INTERNSHIP REPORT ON

PCB DESIGNING & MANUFACTURING

Submitted to

Madhav Institute of Technology & Science, Gwalior

Towards the Partial Fulfillment for the Award of the degree of

Bachelor of Technology

In

ELECTRONICS & COMMUNICATION ENGINEERING

2022-2023

Company Name: Hitsavi Electronics LLP, Greater Noida,U.P

Company Mentor: Mr. Saurabh Kumar

Duration: 01-01-2023 to 30-04-2023

SUBMITTED BY

Shubham Gayakwad

(0901ET191064)

GUIDED BY

Dr. Karuna Markam

ASSISTANT PROFESSOR

DEPARTMENT OF ELECTRONICS ENGINEERING

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR-474005

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal, M.P.)

2022-2023

CERTIFICATE OF APPROVAL

This is to certify that the Internship is carried out in **Hitsavi Electronics LLP, Greater Noida, U.P** submitted by **Shubham Gayakwad (0901ET191064)** student of **B. Tech. IV-Year (VIII Semester)** in partial fulfillment for the award of the degree of **Bachelor of Technology in Electronics & TeleCommunication Engineering** under R.G.P.V., Bhopal. It is a record of their own work carried by them during internship.

29/08/23

Supervised/Verified by

Dr. Karuna Markam
Assistant Professor

29/9/23

Approved by

Dr. Vandana Vikas Thakare
H.O.D

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

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2019-2023

CANDIDATE DECLARATION

We hereby declare that the work which has been carried out during the Internship in the company **Hitsavi Electronics LLP, Greater Noida, U.P** in partial fulfillment for the award of the degree of **Bachelor of Technology** in **Electronics & Communication Engineering** from Madhav Institute of Technology & Science, Gwalior is an authenticated record of our work carried under the supervision /mentorship of **Mr. Saurabh Kumar (**Managing Director) **& Dr. Karuna Markam**(Assistant Professor, MITS, Gwalior). The matter embodied in this internship report is not submitted for the award of any degree or diploma anywhere else.

Name & Signature of Students

Date:
Place: Gwalior

Shubham Gayakwad
(0901ET191064)

ACKNOWLEDGMENT

We express our sincere gratitude and earnest indebtedness to Madhav Institute of Technology & Science, Gwalior (M.P.) for providing us the golden opportunity to complete our internship. We acknowledge with great pleasure and grateful indebtedness towards our internship mentor Mr. Saurabh Kumar (MD) & Dr. Karuna Markam(Assistant Professor, MITS-Gwalior) for providing us with very useful and beneficial guidance throughout the Internship.

We also express our heartfelt gratitude to Dr. Vandana Vikas Thakre, Head of the Electronics Engineering Department for her profound guidance throughout the Internship.

We would also like to acknowledge our Director Dr. R. K. Pandit for helping us with the resources needed to accomplish this task. The environment at M.I.T.S. has been a valuable experience for us. With many difficulties, this Internship has blessed us with great knowledge in our field of interest. We also thank all those who have helped us in every path in the completion of this Internship and made this Internship a success.

Name & Signature of Students

Date: Shubham Gayakwad

Place: Gwalior (0901ET191064)

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Phone: 0751-2409362, Email id: tnp@mitsgwalior.in

(Training and Placement Cell)

Ref.: T&P/22/1464 **Date: 21/12/2022**

To,

Sourabh kumar

MD

Hitsavi electronics LLP

Dear Sir/Ma'am,

We are grateful to the co-operation in imparting Industrial Training/Internship/Vocational Training to the Students of our Institute. Industrial training/Internship is a part of Academic Curriculum in Pre-Final and Final year of B.Tech./MCA/MBA students and the progress of the same will be counted in their overall results and also gives them exposure & improves their skills and personality.

We will be highly obliged, if the following student is/are permitted to undergo Training / Internship at your esteemed Organization for a period of 15/12/2022 to 15/04/2023.

S.No.	Name of the Student	Enrollment No.	Course - Branch
1.	SHUBHAM GAYAKWAD	0901ET191064	B.Tech – Electronics & Telecommunication Engineering

Hoping for your kind cooperation.

Best Regards!

Mr. Vikram Singh Rajput)
Training & Placement Officer

INTERNSHIP CERTIFICATE

HITSAVI ELECTRONICS LLP

GREATER NOIDA, UTTAR PRADESH, INDIA

HT/VT/2023/0409

CERTIFICATE

OF VOCATIONAL TRAINING

This is to certify that Mr./Mrs. SHUBHAM GAYAKWAD
Student of B.Tech/M.Tech(4th/6th/8th Semester) in CS/EC/ET/EE Branch
of MITS GWALIOR (M.P.) has successfully
completed Vocational Training/Industrial Training/Internship for
4 month period (01/01/2023 to 30/04/2023) in
Printed Circuit Board (PCB) Designing & Manufacturing.

We appreciate his/her sincere efforts and wish success in
his/her future endeavours.

For HITSAVI ELECTRONICS LLP

PARTNERS

Managing Director
Hitsavi Electronics LLP

Date: 30-04-2023

INTERNSHIP/PROJECT EXPECTED OUTCOMES

Session: Jan–June 2023

Student Name: Shubham Gayakwad

Enrollment No.: 0901ET191064

Internship/Project Title: PCB DESIGNING & MANUFACTIRUNG

Objective of Internship/Project:

- The objective of my internship is to understand the basic of PCB *(Printed Circuit Board)* designing and its Industrial manufacturing process, Material needs , specification and Uses.
- And basic objective of a PCB (Printed Circuit Board) manufacturing company is to design, fabricate, and assemble high-quality printed circuit boards that meet the specific requirements and demands of their customers.

Brief details of Internship:

- I have done my internship from company HITSAVI ELECTRONICS LLP GREATER NOIDA ,UP . which manufactures the PCB board of LED bulbs, charging driver board and lighting product PCB for the lightening industry like SURYA, PHILIPS AND HALONIKS etc.
- During my internship, industrial mentor lectured us about the details of machines, whole manufacturing process of PCB board, raw material used and specification of machines etc.

Expected/Achieved Outcomes of Internship/Project:

- We understand the complete manufacturing process of PCB, working and mechanisms of different types of uses machines .
- We also understand the software requirement in PCB designing and its uses of tools.
- We understand the raw material selection process that used in PCB manufacturing.

Social relevance/Impact of your Internship/Project:

- This internship improved my practical knowledge on real time application like PCB chips, It also emphasize my ability in the industrial work, Technical skill , Team work ability and also improved my communication skill .
- During internship I have made many Industrial Contact that will surely help in my upcoming future.
- Having a PCB internship experience on my resume demonstrates my practical skills and commitment to the field. Employers often value practical experience, and an internship can make me more marketable for entry-level positions in PCB design or related roles.

29/05/23

Name and Signature of Students **Name & Signature of Institute Mentor**

ABSTRACT

PCB (Printed Circuit Board) designing is the process of creating a physical board layout that connects electronics components using conductive pathways. It involves designing the circuit schematic, selecting appropriate components, placing them on the board, and routing the connections between them. PCB designing plays a crucial role in the development of electronic devices and systems, and requires a deep understanding of electronics and software tools such as CAD, CAM 350 software. The success of a PCB design depends on various factors such as the layout, material selection, signal integrity and manufacturability. An effective PCB design can result in improved performance, reliability, and reduced production costs.

The PCB design process involves translating a schematic diagram into a physical layout that defines the placement and routing of electronic components and interconnecting traces. Design considerations such as signal integrity, power distribution, thermal management, and manufacturability are crucial to ensure the reliability and performance of the final PCB. Design software tools enable engineers to create and optimize PCB layouts, allowing for efficient use of space and adherence to electrical and mechanical design rules.

In conclusion, PCB design and manufacturing are fundamental processes in the development of electronic devices. The design phase transforms conceptual ideas into physical layouts, considering various factors for optimal performance and manufacturability. Successful integration of design and manufacturing practices leads to efficient and reliable electronic products that power our modern world.

TABLE OF CONTENT

COMPANY PROFILE

In this section we mainly focus on the internship company profile and describe briefly about that company**. HITSAVI ELECTRONICS LLP** is one of the growing PCB Designing & Manufacturing company in Greater Noida, Uttar Pradesh with a team of more than 50 people. We have provided PCB Chips of electronic gadgets for many stablished Indian brand Companies like **Surya, Phillips, Halonixs** etc. We are working under the vision of "**Make in India**" for the India project.

HITSAVI ELCTRONICS LLP believes in customers satisfaction and its mission to build up a strong relationship with customers & partners.

Information of company is given below: -

Company Name	**HITSAVI ELECTRONICS PVT LLP**
Address	**Plot no. 180, Ecotech – III, Udyog Kendra, Near ITI collage, Greater Noida, 201306, Uttar Pradesh (U.P.)**
Contact number	**9927022789**
Year of Establishment	**2018**
Email id	**hitsavielectronics@gmail.com**

CHAPTER I: INTRODUCTION OF PCBs

PCB (Printed Circuit Board) designing and manufacturing is an essential process in electronics manufacturing. PCBs serve as a foundation for many electronic devices, and their design and manufacturing are critical to ensuring the proper functioning of the device.

In PCB designing, a schematic is first created, which represents the electrical connections between components in the device. The schematic is then used to create a layout of the PCB, which includes the placement of components and the routing of the electrical connections.

PCB designing requires expertise in electrical engineering, CAD, CAM350 software, and knowledge of manufacturing processes. Once the PCB layout is finalized, the manufacturing process begins.

Overall, PCB designing and manufacturing is a complex process that requires expertise in electrical engineering, CAD, CAM 350 software, and manufacturing processes. A well-designed and properly manufactured PCB is essential to the proper functioning of electronic devices, and its importance cannot be overstated.

1.1 NEED of PCBs

PCB stands for Printed Circuit Board. It is an essential component of modern electronic devices. The main purpose of a PCB is to provide a mechanically stable platform for mounting electronic components and to provide electrical connections between them. PCBs are used in almost every electronic device, including smartphones, laptops, televisions, medical equipment, and many more. They offer several advantages over traditional wiring methods, such as a compact size, improved reliability, and reduced cost. The need for PCBs arises from the fact that electronic circuits require interconnections between different components to function correctly. PCBs provide a way to make these connections in a more efficient, reliable, and cost-effective way than traditional wiring methods.

In summary, PCBs are essential components of modern electronics, providing a mechanically stable platform for mounting electronic components and providing electrical connections between them.

1.2 Types of PCBs

There are other types of circuit boards that are constructed on a range of possible materials. The common types of these are:

• **Single-sided PCB** -

The board has components mounted at one point. The back is usually all copper (earth) a nd covered with a mask.

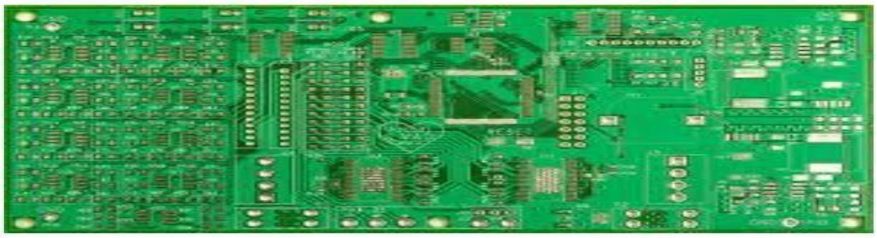


Fig.1 Single sided PCB

• **Double-sided PCB**- This type of card has two ground-mounted components. Each surface is defined as a signal layer in the PCB stack, so these areas will have lines carrying signals between components.

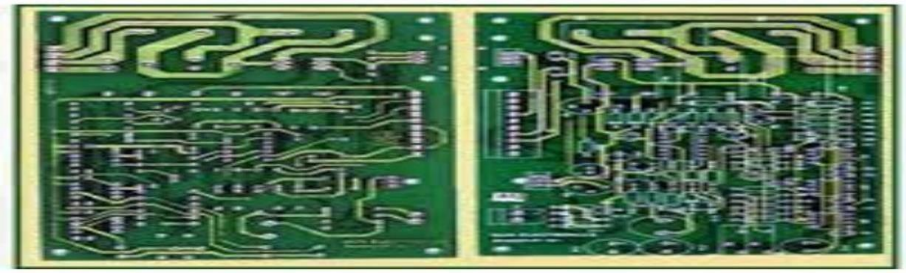


Fig.2 Double sided PCB

• **Multi-layer PCBs** - The inner layers of the boards have electronic components with electrical properties, or the inner layer may be a layered layer. Multilayer PCBs can be single-sided or double-sided.

Fig.3 Multi-layer PCB

• **Rigid PCBs** - Panels are made and installed from rigid laminates such as FR4 grade epoxy resin impregnated fiberglass laminates. Other types of rigid laminate are also available that offer different properties for certain specific applications.

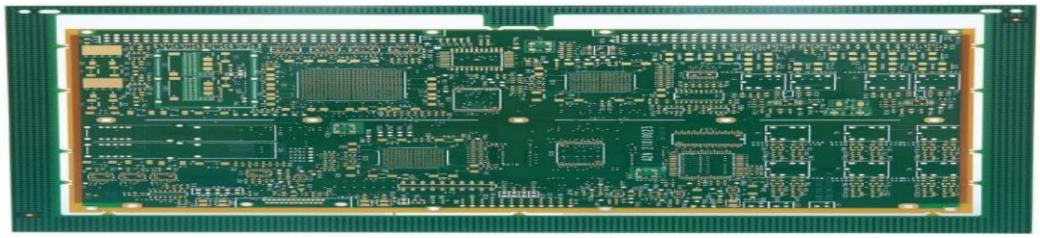


Fig.4 Rigid PCB

• **Rigid-flex PCBs** – Rigid-flexible PCBs use flexible polyimide tape to connect two or more rigid parts in a printed assembly. Rigid-flex boards are used when the design requires some moving parts, such as folding or bending the enclosures.

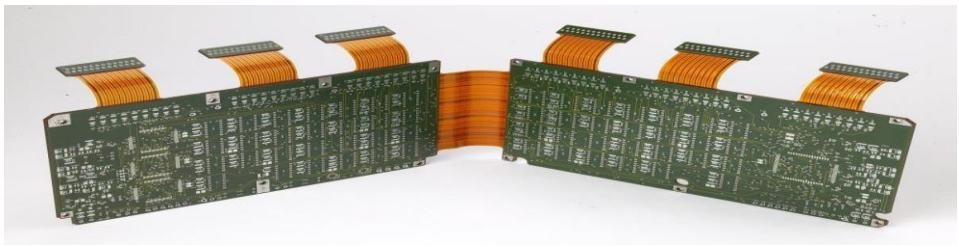


Fig.5 Rigid-flex PCB

• **Flex PCBs** Fully flexible PCBs do not use rigid materials and are made from flexible polyimide materials. These boards can have connectors and connectors such as rigid and rigid flex PCBs.

Fig.6 Flex PCB

• **Metal-core PCBs** – These cards use a metal plate (usually aluminum) in the process to provide greater rigidity and heat dissipation than the rigid printing process. The metal core PCB design-build process is different from the rigid PCB design build process, and there are many design points to consider to ensure solvability. These boards are available in lighting fixtures and some commercial applications.

Fig.7 Metal-core PCB

• **Ceramic PCBs** - These sheets are rarely used and are used in applications that require very high thermal conductivity so that the sheet can heat most things.

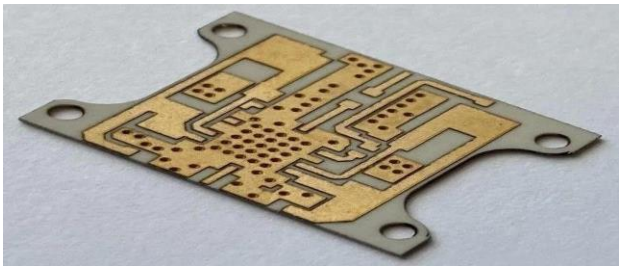


Fig.8 Ceramic PCB

CHAPTER II: **PCB MANUFACTURING MATERIAL**

2.1 LAMINATES:

Laminates are the sheet {may be conducting or non-conducting} of standard thickness over which the Copper layer of standard thickness is laminated, with the help of adhesive layer of dielectric material. The laminate of the PCB is what holds the layers together. Traditionally, there are four layers that make up the board: Substrate, Copper, Solder mask, and Silkscreen (from bottom to top).The laminates are developed by curing under pressure and temperatures of cloth using thermosetresin to create the final piece of uniform thickness.

Manufacturers create laminates from thin layers of various materials, such as fabric, fiberglass or paper, and use resin to bind them together. Thus, they can control the thickness by using more or less layers when laminating. Thinner boards made with fewer layers will not be rigid and prone to warping and damage marks.

By choosing the right laminate, manufacturers can determine the stability, loss and performance of the final PCB. According to PCB manufacturers, product selection depends on the board's operating area and determines three feature choices:

- Coefficient of Thermal Expansion: -

CTE of the laminate determines how much the sheet will expand or contract as the temperature changes. Laminates with low CTE do not shrink or expand with large temperature change. When making a laminate, manufacturers plan the process so that CTE along the plate plane is lower than the CTE perpendicular to the plate plane.

- Glass Transition Temperature: -

During assembly, the PCB must be at a high enough temperature to melt the adhesive on it. For lead-free solder pastes, such heat softens the laminate, turning it into a softer sheet. Technically the PCB will not melt but the will lose its adherence to its original shape. Workers call this the glass transition temperature (Tg) because the laminate begins to soften above this temperature, workers adjust the thermal profile of the soldering machines so that the PCB cools enough to reach this temperature and melt the solder. .

- Dielectric Constant: -

Laminate acts as a feature to hold products and copper lines, as well as a barrier to prevent shorting between them. However, the electrical properties of the laminate can also affect the performance

of the high signal. Engineers call this dielectric constant (Dk) of the laminate and it affects the interaction between the laminate and the frequency signals propagating along the lines.

2.2 Types of Laminates:

1. FR (Flame Retardant) LAMINATES: -

Flame retardant laminates are glass fabric flame retardant technology used in addition to epoxy resins, known for their resistance to heat, all effects, weight and chemicals. PCBs comprise different materials, such as FR1, FR2, FR3, FR4, and many others.

- **FR 1: -**

• Material used- Paper Phenolic

• Feature – low Heat Resistant, Thermal reliability,

• Rated Voltage – 40KV

• Sheet Thickness - 0.3 mm to 1.6 mm

• Cu Thickness- 0.5oz {15um, 18um}, 1oz {25um, 35um}, 2oz{70um}

• Sheet Size – 1020*1220mm, 1030*1230mm

• Application – used in PCB of LED light of low luminance, TV etc.

- **FR 2: -**

• Material used- Halogen-free laminates out of phenolic resin paper

• Feature- High dielectric strength, excellent insulator in high-voltage technology

• Sheet Thickness- 1.5mm

• Copper Thickness - 35µm

• Application- lower intensity-based LED light

- **FR 3: -**

FR3 PCBs are inexpensive, more rigid, and stronger than FR1 PCBs. As a result, they provide a low-cost and reliable board alternative to aluminum PCBs.

In addition, FR3 PCBs are lighter, take up less space, and we can manufacture them faster than FR4 PCBs.

- **FR 4: -**

FR 4 materials are mostly used in the manufacturing of the PCBs. FR4 material is a FIBERGLASS

EPOXY LAMINATES sheet that resembles a thin woven cloth. Fiberglass construction is the best as it offers structural stability to FR4 material. The epoxy resin covering the fiberglass layer is flame resistant, lending strong mechanical properties and durability to the material.

Other benefits that come with using FR4materials include the following:

• FR4 is one of the most low-cost materials

• FR4 has got high dielectric strength, a factor that contributes to electrical insulation

• FR4 material is also lightweight in addition to having a strength-to weight ratio

• FR4 is high moisture-resistant with relative temperature as well

• This material also has excellent electric loss properties

• FR4, unlike other materials, does not absorb water, making it ideal for plenty of marine printed circuit boards applications

• FR4 material is also light green to yellow, making it perfect with almost all applications

➢ Cost-effectiveness of FR PCB: -

The materials used in the production of printed circuit boards remain essential. There are some which are a little bit cost-effective than others. Costs of different materials can range from 10% to 100%. Cost is a factor that can affect the price of a printed circuit board. For example, FR1 and FR2 materials do not differ at all. They are the same type of material with similar cost-effectiveness.

When it comes to PCB production, most manufacturers opt to use FR4 material. The main reason for this is because FR4 material is cost-effective. The rest cost a little bit more. With FR4 materials, printed circuit board companies can cost-effectively manufacture all types of PCBs.

2. COPPER CLAD LAMINATE: -

Copper Clad Laminate (CCL) is made by laminating copper foil on both sides of a glass fiber board impregnated with resin. After completion, the final product is an electronic circuit that is part of the printed circuit board. This is the most common and important method used in the manufacture of electronic products.

copper clad laminate is a product that soaks electric fiberglass or other reinforcing materials in resin to make a single-sided or double-sided copper-clad laminate is widely used in television, radio, computer, mobile communications and other electronic equipment.

Materials of copper clad laminate: -

1. Copper Foil

2. Prepreg

❖ Types of Copper clad laminate: -

There are a lot of kinds of copper clad laminate based on different standard of classification. These classifications are as follows –

1. Classification by reinforcement material: -
• paper base (like XPC)
• glass fiber fabric base (like FR-4, FR-5)
• composite material (like CEM-1, CEM-3)
• Special materials Copper clad laminate (metal-based copper clad laminate, ceramic-based copper clad laminate, etc.)
•
2. Technical classification according to insulating resin use: -
• Phenolic resin copper clad laminate (eg XPC, XXXPC, FR-1, FR) -2, etc.)
• Epoxy resin CCL (FR-3)
• Polyester resin CCL
3.
Classification by performance: -
• General performance CCL
• High temperature resistance CCL
• Low dielectric constant CCL
• Low CTE (coefficient of thermal expansion) CCL
4. Classification by mechanical hardness: -
• Rigid CCL

➢ Aluminum Based Copper-clad Laminate: -

Aluminum-based CCL has excellent flame resistance, overall durability, stability, etc. and has good heat, anti-electromagnetic, floating soldering and other properties. Motorcycles and mobile phones, power LEDs, speakers, power modules and acoustic protection systems, etc. It is widely used in igniters and pyrotechnics for ACCL is popular and widely used in high voltage and LED products because of its excellent heat dissipation capacity.

- Flexural strength - ~450 Mpa lengthwise / ~390 Mpa crosswise
- Flammability - UL-94V0

- Dielectric breakdown - 6.0KV
- Coefficient of thermal expansion - ~27ppm/℃ before Tg / ~30ppm/℃ after Tg
- Thermal conductivity - 1.0~3.0w/mk
- The types and specification of Aluminums based Laminates CCAF-01, CCAF-04-A,CCAF-05 and 0.8mm, 1.0mm, 1.5mm, 2.0mm, 3.0mm etc.
- Thickness of the copper:18um,35um,70um,105um,140um.

3. HIGH Tg EPOXY LAMINATES: -

TG is the mechanical property that designates a transition temperature to each polymer or glass (base material) at which the material changes from a 23 glassy, solid-state to a rubbery state. Materials that exceed their TG do not 'melt.' Instead, they become rubbery through undergoing structural change. The Glass Transition Temperature (Tg) is one of the most important qualities of epoxy. The higher the number, the more rigid the board will be. A material with a high TG (over 170*C) has better heat, moisture, and chemical resistance, as well as better stability.

The characteristics of high TG materials include: -

• Long delamination durability

• Low thermal expansion

• Resistance to high temperature

• High heat resistance

• High PTH reliability

• Low Z-axis CTE

• High thermal shock resistance

• Exceptional thermal stress resistance

Application –
Military, Automotive, Aerospace, Commercial and Industries used electronics devices.

4. POLYIMIDE LAMINATES: -

The word polyimide consists of two sub-phrases that includes 'poly' which typically refers to polymers and 'imide' which refers to the advanced imide monomers. Together they create a diverse polymer group.

Moreover, the polymer group is manufactured using either natural or synthetic process. However, for now, forget about the natural polymers and focus on the synthetically manufactured polyimides. These polyimides are used to build the PCBs, hence the name polyimide PCB.

The synthetic polyimide used in manufacturing PCBs is resourced from different chemicals with imide structures. This manufacturing process is known as polymerizing to us. These polyimides are then used in making PCBs.

Different Types of Polyimide PCBs: -

Like metal PCB and ceramic PCB, the polyimide made printed circuit boards also have multiple types. This classification has been made by determining the material used in synthesizing the amide polymer or polyimide.

The most common polyimide PCBs are: -

- ### Pure Polyimide or 2nd Generation Polyimide: -

This is the simplest PCBs and lacks additional features such as brominated flame retardants. While the word 'lacking' is used negatively for most materials, pure polyimide has used it positively. The lack of flame retardants makes it extremely stable while still being flexible enough to use in different electrical and communicating devices.

- ### 3rd Generation Polyimide: -

It is an updated version of pure polyimides. Also, it has additional additives which effectively make it more flammability resistance. The flammability resistance is crucial because it comes forward in stopping accidental electric fires.

- ### Filled Polyimide: -

This type of polyimide is similar to multilayer PCBs since it comes with more than one filler materials. The additional filler lowers the resin shrinkage.

- ### Low-Flow Polyimides: -

The low-flow polyimides are made without the flexibility of the standard PCBs. So, sometimes people also refer to it as the rigid polyimide PCB. .

Benefits of Polyimide PCB: -

Since the polyimide PCB is a particular type of printed circuit boards, it is mainly used on special

occasions. The characteristics of the Polyimide PCB are: -

- Stable flexibility: - The greatest benefit of the polyimide PCBs is its extreme stability and flexibility at the same time. It is a perfect combination of rigidity and flexibility which regular PCBs lack.
- Tensile strength: - Polyimide PCBs have excellent resistance against warping. It is made possible thanks to the flexibility of the polyimide materials.
- Thermal stability: - Polyimide materials are known for having superior thermal endurance and resilience. So, the polyimide made PCBs are capable of working even at 260° temperature. Furthermore, thermal conduciveness prevents thermal damage during manufacturing and repairing jobs.

- Extreme durability: - Polyimide has resistance against various chemicals and temperature. So, it enjoys enhanced durability. The durability is essential to endure extreme physical stress which is a necessary benefit for PCBs.

Applications of Polyimide PCB: -

Both the rigid polyimide PCB and polyimide flexible PCBs are widely used in different industries. The most common applications of the polyimide PCBs are: -

- Computer and Laptops
- Automotive Electronics
- Military and Aerospace
- Medical Industry

5. BT EPOXY LAMINATES: -

- BT epoxy resins are widely preferred due to their excellent thermal, mechanical, and electrical properties. This laminate is suitable for lead-free PCB assembly.
- is widely used in multi-layer card applications. It has the advantages of electromigration, insulation resistance and high temperature resistance. It also maintains its strength at high temperatures.
- The resin is made of bismaleimide (BMI) and cyanate (CE) resin.
- IT board started to be used for packaging and then continued to work with
  There are more and more forms on the market.

Properties of BT EPOXY Laminates: -

- Exceptional thermal shock resistance
- Great ion migration resistance
- Exceptional dielectric performance, Dk is within 2.8 and 3.5
- Great electrical properties
- Excellent dimensional stability and curing shrinkage
- Good wettability and low melt viscosity

6. <u>TEFLON</u>: -

TEFLON (polytetrafluoroethylene or PTFE) is a material used in the production of PCB (printed circuit board) laminates. TEFLON laminates have several advantages over other materials such as: -

- High temperature resistance
- High Chemical resistance
- Less dielectric constant
- Low moisture absorption

TEFLON laminates are commonly used in high-frequency and highspeed applications, such as inthe aerospace and defense industries, as well as in telecommunications and medical equipment

CHAPTER III: Machines used in PCB manufacturing

3.1 SHEARING OR LAMINATES CUTTING MACHINE: -

- This machine cut the full-size laminates sheet into required laminates size.
- 3 phase induction motor
- POWER KW {hp} = 2.20 {3.00}
- RPM = 1445
- PF at Full Load = 0.85 – 0.90

Fig.9 Shearing or laminate cutting machine

3.2 ETCHING MACHINE: -

A PCB etching machine is used to create the conductive pathways on a printed circuit board (PCB). The machine uses a chemical solution to etch away the copper from the PCB, leaving behind the desired circuit pattern.

There are two main types of PCB etching machines: -

- Wet etching machines use a chemical solution to etch the copper. The most common chemical used for wet etching is ferric chloride.
- Plasma etching machines use a plasma to etch the copper. Plasma etching is a more expensive process than wet etching, but it can produce finer features.

This Machine is used for Extracting the unwanted Copper from the laminates using chemical

- Chemical used = HYDRO CHLORIDE ACID {HCL} with concentration of 0.1% know as ETCHANT.
- Other Etchant used = HYDROCHLORIDE, FERRIC ACID, NITRIC ACID
- Chemical Reaction = Cu + 2 HCl = CuCl2 = H2

Fig.10 Etching machine

3.3 PAINT SCRUBBING MACHINE: -

A scrubber machine is used in PCB manufacturing processes for cleaning the surface of the PCB after etching or soldering. The scrubber machine is typically equipped with soft brushes and a cleaning solution that is applied to the PCB's surface. The brushes are used to scrub the surface of the PCB, removing any residual materials or contaminants that may have been left behind during the manufacturing process. The cleaning solution used in the scrubber machine may vary depending on the type of contamination or residue that needs to be removed.

Fig.11 Paint scrubbing machine

3.4 COMPUTER NUMERICAL CONTROL(CNC): -

A computer numerically controlled (CNC) router is a computer-controlled machine, the usually assembles a hand router as spindle and is used to cut various materials such as wood, composites, metal, plastic, glass and foam. to do the work of carpentry machines such as panel saw, old spindle and drilling machine.

They can also cut hardware such as tenons and tenons. The CNC router is similar in concept to the CNC router. Toolpaths are not controlled manually, but by the computerized CNC.

The CNC router is one of many tools with CNC variants.

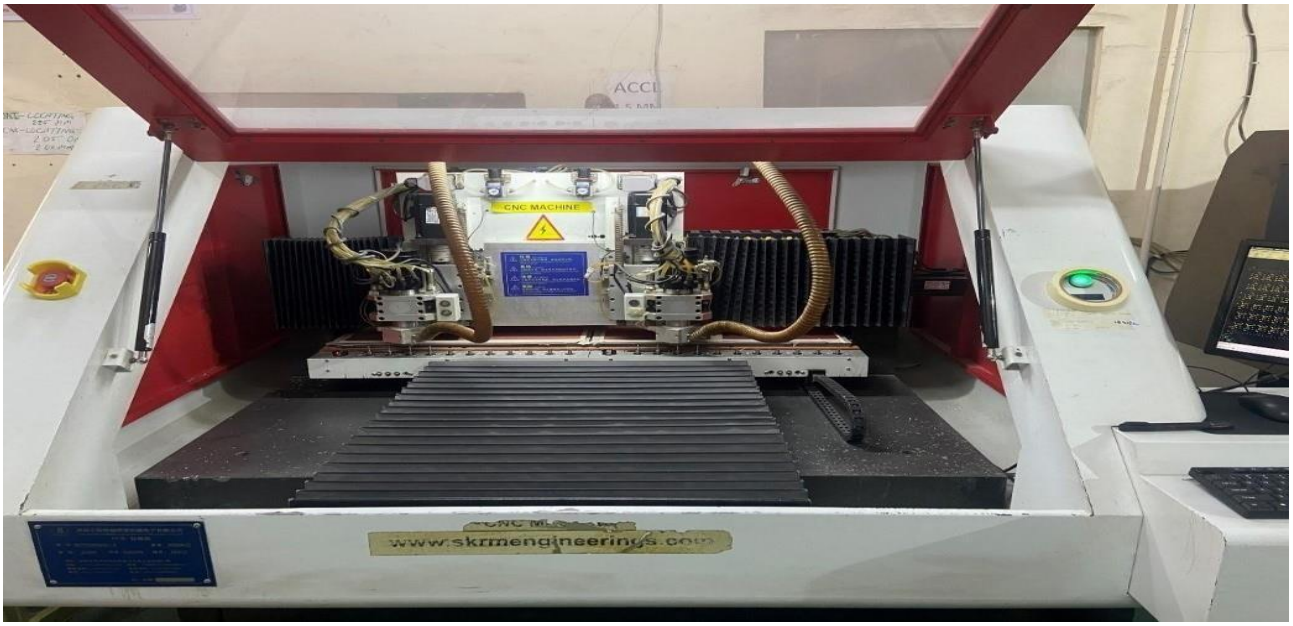


Fig.12 Computer Numerical Control

3.5 - CAMERA CONTROLLED DRILLING MACHINE(CCD):

• CCD machine does automatic positioning hole drilling.

• By using Digital Image processing -Binary integrated image processing method.

• It has Special light source recognition method, can automatically recognize circular diagrams on various materials, and automatically align drilling.

• In working, we can directly watch the drilling live on the computer screen or the drilling place; When drilling, the presser foot on the equipment flattens the drilled film, making the drilling more precise.

• CCD camera positioning accuracy can reach ±0.02mm, high precision

• Working speed of machine is 0.6s/hole.

• Supply Power = 220V/ 50 Hz / 1KW

Fig.13 Camera controlled drilling machine

3.6 MICRO ETCH SCRUBBING MACHINE: -

A micro etch scrubbing machine is a type of equipment used in PCB (printed circuit board) manufacturing processes for the removal of copper material from the surface of the PCB. This process is known as micro etching or micro-etching scrubbing. The micro etch scrubbing machine is typically used in the pre-treatment phase of the PCB manufacturing process, after the copper layer has been laminated onto the substrate material. The machine uses a combination of abrasive materials and chemicals to remove any residual copper from the surface of the PCB, creating a clean and even surface for the subsequent process steps.

Fig.14 Micro Etch scrubbing machine

3.7 UV CURING MACHINE: -

- Ultraviolet curing (often referred to as UV curing) is a photochemical process that uses high-intensity ultraviolet light to instantly cure or "dry" inks, coatings or adhesives.
- UV formulations are liquid monomers and oligomers that are initially mixed with a small amount of photo and then exposed to UV energy. After a few minutes, the formulation - ink, layer or adhesive immediately "hardens" or cures and is ready for the next step.

Fig.15 UV Curving machine

3.8 QUALITY CHECK MACHINE: -

In the PCB (printed circuit board) manufacturing process, there are various quality check machines used to ensure that the PCBs meet the necessary quality standards. Automated Optical Inspection (AOI) Machine: AOI machine is used to inspect the PCB for defects in the soldering process, such as solder bridges, insufficient solder, or misaligned components

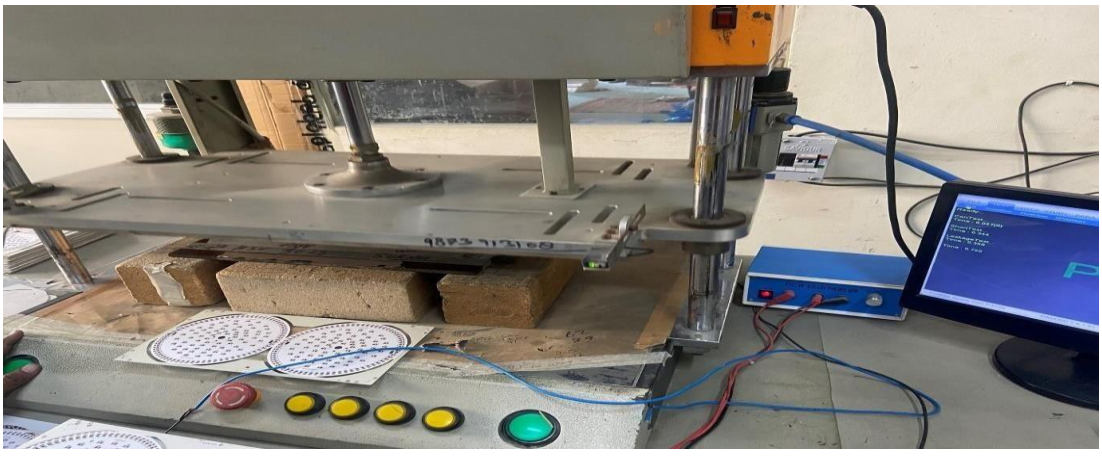
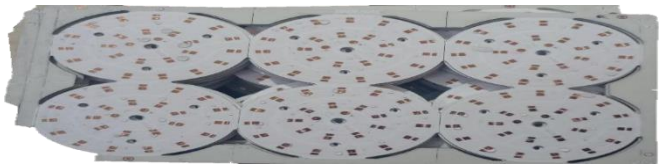


Fig.16 Quality check machine

3.9 CUTTING MACHINE: -

A V-cutting machine is a type of equipment used in the PCB manufact
uring process for separating the individual PCBs from a larger panel. V-cutting is a process of cutting agroove or notch in the panel between the individual PCBs, which allows them to be easily snappedapart after the manufacturing process is complete. The depth of the cut is typically controlled by the machine, and it can be adjusted to accommodate different panel thicknesses. Once the V-cut has been made, the individual PCBs can be easily separated by applying pressure to the panel along the groove.

Fig.17 V-Cutting machine



3.10 LACQUERING MACHINE: -

- This PCB painting machine is designed to use Lacquer or post flux to prevent copper pad oxidation and other contamination on the surface.
- Adopts reliable products, provides high oxidation resistance and fast drying.

Lacquer has the following advantages: -

- Forms a transparent, non-porous film on printed materials.
- Thin film resists heat without affecting performance.
- Dries faster.
- Therefore, it has good performance and storage characteristics.
- Resistant to hydrolysis and impermeable to water vapor.
- Absolutely non-corrosive. PCBs can be stored for a long time in normal storage.

Fig.18 Lacquering machine

CHAPTER IV: SOFTWARE USED IN PCB DESIGNING

4.1 CAM 350 Software: -

CAM350 is a computer-aided manufacturing (CAM) software application for printed circuit board (PCB) design and fabrication. It is developed by Downstream Technologies and is used by PCB manufacturers worldwide. CAM350 offers a complete suite of tools for PCB design, including 3D visualization, verification, optimization, and output generation.

AM350 is a powerful tool that can help PCB manufacturers improve their efficiency and accuracy. It can be used to create complex PCB designs quickly and easily, and it can help to ensure that the finished product meets all specifications. CAM350 is also a valuable tool for PCB designers, as it can help them to visualize their designs and to identify potential problems before they go into production.

4.2 CIRCUIT PRINTING LAYER: -

A circuit printing layer is a layer in PCB design that is used to create the conductive traces and patterns that make up the circuit board. This layer is created using a software program that allows the designer to create the desired traces and patterns, and then to output the layer to a file that can be used by the PCB manufacturer. This layer imprints the circuit up to which the required portion of copper layer remains after the ETCHING process.

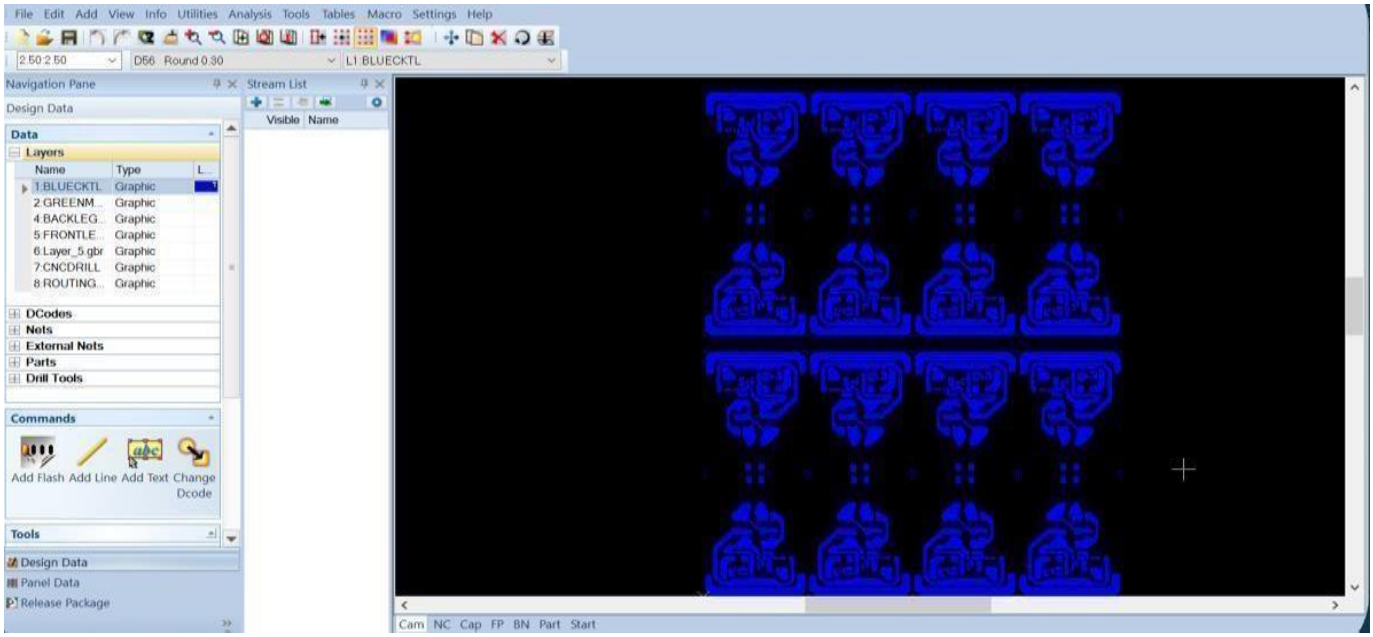


Fig.19 Circuit Printing Layer

4.3 MASKING LAYER: -

This layer is used for masking the laminates without covering the drill portion.

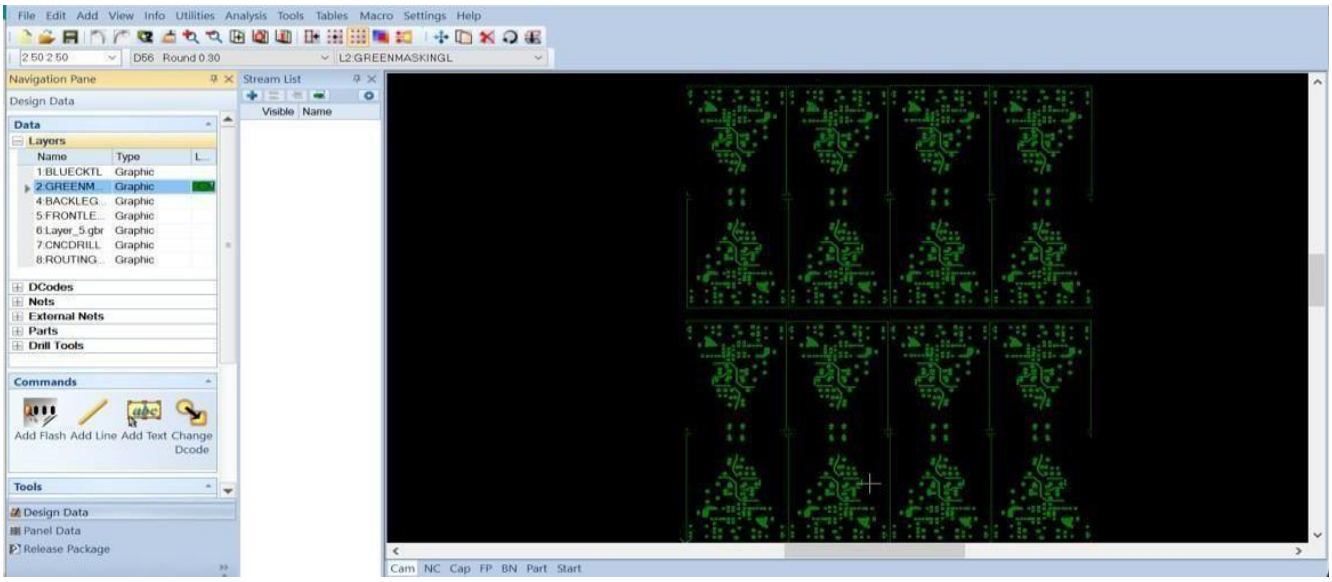


Fig.20 Masking Layer

4.4 BACK LEGEND PRINT LAYER: -

In PCB design, a black legend is a type of solder mask that is used to create a negative image of the circuit board's copper patterns. This is done by applying a black layer of solder mask over the copper patterns, and then etching away the exposed copper. The result is a circuit board with a black background and white copper patterns.

There are two main types of black legends:

- Negative legends are created by etching away the copper patterns, leaving a black background.
- Positive legends are created by applying a black solder mask over the entire board, and then etching away the exposed areas.

Negative legends are the most common type of black legend. They are easier to create, and they provide a better contrast between the copper patterns and the background. However, they can be more difficult to solder, as the black solder mask can act as a heat sink.

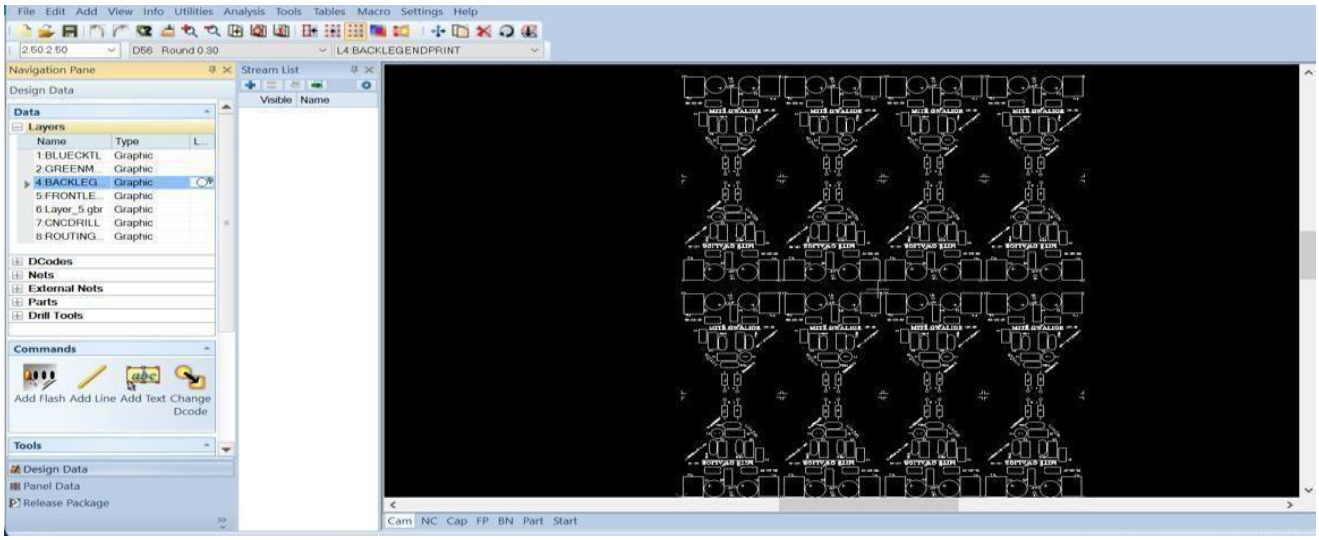


Fig.21 Back Legend Print Layer

4.5 FRONT LEGEND PRINT LAYER: -

The front legend print layer is a layer in PCB design that is used to create the text and graphics that are visible on the front of the circuit board. This layer is created using a software program thatallows the designer to create the desired text and graphics
The front legend print layer is typically used to create the following: -

- Component designators: These are the letters and numbers that are used to identify eachcomponent on the circuit board.
- Net labels: These are the names of the electrical connections between components.
- Board identification: This is the name of the circuit board, or other identifying information.
- Test points

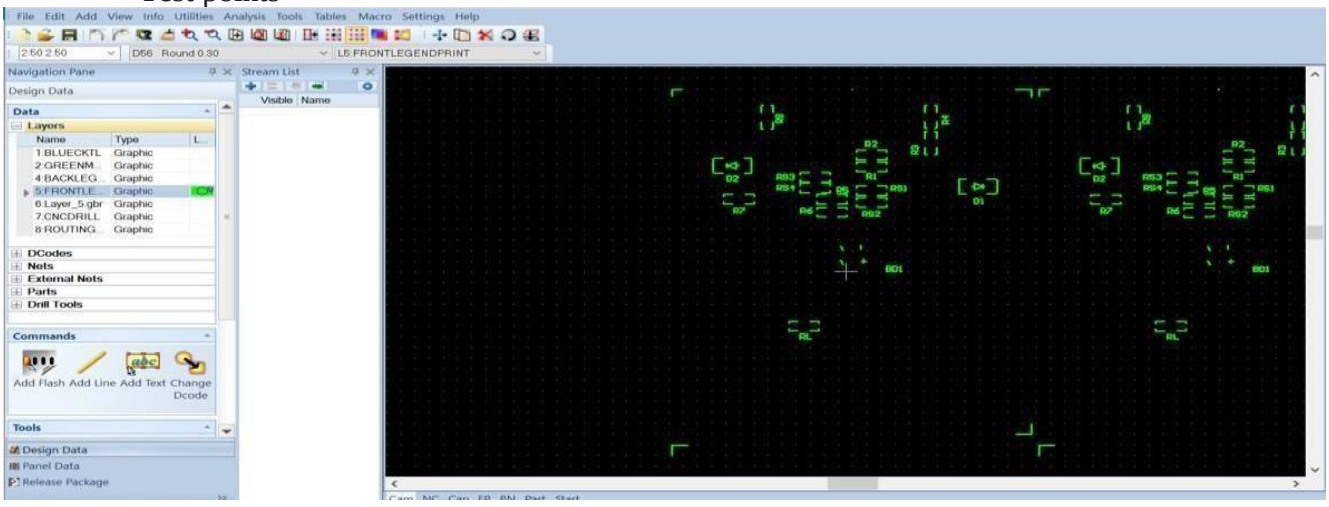


Fig.22 Front Legend Print Layer

4.6 CNC DRILLING LAYER: -

This layer specifies the drilling portion into the PCB over which CNC machine perform its task.

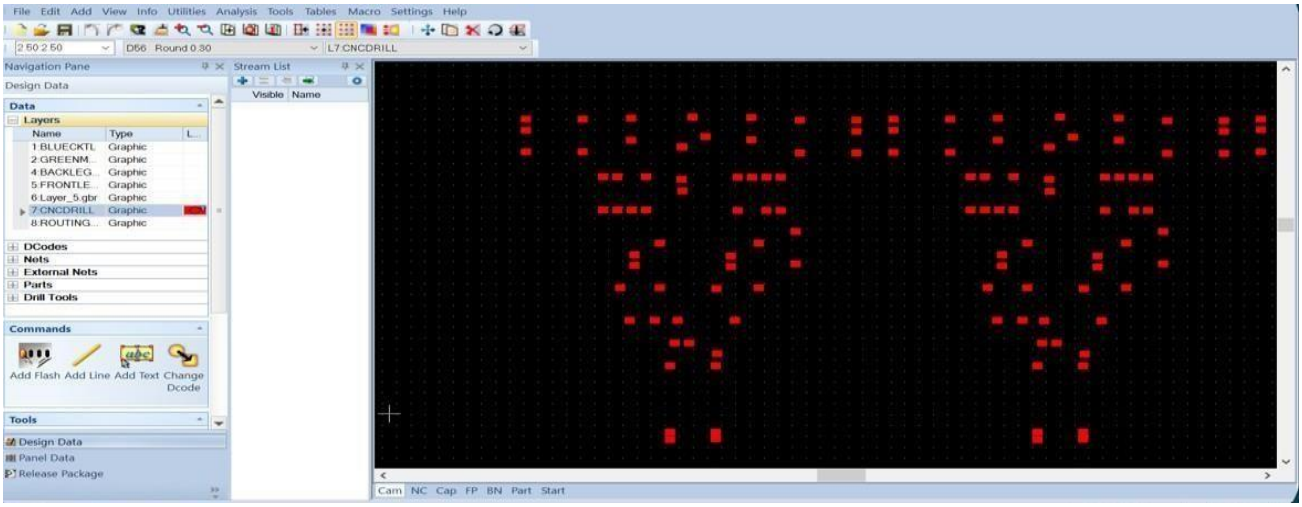


Fig.23 CNC Drilling Layer

4.7 ROUTING LAYER: -

Routing layers are used in PCB design to connect the different components on the board. They aretypically created using a software program that allows the designer to create the desired traces andpatterns, and then to output the layer to a file that can be used by the PCB manufacturer. Routinglayers are an important part of PCB design. Here are some of the benefits of using routing layers in PCB design: -

- Improved conductivity
- Improved manufacturability
- Increased reliability

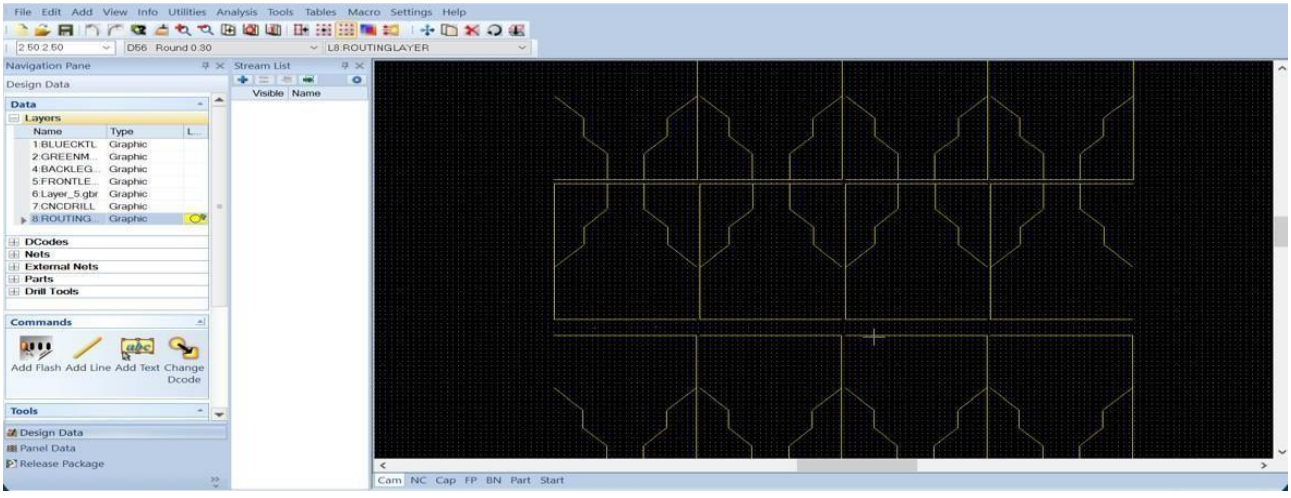


Fig.24 Routing Layer

CHAPTER V: CONCLUSION

Printed circuit boards (PCBs) are an essential part of modern electronics. They provide a way to connect electronic components together in a reliable and efficient manner. PCB design is a complex process that requires a deep understanding of electrical engineering and manufacturing processes.

The first step in PCB design is to create a schematic diagram. This diagram shows the electrical connections between the components in the circuit. Once the schematic is complete, it can be usedto create a PCB layout. The PCB layout shows the physical placement of the components on the board.

There are a number of factors to consider when designing a PCB layout. These factors include thesize and shape of the board, the type of components that will be used, and the desired performanceof the circuit. The PCB layout must also take into account the manufacturing process that will be used to create the board will then be shipped to the customer.

The manufacturing process of printed circuit boards (PCBs), including the utilization of CAM350 software, plays a vital role in ensuring the successful production of high-quality PCBs.Starting from the initial PCB design phase, where the layout, component placement, and routing are defined, CAM350 software proves invaluable. It aids in the translation of the design files intomanufacturing-ready formats, such as Gerber files, that accurately represent the intended PCB layout.

One of the key machines used in PCB manufacturing is the CNC (Computer Numerical Control) machine. CNC machines provide precise control over cutting, drilling, and routing processes, ensuring accurate and consistent fabrication of PCBs. They enable the translation of digital designfiles into physical boards with minimal errors and faster production times. CNC machines offer versatility, allowing for the production of complex and intricate designs, meeting the ever- increasing demands of the electronics industry.

The testing of PCBs is a crucial step in ensuring their functionality and reliability. Through comprehensive testing processes, such as functional testing, electrical testing, and environmental testing, the quality and performance of PCBs can be thoroughly evaluated. Effective testing helpsidentify and rectify any defects or issues, minimizing the risk of faulty PCBs reaching the market.

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INTERNSHIP/PROJECT DAILY DIARY

Session: Jan–June 2023

Name of Students: Shubham Gayakwad
Enrollment Number: 0901ET191064
Branch and Year: Electronics and Telecommunication Engineering, IV year
Internship/Project Title: PCB Designing and Manufacturing
Company Name with Full Address: HITSAVI ELECTRONICS LLP,
Plot no. 180, Ecotech- III, Udhyog Kendra, near, ITI Collage, Greater Noida, UP, INDIA 201306
Stipend Detail: Yes, ~~No~~ Stipend Amount: ….
Industrial Mentor Detail:
Name of Industry Mentor: Mr. Saurabh Kumar
Email Address of Industry mentor: hitsavielectronics@gmail.com

Students must mention the daily progress details with dates in the given format such as daily work done/ software learn/coding/testing/site or field visit/hardware implementation, etc.

Month	Date	Daily Progress Details
Jan. 2023	05/01/2023	Industry visit and lectured about the basic of company and basic interaction with departmental representative.
	20/01/2023	Fully understood the process of selection of raw material for manufacturing of PCB board , which include : Selection of Laminates Selection of printing Inks Selection of Film sheet Selection of chemicals Selection of drilling bit and routing cutter Selection of software design
Feb. 2023	02/02/2023	Understood the basic Working and Specification of Machines that used in Manufacturing of PCB
	10/02/2023	Hands-on experience on Machines 1. Shearing and cutting machines 2. Power press machines 3. Panel printing machines 4. Etching machines 5. Deburring and quality check machines Liquoring machines etc.

March 2023	02/03/2023	Researched & Studied about the Different components and their uses of Machines DC Motor , AC Motor , Switch Gear, Drivers, Relays , Temperature indicator mechanisms
	04/03/2023	Permission to get Hand-on experience on different department of industry 1st week - cutting and painting Department 2nd week- CNC & CCD Department 3rd week – Etching Department 4th week – QC department
April 2023	05/04/2023	Lectured on Software tools and their uses in Designing in PCB Layers with the help of Sample charger driver
	10/04/2023	Project Assign – Design and manufacture the 9 Watt Mobile charger driver with the help of samples available and also design all the layers used in PCB Manufacturing process .
	20/04/2023	Project submitted
	25/04/2023	Industry visit – STAR LED PVT LTD, Ecotech III, Greater Noida
	30/04/2023	Report submission and certificate Collection.
May 2023		

29/05/23

Name and Signature of Students

Name & Signature of Institute Mentor

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	SHUBHAM GAYAKWAD		Department	Electronics Eng.	
Industry/Organization	HITSAVI ELECTRONICS		Date/Duration	DD/MM/YR -DD/MM/YR 05/01/23 - 15/02/23	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge upgradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	fully ~~assign~~ understood the process of selection of Raw material for the manufacturing of PCB. & sucessfully completed the daily assigned task				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT** ✓				
Name of Industry Mentor	Mr. Saurabh komar				
Signature of Industry Mentor	S. Kumar				

Receiving Date		Name Faculty Mentor		Sign	

15/2/23

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Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge upgradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	Completly understood the working of machine used in PCB manufacturing.				
OVERALL GRADE (Any one)	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT ✓				
Name of Industry Mentor	Mr. Saurabh Komar				
Signature of Industry Mentor					

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16/03/23

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Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality Timely completion of assigned work				✓	
Learning capacity/Knowledge upgradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	Understood the types of inks used in PCB manufacturing				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Saurabh Kumar				
Signature of Industry Mentor					

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Industry/Organization	HITSAVI ELECTRONICS		Date/Duration	DD/MM/YR - DD/MM/YR 23/04/23 - 24/04/23	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge upgradation				✓	
Performance/Quality of work			✓		
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	Industrial visit at "Stove LED Pvt. Ltd." Greater Noida, (U.P).				
OVERALL GRADE (Any one)	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT				
Name of Industry Mentor	Mr. Saurabh Kumar				
Signature of Industry Mentor					

Receiving Date		Name Faculty Mentor		Sign	

30/04/23

41

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