

PCB SURFACE FINISHES

A QUICK REFERENCE GUIDE

The surface finish protects the PCB Surface Copper until PCB assembly time making it the most consequential material decision made for the electronic assembly.

Each surface finish has its advantages and disadvantages, which influences:

- process yield
- amount of rework
- ability to test
- scrap rate
- field failure rate
- cost



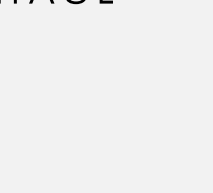
PCB finish is the major contributor to PCB issues

IMPORTANT CONSIDERATIONS FOR SELECTING A PCB FINISH

1. Use of fine pitch devices and leadless components
2. Solderability & SMT process
3. The length of time PCBs are expected to be stored
4. Reworkability
5. PCB cost
6. Solder joint integrity
7. Will the boards be in-circuit tested?
8. Environmental friendliness
9. High frequency loss
10. Aluminum wire bonding

1. SURFACE FLATNESS

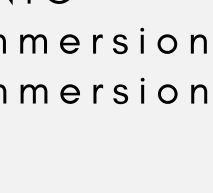
A flat surface which is critical for the assembly of fine pitch devices & leadless components.



- HASL



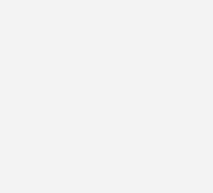
- OSP



- ENIG
- Immersion Ag
- immersion Sn

2. SOLDERABILITY

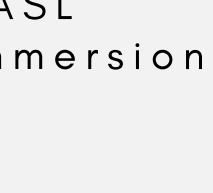
How does the PCB surface finish impact solder paste performance during the surface mount assembly process?



- HASL



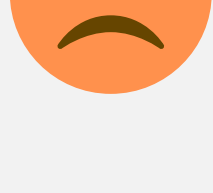
- ENIG
- Immersion Sn
- OSP



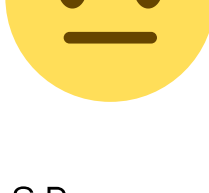
- HASL
- Immersion Ag

3. SHELF LIFE

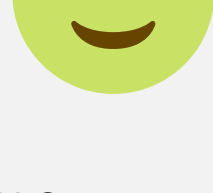
How well is the copper protected from oxidation during storage affects the PCB's performance & reliability.



- ENIG



- OSP
- Immersion Ag



- ENIG
- HASL
- Immersion Sn

4. REWORKABILITY

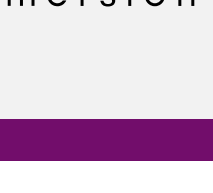
How compliant is the PCB finish to repair and rework? (desoldering and re-soldering)



- OSP



- Immersion Ag



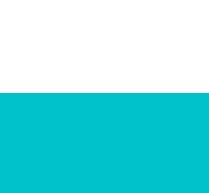
- HASL
- ENIG
- Immersion Ag

5. COST

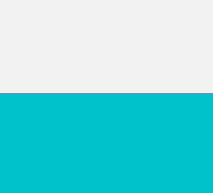
How does the choice of PCB finish affect the final cost of PCB fabrication?



- ENIG



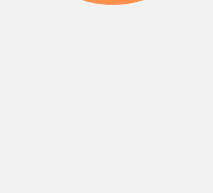
- Immersion Ag
- Immersion Sn



- HASL
- OSP

6. SOLDER JOINT INTEGRITY

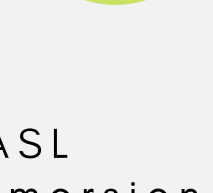
The surface finish can have a strengthening effect on solder joints, resulting in better reliability & performance



- HASL



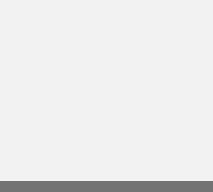
- ENIG
- Immersion Sn
- OSP



- HASL
- Immersion Ag

7. IN-CIRCUIT TEST COMPATIBILITY

Does the PCB finish leave soft solder domes on test points and un-masked vias that make them ideal for probing at ICT?



- OSP



- OSP



- ENIG
- HASL
- Immersion Ag
- immersion Sn

8. ENVIRONMENTAL FRIENDLINESS

Does the PCB finish contain an ingredient that is harmful to the environment or people?



- HASL



- ENIG
- HASL
- Immersion Ag
- immersion Sn



- OSP

9. HIGH-FREQUENCY LOSS

When surface finishes are applied to prevent traces from oxidation, the electrical properties of traces are affected. The net conductor loss that results from surface finishes is the dominant factor in signal degradation when the clock frequency is within the microwave frequency region. Conductive surface finishes have higher loss than the nonconductive surface finishes. (1)



- ENIG
- Hard Gold

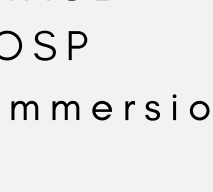


- HASL
- ENIG/SMOBC

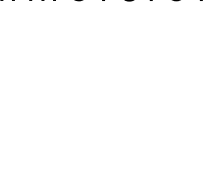


- OSP
- Immersion Ag

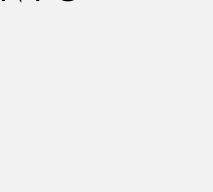
10. ALUMINUM WIRE BONDING



- HASL
- OSP
- Immersion Sn



- Immersion Ag



- ENIG

INDUSTRY SECTOR & PCB SURFACE FINISHES

Automotive

OSP, Silver, Immersion Tin

High-end Consumer Products

OSP, ENIG, Immersion Silver

Basic Consumer Electronics

OSP, Immersion Tin

Mil/Aerospace

HASL, Immersion Tin, ENIG, ENEPIG

Telecom

Immersion Silver, OSP, ENIG

Medical

ENIG, ENEPIG, Immersion Silver

(1) [Surface Finish Effects on High-Speed Signal Degradation](#)