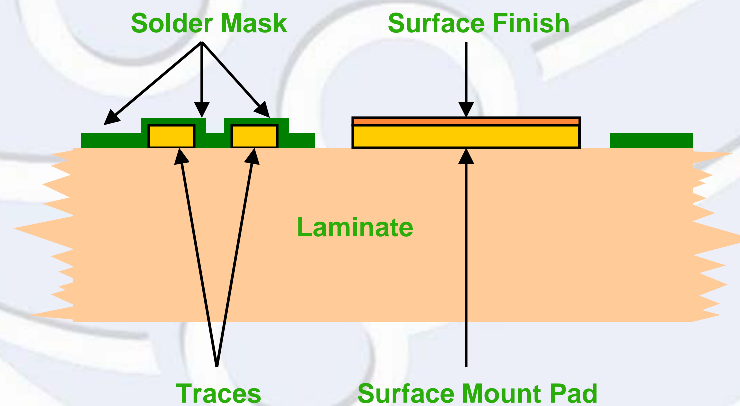
Surface Finishes Overview:

The PCB surface finish forms a critical interface between the component to be assembled and the bare printed circuit board.

The surface finish has two essential functions:

- To protect the exposed copper circuitry.
- To provide a solderable surface when assembling (soldering) the components to the board.

Most surface finishes are considered SMOBC (Solder Mask Over Bare Copper).



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Factors when choosing surface finish:

- Cost
- Reliability
- RoHS \ ELV \ WEEE
- Assembly method (Reflow, IR, Wave, etc…)
- Components used (BGA, QFP, DIP, SOIC, etc…)
- Durability
- Environment
- Shelf life
- Testability
- Productivity
- Failures (Black Pad, Tin Whiskers, etc…)

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Surface Finishes available from PCB Solutions:

- HASL
- Lead Free HASL
- Immersion Tin
- Immersion Silver
- OSP / Entek
- Gold
    - ENIG
    - Full Body Flash Gold
    - Hard Gold (Tabs)
    - Hard Gold (Selective)
    - Wire Bondable Gold

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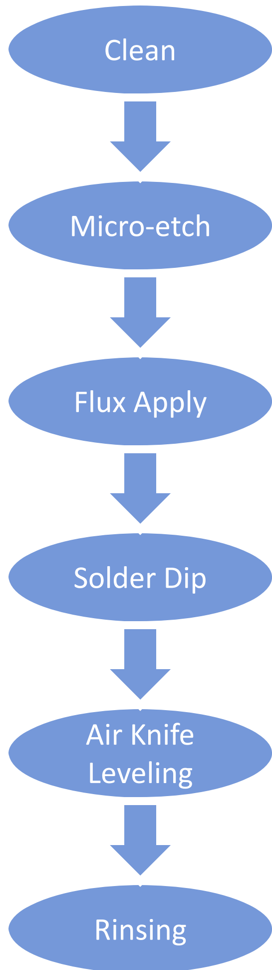
Typical Process Flow:



HASL / Lead Free HASL

Typical thickness: 70 micro inch – 200 micro inch.
IPC spec calls for only complete coverage of copper pads.

Advantages:
- Low cost
- Widely available
- Re-workable

Disadvantages:
- Uneven surfaces
- Not good for fine pitch
- Pb (With non-lead free HASL)
- Thermal shock
- Solder Bridging
- Plugged or reduced PTH's

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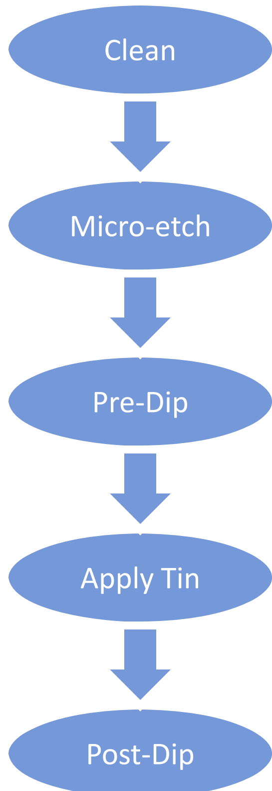
Typical Process Flow:



Immersion Tin

Typical thickness: 20 micro inch – 50 micro inch.

Advantages:
- Flat surface
- No Pb
- Will not tarnish
- Re-workable

Disadvantages:
- Easy to cause handling damage
- Process uses a carcinogen (Thiourea)
- Exposed tin on final assembly can corrode
- Tin Whiskers
- Not good for multiple reflow/assembly processes
- Difficult to measure thickness

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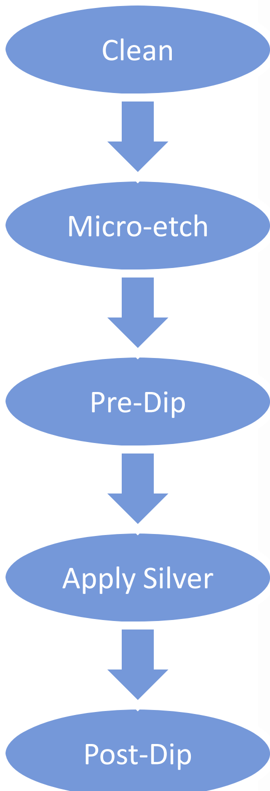

Immersion Silver

Typical thickness: 4 micro inch – 12 micro inch

Advantages:
- Flat surface
- Simple process
- No Pb
- Re-workable
- Easy to measure

Disadvantages:
- Handling sensitive
- Exposed silver on final assembly may corrode
- Tarnishing

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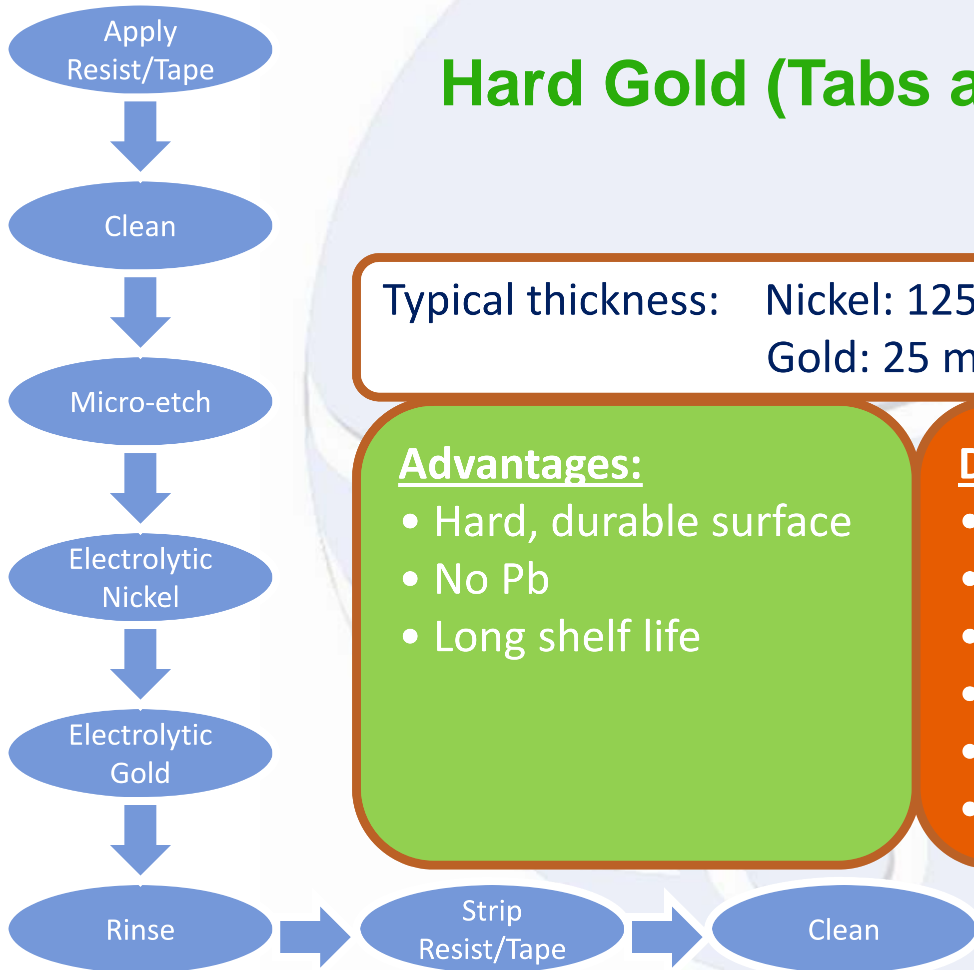
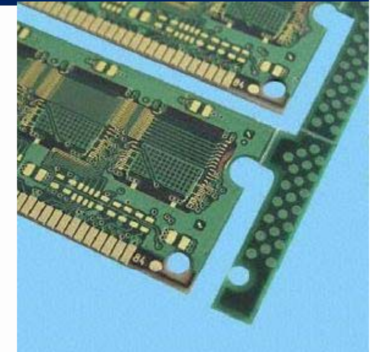


Typical Process Flow:

Apply Resist/Tape → Clean → Micro-etch → Electrolytic Nickel → Electrolytic Gold → Rinse → Strip Resist/Tape → Clean

Hard Gold (Tabs and Selective)



Typical thickness: Nickel: 125 micro inch – 150 micro inch
Gold: 25 micro inch – 40 micro inch

Advantages:

- Hard, durable surface
- No Pb
- Long shelf life

Disadvantages:

- Very Expensive
- Extra processing / Labor intensive
- Use of resist/tape
- Plating/bus bars
- Demarcation
- Difficulty with other surface finishes

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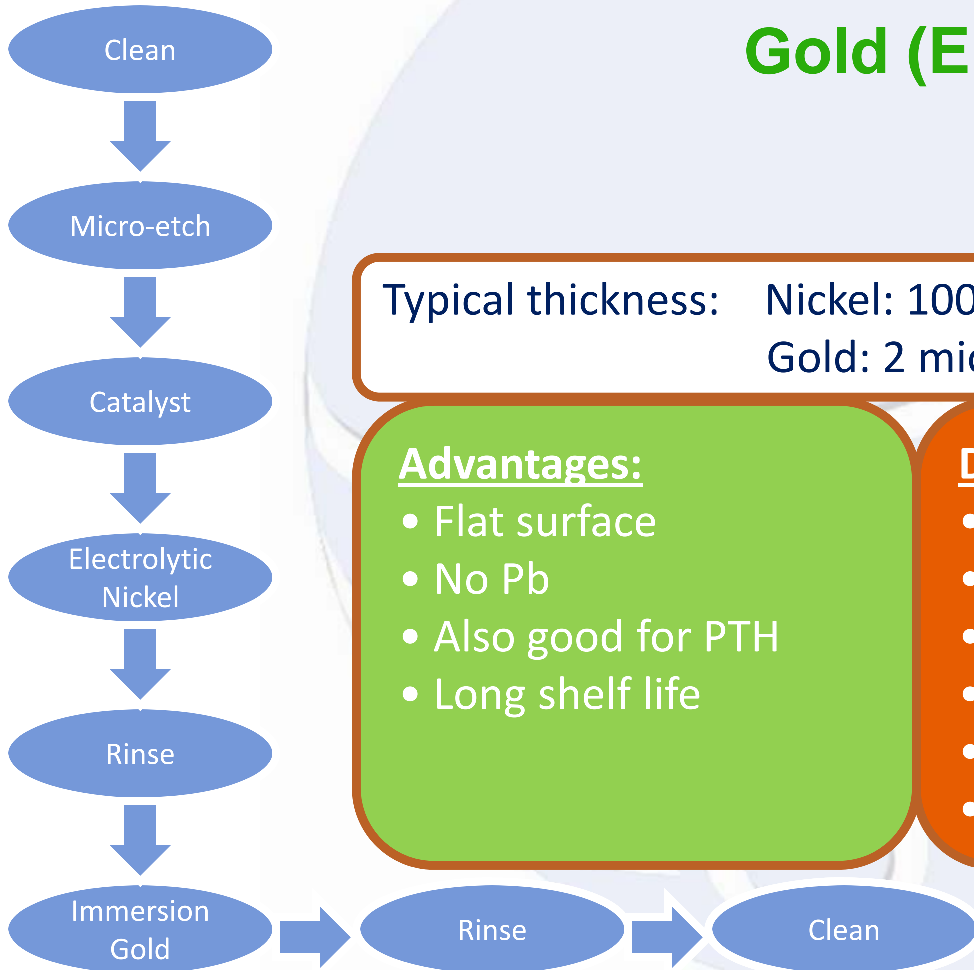
Typical Process Flow:



Gold (ENIG)

Typical thickness: Nickel: 100 micro inch – 200 micro inch
Gold: 2 micro inch – 4 micro inch

Advantages:
- Flat surface
- No Pb
- Also good for PTH
- Long shelf life

Disadvantages:
- Expensive
- Not re-workable
- Black Pad/ Black Nickel
- Damage from ET
- Signal loss (RF)
- Complicated process

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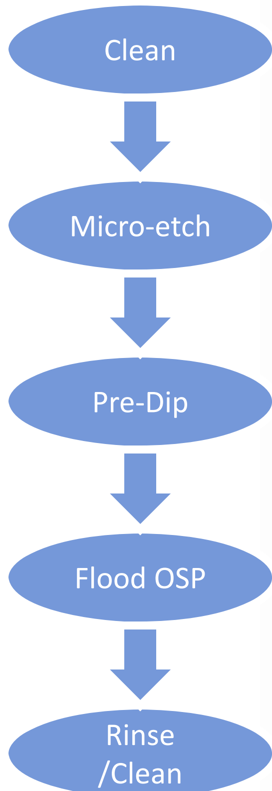
Typical Process Flow:



OSP/Entek

Typical thickness: 4 micro inch – 24 micro inch. Not usually specified.

Advantages:
- Flat surface
- No Pb
- Simple process
- Re-workable

Disadvantages:
- No way to measure thickness
- Not good for PTH
- Very short shelf life
- Can cause ICT issues
- Exposed Cu on final assembly
- Handling sensitive

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Summary:

	Cost	RoHS
HASL	$	No
Lead Free HASL	$	Yes
Immersion Tin	$	Yes
Immersion Silver	$$	Yes
OSP/Entek	$$	Yes
Immersion Gold	$$$	Yes
Hard (Tab/Selective) Gold	$$$$	Yes

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