

Re: American PCB fabs defaulting to lead-free

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- *From:* Joerg <notthisjoergsch@xxxxxxxxxxxxxxxxxxxxxxxx>
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Jeff L wrote:

"Joerg" <notthisjoergsch@xxxxxxxxxxxxxxxxxxxxxxxx> wrote in message [news:aoP%h.1857\\$zj3.633@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:aoP%h.1857$zj3.633@xxxxxxxxxxxxxxxxxxxxxxxx)

Almost got a black eye here on a prototype. Ordered a bunch of large boards at Advanced Circuits and it turns out that the free upgrade to lead-free finish is actually a default that cannot easily be changed. IOW you can normally not decline this "upgrade". However, they were very understanding that we really didn't want lead-free and will now do our protos as production runs. No idea why we go RoHS here in the US now (this is a company that actually produces in the US).

Anyhow, just wanted to let you guys know about that before a nasty surprise happens to you.

No surprises – assuming HASL, they work fine using normal leaded solder. This includes soldering with irons, wave and reflow methods. It does not change the process hardly at all. The leaded solder just dissolves it, creating a slightly non eutectic solder (closer to 60/40). It's the same with tin plated parts which have been used for quite a few years, other than lead free BGA's. The downside is you have a possibility of tin whiskers forming in areas that have not been wetted with the leaded solder. The tin whisker risk is somewhat dependant on the alloy used for the HASL. Tin dendrites are from currents forming in moisture and can be avoided. White tin is really bad, as it compresses the surface during plating and causes rapid tin whisker growth. We've done many thousands of boards with lead free HASL without much issue.

Gold plating (ENIG) is bad, as it is a flash of electroless gold deposits a few atoms thick, over nickel which is plated over the copper traces. The gold is sometimes hard to wet (BGA's for one – they are so bad we pre tin the pads). The intention of the process is when applying solder it dissolves the gold, thus wetting the normally difficult to wet nickel. You now have a

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solder joint with a little gold in it, which if in high enough concentration causes the solder to go brittle. The nickel to solder intermetallic layer is poor and is prone to cracking (a well known repair problem in the repair industry). I think the copper to nickel bond is ok, but I never really looked into it in much detail. Other problems that can arise is weird thermocouples from all of the dissimilar junctions. This would have been a potential problem with some research I did awhile back where were measuring temperature from a thermocouple with a resolution of around 1/1000 of a deg C. The thermocouple was so sensitive you could peg the graph by breathing heavy several feet away!

Thanks for sharing your experience, Jeff. Maybe HASL would then be an option for us, as long as we wet everything. The latter could be a problem in thru-hole areas such as DIN connectors.

ENIG looked a bit scary to me from the beginning so I politely declined when they offered. The nickel-copper is generally good though for mechanical stuff, I have used that a lot for shield mounts and the like in order to avoid dissimilar metals touching (nickel plating the shield studs a well).

Thermocouples would spell disaster for this circuit as it relies on microvolt level DC paths to be stable.

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Regards, Joerg

<http://www.analogconsultants.com>

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