



SANMINA-SCI®

PROLIFERATION OF LOW SILVER (Ag) LEAD-FREE SOLDERING ALLOYS ON BGA COMPONENTS AND THEIR IMPACT ON MANUFACTURING

SUMMARY

To enhance the ability of lead-free solder joints to resist failures induced by mechanical shock and drop, BGA component suppliers have introduced low silver (Ag) containing lead-free solders, such as Sn/1.0Ag/0.5Cu, commonly called SAC105 replacing the widely accepted SAC305 (Sn/3.0Ag/0.5Cu). Even though this conversion was initially targeted for hand-held and mobile products, it will no doubt proliferate to other products affecting the lead-free BGA components supply chain. This change in the alloy composition of lead-free BGA balls introduces a new metallurgical behavior in the solder joints that adversely affect both Sanmina-SCI manufacturing processes and product reliability.

IMPACT ANALYSIS

- Most of the lead-free solder pastes currently in use in Sanmina-SCI plants have relatively higher silver content ranging from 3.0 to 4.0 inclusive. The melting temperature range for the high silver alloys is 217°C - 221°C while the melting temperature range for the new low silver content alloys is 217°C - 228°C. This has a significant impact on Sanmina-SCI's soldering time-temperature profile. In addition to the potential solder joint defect, the reliability of the solder joint will be questionable at best when, say SAC305 paste is mixed with SAC105.
- Due to the change in soldering time-temperature profile, the JSTD-020, Moisture Sensitivity Level (MSL) standards that Sanmina-SCI currently uses may be adversely affected. The introduction of the low silver BGA balls will require a different peak temperature and dwell at peak.
- Standard rework and touch-up processes will also be affected with the change in lead-free solder composition.
- In plants where mixed alloy soldering (lead bearing solder paste and lead-free BGA ball) is taking place with the approval of the customer, the process will be adversely affected due to the introduction of new and unknown metallurgical reactions.
- Because of unavailability of sufficient data, Sanmina-SCI cannot guarantee the long term reliability of solder joints formed by mixing SAC305 solder paste and low silver lead-free solders, such as SAC105.



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REQUIREMENTS

Currently, several suppliers are providing BGA's with low silver content balls. Considering the adverse impact this change has on Sanmina-SCI's manufacturing operations and the potential risk of solder joint reliability, Sanmina-SCI asks its BGA suppliers to comply with the following:

1. In accordance with Supplier Quality Requirements for Purchased Materials or Service ([QAR-0001-C](#)) and the JESD46-B, all changes from existing parts to lead-free/RoHS compliance shall be documented by a PCN issued by the manufacturer. Any component changes related to lead-free/RoHS compliance should be considered major changes. Any change in solder metallurgy is critical and must be considered as a change to form, fit and function. Some examples of changes include but not limited to changes from tin-lead (Sn63/Pb37) to SAC 305/405 (Sn/3-4%Ag/0.5Cu) and from SAC 305/405 (Sn/3-4%Ag/0.5Cu) to SAC (Sn/0.0-<3%Ag/0.5Cu). These changes impact the lead-free manufacturing processes and as a result Sanmina-SCI requires such changes be associated with a change in manufacturing part number.
2. Sanmina-SCI requires the supplier to announce or publish any product discontinuances of existing parts in accordance with [QAR-0001-C](#) and the JESD48-A standards and procedures.
3. Suppliers should periodically provide RoHS compliant product roadmap to Sanmina-SCI indicating the planned changes and implementation timetable. Availability and life cycle information for both current and future lead-free/RoHS compliant products should be specified. This includes any changes from existing to future lead-free solutions. Some examples of changes include but not limited to changes from tin-lead (Sn63/Pb37) to SAC 305/405 (Sn/3-4%Ag/0.5Cu) and from SAC 305/405 (Sn/3-4%Ag/0.5Cu) to SAC (Sn/0.0-<3%Ag/0.5Cu).
4. Sanmina-SCI requires BGA suppliers to provide sample devices and qualification data pertinent to the changes prior to the release of the PCN or introduction of the new product. Qualification data should include compatibility data with existing solutions, i.e., SAC 305 solder paste and SAC 105 solder balls.



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5. Sanmina-SCI requires the component datasheets to clearly indicate the solder composition of the ball or lead termination, maximum component temperature rating, recommended & absolute reflow profile limits, and the moisture sensitivity rating. If this information is not present on the datasheet, there should be a clear reference as to where it can be found.

6. Sanmina-SCI requires that components have the outer packaging boxes and inner package material (tray, tube, and reel) marked with some traceable information indicating that the components are lead-free/RoHS compliant. This marking should also appear on the component package where there is room for such a marking.

For additional information please contact the following...

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