PCB Fabrication Processes

Brief Introduction

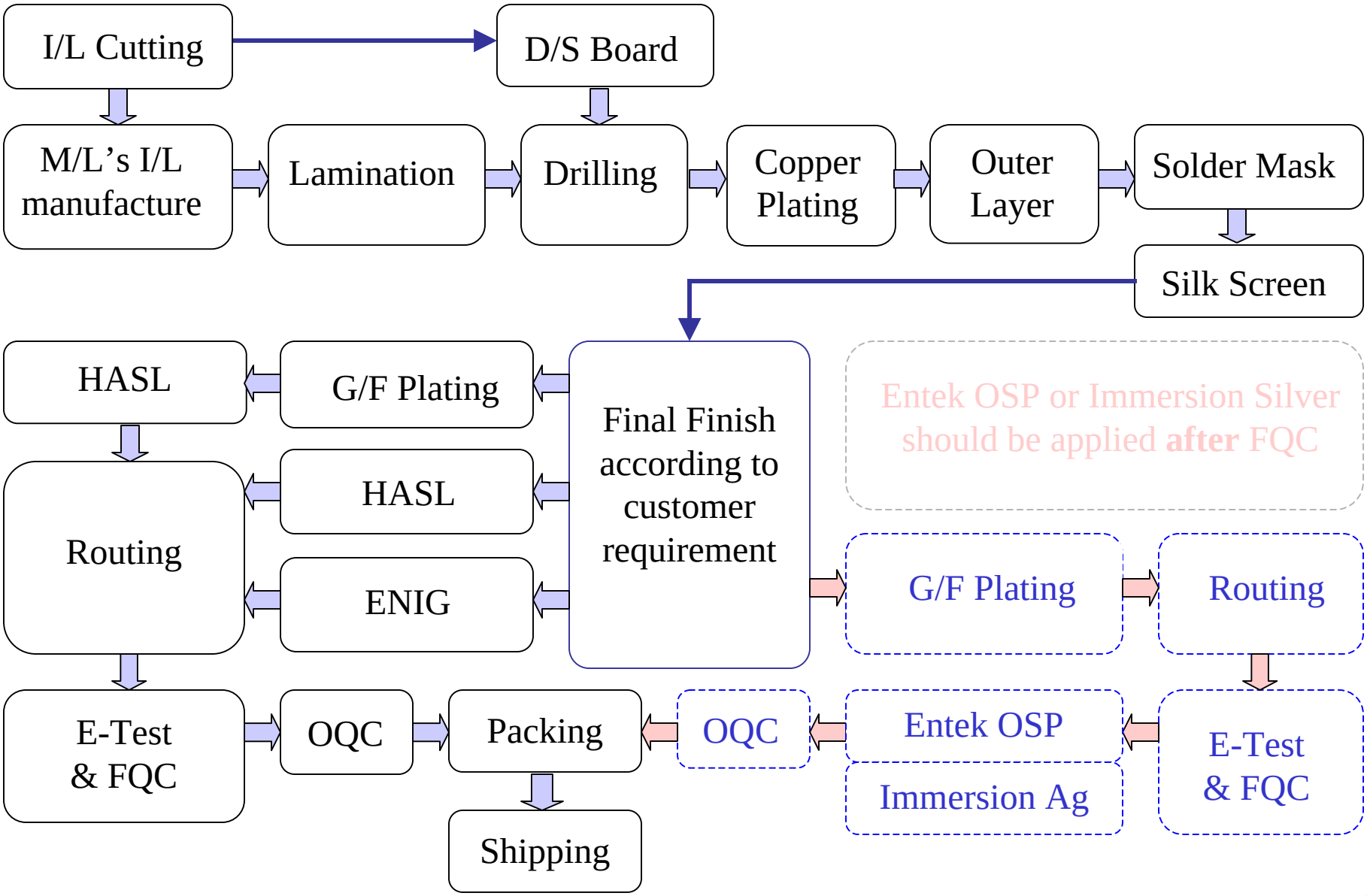
Orig2004/08/21 Edit2011/01/04

Contents

PCB Fabrication Processes

Brief Introduction

PCB Processes Flow Chart



Inner Layer Processing

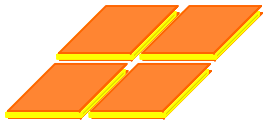
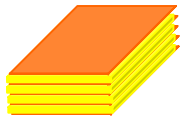
I/L Flow

1-1 Cutting ➡ 1-2 Beveling ➡ 1-3 Pre-treatment ➡ 1-4 Roller Coating ➡ 1-5 Exposure ➡ 1-6 DES Line ➡ 1-7 I/L holes

---

1-1 Cutting

Base materials before cutting ⇨ Base materials after cutting ⇨ Stack panels and send to next process

1-2 Beveling

Before beveling ⇨ After beveling ⇨ Double sided：send to drilling

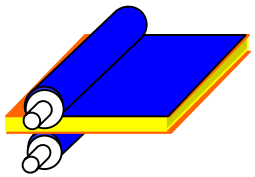
Multi-Layer：send to inner layer pre-treatment


1-3 Pre-treatment

Brush foreign materials away from board surface ⇨ After pre-treatment brushing


1-4 Roller Coating

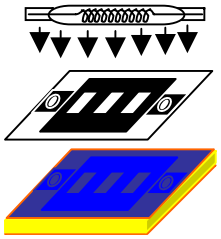
Before roller coating ⇨ Roller coating ⇨ After roller coating

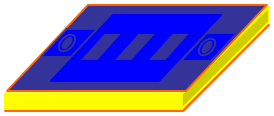

Inner Layer Processing (continued)

1-5
Exposure

Exposure

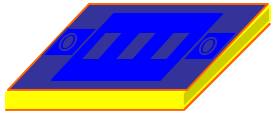


Board surface
after exposure



1-6
DES Line

Before
developing



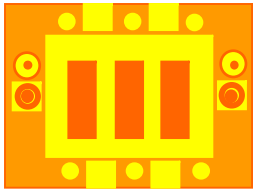
After
developing

After
etching

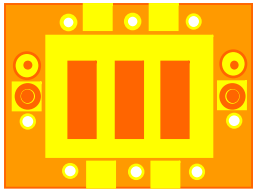
After stripping
away the film

1-7
I/L holes

Before hole
formation



After hole
formation



Mass Lamination Process

ML Flow : 2-1 Brown Oxide ➡ 2-2 Pre-lay up ➡ 2-3 Pinning ➡ 2-4 Lay up ➡ 2-5 Lamination ➡ 2-6 Unload boards

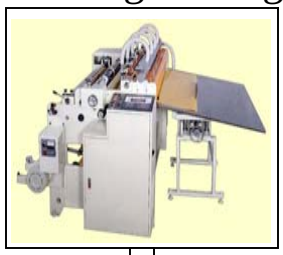
➡ 2-7 Drill tooling holes ➡ 2-8 Routing ➡ 2-9 Beveling

2-1 Brown Oxide

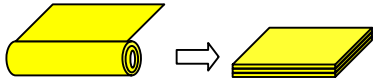
Inner layer surface before brown oxidation ⇨ Inner layer surface after brown oxidation

Cut prepreg before pre-layup

PrePreg Cutting



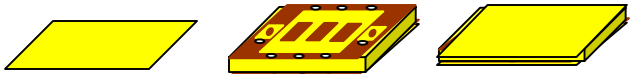
P/P roll is cut into pieces to prepare for pre-lay up



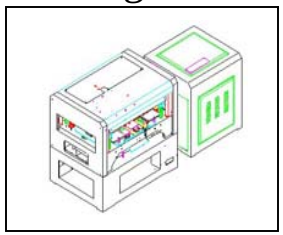
2-2 Pre Lay-up

Multilayer board procedure:

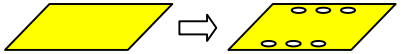
Step 1 **Step 2** **Step3**



PrePreg Hole Punching

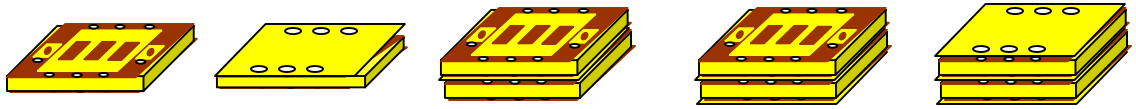


punch the holes used for lamination



Above 8L boards should punch holes before pre-lay up procedure.

Step 1 **Step 2** **Step3** **Step4** **Step5**

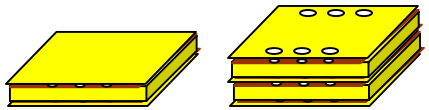


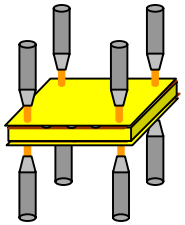
Mass Lamination (continued)

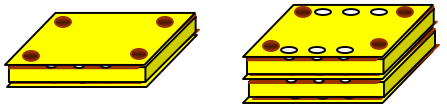
2-3 Stack-up Pinning

Hot copper rods melt spots to preserve layer alignment. ⇨ Pinning ⇨ Boards shown after pinning

4L boards above 8L boards

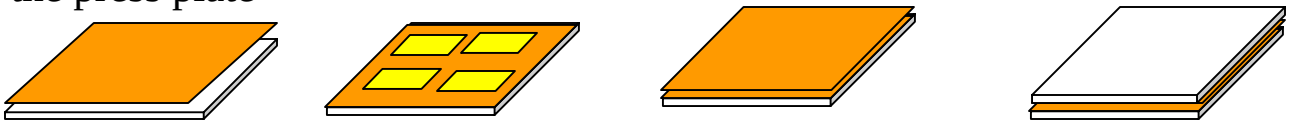




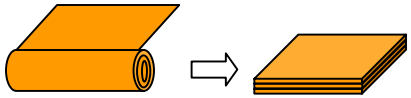


2-4 Lay up

bottom copper foil placed on the press plate ⇨ Lay up ⇨ upper copper foil placed ⇨ Cover the press plate

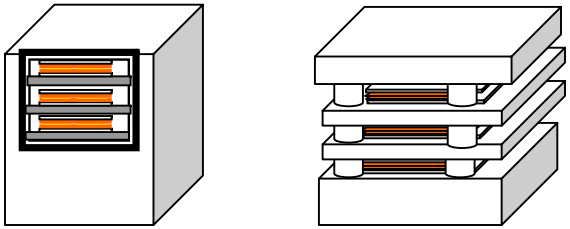


⇧ Copper foil cutting



2-5 Lamination

Hot press Cool press



Mass Lamination (continued)

2-6 Unload boards

Step 1 Step 2 Step 3 Step 4

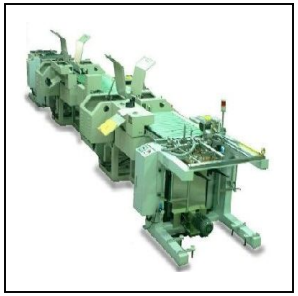
2-7 Drill target holes

X-ray target hole drilling ⇨ Board surface after X-ray drilling

2-8 Routing

Before routing ⇨ After routing

2-9 Beveling



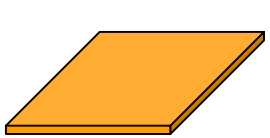
Before beveling ⇨ After beveling

Drilling Process

Drilling Flow : 3-1 Entry and Backing ➡ 3-2 Alignment Pins ➡ 3-3 Drilling ➡ 3-4 Pin removal

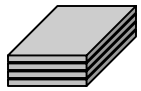
3-1 Backing & Entry board cutting

Before cut ⇨ After cutting ⇨ Stack for next procedure.



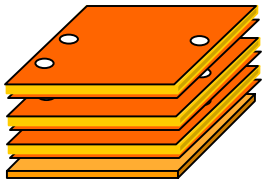
Back-up boards

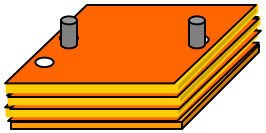
Entry boards



3-2 Add pins

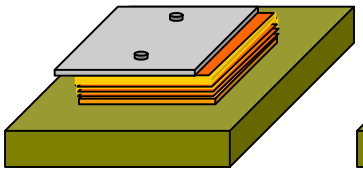
Stack panels ⇨ Add pins

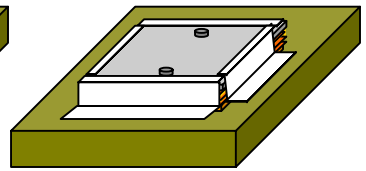


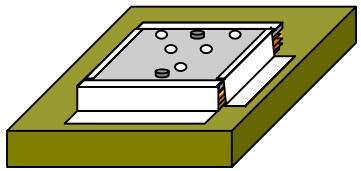


3-3 Drilling

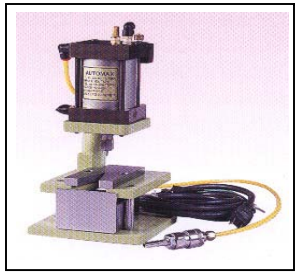
Add entry board ⇨ Tape Edges ⇨ Drill



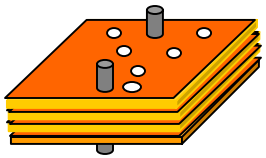


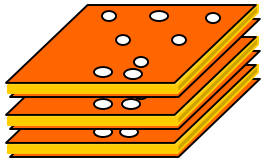


3-4 Pin removal



Pins shown ⇨ After pin removal





Copper Plating

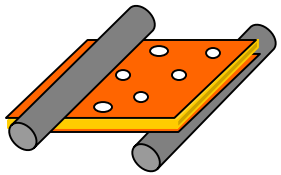
CP Flow : 4-1 Deburr ➡ 4-2 Desmear ➡ 4-3 PTH ➡ 4-4 Copper Plating

4-1 Deburr

Deburr pre-treatment:

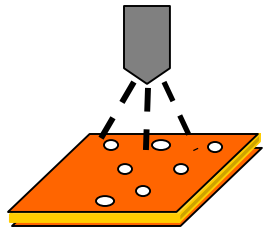
Use the brushing & high pressure water rinse to clean away the fibers on the board surface and in the holes.

non-woven rollers



⇨ High pressure water rinse

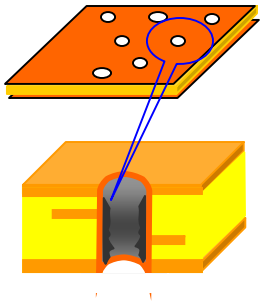
Water column spray pressure 15kg/cm2



4-2 Desmear

1. Swelling

Dip boards into high temperature alkali bath liquids (which containes organic solvent) to swell the resin smears.



resin smear on hole wall

⇨ **2. Desmear**

Cleaning away the resin smears attached on the hole wall to expose a clean copper surface.

hole wall after desmear

Copper Plating (continued)

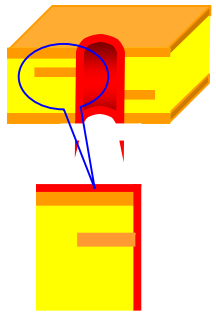
4-3
PTH

PTH:

Plated Through Holes provide conductive connections between layers, and mechanical support for components

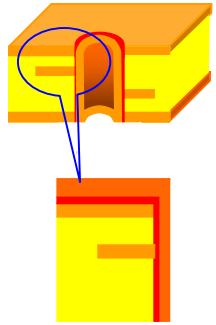
PTH process：

→ Desmear
→ Hole conditioning
→ Micro-etch
→ Activation
→ Acceleration
→ Electroless copper



4-4
Plating

PTH plating must establish minimum hole wall thickness, and increase surface copper thickness to meet specification or customer requirement.



“ ” indicates Electroless copper plating on base copper and hole wall

“ ” indicates the plated copper layer

Outer Layer Processing

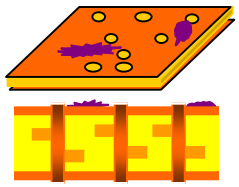
O/L Flow : 5-1 Pre-treatment ➡ 5-2 Etch Resist ➡ 5-3 Exposure ➡ 5-4 DES Line

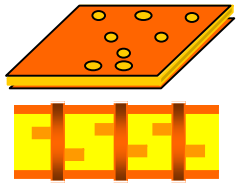
5-1 Pre-treat

Pumice Line：

Clean foreign material from board surface and roughen board surface to increase adhesion to dry film

Board surface before pre-treat ⇨ Board surface after pre-treat

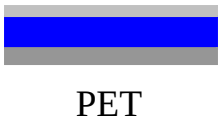




5-2 Etch Resist

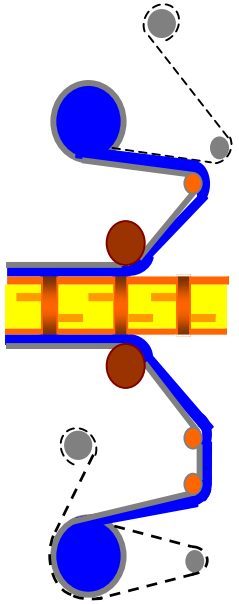
Dry film：

consists of PE film, photopolymer film resist and PET film



Laminator:

Heat and sentering press to apply the dry film on the board surface.

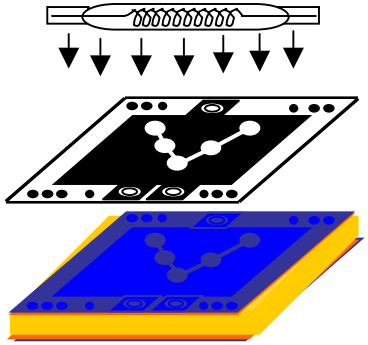


Outer Layers (continued)

5-3 Image Exposure

Exposure:

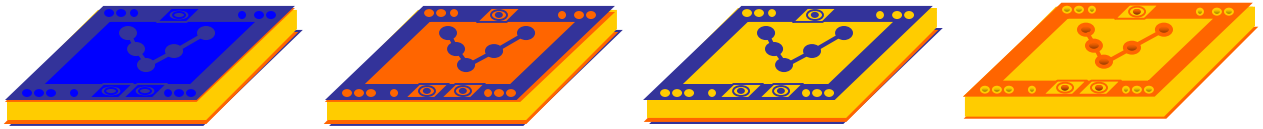
Blue material is light-sensitive, so UV energy will cause a chemical reaction to “cure” the areas that are exposed by the image.



clean room

5-4 DES Line

Before developing ⇨ After developing ⇨ After etching ⇨ After stripping away the film



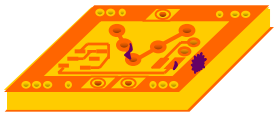
Solder Mask Process

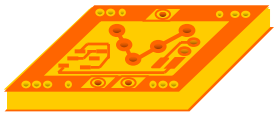
S/M Flow : 6-1-1 Pre-treatment ➡ 6-1-2 Printing ➡ 6-1-3 Pre-curing ➡ 6-1-4 Developing ➡ 6-1-5 Post-Curing

6-1-1 Pre-treat

Pumice Line:
Clean foreign material and roughen the board surface to increase solder mask adhesion

Before pre-treat ⇨ After pre-treat

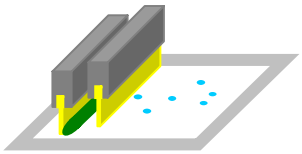


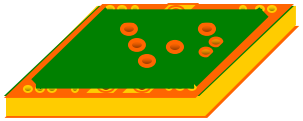


6-1-2 Print

Printing:
Apply photoimagible mask on board surface to protect circuitry, prevent copper surface oxidation and act as solder resist

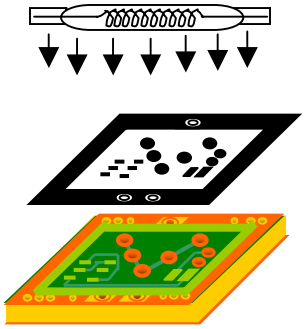
Before mask ⇨ After mask





6-1-3 Pre-cure

Pre-curing:
Partially remove solvent so surface is not tacky



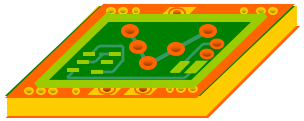
Solder Mask Process

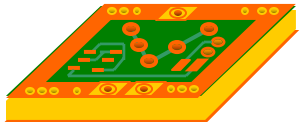
6-1-4
Develop

Developing:

Remove the solder mask which wasn't exposed to UV curing

Before developing ⇨ After developing

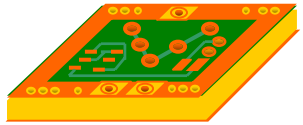




6-1-5
Post
curing

Post Cure :

Final cure to increase surface hardness and resist soldering



(board appears same as in previous step)

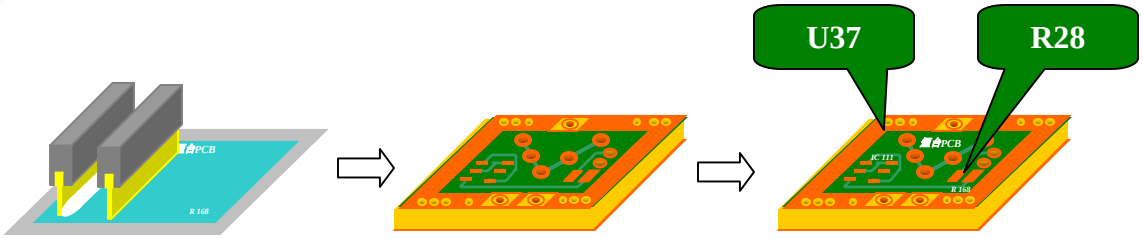
Silk Screen Process

S/S Flow : 6-2-1 Screen printing ➡ 6-2-2 Post curing

6-2-1 Screen printing

Legend:

Text and/or numbers printed on the final board surface using non-conductive ink. Commonly used to identify components (and orientation or polarity), and identifying board part number and revision level.



6-2-2 Post curing

Legend baking oven:

The ink used for silk screen printing contains hardening ingredients that are activated thermally, so it is cured at high temperature. This is called “Polymerization” or a “crosslinkage reaction”

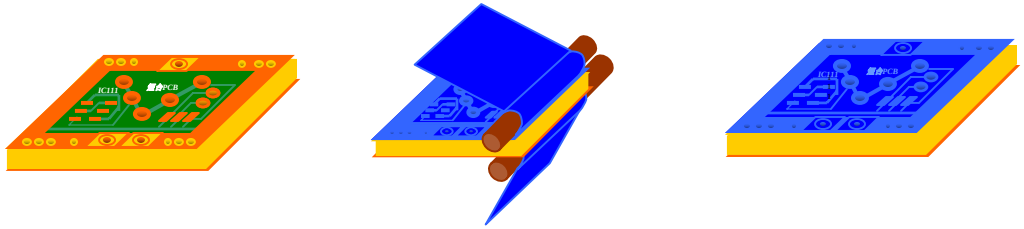
Gold Finger Plating

G/F Flow : 7-1-1 Blue Tape ➡ 7-1-2 Expose ➡ 7-1-3 Gold plating ➡ 7-1-4 Tape removal

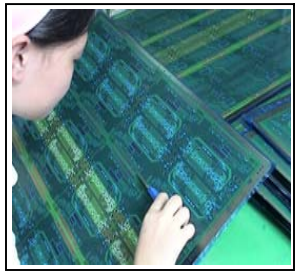
7-1-1 Blue Tape

Cover entire board with semi-transparent film to mask from plating

Before ⇨ Apply Blue tape ⇨ After Covering

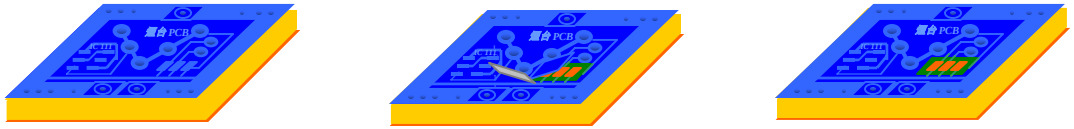


7-1-2 Opening



Expose the gold finger area.

Before ⇨ Remove for Plating ⇨ Exposed Fingers



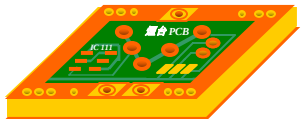
7-1-3 Gold Plate

Gold plating line:
→Pre-treat
→Ni plating →Au activation →Gold Plate →Rinse →Bake

Before ⇨ After pre-treat ⇨ After Ni-plating ⇨ After gold plating

7-1-4 tape removal

Remove the blue tape covering from the board



Board surface after gold finger plating

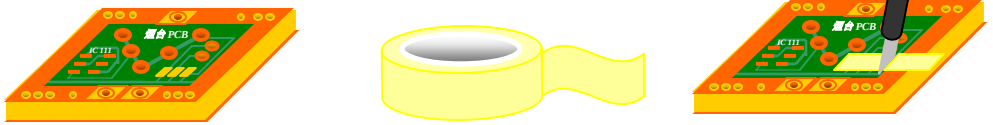
Hot Air Solder Level (HASL)

HASL Flow : 7-2-1 Tape Mask ➡ 7-2-2 Tape Press ➡ 7-2-3 Pre-Treat ➡ 7-2-4 HASL ➡ 7-2-5 Post Treat ➡ 7-2-6 Tape Remove ➡ 7-2-7 Hole Count

7-2-1 Tape Mask

Mask areas that should not be coated with HASL

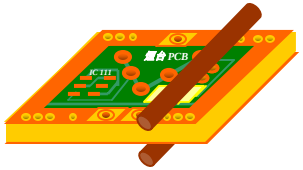
Before ⇨ Apply tape manually



7-2-2 Tape pressure

Increase temperature and pressure to make the tape adhere to the gold surface。

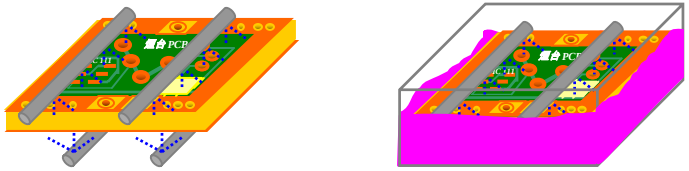
Press tape to board surface



7-2-3 Pre-treat

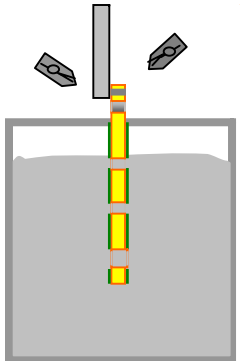
HASL pre-treat:
1.Clean copper surface
2.Flux coating

micro-etch spray ⇨ Flux coating & dip



7-2-4 HASL

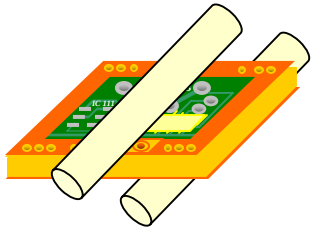
Hot Air knives blow excess solder from board surface



HASL process (continued)

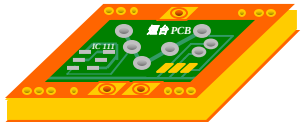
7-2-5 Post Treat

Post treatment cleaning line brushes debris from the board surface



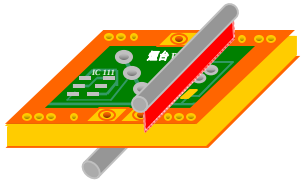
7-2-6 Tape Removal

Solder board surface after removing tape



7-2-7 Hole Count

Hole Counter :
Uses light to perform automatic checking for correct hole count, will detect missed drilling and plugged holes



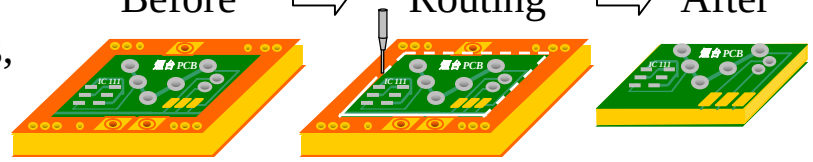
Routing Process

F/M Flow : 7-3-1 Routing ➡ 7-3-2 V-cut ➡ 7-3-3 Beveling ➡ 7-3-4 Water Rinse

7-3-1 Routing

Route away the outer frame and board edge of the panels, and route slots if needed

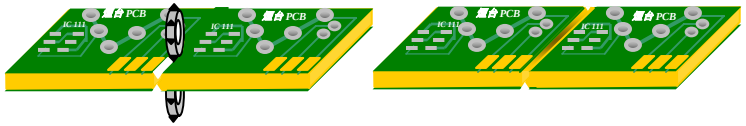
Before ⇨ Routing ⇨ After



7-3-2 V-Cut

V-Groove : cutter creates grooves for easier de-panelization after assembly.

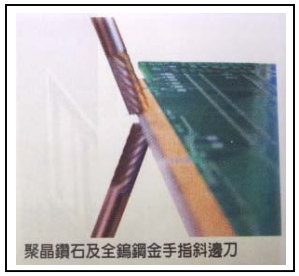
V-cutting ⇨ after V-cut



7-3-3 Beveling

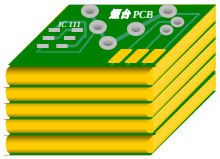
Bevel: To aid gold finger insertion into socket, board edge is bevelled to 30~45 degree angle

Beveling ⇨ edge after beveling



7-3-4 Water Rinse

High pressure water rinse and brushes remove dust. Board are then stacked



Electrical Test & FQC

ET Flow : 8-1 Electrical Test ➡ 8-2 Repair

8-1 Electrical Test

Test Fixture is developed using customer data, and will make sure finished board matches design. Test program will identify opens and shorts

Board loaded into fixture

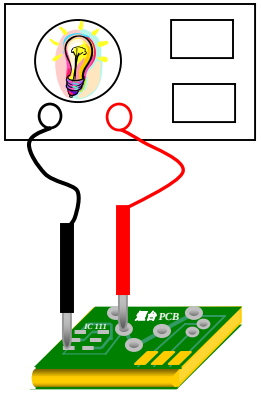
⇨

Fixture engaged

8-2 Repair

Boards that didn't pass test are evaluated by the repair operator to determine whether the fault is "real" or "false", to avoid waste and cost caused by wrong judgment.

Repair work



Final Finish (OSP and ImAg)

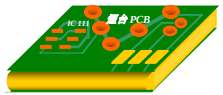
FQC Flow : 8-3 Entek ➡ 8-4 Immersion Silver

8-3 Entek

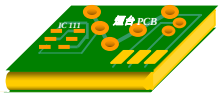
Entek OSP:

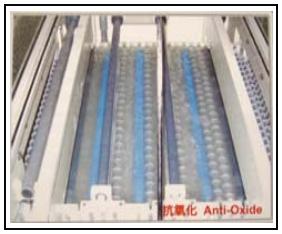
Liquid bath of organic chemicals to protects copper from oxidation to preserve solderability

Before Entek



After Entek





Entek Flow：

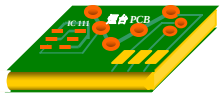
Acid degrease→Micro-etch→Acid water rinse→Entek major bath→Blowing→Pure water rinse→Blowing

8-4 Immersion Silver

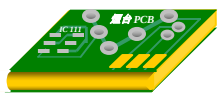
Immersion Silver:

Apply a layer of organic silver on the copper surface to prevent oxidation and preserve solderability

Before ImAg



After ImAg



Immersion Silver Flow ：

Acid degrease→Micro-etch→Pre-dip→Immersion Silver Bath→Hot water rinse→Blowing