



2nd generation lead free solder pastes

Comparative evaluation of 12 variants of tin-silver-
copper type solder paste products

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Annex 1 Manufacturer references

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Summary

This report outlines the results from comparative testing of 12 variants of tin-silver-copper type lead free solder paste products. The work is done in collaboration between Bang & Olufsen A/S and DELTA and involves design of test board, production scale screen printing and paste reflow, qualification testing and technology studies. Tested solder paste products are selected and provided by the local paste suppliers, CYNCRONA A/S, Teleinstrument A/S, Venso Elektronik AB, Ketec A/S, Interflux DK, PC-Trading A/S, Boliden A/S, HIN Horsens A/S, Inimar K/F, KOKI A/S and Tamura Kaken UK.

Single-sided FR4 glass-epoxy type test boards are supplied in two different board finishes:

- OSP
- Immersion gold

and the paste product properties have been evaluated by SEM examination, slump, hot slump, printability, reflow and SIR testing.

In general, the results show a relatively big difference in the hot slump performance, as only 2 solder paste products exhibit perfect performance. 5 solder pastes are found to have somehow acceptable performance, however, the remaining products and in addition the reference tin-lead pastes are found to suffer from serious slump bridging and paste lay down flow-out.

By printing and reflow on OSP all of the tested pastes are found to have a wetting ratio of approx. 1.0, showing that the pastes only wets where it is printed. In contrast to this the wetting ratio on immersion gold, is found to vary from 1.1 to 1.7, showing a relatively good wetting ability of some pastes and major difference between the solder pastes tested.

The ability to recover from overprinting is found to be perfect for all of the pastes tested and similar to what is seen for the reference tin-lead paste. Solder ball formation on non-wetting epoxy laminate is also found to be perfect for all of the pastes, indicating a consistent paste reflow without solder splash/balling.

SIR testing confirmed perfect insulation resistance $>10 \times 10^4 \text{ M}\Omega$ for 5 of the tested pastes, and 7 pastes are found to have acceptable insulation resistance according to the IPC-TM-650 specification in the range of $1 \times 10^2 - 1 \times 10^4 \text{ M}\Omega$.

For various technical reasons one manufacturer has requested not to disclose the results and in this respect it was agreed upon to remove all specific test results of this solder paste test variant. Please see *annex 2: Manufacturers' comments*.