EMSF

EMS Forum
on Lead-Free PCB Assembly

Guidelines for Suppliers Transitioning to RoHS Compliant Ball Grid Array (BGA) Packages with Low-Ag SAC Alloys

Rev. 1.0
(April 2007)

Background

- In order to improve the resistance to failures under mechanical shock, some component suppliers are choosing to provide BGAs with SnAgCu (SAC) balls containing lower silver (Ag) content (<3wt%Ag). This change in metallurgy can impact assembly process and long term reliability.

Process Impact

- *Melting Range Increase:* The melting range of low-Ag SAC alloys (217-228°C) is higher than that of the SAC 305/405 alloys (217-221°C). Accordingly, the reflow profile may need to be reassessed.
- *Alloy Selection:* The selection of solder alloys is inconsistent across multiple BGA manufacturers. This may require additional work by BGA manufactures as well as users to study the impact prior to any change.
- *MSL Rating Impact:* Potential impact on JSTD-020 qualification temperature may need to be reviewed as the process reflow peak temperature may increase.
- *Mixed Alloy Soldering:* This change also impacts mixed alloy soldering solutions. If a customer is required to use a lead-free BGA in a tin-lead process, significant effort is necessary in order to determine the optimum reflow solution. A change from SAC 305/405 alloys to low-Ag solder alloys for the BGA balls will require a thorough re-evaluation of mixed alloy soldering process solutions**. BGAs with SAC alloy variations are not considered backward compatible.**

Reliability Impact

- Limited or no data on long term reliability are currently available for partially or fully mixed SAC 305 solder paste and low-Ag content BGA ball alloy.

Logistics

- As per JESD46-B, all changes from existing parts to lead-free/RoHS compliance should be documented by a PCN issued by the manufacturer. Any component changes related to lead-free/RoHS compliance should be considered major changes. The EMS Forum considers a change in solder metallurgy as a change to form, fit and function. Some examples of changes could be 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 may impact the lead-free manufacturing processes by requiring a variety of reflow temperatures, which in turn may impact other components. **The EMS forum requires that such changes be associated with a change in manufacturing part number.**
- Any product discontinuances of existing parts should be published to the customers as per the standard JESD48-A.
- All manufacturers who provide notification that they will be producing lead-free/RoHS compliant products should provide a product roadmap to their customers indicating the planned changes and implementation timetable. Availability and life cycle information for both current and lead-free/RoHS compliant products should be specified. This requirement includes any changes from existing to future lead-free solutions. Some examples of changes could be 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).

- Sample devices and qualification data should be available to customers 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.

Part Identification

- All components should have the outer packaging boxes and inner package material (tray, tube, reel) marked with some form of 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.
- All lead-free/RoHS compliant components should have new supplier P/N's assigned. Suffix or prefix additions to existing P/N structures are acceptable.
- **Device datasheets should clearly indicate the solder composition, 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 located.
- We encourage industry associations and consortia to come up with globally accepted labels or marking for easy identification of lead-free/RoHS compliant products. At this time, we endorse JEDEC JESD97 "Marking, Symbols, and Labels for Identification of Lead (Pb) Free Assemblies, Components, and Devices" (May 2004).

Contacts

Celestica:	Kevin Weston	(kweston@celestica.com)
Flextronics:	Bill Ricci	(bill.j.ricci@flextronics.com)
Jabil:	Courtney Ryan	(courtney_ryan@jabil.com)
Plexus:	Denis Jean	(Denis.Jean@plexus.com)
Sanmina-SCI:	Mulugeta Abtew	(mulugeta.abtew@sanmina-sci.com)

EMSF Steering Committee

Celestica:	Kevin Weston	Thilo Sack
Flextronics:	Dongkai Shangguan	Sammy Yi
Jabil:	Girish Wable	Tom Cipielewski
Plexus:	Bill Barthel	Denis Jean
Sanmina-SCI:	Robert Kinyanjui	Mulugeta Abtew

Dr. Dongkai Shangguan, Coordinator

Celestica * Flextronics * Jabil * Plexus * Sanmina-SCI