



RoHS –COMPLIANT (LEAD-FREE) PCB FINISH RECOMMENDATIONS

Electroless Nickel with Immersion Gold (ENIG) is recommended by Servatron for RoHS-Compliant PCB finish for most applications. Immersion silver (ImAg) is second choice, then Organic Solderability Protectant (OSP); both of these present additional challenges and constraints for PCA assembly and testing processes. Hot Air Leveled solder (HAL) that uses a lead-free alloy is another possibility. Immersion tin (ImSn) is not recommended.

Electroless Nickel with Immersion Gold (ENIG) is well-established and widely available. The nickel plating layer reinforces the barrels of plated through holes, which reduces risk of failures due to Z-axis expansion stresses at the higher Pb-Free processing temperatures; this is especially important for thicker than normal boards, and for high reliability applications. The nickel layer also allows more successful rework, when necessary. Intermetallic formations and joint microstructures are well known, and generally are sound mechanically. (Vendors claim that processing improvements have mostly eliminated the occasional brittle fracture of BGA joints at the nickel layer (e.g. “black pad”). Adding an immersion palladium (Pd) layer between the nickel and gold is said to reduce brittle Ni-Sn failures, but adds more complexity and cost to an already complex process.) ENIG finish withstands multiple soldering and cleaning processes without degradation. Shelf life and board handling for ENIG is very good; only ENIG is comparable to HAL. The immersion gold is a self-passivating process, so the gold deposit is inherently less than 10 micro inches thick; this is not enough to cause gold embrittlement in solder joints. (By comparison, electroplated gold can be 100-200 micro inches, or even more; solder joints can exceed 3 % gold (by weight) and be brittle, especially if the component leads are also gold plated.) ENIG also provides very good planarity for fine pitch and microBGA component attach. Gold surface is ideal for good electrical test probe contact, and contact to RF/EMI shields. The added electrical resistance due to the nickel layer may require consideration for designing sensitive RF circuits.

Immersion silver (ImAg) is good for planarity, solderability, good intermetallics, multiple process steps, electrical testing, press-fit connectors. RF/EMI shield contact, etc. Applications that may not want ENIG should consider ImAg. However, it is not yet as widely available as ENIG. Shelf life is more limited than ENIG.

Organic Solderability Protectant (or Preservative) (OSP) is widely available, has good planarity, and may be the cheapest finish. It is hard to see the presence or quality of OSP

finish (looks like bare copper). Shelf life is limited, special handling restrictions are needed, and OSP does not survive multiple heat and process cycles as well as other finishes. OSP is harder for solder to wet, though joints are strong if made under good conditions. Since OSP is an electrical insulator, special measures must be taken for testing, and for RF/EMI shield contacts, etc. OSP gives worst looking overall PCAs.