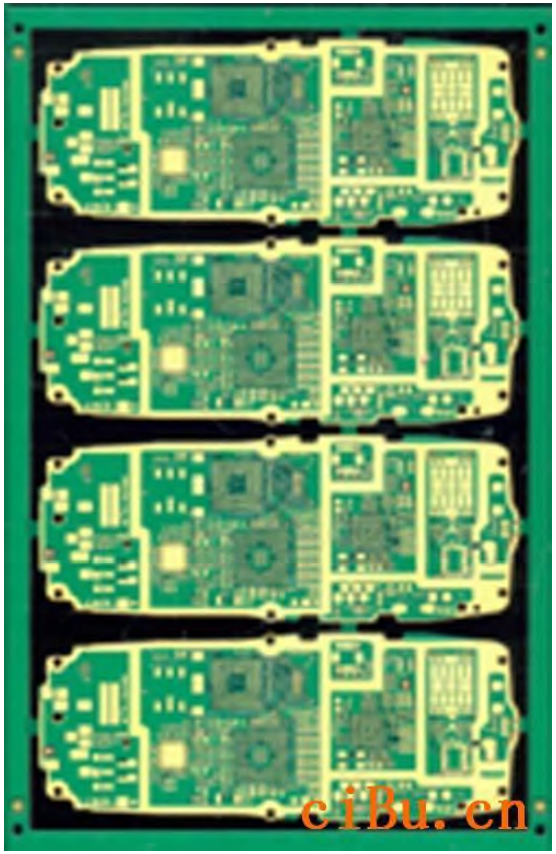
Rocket PCB Solution.,LTD

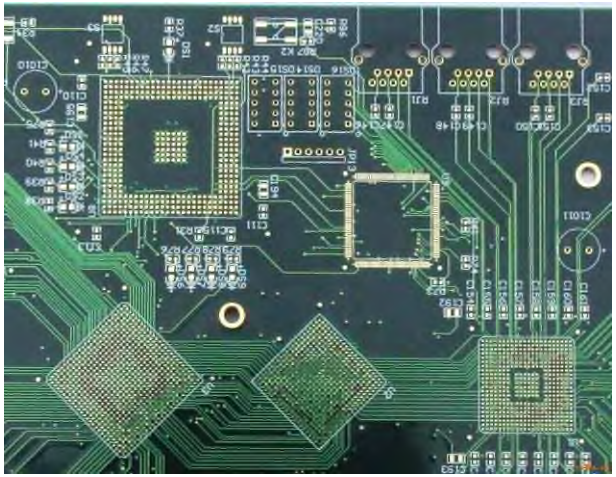
PCB basic knowledge learning materials

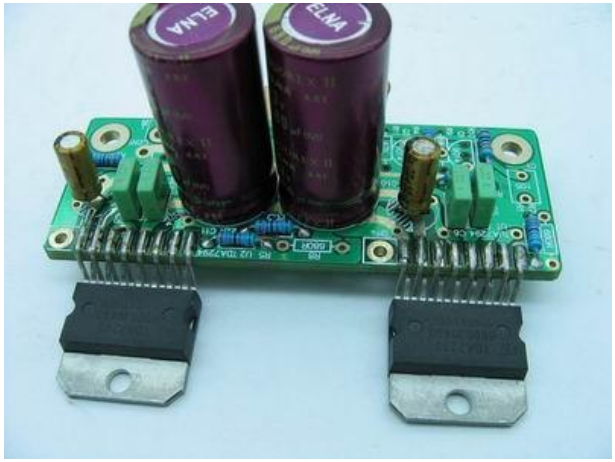
- 1、What is PCB
- 2、Classification of PCB
- 3、PCB production process
- 4、Process principle of each production process



1、What is PCB

- Printed circuit board (PCB) is also known as printed wire board (PWB).It is called PCB in English. The so-called printed circuit board refers to the assembly board on which the mounting holes, connecting wires and welding pads of electronic components are selectively processed on the insulating substrate to realize the electrical connection between components.





2、 Classification:

1.By application

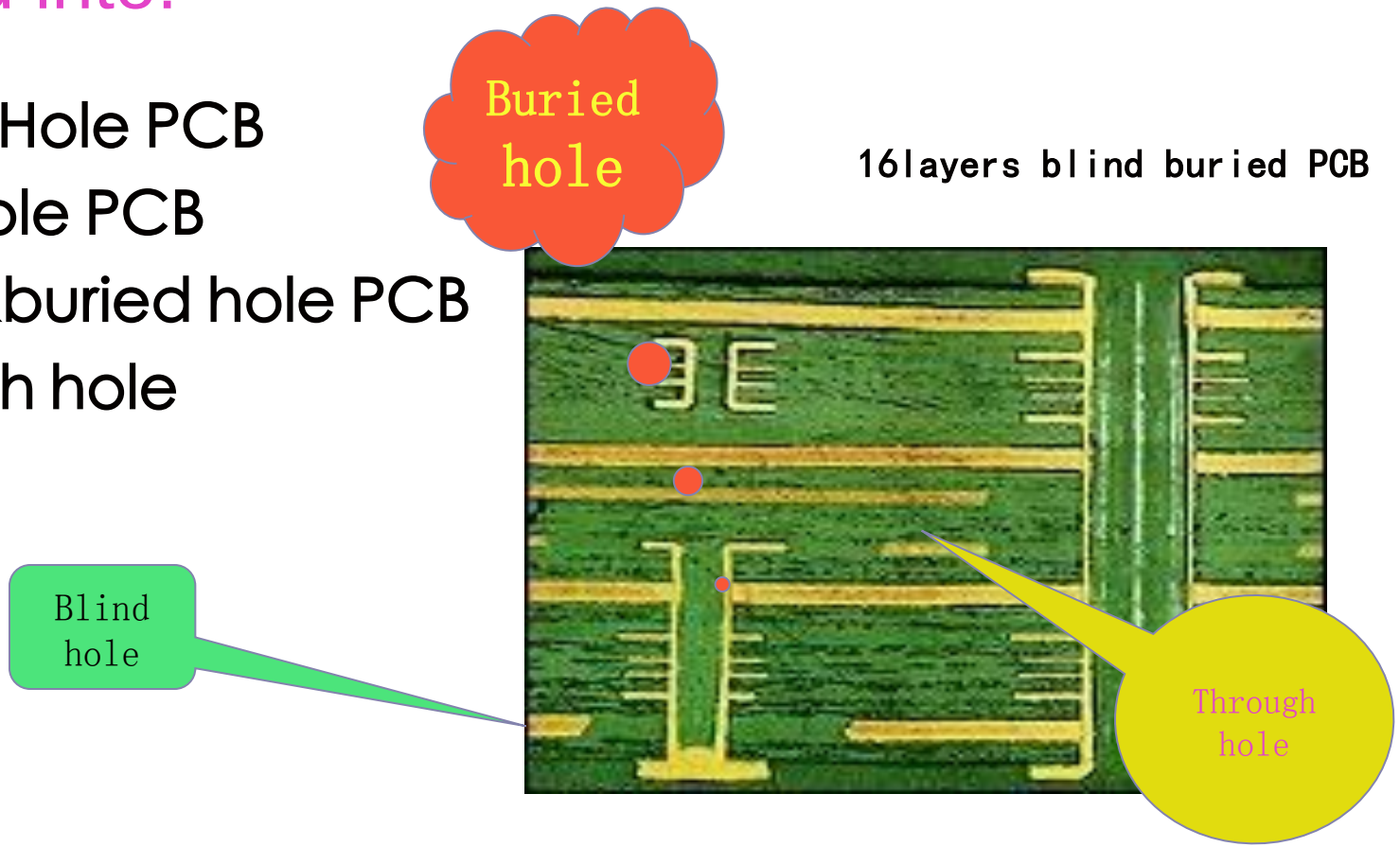
- A. Printed circuit boards for civil use (TV sets, electronic toys, etc.)
- B. Industrial printed boards (computers, instruments, etc.)
- C. Military printed board

2. According to hardness, it can be divided into:

- A. Rigid PCB board
- B. Flexible board
- C. Rigid-flex board

3. According to the conduction state of PTH, it can be divided into:

- A.Buried Hole PCB
- B.Blind hole PCB
- C.Blind &buried hole PCB
- D.Through hole



4. According to the layer, it can be divided into:

- A. Single-sided PCB
- B. Double-sided board
- C. Multilayer board

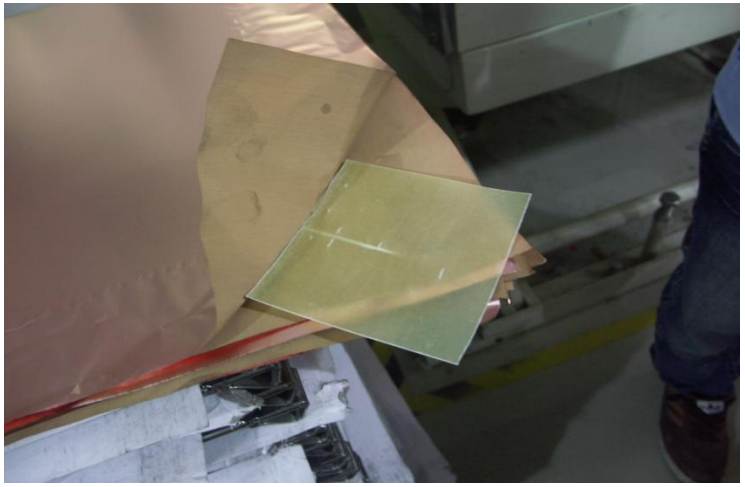
5. According to surface fabrication, it can be divided into:

- 1. HASL
- 2. Lead free HASL
- 3. Immersion Tin
- 4. Immersion Gold
- 5. Gold plated
- 6. Gold finger plated
- 7. OSP
- 8. Immersion Silver

6. Classification by substrate:

- Paper based printed board
- Glass cloth based printed circuit board
- Synthetic fiber printed board
- Printed circuit board with ceramic substrate
- Metal core based printed circuit board

epoxy resin



PCB substrate structure

3、 Production process of Multilayer PCB

- Cutting → inner layer → lamination → drilling → PTH dry film → Plating → Soldermask → Silkscreen → surface treatment → Profiling →

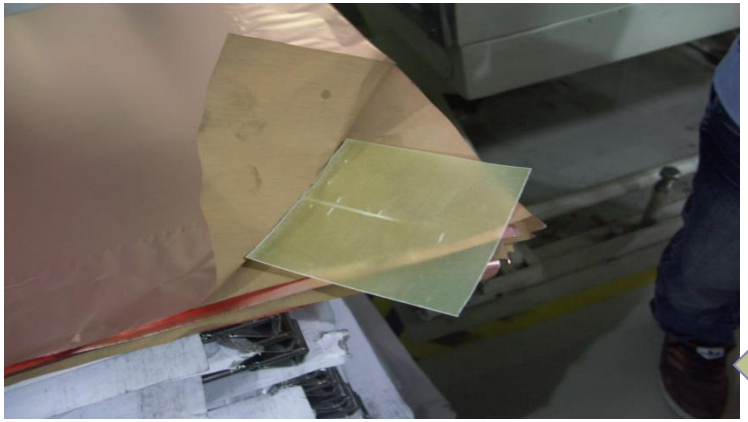
Electrical test → FQC → FQA → package

Material

Material warehouse

Material identification

Material unit- sheet

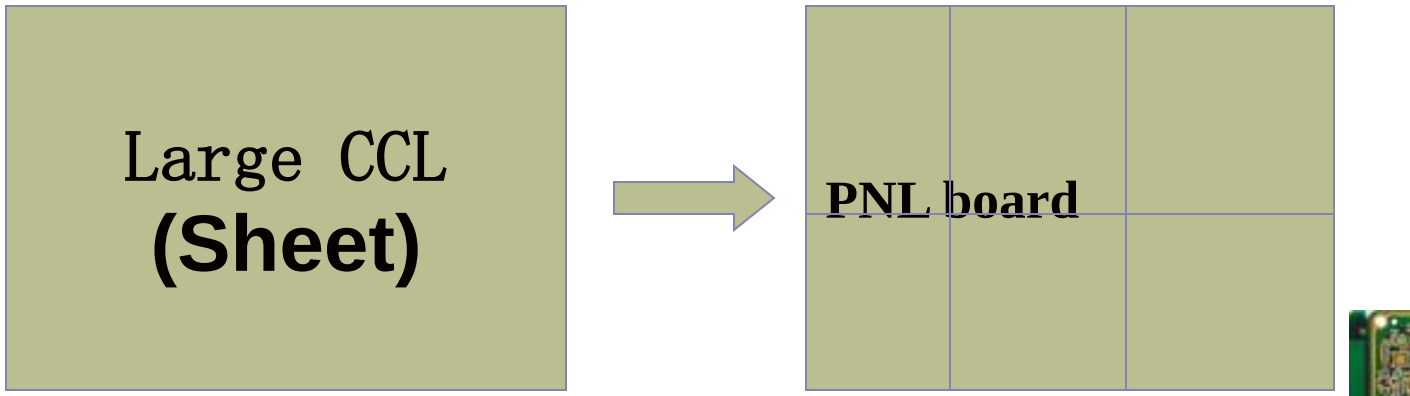


material structure

Our company uses PCB material and PP from mainstream manufacturers including SHENGYI.KB.IETQ .NANYA.

4、Process principle of each production process

- 1. Cutting: according to the size required by Mi, the large copper clad laminate is divided into manufacturing unit panel (PNL).
- (sheet → working panel → set → piece)



- **A. Production process flow:**
- Inspection of incoming materials ➡ cutting ➡ grinding edge➡fillet➡cleaning➡baking ➡ next process
- **B. Common materials and specifications:**
- The plate is FR-4 and CEM-3, and the bulk size is 36 ″×48″, 40 ″×48″, 42 ″×48″, 41 ″×49″, 48 ″×72″
- **C. Utilization rate of cutting material:**
- The utilization ratio is the percentage of finished product delivery area and cutting area.Generally, the requirement of double-sided PCB is more than 85%, and that of multilayer board is more than 75%

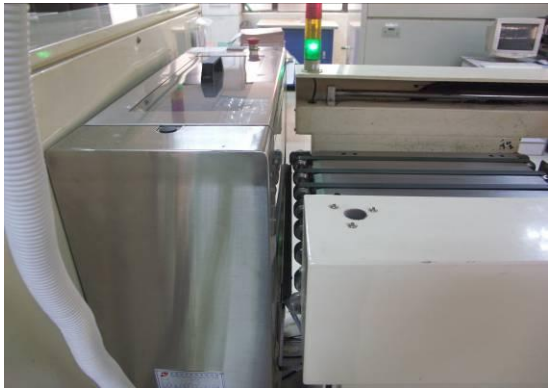
Physical Picture

Cutting machine

CCL to be milled after cutting

Edge grinding machine

Edger and fillet machine



Washing machine

Plate after cleaning

2. Inner pattern

- The uncoated core board is treated with pre-treatment micro etching and roughening the copper surface, and then the core plate coated with the photosensitive layer is exposed with production film to make the photosensitive layer of the circuit part polymerize and cross-linked. After weak alkali development, the unreacted photosensitive layer is dissolved to expose the copper surface, and then exposed by acid etching, Part of the copper is etched away, leaving the copper in the area covered by the photosensitive layer and forming a circuit pattern.This process is the process of film graphics transferring to core board graphics, also known as graphics transfer.

Production process flow:

- Pretreatment → Press dry film (wet film) → Exposure → Development → Etching → stripping film → QC inspection (through AOI) → next process

A. Pretreatment (chemical cleaning line)

- 3% - 5% acid solution is used to remove the oxide layer on the copper surface and the protective layer on the original copper substrate to prevent copper from being oxidized, and then micro etching treatment is carried out to obtain fully roughened copper surface and increase the adhesion property between dry film and copper surface.

B. Apply wet film or press dry film

- Firstly, the polyethylene protective film is peeled off from the dry film, and then the dry film corrosion inhibitor is pasted on the copper clad laminate under the condition of heating and pressure. The resist layer in the dry film becomes soft after being heated and the fluidity is increased. Then the film is pasted with the help of the pressure of the hot pressing roller and the role of the binder in the resist.

C. Dry film exposure principle:

- Under UV irradiation, photoinitiators absorb light energy and decompose into free radicals. The free radicals lead to photopolymerization monomers for cross-linking reaction. After the reaction, stereoscopic macromolecular structure insoluble in weak base is formed.

D. Development principle, etching and stripping

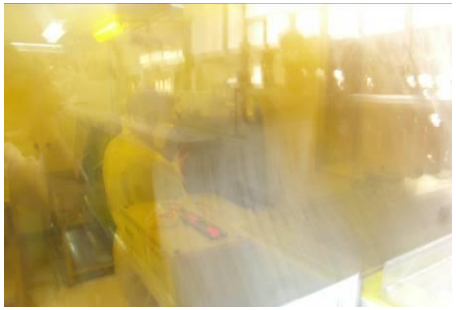
- The active group in the unexposed part of the photosensitive film reacts with the weak alkali solution to form a soluble substance to dissolve; the unexposed photosensitive film reacts with the developer and is dissolved, and the exposed film does not react with the weak alkali solution and is retained, so as to obtain the required circuit pattern.
- Etching
- Stripping film

Physical drawing (1)

Pretreatment line

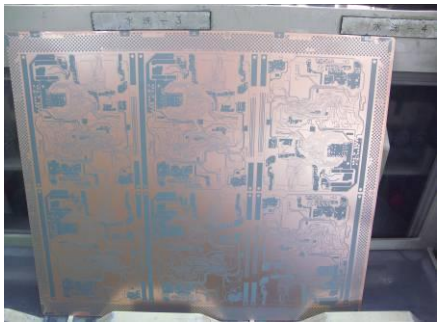
Coating line

Exposure unit



board before development

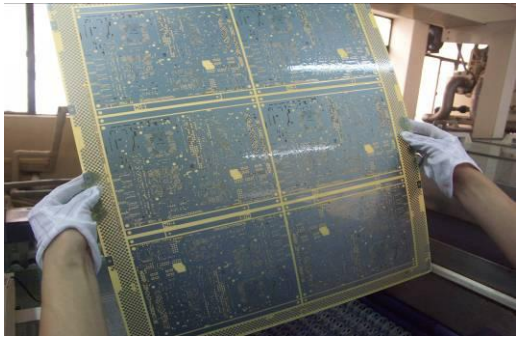
Developing cylinder



Developed

Physical group drawing (2)

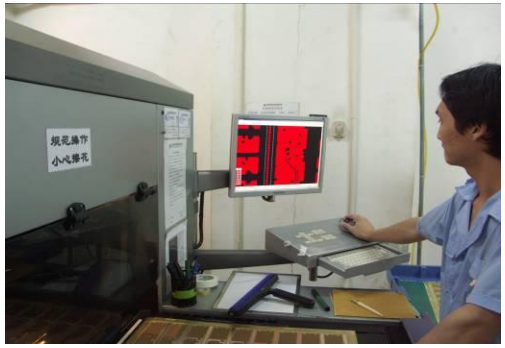
Etching cylinder



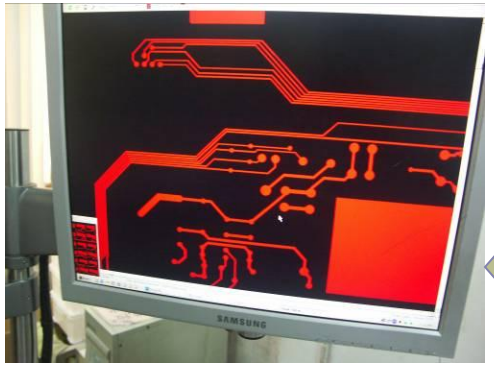
Etched

Strip film cylinder

The board that completes the inner circuit



AOI test



AOI test

Browning:

- The purpose of browning is to increase the surface roughness of copper foil and increase the contact area with resin, which is conducive to the full diffusion and filling of resin.

Browning solution after curing (micro)

3. Lamination

- According to the MI requirements, the inner core board and PP sheet are stacked together and fixed. According to the process parameters, the inner core board and PP sheet are pressed together to form a complete Multilayer PCB under certain temperature, pressure and time conditions.
- Production process flow:
- Browned → Riveting → Pre stack → Stack → hot pressing → cold pressing → dismantle → X-ray drilling → Gong edge → next step

A. Hot pressing and cold pressing:

- Hot pressing
- The plate pressed in the hot pressing bin is transported to the cold pressing bin by a transport vehicle. The purpose is to gradually reduce the temperature in the plate under the action of cooling water, so as to better release the internal stress in the plate and prevent the plate from bending.

B. Board removal:

- The cold pressed board shall be removed manually. When removing the plate, the production plate and steel plate shall be separated by paper sheet to prevent scratching.

Physical group drawing (1)

hole-punching machine

Browning line

Inner layer after Browning

Laminated plate

Laminated plate

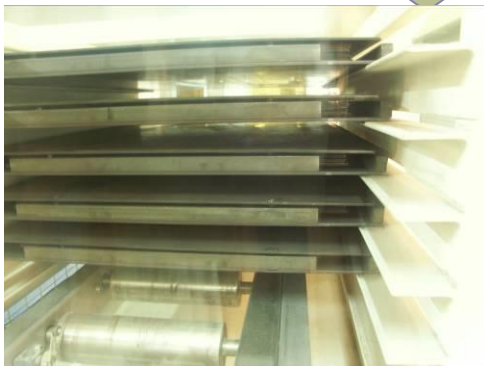
Fused plate

Physical group drawing (2)

Cover copper foil

Steel plate

Cowhide paper



Large steel plate

Into hot press

Cold press

Physical group drawing (3)

Computer instructions

oven

Pressed plate

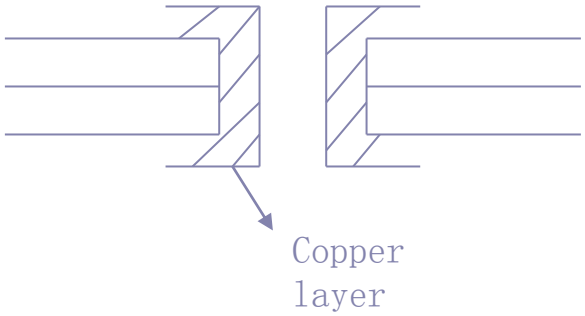
Grinding steel plate

4. Drilling principle:

- Use the drill bit on the drilling rig to drill the required holes on the circuit board at high speed and falling speed.
- Production process flow:
- Drilling positioning hole → loading board → input data → drilling → head board inspection → shooting red film → grinding peak → next process

A. The role of Drilling:

- The drilling of circuit board is suitable for component welding, assembly and layer to layer conduction



Conduction between layers 1 and 2

B. The function of aluminum sheet is as follows

- Aluminum sheet plays the role of heat conduction, positioning, reducing the peak of orifice and preventing the scratch of board surface.

C. Polishing and flapping:

- Due to the different material of the plate, there is a peak at the edge of the hole. After drilling, it is necessary to use a manual grinding machine to grind off the peak.

D. Red film:

- When drilling the head plate, drill it together with the red film, and then use the hole point phenanthrene to check whether the drilling head plate has the problem of crooked drilling and missed drilling. If the first board is qualified, the red film can be used to check the batch production board to see whether there is skew or missed drilling.

Physical group drawing (1)

Drilling positioning hole

Rough edge of Gong

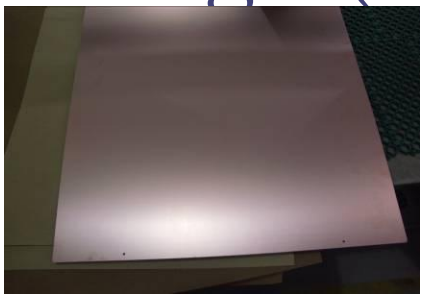


Plate to be drilled

Rig platform

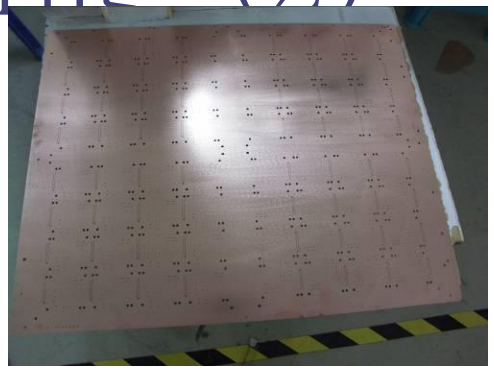
Upper plate

Preparation before drilling is completed

Physical group drawing (2)

Drilling rig in working condition

Drilling rig in working condition



Drilled plate

Red film for inspection of drilling quality

Red film inspection of drilled plate

Production process of Multilayer PCB

- Cutting → inner layer figure → lamination drilling → electroplating → outer layer solder resistance → surface treatment molding →

Electrical test → FQC →

FQA → packaged products

→ leave factory

5. Copper deposition (principle)

- After drilling PCB board, through chemical treatment, deposit (cover) a layer of uniform, heat-resistant impact metal copper in the drilled hole.
- Production process flow:
- Grinding → clear up hole → washing → micro etching → washing → pre leaching → activation → washing → Acceleration → washing → chemical copper → washing → next step

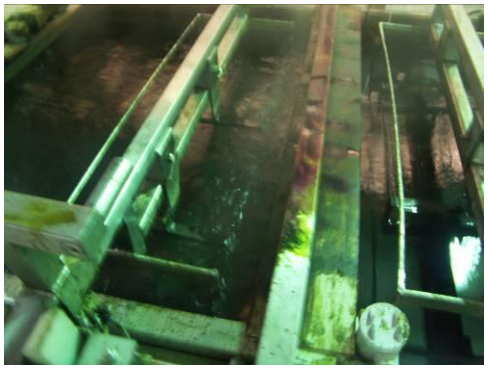
- A. The function of copper deposition is as follows
- A layer of copper is covered in the drilled hole to realize the circuit connection between PCB layers and realize the plug-in welding function at the customer's site.
- B. Decontamination:
- Under certain temperature and concentration conditions, potassium permanganate solution oxidizes the swelling resin in the hole to remove drilling pollution.(drilling pollution is resin residue in the hole during drilling)

6. Full board plating

- A layer of copper is electrodeposited in the hole after copper deposition to realize the reliable interconnection of layer patterns.

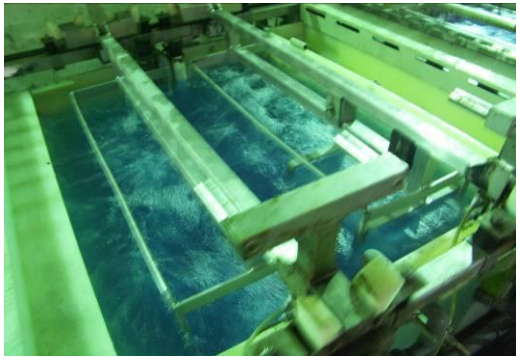
Physical group diagram

Copper deposition line

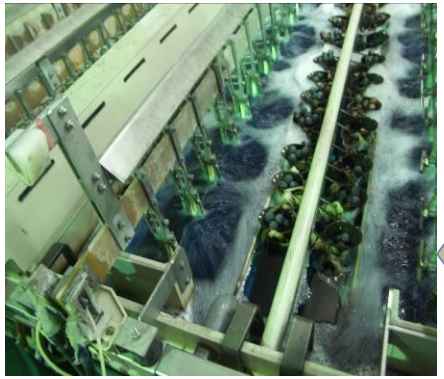


Potassium permanganate degumming residue

Plate after removing glue residue



Copper deposition

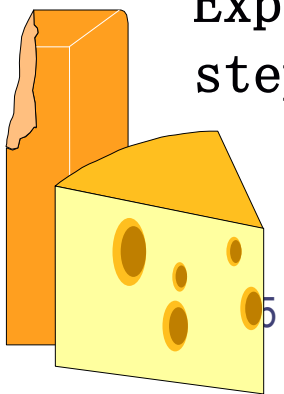


Board Electricity

Board after electricity

7. Outer pattern

- The pre-processing board is pasted with photosensitive layer (dry film), and aligned with film pattern. Then, the aligned PCB is sent to the exposure machine for exposure, and then the unreacted photosensitive layer is dissolved through the developer, and finally the required circuit pattern is obtained on the copper plate.
- Production process flow:
- pre-treatment ➡ paste film ➡ position ➡ Exposure ➡ Development ➡ QC inspection ➡ next step



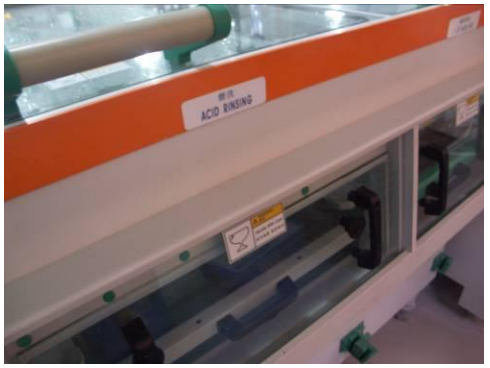
- **A. Pretreatment (super coarsening)**
- **The finished plate is sent into the equipment to form a copper surface with high roughness under the joint action of spray, temperature, liquid medicine and speed, thus increasing the adhesion between dry film and copper surface.**
- **B. Dry film application:**
- **Firstly, the polyethylene protective film is peeled off from the dry film, and then the dry film corrosion inhibitor is pasted on the copper clad laminate under the condition of heating and pressure. The resist layer in the dry film becomes soft after being heated and the fluidity is increased. Then the film is pasted with the help of the pressure of the hot pressing roller and the role of the binder in the resist.**

- **C. Exposure:**
- **Under UV irradiation, photoinitiators absorb light energy and decompose into free radicals. The free radicals lead to photopolymerization monomers for cross-linking reaction. After the reaction, stereoscopic macromolecular structure insoluble in weak base is formed.**
- **D. Development:**
- **The active group in the unexposed part of the photosensitive film reacts with the weak alkali solution to form a soluble substance to dissolve; the unexposed photosensitive film reacts with the developer and is dissolved, and the exposed film does not react with the weak alkali solution and is retained, so as to obtain the required circuit pattern.**

Physical group drawing (1)

Board after electricity

Pretreatment and micro etching



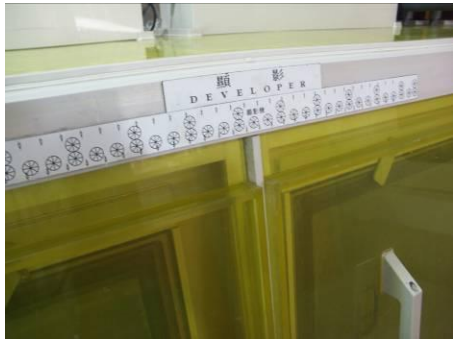
Washing board

Dry film

Apply dry film (similar)

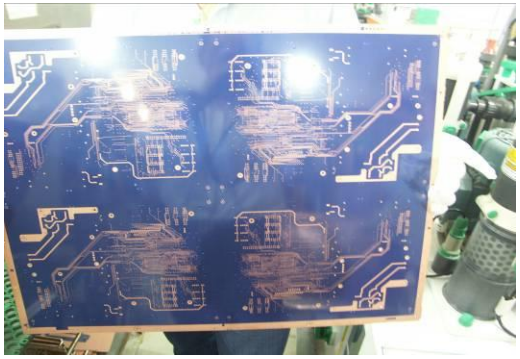
Exposure

Physical group drawing (2)



development

Washing line



Etched plate

8. Pattern plating

- **A. Electroplating definition:**
- Electroplating is a process in which the metal or alloy is deposited on the surface of the workpiece by electric current to form a uniform and dense metal layer with good adhesion.
- **B. Purpose of electroplating:**
- Increase the thickness of wire and hole coating, improve the electrical properties and physical and chemical properties of the coating in the hole.The function of the lead tin plating process is to provide a protective coating to protect the copper wire of the graphic part from being corroded by the etching solution.

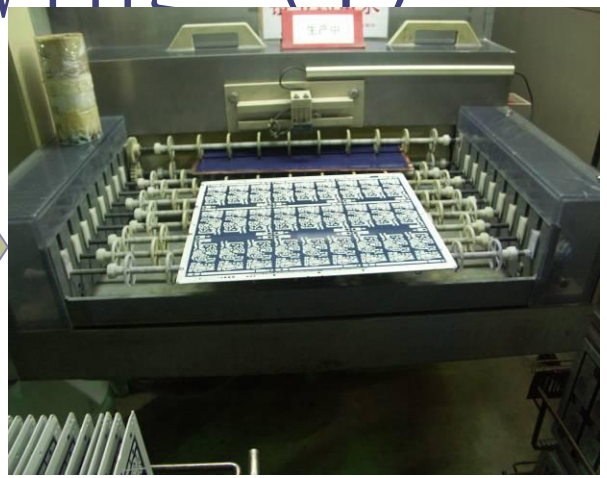
9. Etching

- A. Principle:
- The unprotected copper is dissolved by chemical method, the protected copper is left, and then the protective layer (tin layer) on the circuit layer is removed. Finally, the required circuit pattern is obtained on the bare copper plate.
- B. Production process:
- Place → Strip → Washing → Etching → Washing → Strip Tin → washing → Baking → QC inspection next process

Physical group drawing (1)

Pattern plating

Tinplate



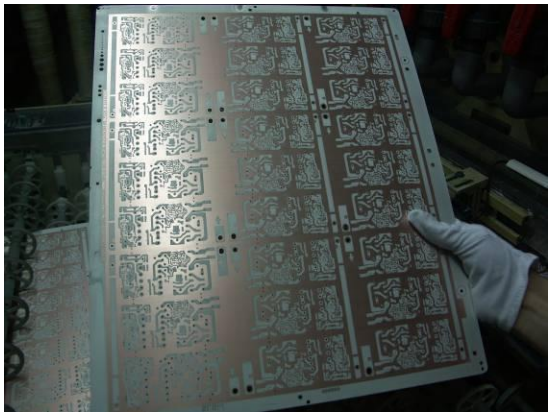
Etch line

After exposure

Etching cylinder

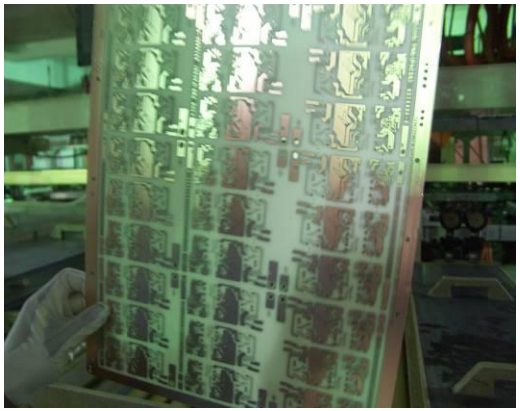
After etching and before remove tin

Physical group drawing (2)



After etching and before remove tin

Stripping tin cylinder



Board after stripping tin

10. Soldermask

- **Principle:**
- After pretreatment, solder mask ink is printed to the board surface through screen. Under certain temperature, time and air volume, the solvent in the ink will evaporate initially. Then, the pad and hole required by the customer will be protected by film graphics for exposure. The ink that does not react with UV light will be dissolved during development, and finally the pad and hole required by the customer can be obtained.

- Function of soldermask:
- 1. Beautiful
- 2. Protection
- 3. Insulation
- 4. Anti welding
- 5. Acid and alkali resistant
- Production process:

Grinding board → silk screen solder mask → pre-baking → exposure → Develeping → PQC inspection → post-curing → next process

11. Silkscreen

- **Principle:**
- Under a certain force, the character ink required by customers can be printed on the surface of PCB board through a certain number of mesh screen screen, which can provide information for component installation and future maintenance of PCB board.

- Production process:
- Check the lot card to determine whether it is necessary to screen the characters and the character production requirements → According to the requirements of the lot card, select the character ink → turn on the oil → check whether the character net is qualified → Alter the Date code → Lock the screen plate on the screen printing machine → para-position → Head board printed → After the first plate is OK, print in batches → collect oil → clean the screen plate → Remove the screen plate

- **Character ink type:**
- **Character ink is thermosetting ink, when it is thermosetting, even with strong acid and alkali are difficult to clean it.**
- **Common defects:**
- **Characters on pad, Character blur, less oil on characters, characters sticking on board, etc.**

Physical group drawing (1)

Pretreatment

Micro etching cylinder

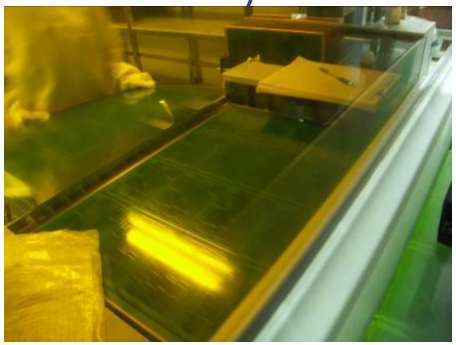
Pozzolanic grinding

Ultrasonic washing

washing

Soldermask house

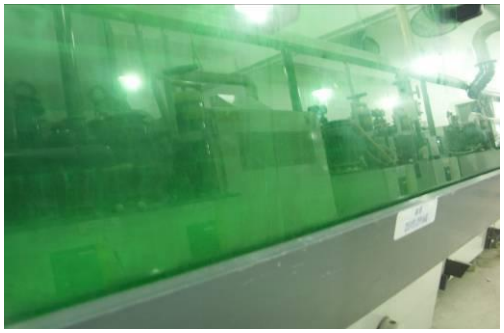
Physical group drawing (2)



After Screen printed

oven

Exposure

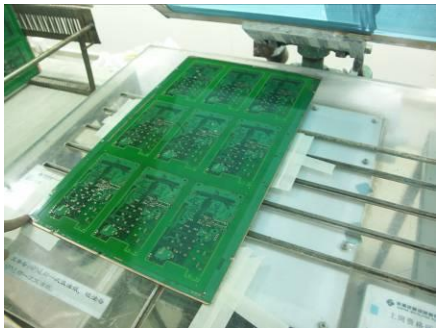


development

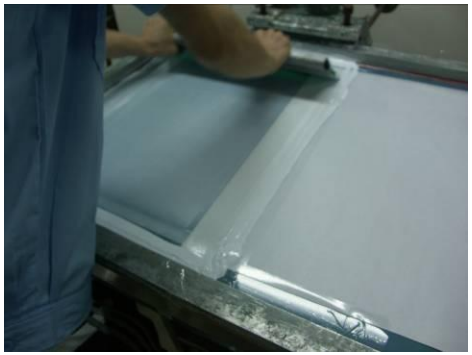
washing

Washed plate

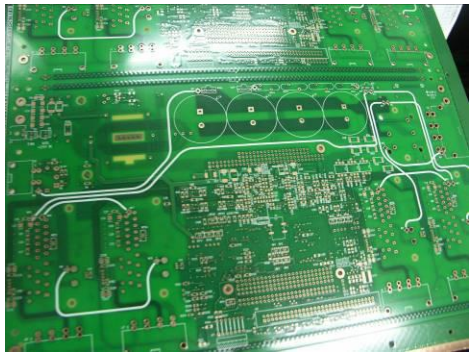
Physical group drawing (3)



Text board for silk screen printing



Silk screen characters



After the silk screen

12. Surface treatment

- **A. Our common surface treatment:**
- HASL
- Lead free-HASL
- Immersion Gold
- Immersion tin
- Immersion Silver
- Antioxidant (OSP)
- Electro-gold
- Gold Plated fingers

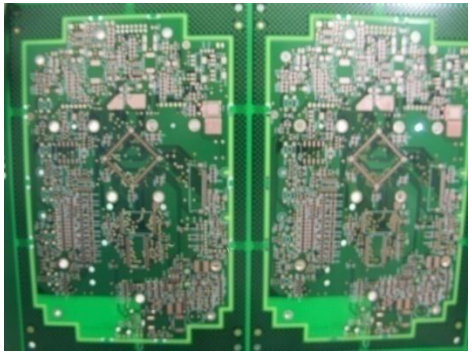
- **A. Production process:**

Micro etching → washing → Apply flux → HASL → Air bed cooling → Hot water washing → Water washing → Drying → PQC inspection → Next process

B. Comparison of melting points of alloy solders:

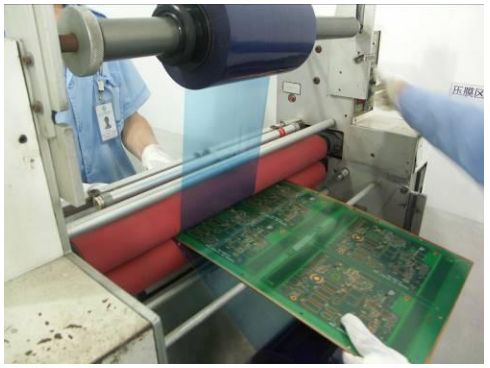
- **The melting point of lead solder is 183 ℃ (Sn63 / Pb37)**
- **The melting point of lead-free solder is 227 ℃ (Sn / Cu / Ni)**

Physical group drawing (gold plate) (1)



Wait for the gold plate

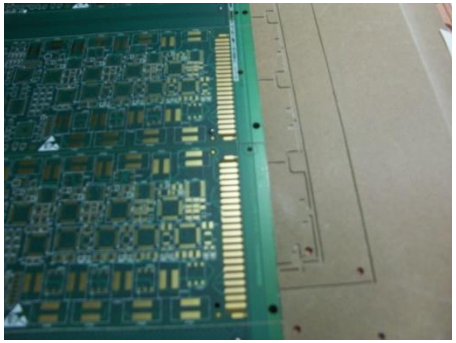
Grinding board



Hemming

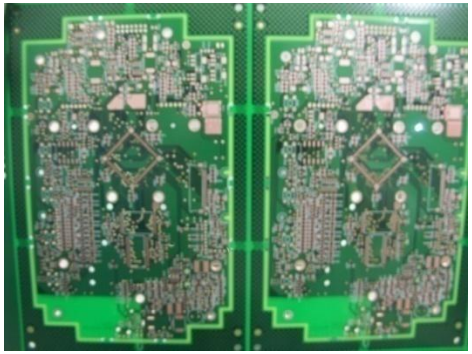
Immersion gold line

After immersion gold



Gold Plated finger board

Physical group drawing (2)



Prepere HASL

Grinding board

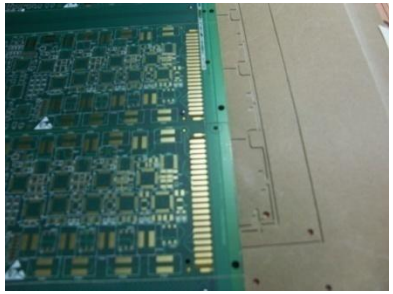
Tin spray

HASL board

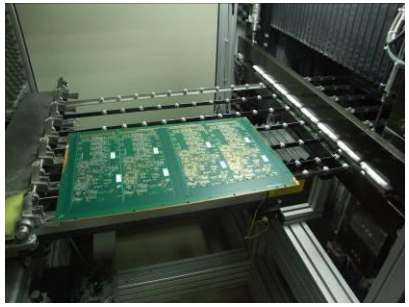
13. Profiling

- **A. Principle:**
- Input the data (Gong route) into the CNC milling machine, and divide the PNL board (Gong board) into the external dimensions required by customers.
- **B. Production process:**
- Drilling positioning holes ➡ put on the board input data ➡ Gong ➡ cleaning finished board ➡ next process

Physical group diagram

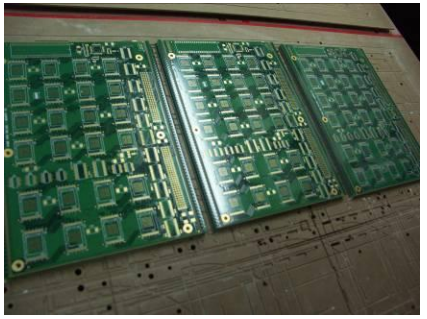


V-groove plate to be opened

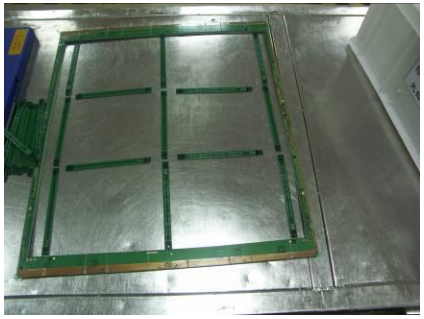


Open V-groove

PNL Gong to set



The board after gong



Auxiliary production border

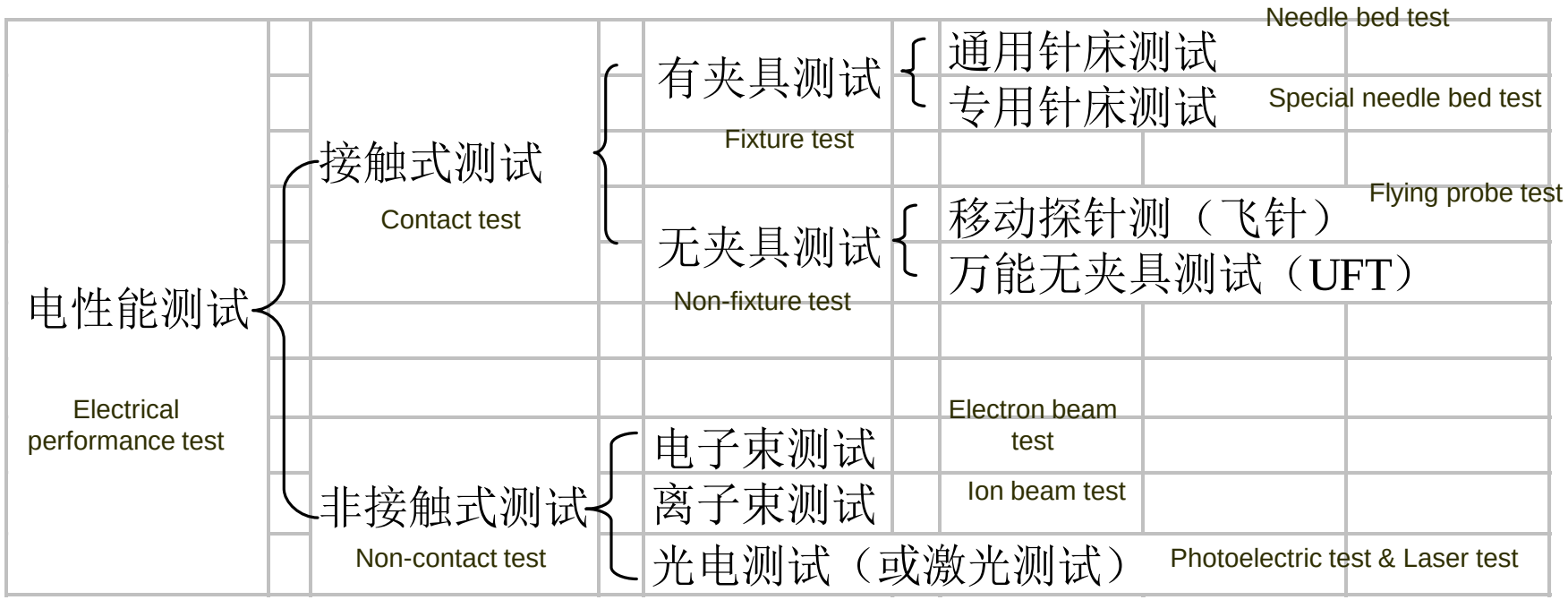
Washing board

14. Electrical test

- **A. Objective:**

  The electrical performance test of PCB is usually called "on", "off" test or "on" and "short" circuit test to check whether the network status of the produced PCB board meets the design requirements of the original PCB
- **B. Principle:**
- **Connectivity test: apply current to one end of a network to be tested, measure the other end of the network, and judge whether the network (wire) is on or off and the resistance value according to the change value of current.**

- **Insulation test: apply voltage to a network (wire) to be tested, and detect whether there is voltage value on other adjacent network, so as to judge whether the network (wire) is insulated.**
- **C. Test classification:**



15. Finished product inspection (FQC)

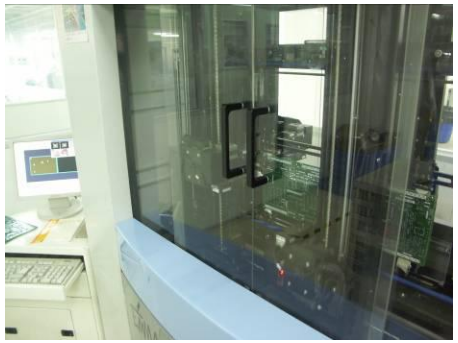
- **A. Objective: According to the customer's acceptance standard and our company's inspection standard, the appearance of the finished PCB board is inspected, and if there is any defect, it is repaired in time to ensure that it provides customers with excellent quality control.**

16. Finished product packaging

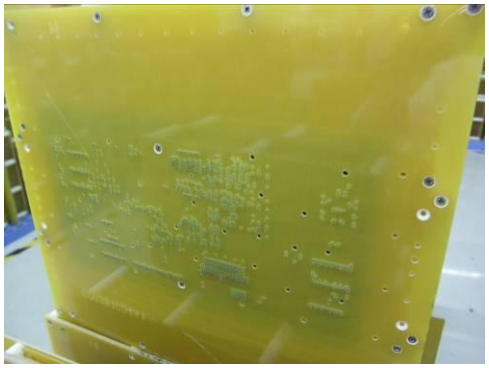
- **A. Objective:**

  According to the requirements of MI, the finished PCB board that has been inspected and qualified is packaged by vacuum packaging film under the condition of heating and vacuumizing, so as to prevent the finished PCB board from moisture and facilitate storage and transportation.

Physical group drawing (1)

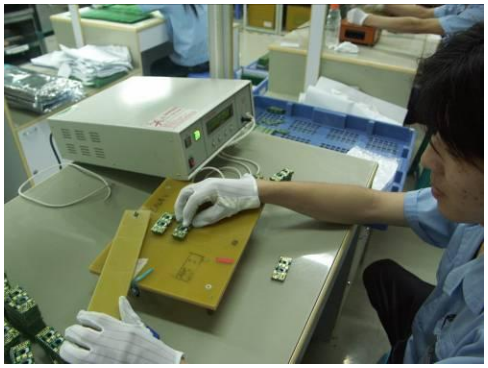


Vertical flying needle testing machine



Test fixture

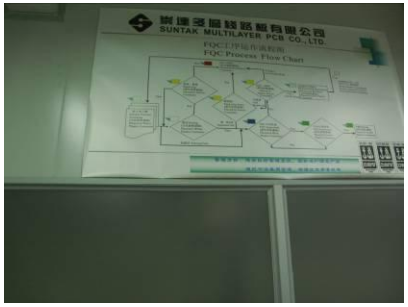
On off test



High voltage test

Fixture test

Physical group drawing (2)



FQC workflow

FQC workshop

oven

FQC workshop

packing

Finished product warehouse