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JSS SCIENCE AND TECHNOLOGY UNIVERSITY
SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING

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Report on Industrial Visit
Company Name: AT & S India Pvt.Ltd, Nanjangud

Visited on: 11th June 2022

INTRODUCTION

AT&S is currently Europe's largest printed circuit board manufacturer and one of the market leaders in high-end printed circuit board technology. Depending on technological and economic requirements, AT&S offers the widest possible range of printed circuit boards specially tailored to customers' needs: single-sided, double-sided plated-through, multi-layer, HDI (high density interconnection, laser-drilled), IMS (insulated metallic substrate), flexible, rigid-flex and semiflexible.

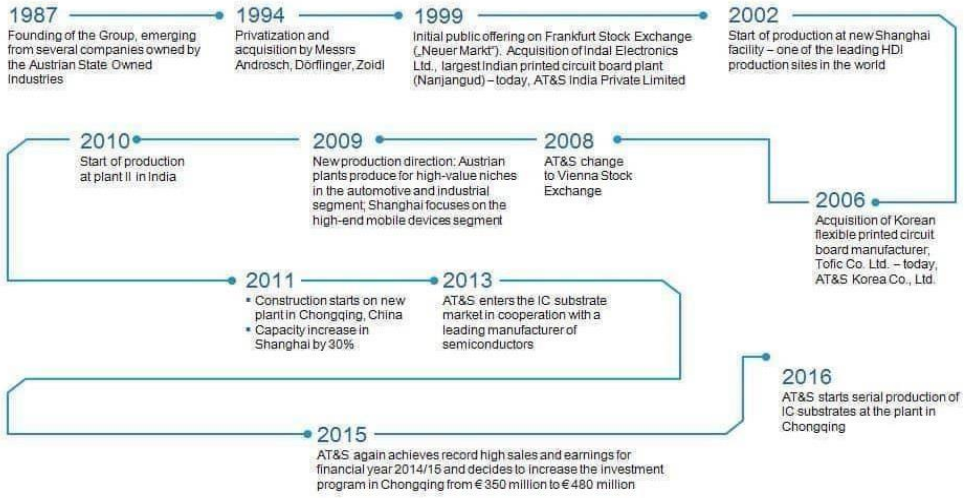
The core businesses of AT&S are Mobile Devices, Automotive, Industrial, Medical,Aviation and Advanced Packaging.

The AT&S Group has production facilites in Europe and Asia: Leoben and Fehring in Austria, Ansan in Korea, Nanjangud in India, Shanghai and Chongqing in China. AT&S employs 12,000 people worldwide.

Each of the plants concentrates on a specific portfolio of technologies. The Austrian plants are geared to the European market and also, increasingly, to the American one. Short production times, special applications and a greater emphasis on suppliers' closeness to customers are typical for Europe. The plants in Austria, India and Korea usually concentrate on small and medium-sized batches for industrial and automotive customers, while in China the focus is on large volumes for mobile communications customers.

Shanghai and Leoben are a major innovative force within the AT&S Group thanks to their research and development facilities.

HISTORY OF AT&S:



Vision & Mission of Company:

Vision: First Choice for Advanced Solutions.

Mission: We Set the Highest Quality Standard in Our Industry.

Products, customer & business units:

AT&S is a supplier for following companies:

- Apple (Mobile Devices & Substrates): AT&S was 2015 and 2016 among the Top 200 worldwidesuppliers of Apple.
- Fairphone: 2015. AT&S became supplier of Fairphone.
- Sony Ericsson: AT&S obtained suppliers award by Sony-Ericson 2017

Products of AT&S Company:

- Double Sided PTH PCBs.
- Multilayer PCBs.
- HDI Micro via PCBs.
- HDI Any-layer PCBs.
- Flexible & Rigid Flexible PCBs.
- IMS Insulated Metallic Substrate PCBs.
- IC Substrate.

Double Sided PTH PCBs: A printed circuit board (PCB) or printed wiring board (PWB) is a laminated sandwich structure of conductive and insulating layers. PCBs have two complementary functions. PCBs mechanically support electronic components using conductive pads in the shape designed to accept the component's terminals, and also electricallyconnect them using traces, planes and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a nonconductive substrate.

Multilayer PCBs: Multi-layer printed circuit boards have trace layers inside the board. This is achieved by laminating a stack of materials in a press by applying pressure and heat for a period of time. This results in an inseparable one-piece product. For example, a four-layer PCB can be fabricated by starting from a two-sided copper-clad laminate, etch the circuitry on both sides, then laminate to the top and bottom pre-preg and copper foil. It is then drilled, plated, and etched again to get traces on top and bottom layers.

HDI Micro via PCBs / HDI Any-Layer PCBs: HDI PCBs have high-density attributes, including laser microvias, sequential lamination structures, fine lines, and high-performance thin materials. This increased density enables more functions per unit area. Advanced technology HDI PCBs have multiple layers of copper-filled stacked microvias, which creates a structure that allows even more complex interconnections. These complex structures provide the necessary routing and signal integrity solutions for today's large pin-count, fine pitch, and high-speed chips in high technology products.

Flexible & Rigid Flexible PCBs: The term flexible circuit or flex circuit (aka flexi circuits in the UK) is a much more common term having a history that goes back nearly 60 years or more. Much like the printed circuit, there have been several books and many book chapters written and numerous industry standards written on the topic of flexible circuits of which there are no less than 1/2 dozen structural variations, most of which cannot be considered flexible electronics.

IMS Insulated Metallic Substrate PCBs: The abbreviation, IMS stands for "Insulated Metal Substrate". This is a PCB built on a metal pate-normally aluminium-on which a special prepreg is applied, the primary qualities of which are an excellent capacity for heat dissipation and great dielectric strength against high voltage

IC Substrate: IC substrate has been developing with the booming of new types of ICs like BGA (ball grid array) and CSP (chip scale package) which call for new carriers of package. As one type of the most advanced PCB (Printed Circuit Board), IC substrate PCB has exploded in both popularity and applications together with any layer HDI PCB and flex-rigid PCB, now widely applied in telecommunications and electronics updates.

Technology:

AT&S has a comprehensive product portfolio, efficient manufacturing operations and highquality standards. AT&S is developing specialized PCB technologies such as thick copper, IMS, HSMtec for heat management and high current applications. AT&S increased focus on research and development has also led to more than 64 patents applied. The aim is to produce smaller volumes and more complex boards in a simpler and more efficient way. Our patented technology portfolio focuses on incorporating structure recesses (cavities) into and onto PCB´s. This facilitates deeper embedding of electronic components and makes thinner PCB´s possible.

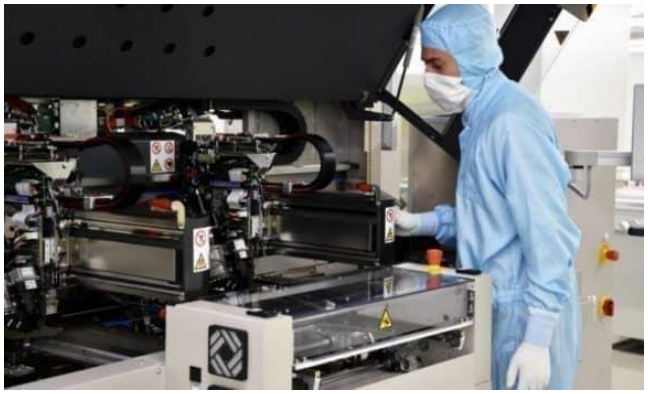


Fig 1: Operator working on photofilm process

Fig 2: Surface finish department

PCB´s with structural recesses are just one of many AT&S product features which meet currentand future customer requirements. The feature relates to defined indents (cavities) in the PCB which can be used to position electronic components such as capacitors, transistors and even logic modules "lower", thereby giving the assembled PCB a thinner overall structure. Electricalcontacting can also take place in the cavity.

PCB Manufacturing Process Steps

Step 1: Design and Output

Circuit boards should be rigorously compatible with, a PCB layout created by the designer using PCB design software. Commonly-used PCB design software includes Altium Designer, OrCAD, Pads, KiCad, Eagle etc. *NOTE: Before PCB fabrication, designers should inform theircontract manufacturer about the PCB design software version used to design the circuit since it helps avoid issues caused by discrepancies.*

Step 2: From File to Film

PCB printing begins after designers output the PCB schematic files and manufacturers conducta DFM check. Manufacturers use a special printer called a plotter, which makes photo films ofthe PCBs, to print circuit boards. Manufacturers will use the films to image the PCBs. Althoughit's a laser printer, it isn't a standard laser jet printer. Plotters use incredibly precise printing technology to provide a highly detailed film of the PCB design.

The final product results in a plastic sheet with a photo negative of the PCB in black ink. For the inner layers of PCB, black ink represents the conductive copper parts of the PCB. The remaining clear portion of the image denotes the areas of nonconductive material. The outer layers follow the opposite pattern: clear for copper, but black refers to the area that'll be etched away. The plotter automatically develops the film, and the film is securely stored toprevent any unwanted contact. Each layer of PCB and solder mask receives its own clear andblack film sheet. In total, a two-layer PCB needs four sheets: two for the layers and two for the solder mask. Significantly, all the films have to correspond perfectly to each other. When used in harmony, they map out the PCB alignment.

Step 3: Printing the Inner layers: Where Will the Copper Go?

The creation of films in previous step aims to map out a figure of copper path. Now it's time to print the figure on the film onto a copper foil.

This step in PCB manufacturing prepares to make actual PCB. The basic form of PCB comprises a laminate board whose core material is epoxy resin and glass fiber that are also called substrate material. Laminate serves as an ideal body for receiving the copper that structures the PCB. Substrate material provides a sturdy and dust-resistant starting point for the PCB. Copper is pre-bonded on both sides. The process involves whittling away the copperto reveal the design from the films.

In PCB construction, cleanliness does matter. The copper-sided laminate is cleaned and passed into a decontaminated environment. During this stage, it's vital that no dust particles settle on the laminate. An errant speck of dirt might otherwise cause a circuit to be short or remain open.

Step 4: Removing the Unwanted Copper

With the photo resist removed and the hardened resist covering the copper we wish to keep, the board proceeds to the next stage: unwanted copper removal. Just as the alkaline solution removed the resist, a more powerful chemical preparation eats away the excess copper. The copper solvent solution bath removes all of the exposed copper. Meanwhile, the desired copper remains fully protected beneath the hardened layer of photo resist.

Step 5: Layer Alignment and Optical Inspection

With all the layers clean and ready, the layers require alignment punches to ensure they all line up. The registration holes align the inner layers to the outer ones. The technician places the layers into a machine called the optical punch, which permits an exact correspondence sothe registration holes are accurately punched.

Step 6: Layer-up and Bond

In this stage, the circuit board takes shape. All the separate layers await their union. With the layers ready and confirmed, they simply need to fuse together. Outer layers must join with the substrate. The process happens in two steps: layer-up and bonding.

The outer layer material consists of sheets of fiber glass, pre-impregnated with epoxy resin. The shorthand for this is called prepreg. A thin copper foil also cove rs the top and bottom of the original substrate, which contains the copper trace etchings. Now, it's time to sandwich them together.

Step 7: Drill

Finally, holes are bored into the stack board. All components slated to come later, such as copper-linking via holes and leaded aspects, rely on the exactness of precision drill holes. The holes are drilled to a hairs-width - the drill achieves 100 microns in diameter, while hair averages at 150 microns.

Step 8: Plating and Copper Deposition

After drilling, the panel moves onto plating. The process fuses the different layers together using chemical deposition. After a thorough cleaning, the panel undergoes a series of chemical baths. During the baths, a chemical deposition process deposits a thin layer - about one micron thick - of copper over the surface of the panel. The copper goes into the recently drilled holes.

Step 9: Outer Layer Imaging

In Step 3, we applied photo resist to the panel. In this step, we do it again - except this time, we image the outer layers of the panel with PCB design. We begin with the layers ina

sterile room to prevent any contaminants from sticking to the layer surface, then apply a layer of photo resist to the panel. The prepped panel passes into the yellow room. UV lights affect photo resist. Yellow light wavelengths don't carry UV levels sufficient to affect the photoresist.

Step 10: Plating

We return to the plating room. As we did in Step 8, we electroplate the panel with a thin layer of copper. The exposed sections of the panel from the outer layer photo resist stage receive the copper electro-plating. Following the initial copper plating baths, the panel usually receives tin plating, which permits the removal of all the copper left on the board slated for removal. The tin guards the section of the panel meant to remain covered with copper during the next etching stage. Etching removes the unwanted copper foil from the panel.

Step 11: Final Etching

The tin protects the desired copper during this stage. The unwanted exposed copper and copper beneath the remaining resist layer undergo removal. Again, chemical solutions are applied to remove the excess copper. Meanwhile, the tin protects the valued copper duringthis stage.

Step 12: Solder Mask Application

Before the solder mask is applied to both sides of the board, the panels are cleaned and covered with an epoxy solder mask ink. The boards receive a blast of UV light, which passesthrough a solder mask photo film. The covered portions remain unhardened and will undergoremoval. Finally, the board passes into an oven to cure the solder mask.

Step 13: Surface Finish

To add extra solder-ability to the PCB, we chemically plate them with gold or silver. Some PCBs also receive hot air-leveled pads during this stage. The hot air leveling results in uniform pads. That process leads to the generation of surface finish. PCBCart can process multiple types of surface finish according to customers' specific demands. Step 14: Silkscreen

The nearly completed board receives ink-jet writing on its surface, used to indicate all vital information pertaining to the PCB. The PCB finally passes onto the last coating and curing stage.

Step 15: Electrical Test

As a final precaution, a technician performs electrical tests on the PCB. The automated procedure confirms the functionality of the PCB and its conformity to the original design. At PCBCart, we offer an advanced version of electrical testing called Flying Probe Testing, which depends on moving probes to test electrical performance of each net on a bare circuit board.

Step 16: Profiling and V-Scoring

Now we've come to the last step: cutting. Different boards are cut from the original panel. The method

employed either centers on using a router or a v-groove. A router leaves small tabs along the board edgeswhile the v-groove cuts diagonal channels along both sides of the board. Both ways permit the boards to easily pop out from the panel.

Conclusion:

By the visit to AT&S PCB manufacturing company we have learnt the process of PCB production practically. We have collectively seen wide varieties of pcb boards that is used in different applications.We have come across different types of machines that is based on sensors and actuators which is involved in the mass production. By this visit we have introduced to many new technologies and got some basic idea of marketing and business field.

List of Students and Faculties visited:

Sl No.	Students Name
1	Rahul M
2	Punith G V
3	Pradyumna Bhat L P
4	Abhidhamma Acariya
5	Advith K
6	Anagha R
7	Bhavani R
8	Bharat S
9	Likita K
10	Meghana
11	Niharika D V
12	Aditya Pawar
13	Rohit Pawar
14	Samarla Praneeth
15	Chinmayi S
16	Manjunath
17	Panchakshari H M
18	Shrilaxmi K
19	Vishakantamurthy
20	Yogita S Gowda
21	Vivek Rathod
22	Vallish S
23	Vivek K S
24	Atul S
25	Jashwanth
26	Vaibhav
27	Abhishek
28	Shreekara Bhat
Sl No.	**Names of Faculties**
1	Prof. M S VinayPrasad
2	Prof. Roopa M
3	Prof. ThyagrajMurthy
4	Dr. Sudharshan Patil Kulkarni
5	Inst. ManjuPrasad