number, but perhaps other data such as a lot or batch number. (3) Full "read-write" tags allow new data to be written to the tag as needed—and even written over the original data. Examples for the latter capability might include the time and date of ownership transfer or updating the repair history of a fixed asset. While these are the most costly of the three tag types and are not practical for tracking inexpensive items, future standards for electronic product codes (EPC) appear to be headed in this direction.



**RFID TAGS**

### *Data capacity*

The amount of data storage on a tag can vary, ranging from 16 bits on the low end to as much as several thousand bits on the high end. Of course, the greater the storage capacity, the higher the price per tag.

### *Form factor*

The tag and antenna structure can come in a variety of physical form factors and can either be self-contained or embedded as part of a traditional label structure (i.e., the tag is inside what looks like a regular bar code label—this is termed a 'Smart Label') companies must choose the appropriate form factors for the tag very carefully and should expect to use multiple form factors to suit the tagging needs of different physical products and units



of measure. For example, a pallet may have an RFID tag fitted only to an area of protected placement on the pallet itself. On the other hand, cartons on the pallet have RFID tags inside bar code labels that also provide operators human-readable information and a back-up should the tag fail or pass through non RFID-capable supply chain links.

### *Passive versus active*

“Passive” tags have no battery and "broadcast" their data only when energized by a reader. That means they must be actively polled to send information. "Active" tags are capable of broadcasting their data using their own battery power. In general, this means that the read ranges are much greater for active tags than they are for passive tags—perhaps a read range of 100 feet or more, versus 15 feet or less for most passive tags. The extra capability and read ranges of active tags, however, come with a cost; they are several times more expensive than passive tags. Today, active tags are much more likely to be used for high-value items or fixed assets such as trailers, where the cost is minimal compared to item value, and very long read ranges are required. Most traditional supply chain applications, such as the RFID-based tracking and compliance programs emerging in the consumer goods retail chain, will use the less expensive passive tags.

### *Frequencies*

Like all wireless communications, there are a variety of frequencies or spectra through which RFID tags can communicate with readers. Again, there are trade-offs among cost, performance and application requirements. For instance, low-frequency tags are cheaper than ultra high-frequency (UHF) tags, use less power and are better able to penetrate non-metallic substances. They are ideal for scanning objects with high water content, such as fruit, at close range. UHF frequencies typically offer better range and can transfer data faster. But they use more power and are less likely to pass through some materials. UHF tags are typically best suited for use with or near wood, paper, cardboard or clothing products. Compared to low-frequency tags, UHF tags might be better for scanning boxes of goods as they pass through a bay door into a warehouse. While the tag requirements for compliance mandates may be narrowly defined, it is likely that a variety of tag types will be required to solve specific operational issues. You will want to work with a company that is very knowledgeable in tag and reader technology to appropriately identify the right mix of RFID technology for your environment and applications.

### *EPC Tags*

EPC refers to "electronic product code," an emerging specification for RFID tags, readers and business applications first developed at the Auto-ID Center at the Massachusetts Institute of Technology. This organization has provided significant intellectual leadership toward the use and application of RFID technology. EPC represents a specific approach to item identification, including an emerging standard for the tags themselves, including both the data content of the tag and open wireless communication protocols. In a sense,

the EPC movement is combining the data standards embodied in certain bar code specifications, such as the UPC or UCC-128 bar code standards, with the wireless data communication standards that have been developed by ANSI and other groups.

### 3. *RF Transceiver:*

The RF transceiver is the source of the RF energy used to activate and power the passive RFID tags. The RF transceiver may be enclosed in the same cabinet as the reader or it may be a separate piece of equipment. When provided as a separate piece of equipment, the transceiver is commonly referred to as an RF module. The RF transceiver controls and modulates the radio frequencies that the antenna transmits and receives. The transceiver filters and amplifies the backscatter signal from a passive RFID tag.

### *Typical Applications for RFID*

- Automatic Vehicle identification
- Inventory Management
- Work-in-Process
- Container/ Yard Management
- Document/ Jewellery tracking
- Patient Monitoring

### *The Advantages of RFID Over Bar Coding*

No "line of sight" requirements: Bar code reads can sometimes be limited or problematic due to the need to have a direct "line of sight" between a scanner and a bar code. RFID tags can be read through materials without line of sight.

More automated reading: RFID tags can be read automatically when a tagged product comes past or near a reader, reducing the labor required to scan product and allowing more proactive, real-time tracking.

Improved read rates: RFID tags ultimately offer the promise of higher read rates than bar codes, especially in high-speed operations such as carton sortation.

Greater data capacity: RFID tags can be easily encoded with item details such as lot and batch, weight, etc.

"Write" capabilities: Because RFID tags can be rewritten with new data as supply chain activities are completed, tagged products carry updated information as they move throughout the supply chain.

## Common Problems with RFID

Some common problems with RFID are reader collision and tag collision. Reader collision occurs when the signals from two or more readers overlap. The tag is unable to respond to simultaneous queries. Systems must be carefully set up to avoid this problem. Tag collision occurs when many tags are present in a small area; but since the read time is very fast, it is easier for vendors to develop systems that ensure that tags respond one at a time. See Problems with RFID for more details.

## Hardware description

Library Management System			
Name	Capacity	Quantity	Code
Regulator	7805	1	U1
Capacitor	1000 $\mu$ f	1	C1
Capacitor	10 $\mu$ f	1	C2
Ceramic Capacitor	22pf	2	C3,C4
Diode		4	D1,D2,D3,D4
Push Button		1	
RFID READER		1	
RFID Cards		3	
LCD	16*2	1	
40 Pin Base		1	U2
8051(AT89S52)		1	
Oscillator	11.0592mhz	1	X1
LED		2	D5,D6
Resistance	220 $\Omega$	3	R1,R4,R6
Resistance	1k	1	R3
Resistance	10k	2	R2,R5
Buzzer		1	BUZ1
BC547		1	Q1

## POWER SUPPLY:

**Power supply** is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a **power supply unit** or **PSU**. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Here in our application we need a 5v DC power supply for all electronics involved in the project. This requires step down transformer, rectifier, voltage regulator, and filter circuit for generation of 5v DC power. Here a brief description of all the components are given as follows:

## TRANSFORMER:

A **transformer** is a device that transfers electrical energy from one circuit to another through inductively coupled conductors — the transformer's coils or "windings". Except for air-core transformers, the conductors are commonly wound around a single iron-rich core, or around separate but magnetically-coupled cores. A varying current in the first or "primary" winding creates a varying magnetic field in the core (or cores) of the transformer. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the "secondary" winding. This effect is called mutual induction.



If a load is connected to the secondary circuit, electric charge will flow in the secondary winding of the transformer and transfer energy from the primary circuit to the load connected in the secondary circuit.

The secondary induced voltage  $V_S$ , of an ideal transformer, is scaled from the primary  $V_P$  by a factor equal to the ratio of the number of turns of wire in their respective windings:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

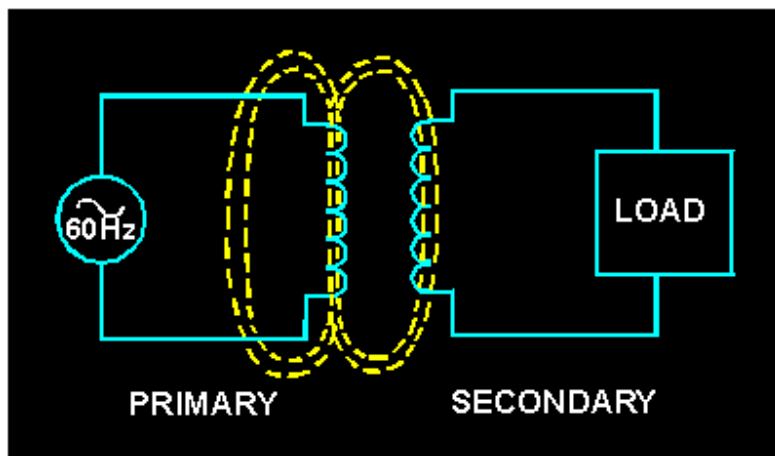
By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up — by making  $N_S$  more than  $N_P$  — or stepped down, by making it

### BASIC PARTS OF A TRANSFORMER

In its most basic form a transformer consists of:

- A primary coil or winding.
- A secondary coil or winding.
- A core that supports the coils or windings.

Refer to the transformer circuit in figure as you read the following explanation: The primary winding is connected to a 60-hertz ac voltage source. The magnetic field (flux) builds up (expands) and collapses (contracts) about the primary winding. The expanding and contracting magnetic field around the primary winding cuts the secondary winding and induces an alternating voltage into the winding. This voltage causes alternating current to flow through the load. The voltage may be stepped up or down depending on the design of the primary and secondary windings.



### THE COMPONENTS OF A TRANSFORMER

Two coils of wire (called windings) are wound on some type of core material. In some cases the coils of wire are wound on a cylindrical or rectangular cardboard form. In effect, the core material is air and the transformer is called an AIR-CORE TRANSFORMER. Transformers used at low frequencies, such as 60 hertz and 400 hertz, require a core of low-reluctance magnetic material, usually iron. This type of transformer is called an IRON-CORE TRANSFORMER. Most power transformers are of the iron-core type. The principle parts of a transformer and their functions are:

- The CORE, which provides a path for the magnetic lines of flux.
- The PRIMARY WINDING, which receives energy from the ac source.
- The SECONDARY WINDING, which receives energy from the primary winding and delivers it to the load.
- The ENCLOSURE, which protects the above components from dirt, moisture, and mechanical damage.

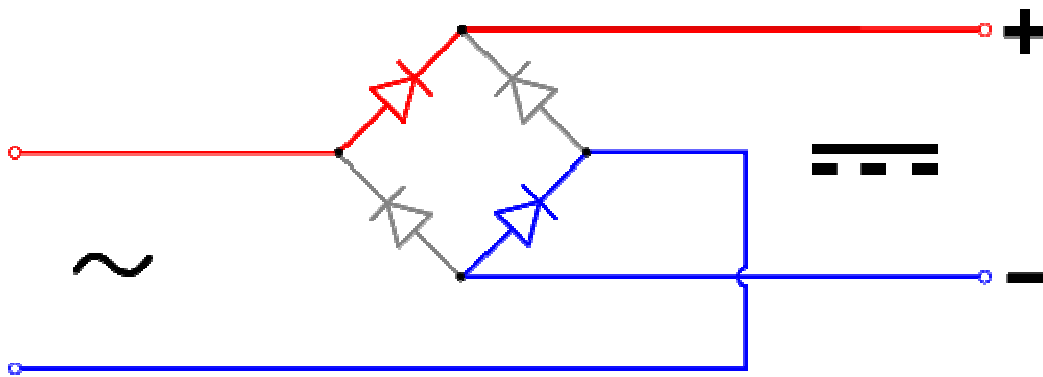
## BRIDGE RECTIFIER

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

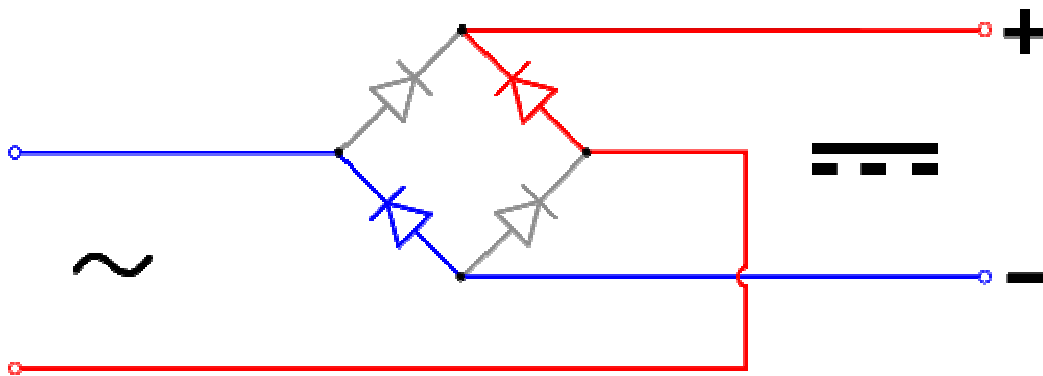
### Basic operation

According to the conventional model of current flow originally established by Benjamin Franklin and still followed by most engineers today, current is *assumed* to flow through electrical conductors from the **positive** to the **negative** pole. In actuality, free electrons in a conductor nearly always flow from the **negative** to the **positive** pole. In the vast majority of applications, however, the *actual* direction of current flow is irrelevant. Therefore, in the discussion below the conventional model is retained.

In the diagrams below, when the input connected to the **left** corner of the diamond is **positive**, and the input connected to the **right** corner is **negative**, current flows from the **upper** supply terminal to the right along the **red** (positive) path to the output, and returns to the **lower** supply terminal via the **blue** (negative) path.



When the input connected to the **left** corner is **negative**, and the input connected to the **right** corner is **positive**, current flows from the **lower** supply terminal to the right along the **red** path to the output, and returns to the **upper** supply terminal via the **blue** path.

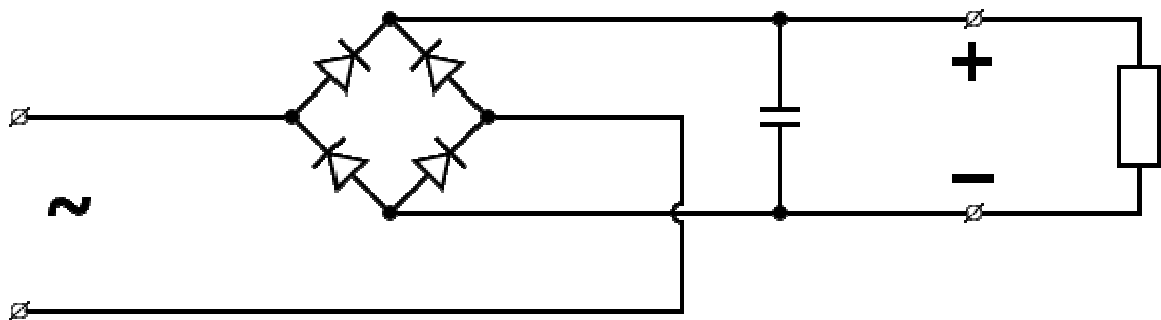


In each case, the upper right output remains positive and lower right output negative. Since this is true whether the input is AC or DC, this circuit not only produces a DC output from an AC input, it can also provide what is sometimes called "reverse polarity protection". That is, it permits normal functioning of DC-powered equipment when batteries have been installed backwards, or when the leads (wires) from a DC power source have been reversed, and protects the equipment from potential damage caused by reverse polarity.

Prior to availability of integrated electronics, such a bridge rectifier was always constructed from discrete components. Since about 1950, a single four-terminal component containing the four diodes connected in the bridge configuration became a standard commercial component and is now available with various voltage and current ratings.

## Output smoothing

For many applications, especially with single phase AC where the full-wave bridge serves to convert an AC input into a DC output, the addition of a capacitor may be desired because the bridge alone supplies an output of fixed polarity but continuously varying or "pulsating" magnitude (see diagram above).



The function of this capacitor, known as a reservoir capacitor (or smoothing capacitor) is to lessen the variation in (or 'smooth') the rectified AC output voltage waveform from the bridge. One explanation of 'smoothing' is that the capacitor provides a low impedance path to the AC component of the output, reducing the AC voltage across, and AC current through, the resistive load. In less technical terms, any drop in the output voltage and current of the bridge tends to be canceled by loss of charge in the capacitor. This charge flows out as additional current through the load. Thus the change of load current and voltage is reduced relative to what would occur without the capacitor. Increases of voltage correspondingly store excess charge in the capacitor, thus moderating the change in output voltage / current.

The simplified circuit shown has a well-deserved reputation for being dangerous, because, in some applications, the capacitor can retain a *lethal* charge after the AC power source is removed. If supplying a dangerous voltage, a practical circuit should include a reliable way to safely discharge the capacitor. If the normal load cannot be guaranteed to perform this function, perhaps because it can be disconnected, the circuit should include a bleeder resistor connected as close as practical across the capacitor. This resistor should consume a current large enough to discharge the capacitor in a reasonable time, but small enough to minimize unnecessary power waste.



Because a bleeder sets a minimum current drain, the regulation of the circuit, defined as percentage voltage change from minimum to maximum load, is improved. However in many cases the improvement is of insignificant magnitude.

The capacitor and the load resistance have a typical time constant  $\tau = RC$  where  $C$  and  $R$  are the capacitance and load resistance respectively. As long as the load resistor is large enough so that this time constant is much longer than the time of one ripple cycle, the above configuration will produce a smoothed DC voltage across the load.

In some designs, a series resistor at the load side of the capacitor is added. The smoothing can then be improved by adding additional stages of capacitor-resistor pairs, often done only for sub-supplies to critical high-gain circuits that tend to be sensitive to supply voltage noise.

The idealized waveforms shown above are seen for both voltage and current when the load on the bridge is resistive. When the load includes a smoothing capacitor, both the voltage and the current waveforms will be greatly changed. While the voltage is smoothed, as described above, current will flow through the bridge only during the time when the input voltage is greater than the capacitor voltage. For example, if the load draws an average current of  $n$  Amps, and the diodes conduct for 10% of the time, the average diode current during conduction must be  $10n$  Amps. This non-sinusoidal current leads to harmonic distortion and a poor power factor in the AC supply.

In a practical circuit, when a capacitor is directly connected to the output of a bridge, the bridge diodes must be sized to withstand the current surge that occurs when the power is turned on at the peak of the AC voltage and the capacitor is fully discharged. Sometimes a small series resistor is included before the capacitor to limit this current, though in most applications the power supply transformer's resistance is already sufficient.

Output can also be smoothed using a choke and second capacitor. The choke tends to keep the current (rather than the voltage) more constant. Due to the relatively high cost of an effective choke compared to a resistor and capacitor this is not employed in modern equipment.

Some early console radios created the speaker's constant field with the current from the high voltage ("B +") power supply, which was then routed to the consuming circuits, (permanent magnets were then too weak for good performance) to create the speaker's constant magnetic field. The speaker field coil thus performed 2 jobs in one: it acted as a choke, filtering the power supply, and it produced the magnetic field to operate the speaker.

### REGULATOR IC (78XX)

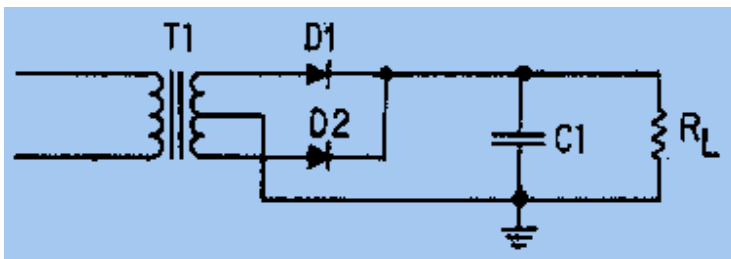
It is a three pin IC used as a voltage regulator. It converts unregulated DC current into regulated DC current.



Normally we get fixed output by connecting the voltage regulator at the output of the filtered DC (see in above diagram). It can also be used in circuits to get a low DC voltage from a high DC voltage (for example we use 7805 to get 5V from 12V). There are two types of voltage regulators 1. fixed voltage regulators (78xx, 79xx) 2. variable voltage regulators (LM317) In fixed voltage regulators there is another classification 1. +ve voltage regulators 2. -ve voltage regulators **POSITIVE VOLTAGE REGULATORS** This include 78xx voltage regulators. The most commonly used ones are 7805 and 7812. 7805 gives fixed 5V DC voltage if input voltage is in (7.5V, 20V).

### The Capacitor Filter

The simple capacitor filter is the most basic type of power supply filter. The application of the simple capacitor filter is very limited. It is sometimes used on extremely high-voltage, low-current power supplies for cathode ray and similar electron tubes, which require very little load current from the supply. The capacitor filter is also used where the power-supply ripple frequency is not critical; this frequency can be relatively high. The capacitor (C1) shown in figure 4-15 is a simple filter connected across the output of the rectifier in parallel with the load.

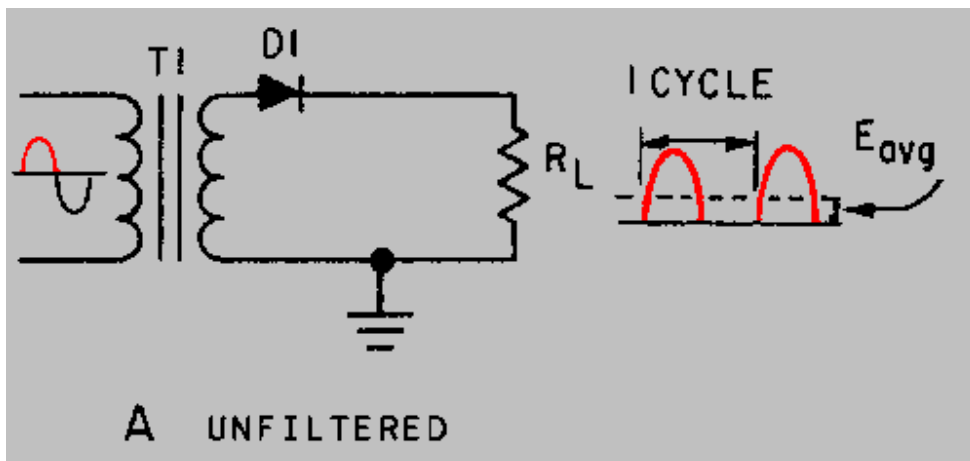


Full-wave rectifier with a capacitor filter.

When this filter is used, the RC charge time of the filter capacitor (C1) must be short and the RC discharge time must be long to eliminate ripple action. In other words, the capacitor must charge up fast, preferably with no discharge at all. Better filtering also results when the input frequency is high; therefore, the full-wave rectifier output is easier to filter than that of the half-wave rectifier because of its higher frequency.

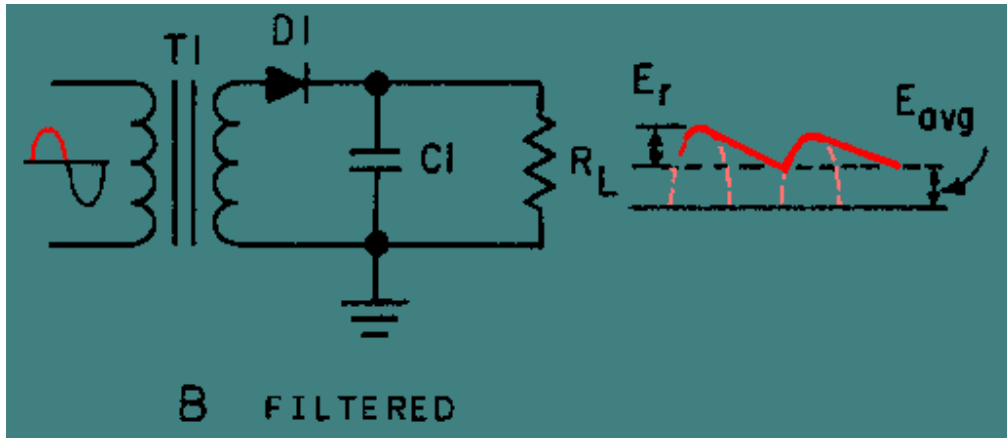
For you to have a better understanding of the effect that filtering has on  $E_{avg}$ , a comparison of a rectifier circuit with a filter and one without a filter is illustrated in views A and B of figure 4-16. The output waveforms in figure 4-16 represent the unfiltered and filtered outputs of the half-wave rectifier circuit. Current pulses flow through the load resistance ( $R_L$ ) each time a diode conducts. The dashed line indicates the average value of output voltage. For the half-wave rectifier,  $E_{avg}$  is less than half (or approximately 0.318) of the peak output voltage. This value is still much less than that of the applied voltage. With no capacitor connected across the output of the rectifier circuit, the waveform in view A has a large pulsating component (ripple) compared with the average or dc component. When a capacitor is connected across the output (view B), the average value of output voltage ( $E_{avg}$ ) is increased due to the filtering action of capacitor C1.

#### UNFILTERED



Half-wave rectifier with and without filtering.

## *FILTERED*



The value of the capacitor is fairly large (several microfarads), thus it presents a relatively low reactance to the pulsating current and it stores a substantial charge.

The rate of charge for the capacitor is limited only by the resistance of the conducting diode, which is relatively low. Therefore, the RC charge time of the circuit is relatively short. As a result, when the pulsating voltage is first applied to the circuit, the capacitor charges rapidly and almost reaches the peak value of the rectified voltage within the first few cycles. The capacitor attempts to charge to the peak value of the rectified voltage anytime a diode is conducting, and tends to retain its charge when the rectifier output falls to zero. (The capacitor cannot discharge immediately.) The capacitor slowly discharges through the load resistance ( $R_L$ ) during the time the rectifier is non-conducting.

The rate of discharge of the capacitor is determined by the value of capacitance and the value of the load resistance. If the capacitance and load-resistance values are large, the RC discharge time for the circuit is relatively long.

A comparison of the waveforms shown in figure 4-16 (view A and view B) illustrates that the addition of  $C_1$  to the circuit results in an increase in the average of the output voltage ( $E_{avg}$ ) and a reduction in the amplitude of the ripple component ( $E_r$ ) which is normally present across the load resistance.

Now, let's consider a complete cycle of operation using a half-wave rectifier, a capacitive filter ( $C_1$ ), and a load resistor ( $R_L$ ). As shown in view A of figure 4-17, the capacitive filter ( $C_1$ ) is assumed to be large enough to ensure a small reactance to the pulsating rectified current. The resistance of  $R_L$  is assumed to be much greater than the reactance of  $C_1$  at the input frequency. When the circuit is energized, the diode conducts on the positive half cycle and current flows through the circuit, allowing  $C_1$  to charge.  $C_1$  will charge to approximately the peak value of the input voltage. (The charge is less than the

peak value because of the voltage drop across the diode (D1)). In view A of the figure, the heavy solid line on the waveform indicates the charge on C1. As illustrated in view B, the diode cannot conduct on the negative half cycle because the anode of D1 is negative with respect to the cathode. During this interval, C1 discharges through the load resistor ( $R_L$ ). The discharge of C1 produces the downward slope as indicated by the solid line on the waveform in view B. In contrast to the abrupt fall of the applied ac voltage from peak value to zero, the voltage across C1 (and thus across  $R_L$ ) during the discharge period gradually decreases until the time of the next half cycle of rectifier operation. Keep in mind that for good filtering, the filter capacitor should charge up as fast as possible and discharge as little as possible.

Figure 4-17A. - Capacitor filter circuit (positive and negative half cycles). POSITIVE HALF-CYCLE

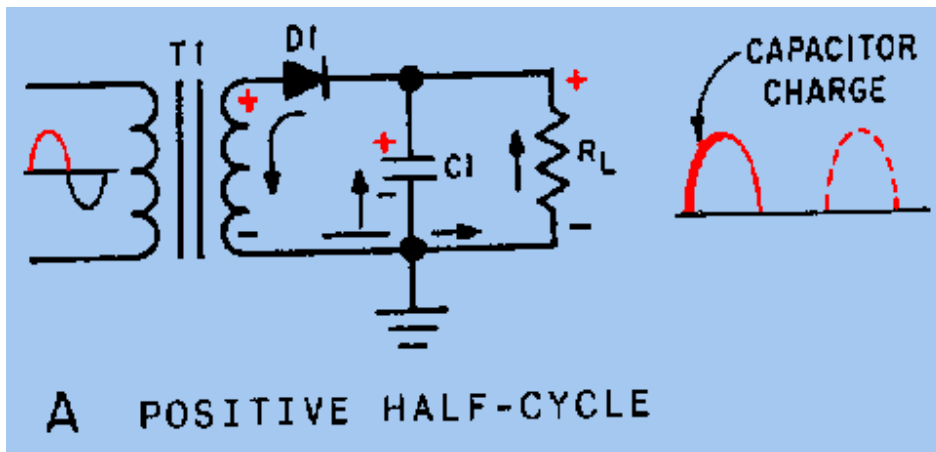
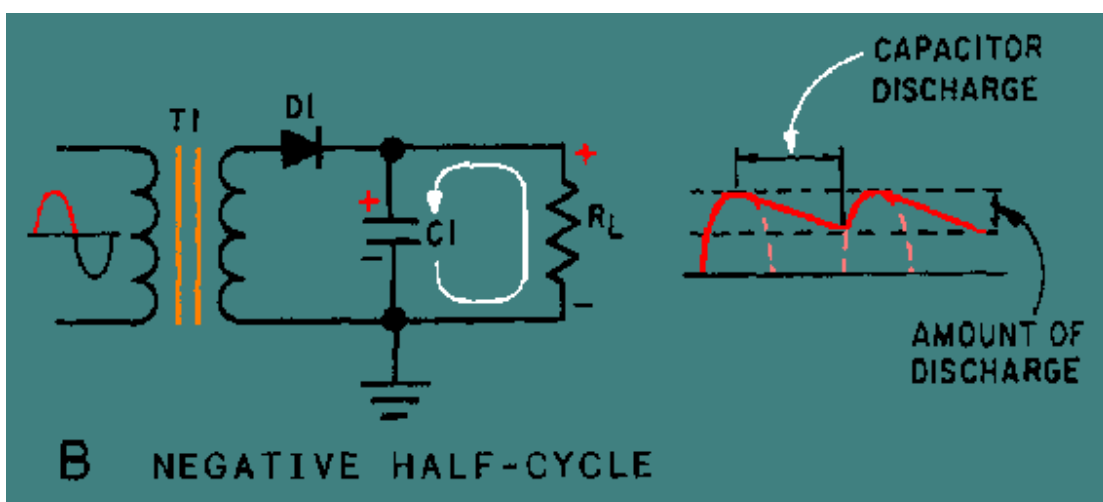


Figure 4-17B. - Capacitor filter circuit (positive and negative half cycles). NEGATIVE HALF-CYCLE

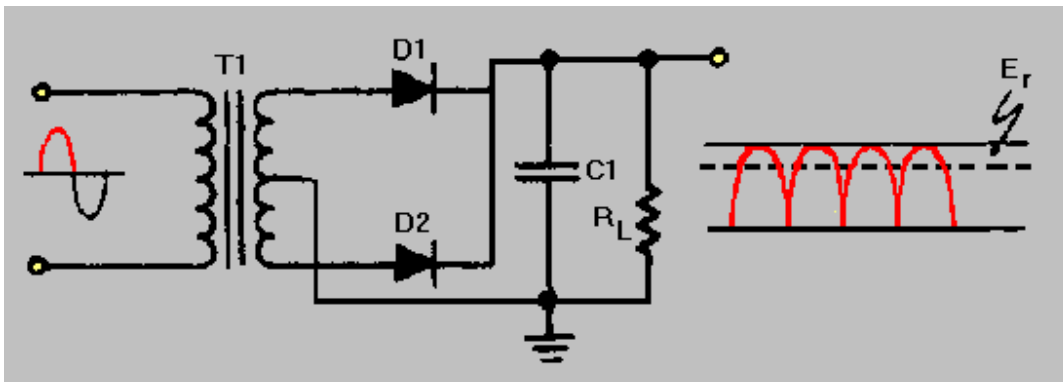


Since practical values of  $C_1$  and  $R_L$  ensure a more or less gradual decrease of the discharge voltage, a substantial charge remains on the capacitor at the time of the next half cycle of operation. As a result, no current can flow through the diode until the rising ac input voltage at the anode of the diode exceeds the voltage on the charge remaining on  $C_1$ . The charge on  $C_1$  is the cathode potential of the diode. When the potential on the anode exceeds the potential on the cathode (the charge on  $C_1$ ), the diode again conducts, and  $C_1$  begins to charge to approximately the peak value of the applied voltage.

After the capacitor has charged to its peak value, the diode will cut off and the capacitor will start to discharge. Since the fall of the ac input voltage on the anode is considerably more rapid than the decrease on the capacitor voltage, the cathode quickly become more positive than the anode, and the diode ceases to conduct.

Operation of the simple capacitor filter using a full-wave rectifier is basically the same as that discussed for the half-wave rectifier. Referring to figure 4-18, you should notice that because one of the diodes is always conducting on either alternation, the filter capacitor charges and discharges during each half cycle. (Note that each diode conducts only for that portion of time when the peak secondary voltage is greater than the charge across the capacitor.)

Figure 4-18. - Full-wave rectifier (with capacitor filter).



Another thing to keep in mind is that the ripple component ( $E_r$ ) of the output voltage is an ac voltage and the average output voltage ( $E_{avg}$ ) is the dc component of the output. Since the filter capacitor offers relatively low impedance to ac, the majority of the ac component flows through the filter capacitor. The ac component is therefore bypassed (shunted) around the load resistance, and the entire dc component (or  $E_{avg}$ ) flows through the load resistance. This statement can be clarified by using the formula for  $X_C$  in a half-wave and full-wave rectifier. First, you must establish some values for the circuit.

### HALFWAVE RECTIFIER

FREQUENCY AT  
RECTIFIER OUTPUT: 60 Hz

VALUE OF FILTER  
CAPACITOR: 30 $\mu$ F

LOAD RESISTANCE: 10k $\Omega$

$$X_c = \frac{1}{2\pi fC}$$

$$X_c = \frac{.159}{fC}$$

$$X_c = \frac{.159}{60 \times .000030}$$

$$X_c = \frac{.159}{.0018}$$

$$X_c = 88.3\Omega$$

FREQUENCY AT  
RECTIFIER OUTPUT: 120Hz

VALUE OF FILTER  
CAPACITOR: 30 $\mu$ F

LOAD RESISTANCE: 10k $\Omega$

$$X_c = \frac{1}{2\pi fC}$$

$$X_c = \frac{.159}{fC}$$

$$X_c = \frac{.159}{120 \times .000030}$$

$$X_c = \frac{.159}{.0036}$$

$$X_c = 44.16\Omega$$

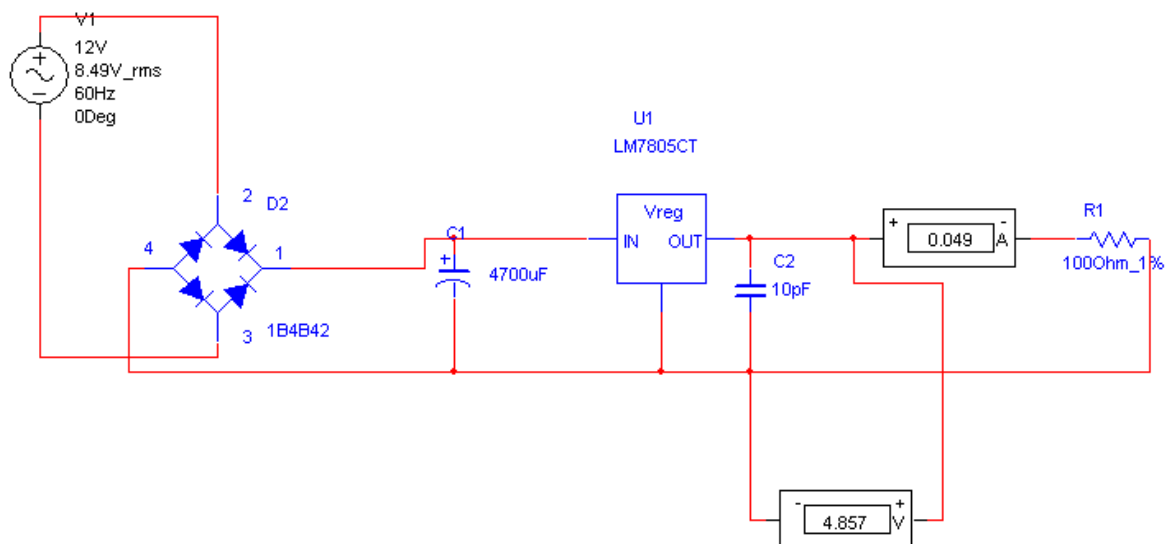
As you can see from the calculations, by doubling the frequency of the rectifier, you reduce the impedance of the capacitor by one-half. This allows the ac component to pass through the capacitor more easily. As a result, a full-wave rectifier output is much easier to filter than that of a half-wave rectifier. Remember, the smaller the  $X_C$  of the filter capacitor with respect to the load resistance, the better the filtering action. Since

$$X_C = \frac{1}{2\pi fC}$$

the largest possible capacitor will provide the best filtering.

Remember, also, that the load resistance is an important consideration. If load resistance is made small, the load current increases, and the average value of output voltage ( $E_{avg}$ ) decreases. The RC discharge time constant is a direct function of the value of the load resistance; therefore, the rate of capacitor voltage discharge is a direct function of the current through the load. The greater the load current, the more rapid the discharge of the capacitor, and the lower the average value of output voltage. For this reason, the simple capacitive filter is seldom used with rectifier circuits that must supply a relatively large load current. Using the simple capacitive filter in conjunction with a full-wave or bridge rectifier provides improved filtering because the increased ripple frequency decreases the capacitive reactance of the filter capacitor.

### CIRCUIT DIAGRAM OF POWER SUPPLY



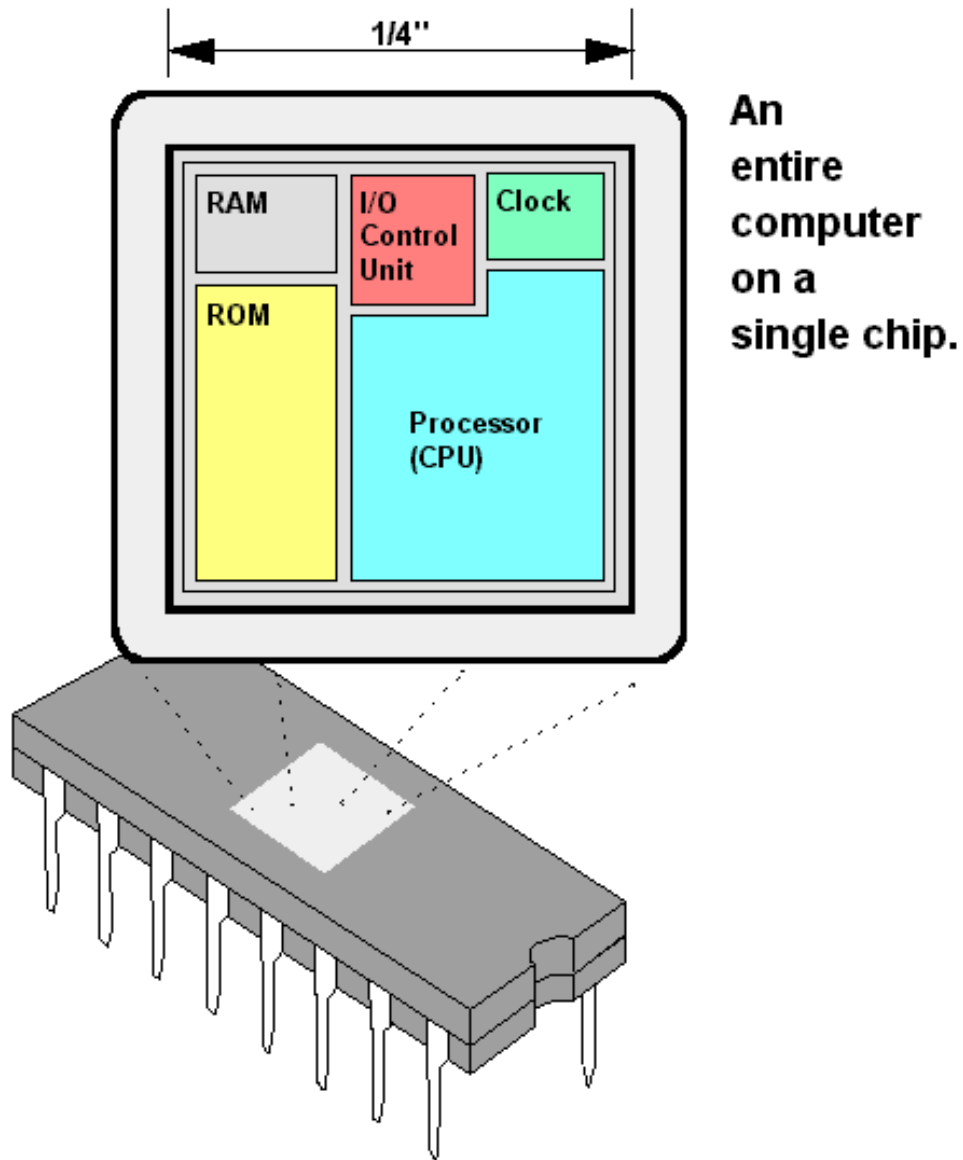


# A BRIEF INTRODUCTION TO 8051 MICROCONTROLLER:

When we have to learn about a new computer we have to familiarize about the machine capability we are using, and we can do it by studying the internal hardware design (devices architecture), and also to know about the size, number and the size of the registers.

A microcontroller is a single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit. Also called a "computer on a chip," billions of microcontroller units (MCUs) are embedded each year in a myriad of products from toys to appliances to automobiles. For example, a single vehicle can use 70 or more microcontrollers. The following picture describes a general block diagram of microcontroller.

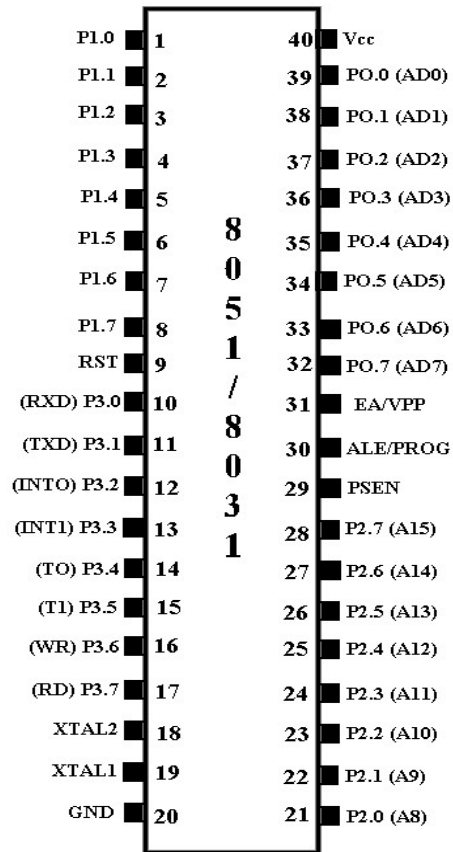
89s52: The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many, embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt



**An  
entire  
computer  
on a  
single chip.**

The hardware is driven by a set of program instructions, or software. Once familiar with hardware and software, the user can then apply the microcontroller to the problems easily.

The pin diagram of the 8051 shows all of the input/output pins unique to microcontrollers:



The following are some of the capabilities of 8051 microcontroller.

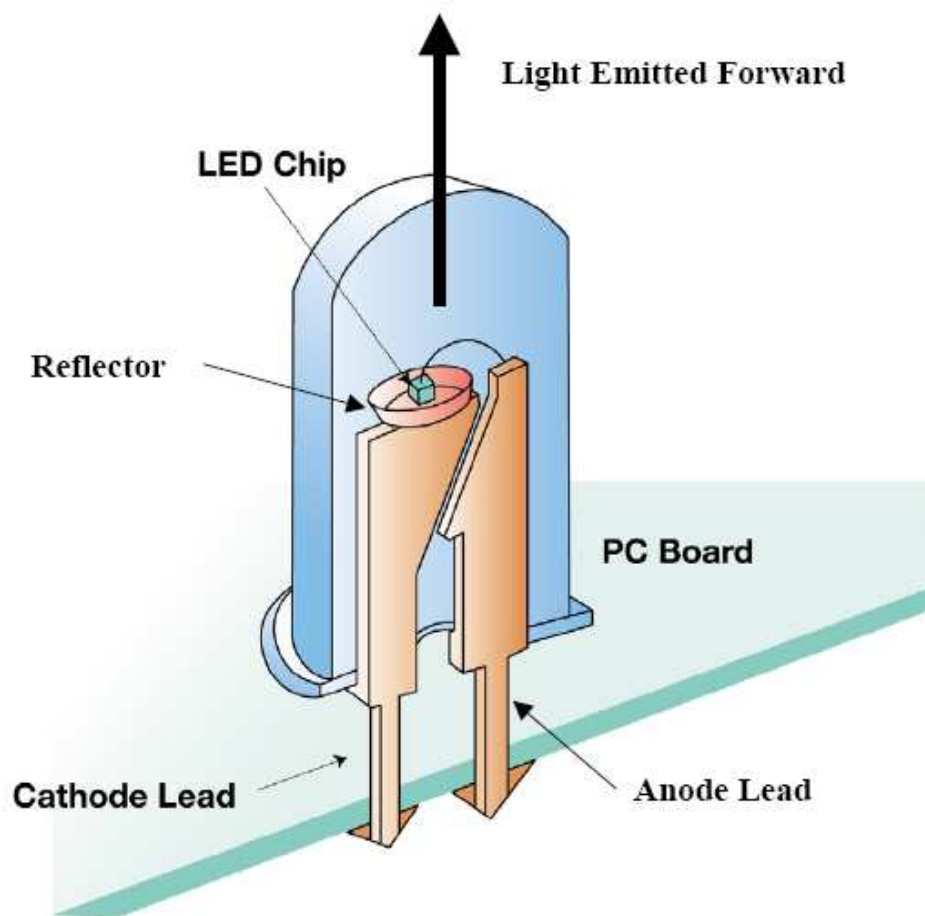
- ✓ Internal ROM and RAM
- ✓ I/O ports with programmable pins
- ✓ Timers and counters
- ✓ Serial data communication

The 8051 architecture consists of these specific features:

- 16 bit PC & data pointer (DPTR)
- 8 bit program status word (PSW)
- 8 bit stack pointer (SP)
- Internal ROM 4k
- Internal RAM of 128 bytes.
- 4 register banks, each containing 8 registers

- 80 bits of general purpose data memory
- 32 input/output pins arranged as four 8 bit ports: P0-P3
- Two 16 bit timer/counters: T0-T1
- Two external and three internal interrupt sources Oscillator and clock circuits.

## LED



## Typical spec. of HB LED

1 Watt LED Full intensity 350mA, Maximum current 500mA  
2.8V Volt drop @ 350mA

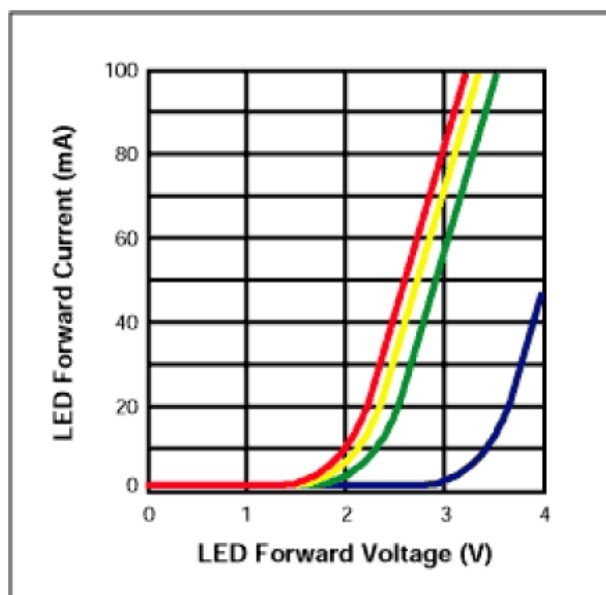
3 Watt LED Full intensity 700mA, Maximum current 1A  
4.3V Volt drop @ 700mA

5 Watt LED (multi-die package) Full intensity 700mA, Maximum current 1A  
7.1V Volt drop @ 700mA

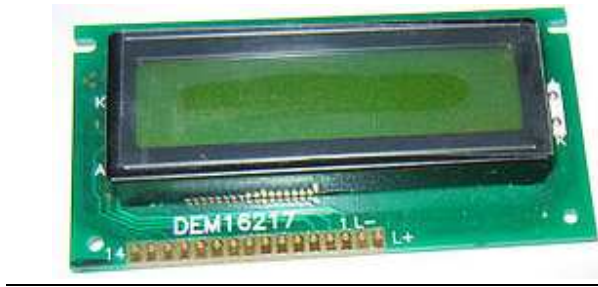
5 Watt LED (single-die) Full intensity 1.5A

## Characteristics of LEDs

- Forward Voltage (VF) drop across LED Diodes are current driven!
- Wavelength variations Crystal and junction growth defects
- Brightness variations Crystal defects resulting formation of phonons and non-radiation energy transfer
- Temperature Junction temperature of the device affects each of the parameters above



## 16 x 2 Character LCD



## FEATURES

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

## PIN NUMBER SYMBOL FUNCTION

- 1 Vss GND
- 2 Vdd + 3V or + 5V
- 3 Vo Contrast Adjustment
- 4 RS H/L Register Select Signal
- 5 R/W H/L Read/Write Signal
- 6 E H → L Enable Signal
- 7 DB0 H/L Data Bus Line
- 8 DB1 H/L Data Bus Line
- 9 DB2 H/L Data Bus Line
- 10 DB3 H/L Data Bus Line
- 11 DB4 H/L Data Bus Line
- 12 DB5 H/L Data Bus Line
- 13 DB6 H/L Data Bus Line

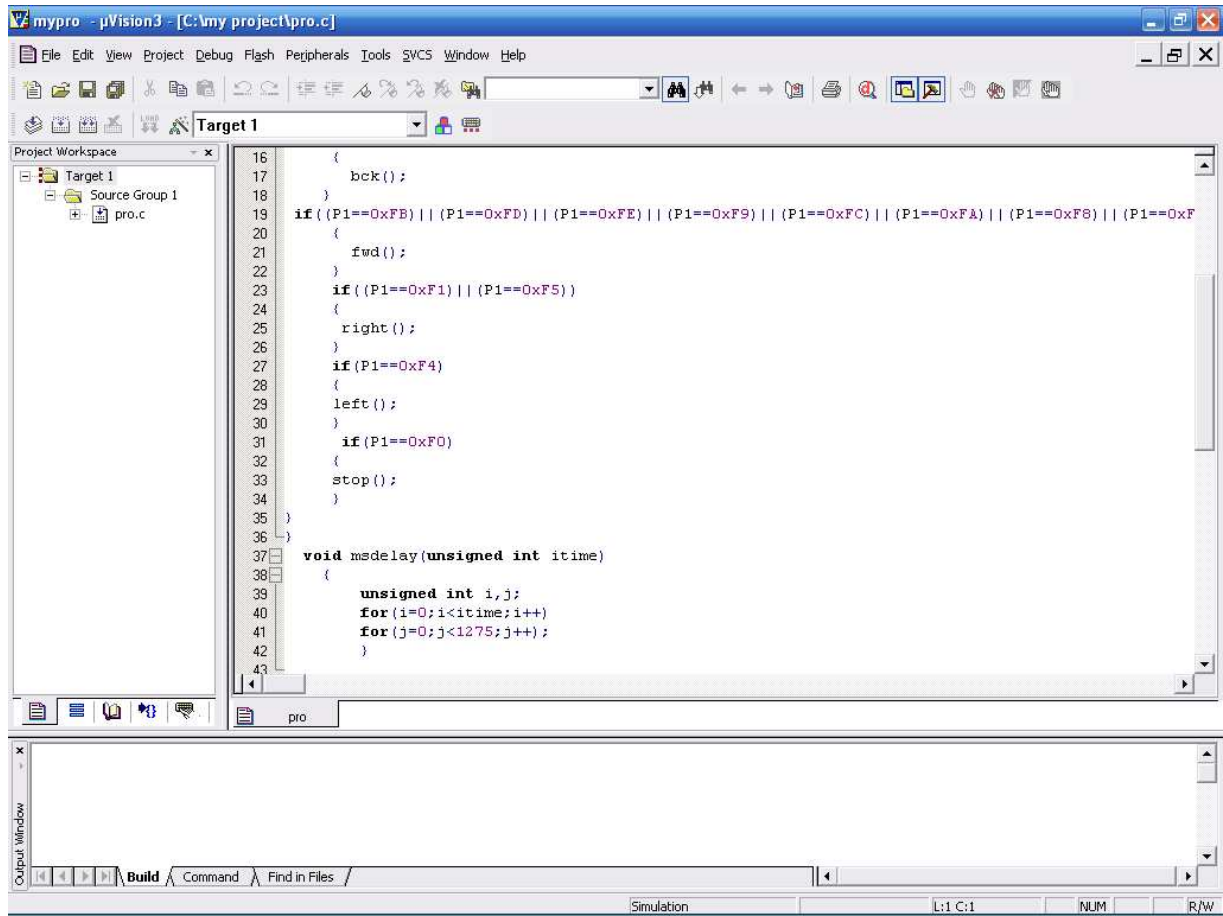
- 14 DB7 H/L Data Bus Line
- 15 A/Vee + 4.2V for LED/Negative Voltage Output
- 16 K Power Supply for B/L (OV)

### About Keil uVision 3

Keil Software to provide you with software development tools for 8051 based microcontrollers. With the Keil tools, you can generate embedded applications for virtually every 8051 derivative. The supported microcontrollers are listed in the  $\mu$ Vision

**Device Database™.** The Keil Software 8051 development tools are designed for the professional software developer, but any level of programmer can use them to get the most out of the 8051 microcontroller architecture.

**Keil software converts the C-codes into the Intel Hex code.**

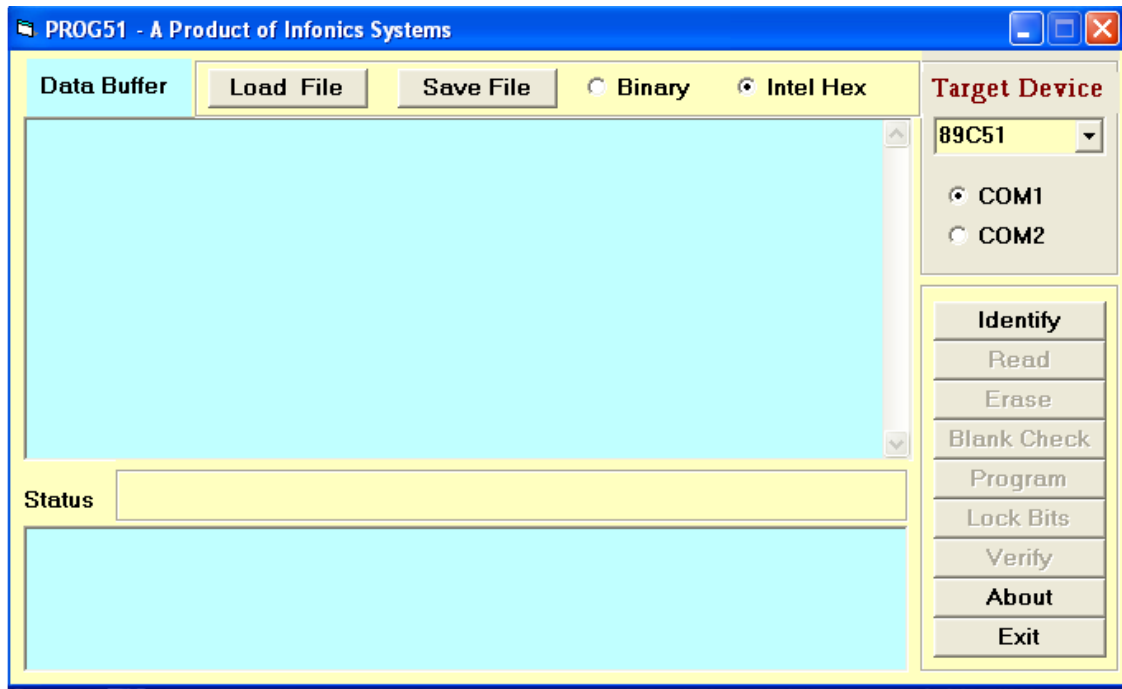


## *A view of Keil uVision 3*

### *PRO51 Burner Software*

PRO51 BURNER provides you with software burning tools for 8051 based Microcontrollers in their Flash memory. The 51 BURNER tools, you can burn AT89C/SXXXX series of ATMEL microcontrollers.





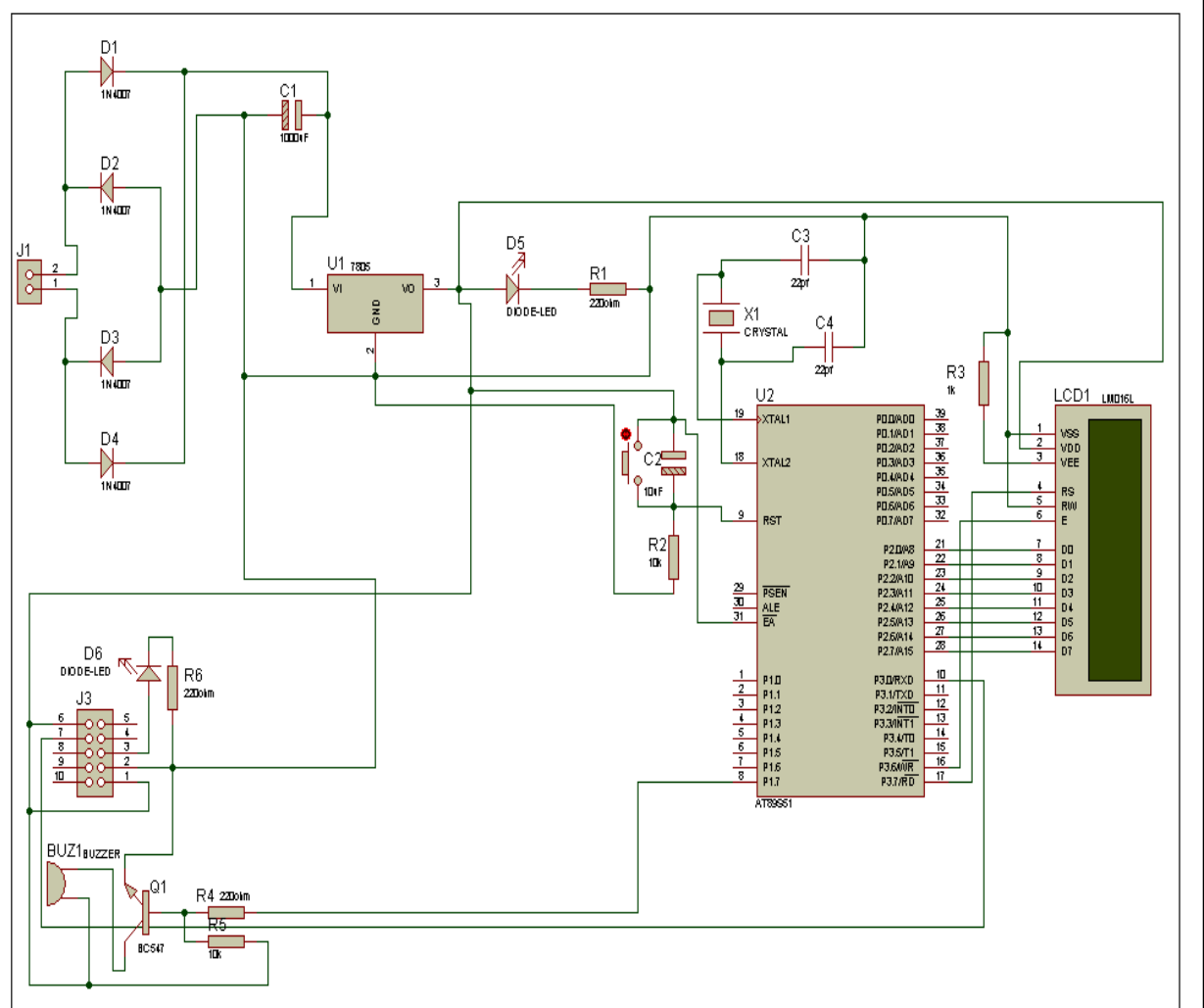
*A view of PRO51*

## **PROBLEM FACED**

- During soldering, many of the connection become short cktd. So we desolder the connection and did soldering again.
- A leg of the crystal oscillator was broken during mounting. So it has to be replaced.
- LED`s get damaged when we switched ON the supply so we replace it by the new one.
- TROUBLESHOOT
- Care should be taken while soldering. There should be no shorting of joints.
- Proper power supply should maintain.
- Project should be handled with care since IC are delicate
- Component change and check again circuit

## Circuit diagram of the project

## Circuit diagram of the project



### Procedure:

Now here we will be attach all component those are give above with the Specific value connect through the given circuit diagram and in this manner Our RFID BASED LBRARY MANAGEMENT SYSTEM system project will be complete.

### Reference:

- **“8051 and embedded system” by Mazidi and Mazidi**
- **All datasheets from [www.datasheetcatalog.com](http://www.datasheetcatalog.com)**
- **About AT89s8252 from [www.atmel.com](http://www.atmel.com)**
- **And [www.triindia.co.in](http://www.triindia.co.in)**
- **About DS1820 from [www.dallas.com](http://www.dallas.com).**

- For further details regarding to software and hardware and any further queries contact to the given address.

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