Industrial Training Report

Place of training: Integrated Power Solutions, Udaipur, Rajasthan

Period of training: 11th March to 11th April 2023

Submitted to

Department of Electrical Engineering

Summer Training In-charge at TINJRIT: **Mr. Rajkumar Soni**

By

Akshay Solanki: 20ETCEE001

Jayesh Menariya: 20ETCEE002

Praveen Meghwal: 20ETCEE005

Puneet Jain: 20ETCEE006

(Batch 2020-2024)

Branch: Electrical Engineering

Techno India NJR Institute of Technology

Plot-T, Bhamashah (RIICO) Industrial Area, Kaladwas,

Udaipur – 313001, Rajasthan

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Certificate

INTEGRATED POWER SOLUTION
101-A, HINGOR NEAR GSS, EKLINGPURA
UDAIPUR, RAJASTHAN – 313003
PHONE: +91 7062737735, E-mail: integratedpower@outlook.com

Internship Certificate

This is to certify that Akshay Solanki has successfully completed an internship with Integrated Power Solution as a Intern in the R&D Department from 11/03/2023 to 11/04/2023.

They have worked on the PCB Tracing and Circuit Design.

During the internship, he has gained several learnings. Besides showing high comprehension capacity, managing assignments with the utmost expertise, and exhibiting maximal efficiency, he has also maintained an outstanding professional demeanour and showcased excellent moral character throughout the internship period. I hereby certify his overall work as excellent to the best of my knowledge. Wishing him the best of luck in his future endeavours.

Date: 14/04/2023

GST No: 08AAFFI2479C1ZG
PAN No: AAFFI2479C

For INTEGRATED POWER SOLUTION

Authorised signatory

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UDAIPUR, RAJASTHAN – 313003
PHONE: +91 7062737735, E-mail: integratedpower@outlook.com

Internship Certificate

This is to certify that Jayesh Menariya has successfully completed an internship with Integrated Power Solution as a Intern in the R&D Department from 11/03/2023 to 11/04/2023.

They have worked on the PCB Tracing and Circuit Design.

During the internship, he has gained several learnings. Besides showing high comprehension capacity, managing assignments with the utmost expertise, and exhibiting maximal efficiency, he has also maintained an outstanding professional demeanour and showcased excellent moral character throughout the internship period. I hereby certify his overall work as excellent to the best of my knowledge. Wishing him the best of luck in his future endeavours.

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PHONE: +91 7062737735, E-mail: integratedpower@outlook.com

Internship Certificate

This is to certify that Praveen Meghwal has successfully completed an internship with Integrated Power Solution as a Intern in the R&D Department from 11/03/2023 to 11/04/2023.

They have worked on the PCB Tracing and Circuit Design.

During the internship, he has gained several learnings. Besides showing high comprehension capacity, managing assignments with the utmost expertise, and exhibiting maximal efficiency, he has also maintained an outstanding professional demeanour and showcased excellent moral character throughout the internship period. I hereby certify his overall work as excellent to the best of my knowledge. Wishing him the best of luck in his future endeavours.

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Internship Certificate

This is to certify that Puneet Jain has successfully completed an internship with Integrated Power Solution as a Intern in the R&D Department from 11/03/2023 to 11/04/2023.

They have worked on the PCB Tracing and Circuit Design.

During the internship, he has gained several learnings. Besides showing high comprehension capacity, managing assignments with the utmost expertise, and exhibiting maximal efficiency, he has also maintained an outstanding professional demeanour and showcased excellent moral character throughout the internship period. I hereby certify his overall work as excellent to the best of my knowledge. Wishing him the best of luck in his future endeavours.

Date: 14/04/2023

GST No: 08AAFFI2479C1ZG
PAN No: AAFFI2479C

For INTEGRATED POWER SOLUTION

Authorised signatory

This is to certify that (Akshay Solanki, Jayesh Menariya, Praveen Meghwal, Puneet Jain), Bachelor of Electrical Engineering has successfully completed Industrial Training on the B.L.D.C fan's driver circuit from INTEGRATED POWER SOLUTIONS as partial fulfillment of Bachelor of Engineering EE. The Industrial Training Report, Presentation and Project are genuine work done by them and the same is being submitted for evaluation.

Signature

Mr. Rajkumar Soni

HOD EE

ACKNOWLEDGMENT's

We take this opportunity to express my profound gratitude and deep regards to my guide **Dr. Prakash Bahrani** (Head of EE) for his exemplary guidance, monitoring and constant encouragement throughout the course of the training. The blessing, help and guidance given by him time to time shall carry me a long way in the journey of life on which we are about to embark.

We specially take the opportunity to thank our coordinator Mr. Rajkumar Soni, for their valuable information and guidance which helped me in completing this task through various stages. We also take this opportunity to express a deep sense of gratitude to all my teachers of Electrical Engineering Department for their coordinal support.

We are obliged to the staff members of the (**INTEGRATED POWER SOLUTIONS** and **Mr. Jitendra Nagda**), for the valuable information provided by them in their respective fields. We are grateful for their corporation provided by them during my training period.

We are thankful to the almighty and our parents for their moral support and my friends with whom we shared our day-to-day experience and received lots of suggestions that improved our quality of work.

INTRODUCTION OF COMPANY: Integrated Power Solution is a prominent manufacturer, established in 2015 as a Partnership firm. They specialize in producing a diverse array of products, including Led Drivers, Mppt Solar Charge Controllers, and Bldc Ceiling Fans. With their commitment to quality and innovation, Integrated Power Solution has established itself as a leading player in the industry. Their products are known for their reliability and efficiency, making them a preferred choice for customers seeking sustainable power solutions.

Integrated Power Solutions(Driver circuits manufacturing unit)
Main office: Udaipur, Rajasthan.

4 . Genaral information about PCB

A printed circuit board (PCB) is a flat board made of insulating material, such as fiberglass or composite epoxy, with conductive pathways etched or printed onto it. PCBs are used to provide mechanical support and electrical connections for electronic components.

Here are some general points about PCBs:

1. Function: The main purpose of a PCB is to provide a platform for mounting and interconnecting electronic components, such as integrated circuits (ICs), resistors, capacitors, and other active and passive devices. The conductive pathways on the PCB, known as traces, allow electrical signals to flow between the components.

2. Layers: PCBs can have multiple layers, typically ranging from one to many layers, depending on the complexity of the circuit. Each layer can contain conductive traces and insulating material. The layers are laminated together to form a single board.

3. Design: PCBs are designed using specialized software called electronic design automation (EDA) tools. The design process involves placing components on the board, routing the interconnections, and specifying the necessary electrical characteristics.

4. Manufacturing: PCBs are manufactured through a series of processes. It starts with the fabrication of the bare board, which includes etching or printing the copper traces on the insulating material. Then, the board is populated with electronic components using automated machines or manual soldering. Finally, the assembled PCB undergoes testing to ensure proper functionality.

5. Types: PCBs can be classified into different types based on their construction and application. Some common types include single-sided PCBs, double-sided PCBs (with traces on both sides), and multilayer PCBs (with multiple layers of traces). There are also flexible PCBs (flex PCBs) and rigid-flex PCBs that offer flexibility for specific applications.

6. Advantages: PCBs offer several advantages over other wiring methods. They provide a compact and organized way to connect electronic components, reducing the overall size of electronic devices. PCBs also enhance the reliability and

durability of circuits, as the traces are protected and insulated. They can be mass-produced, making them cost-effective for large-scale production.

7. Applications: PCBs are used in a wide range of electronic devices, from simple consumer electronics like smartphones, laptops, and televisions to complex systems such as medical devices, aerospace equipment, and industrial machinery. They are found in almost every electronic device or system that requires circuitry.

It's important to note that PCB technology is constantly evolving, and new advancements are being made to meet the demands of smaller, more powerful electronic devices.

5.1 • Pick and place machine (SMT)

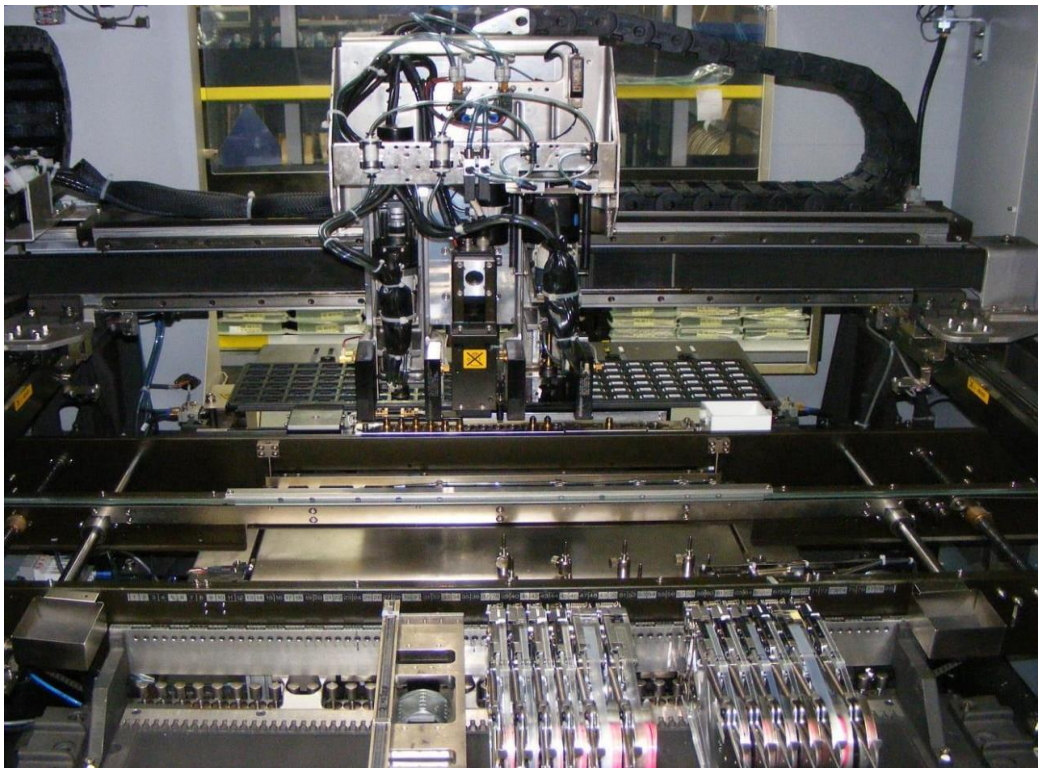


Fig.1: (SMT or Pick and place machine)

For a good circuit of any electrical device we need a good assembly of components which will be used on the circuit board, and for that purpose pick and place machine is used which is SURFACE MOUNT TECHNOLOGY based machine.

Surface-mount technology (SMT) component placement systems, commonly called pick-and-place machines or P&Ps, are robotic machines which are used to place surface-mount devices (SMDs) onto a printed circuit board (PCB). They are used for high speed, high precision placing of a broad range of electronic components, like capacitors, resistors, integrated circuits onto the PCBs which are in turn used in computers, consumer electronics as well as industrial, medical, automotive, military and telecommunications equipment. Similar equipment exists for through-hole components. This type of equipment is sometimes also used to package microchips using the flip chip method.

5.2 • Operation

The placement equipment is part of a larger overall machine that carries out specific programmed steps to create a PCB assembly. Several sub-systems work together to pick up and correctly place the components onto the PCB. These systems normally use pneumatic suction cups, attached to a plotter-like device to allow the cup to be accurately manipulated in three dimensions. Additionally, each nozzle can be rotated independently.

Fig.2:Tape-and-reel feed mechanism used to load components into a pick-and-place machine

5.3 • Component feeds

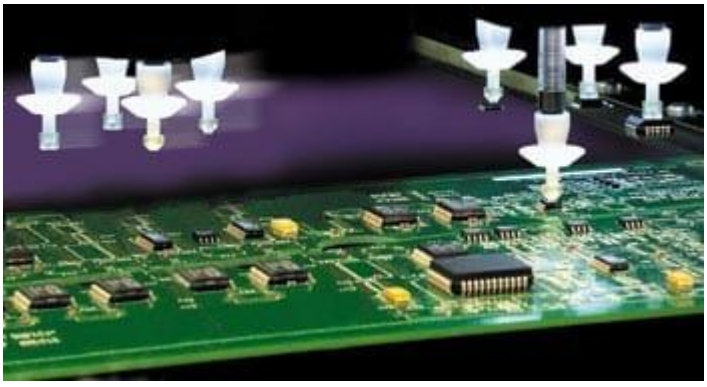


Fig.3: SMD pick-and-place machine

Surface mount components are placed along the front (and often back) faces of the machine. Most components are supplied on paper or plastic tape, in tape reels that are loaded onto feeders mounted to the machine. Larger integrated circuits

(ICs) are sometimes supplied arranged in trays which are stacked in a compartment. More commonly used ICs will be provided in tapes rather than trays or sticks. Improvements in feeder technology mean that tape format is becoming the preferred method of presenting parts on an SMT machine.

5.4 • Conveyor belt

Through the middle of the machine there is a conveyor belt, along which blank PCBs travel, and a PCB clamp in the center of the machine. The PCB is clamped, and the nozzles pick up individual components from the feeders/trays, rotate them to the correct orientation and then place them on the appropriate pads on the PCB with high precision. High-end machines can have multiple conveyors to produce multiple same or different kinds of products simultaneously.

5.5 • Inspection and visual system

The part being carried from the part feeders on either side of the conveyor belt to the PCB, it is photographed from below by using high resolution camera and lighting system. Its silhouette is inspected to see if it is damaged or missing (was not picked up), and the inevitable registration errors in pickup are measured and compensated for when the part is placed. For example, if the part was shifted 0.25 mm and rotated 10° when picked up, the pickup head will adjust the placement position to place the part in the correct location.

Some machines have these optical systems on the robot arm and can carry out the optical calculations without losing time, thereby achieving a lower derating factor. The high-end optical systems mounted on the heads can also be used to capture details of the non-standard type components and save them to a database for future use. In addition to this, advanced software is available for monitoring the production and interconnect database — of the production floor to that of supply chain — in real-time. ASM provides an optional feature for increasing accuracy while placing LED components on a high end product where in the optical center of the LED is critical rather than the calculated mechanical center based on the component's lead structure. The special camera system measures both physical and optical center and makes the necessary adjustments before placement. It also can acquire the images in either single field of view multiple field of view modes.

A separate camera on the pick-and-place head photographs fiducial marks on the PCB to measure its position on the conveyor belt accurately. Two fiducial marks, measured in two dimensions each, usually placed diagonally, let the PCB's orientation and thermal expansion be measured and compensated for as well. Some machines are also able to measure the PCB shear by measuring a third fiducial mark on the PCB.

5.6 • Variations

To minimize the distance the pickup gantry must travel, it is common to have multiple nozzles with separate vertical motion on a single gantry. This can pick up multiple parts with one trip to the feeders. Also, advanced software in the newer generation machines allows different robotic heads to work independently of each other to further increase the throughput.

The components may be temporarily adhered to the PCB using the wet solder paste itself, or by using small blobs of a separate adhesive, applied by a glue-dispensing machine that can be incorporated on to the pick and place machine. The glue is added before component placement. It is dispensed by nozzles or by using jet dispensing. Jet dispensing dispenses material by shooting it towards the target, which in this case, is the circuit board.

6.1 • Component fitting

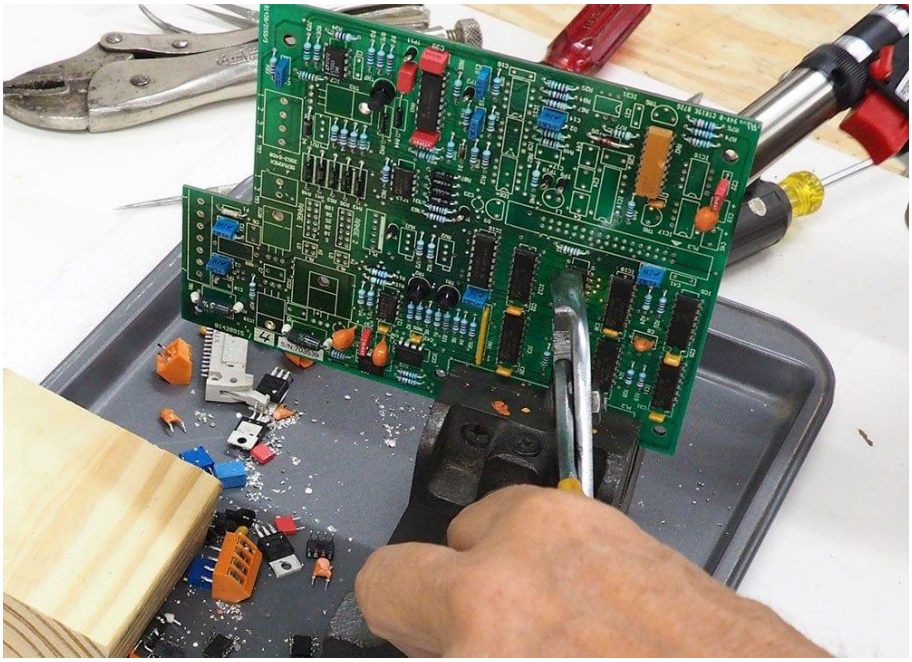


Fig.4: Component fitting manually by a worker

In the workshop, there are certain components that cannot be effectively fitted with machines and require manual intervention. These components are carefully mounted into their predetermined sections on a circuit board. The process involves placing each component in its designated spot, ensuring proper alignment and connection.

Once the components are mounted, the next step is soldering. Soldering is a technique used to join the electrical connections between components and the circuit board. This process requires skilled manual work to accurately apply the solder and create secure connections.

After the soldering process, the entire circuit board is immersed in a soldering solution. This solution helps to ensure that all the components are properly soldered and connected. If any component was inadvertently left out during the initial mounting or soldering process, this immersion in the soldering solution helps identify and rectify the mistake.

The manual work involved in mounting components, soldering, and using the soldering solution plays a crucial role in ensuring the accuracy and reliability of the circuit board assembly. Despite advancements in automation, certain tasks still require human expertise and attention to detail to achieve optimal results.

6.2 • Visualization process

Once all the necessary tasks have been completed, the supervisor takes charge of the visualization process. This step involves meticulously examining the work done thus far. The supervisor thoroughly inspects the soldering to ensure it has been executed correctly, as it is crucial for the overall functionality and longevity of the project. They also verify if the components have been fitted properly; if any discrepancies are found, they promptly desolder them and reattach them correctly.

Additionally, the supervisor pays close attention to the finer details of the project. They carefully trim any unwanted legs or excess material to achieve a neater and more professional appearance. This step is crucial as it ensures that the final product meets the required standards and specifications.

The supervisor, being an expert in their field, possesses the necessary expertise and precision to identify and rectify any imperfections or mistakes before moving on to the subsequent stages. By conducting a thorough visual inspection, they play a vital role in ensuring the overall quality and integrity of the completed work.

6.3 • Programming of PCB boards

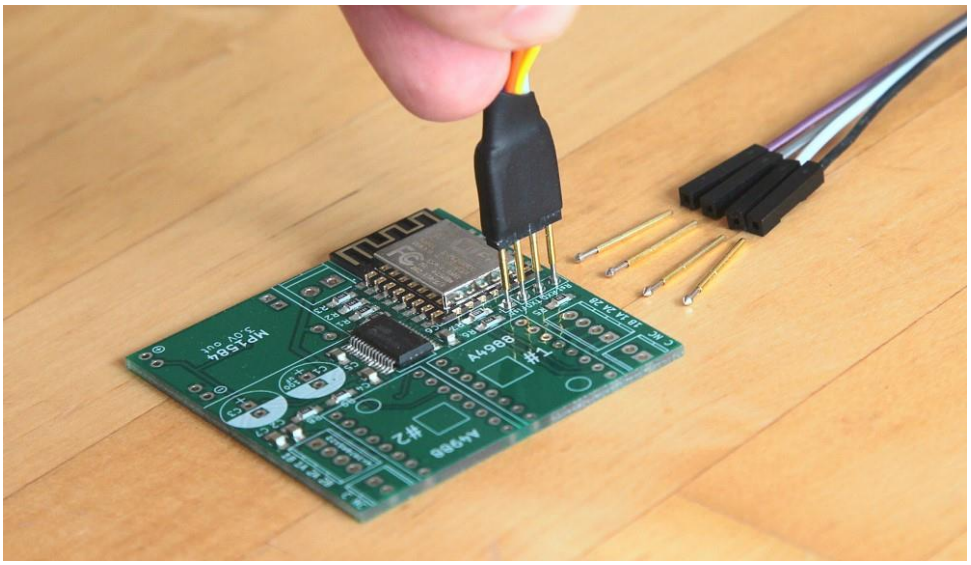


Fig.5:Programming the PCB

Once the visualization process is completed, the programming phase for the PCB board begins, tailored to meet specific requirements. This programming involves configuring parameters such as the fan's RPM (rotations per minute), direction, frequency, and fulfilling other necessary functions. By programming the PCB board, engineers can control the fan's speed, determine its rotational direction (clockwise or counterclockwise), set its frequency of operation, and ensure that all the necessary functions are implemented. This programming phase is crucial in fine-tuning the PCB board's behavior and ensuring it operates in accordance with the desired specifications and functions.

6.4 • Cleaning of PCB

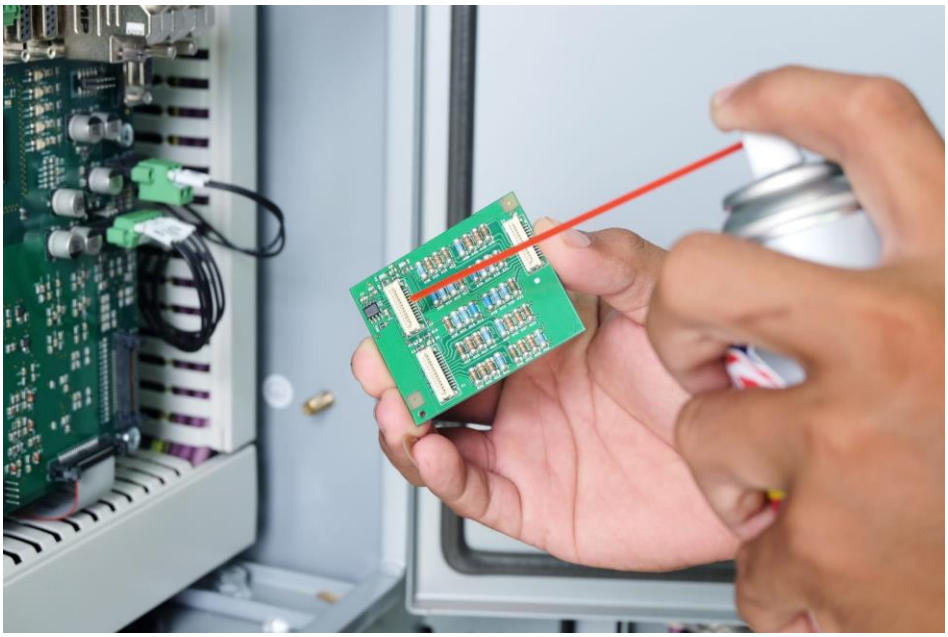


Fig.5:Cleaning the PCB

Cleaning PCBs (Printed Circuit Boards) is crucial to ensure optimal device performance. Unwanted foreign particles, such as dust, debris, or residue, can negatively impact the functioning of electronic components on the PCB. These particles may disrupt electrical connections, cause short circuits, or impede heat dissipation, leading to device malfunctions or failures. Moreover, thorough cleaning helps maintain the integrity of the PCB by preventing corrosion and oxidation. Additionally, removing the identifying marks, such as the I.C (Integrated Circuit) number, safeguards against unauthorized duplication or copying of the device by other manufacturers, protecting intellectual property and ensuring market competitiveness.

6.5 • Testing of PCB boards

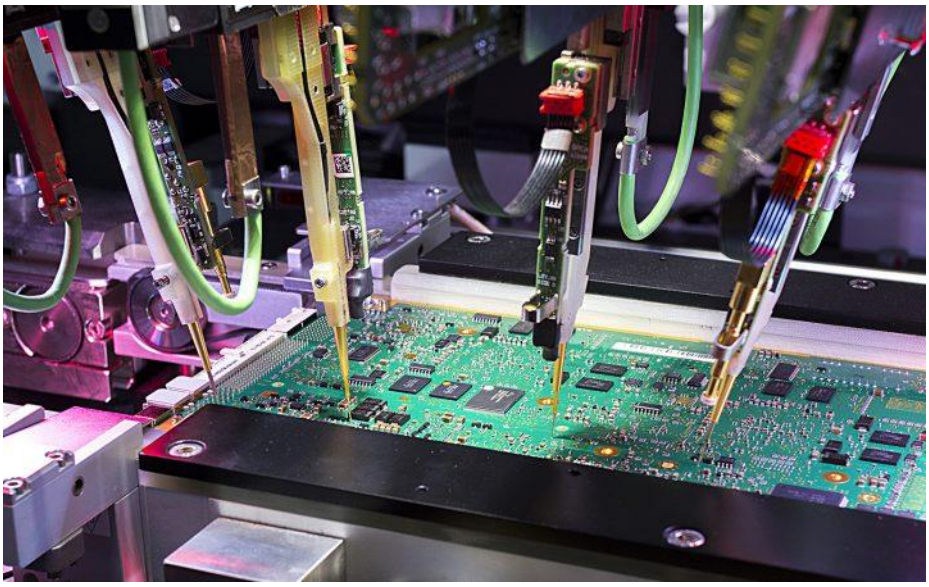


Fig.5:Testing the PCB

Once the program has been successfully uploaded to the printed circuit board (PCB), the testing phase commences under the supervision of a supervisor. This crucial step ensures the functionality and reliability of the board before it proceeds to the packaging stage. The supervisor conducts various tests to verify the performance of the PCB.

One of the tests involves the beep testing of the board using a remote control. This test helps in assessing the audio functionality of the circuit. The supervisor triggers specific signals through the remote control and listens for the expected beeping sounds from the PCB. This ensures that the audio components are functioning correctly.

Additionally, the supervisor checks the revolutions per minute (RPM) of the board. By measuring the RPM, the supervisor ensures that the board is reaching the maximum rotational speed as intended. Furthermore, the supervisor ensures that the board is rotating in the correct direction, which is crucial for its proper operation.

Only if the PCB passes these tests successfully, it is deemed eligible for the packaging stage. This ensures that the PCB is in optimal condition and ready for its intended use.

7.1 • Capacitors

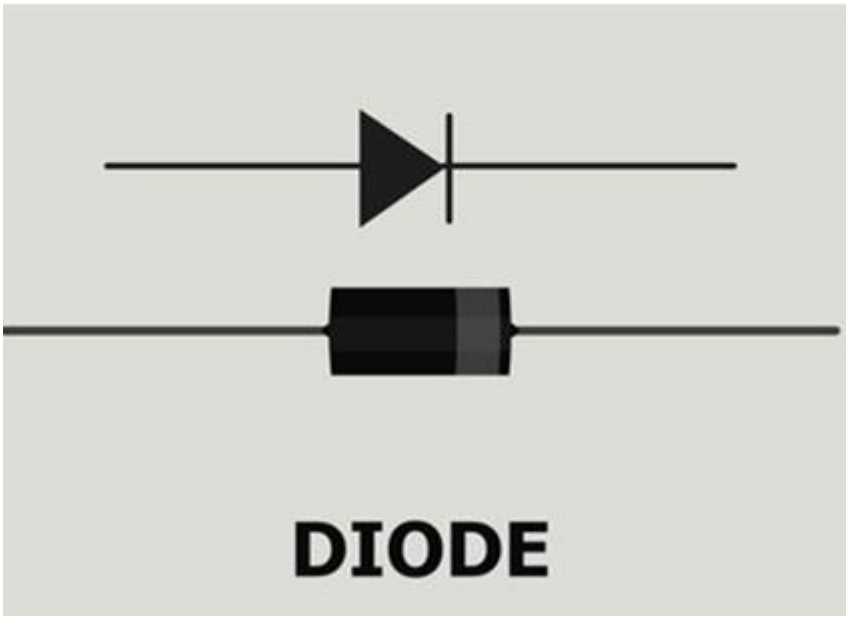
Fig.6: Capacitor

A PCB capacitor is a core electronic component on a printed circuit board. This electronic component saves energy and discharges it into a circuit. A capacitor is indispensable in PCB. Therefore, it passes an alternating current but doesn't pass a direct current.

7.2 •Inductor

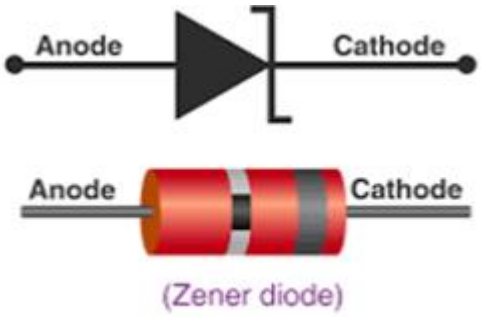
Inductors for PCBs. Anywhere voltage is required, inductors are used. High-frequency inductors are used in the form of power transformers for galvanic isolation in switch mode power supplies, as storage reactors in boost converters, or as current-compensated reactors for minimizing disruptions.

7.3 • Diode



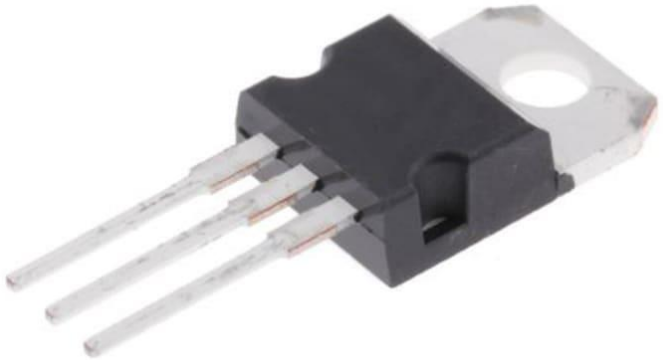
A PCB diode is a semiconductor device that allows current to flow in only one direction. It is made of semiconductor material, such as silicon, and has two terminals, called the anode and the cathode. The anode is the positive terminal, and the cathode is the negative terminal.

7.5 • Zener diode



The Zener diode is often in use as a voltage regulator, primarily because the voltage drop across the diode is constant. Furthermore, the supply voltage must exceed the Zener voltage for the circuit to operate. Thereby, any electronic component connected in parallel with these diodes will have the same applied voltage.

7.4 • PIN Diodes (3 Leg diode)



Laser diodes are electronic devices that emit coherent light. They use a process of stimulated emission to generate and control light. The three pins on a laser diode help the diode produce a specific wavelength of light. The pins are called active, passive, and ground.

Thyristor diodes are three terminal devices. The three terminals are gate, anode, and cathode. The gate controls the current that flows between the anode and cathode.

7.6 • Varistor

A varistor is an electronic component with an electrical resistance that varies with the applied voltage. Also known as a voltage-dependent resistor (VDR), it has a nonlinear, non-ohmic current–voltage characteristic that is similar to that of a diode.

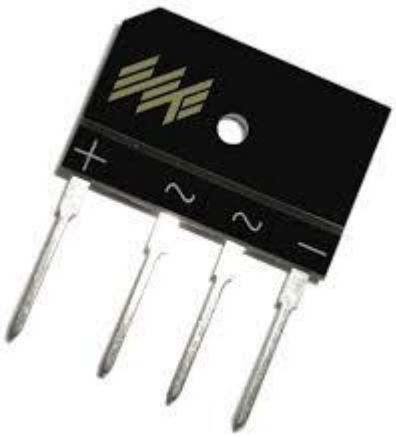
7.7 • MOV (Metal-Oxide Varistor)

An MOV is a voltage dependent device which has an electrical behavior similar to back to back zener diodes. changes from a near open circuit to a very low value, thus clamping the transient voltage to a safe level. pulse is absorbed by the Varistor, thereby protecting vulnerable circuit components.

7.9 • SMPS Transformer

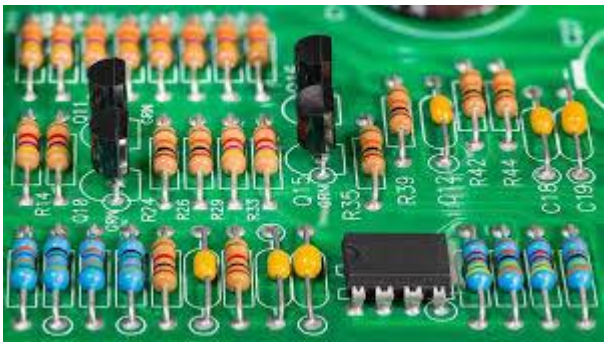
A switch mode power supply is an electronic power supply that incorporates a switching regulator to efficiently convert electrical power. On the other hand, switch mode power supply (SMPS) transformers are a highly efficient form of transformer, which can be found in devices such as computer systems.

7.8 • Bridge rectifier (Ac to Dc converter)



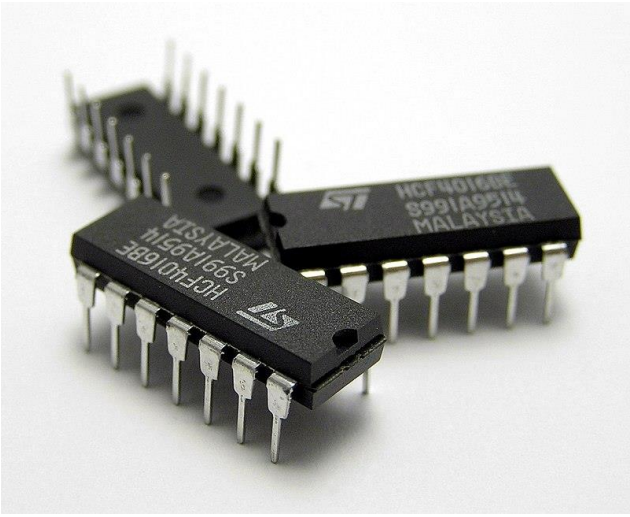
A bridge rectifier, also known as a diode bridge, is a type of discrete semiconductor module product. They are primarily designed to convert AC input from mains power to a DC output, i.e. usable device power.

7.10 • Resistors



A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor.A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor.

7.11 • Integrated Circuit(IC)



An integrated circuit or monolithic integrated circuit (also referred to as an IC, a chip, or a microchip) is a set of electronic circuits on one small flat piece (or "chip") of semiconductor material, usually silicon. Large numbers of miniaturized

transistors and other electronic components are integrated together on the chip. This results in circuits that are orders of magnitude smaller, faster, and less expensive than those constructed of discrete components, allowing a large transistor count. The IC's mass production capability, reliability, and building-block approach to integrated circuit design has ensured the rapid adoption of standardized ICs in place of designs using discrete transistors. ICs are now used in virtually all electronic equipment and have revolutionized the world of electronics. Computers, mobile phones and other home appliances are now inextricable parts of the structure of modern societies, made possible by the small size and low cost of ICs such as modern computer processors and microcontrollers.

7.12 • Mosfet

MOSFETs with through-hole mounts feature component leads, inserted into holes and securely attached to printed circuit boards (PCBs). They offer relatively strong mechanical bonds when compared to the surface-mounted variety. However, these MOSFETs are preferred for large and heavy components such as semiconductors.

7.13 • Buzzer

It can be operated directly from 5V DC, unlike other Piezo buzzers, it does not require an oscillatory signal or AC signal. It has an inbuilt 2KHz oscillation circuit which operates the piezo element to generate audible tone.

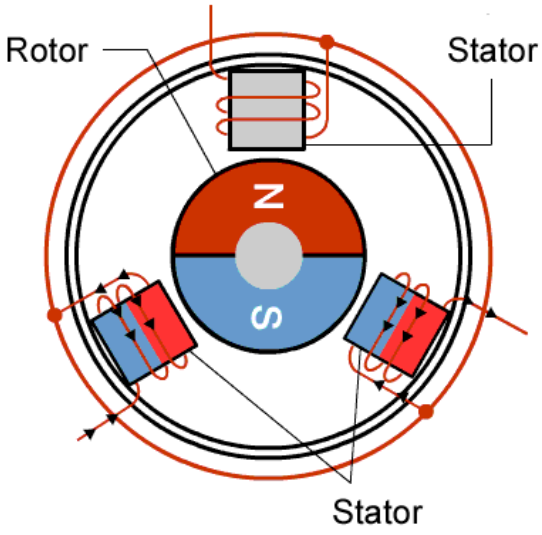
7.14 • Crystall oscillator

A crystal oscillator is an electric oscillator type circuit that uses a piezoelectric resonator, a crystal, as its frequency-determining element. Crystal is the common term used in electronics for the frequency-determining component, a wafer of quartz crystal or ceramic with electrodes connected to it.

7.16 • Connectors

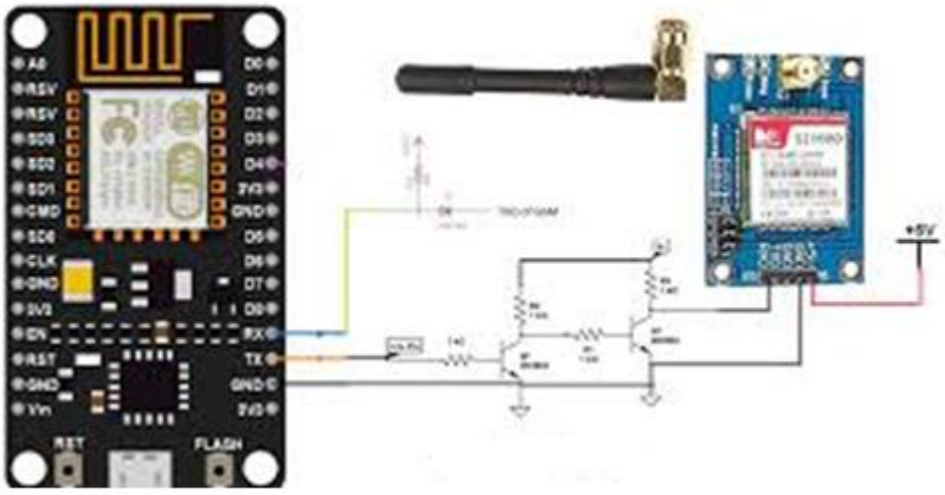
PCB Connectors can also be known as PCB Interconnects. Specific terms are also used for the two mating sides of the connection. Male PCB Connectors are often referred to as Pin Headers, as they are simply rows of pins. Female PCB Connectors can be called Sockets, Receptacles, or sometimes even Header Receptacles.

7.15 • BLDC Motor



A Brushless DC Electric Motor (BLDC) is an electric motor powered by a direct current voltage supply and commutated electronically instead of by brushes like in conventional DC motors.
It uses an electronic controller to switch DC currents to the motor windings producing magnetic fields which effectively rotate in space and which the permanent magnet rotor follows. The controller adjusts the phase and amplitude of the DC current pulses to control the speed and torque of the motor.

7.17 • Wifi Module



WiFi modules (wireless fidelity) also known as WLAN modules (wireless local area network) are electronic components used in many products to achieve a wireless connection to the internet.

Wifi modules or wifi microcontrollers are used to send and recieve data over Wi-Fi. They can also accept commands over the Wi-Fi. Wi-Fi modules are used for communications bewtween devices. They are most commonly used in the field of Internet of Thnigs.

7.18 • Transistor

A transistor is a miniature semiconductor that regulates or controls current or voltage flow in addition amplifying and generating these electrical signals and acting as a switch/gate for them. Typically, transistors consist of three layers, or terminals, of a semiconductor material, each of which can carry a current.