Business Electronics Soldering Technologies

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Lead-Free BGA Rework-Transition Issues

Determining which assemblies are lead free and which are tin lead

Visual Differentiation

While experienced inspectors may be able to determine the aesthetic differences between a lead-free PCB assembly and a tin-lead version, one cannot rely on the "experienced eye". "Less wetting out to the pad edges" (Figure A) and "graininess and lack of shininess of the solder joint" (Figure B) are typical comments about some lead-free solder joints. However, in cases where a Nitrogen atmosphere was present during the reflow of the solder joint (Figure C), there will be little visual differences between the lead free alloys and their tin-lead counterparts.

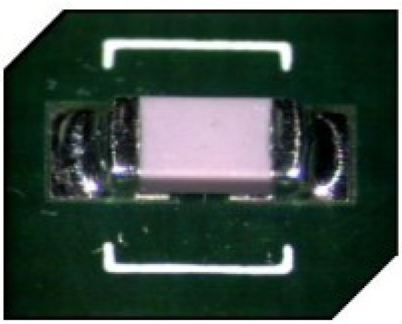

Figure A- Example of less wetting out to the pad edges on a lead free device

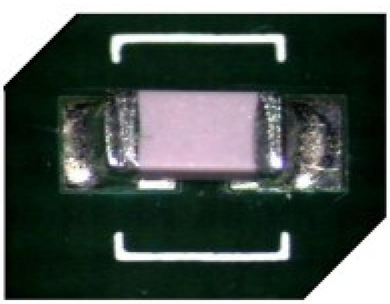

Figure B- Example of grainy and dull surface finish of lead free BGA solder ball

Figure C- Example of solder ball where Nitrogen was used in the reflow

Analytical testing

There are several levels of testing that can be performed in order to confirm the presence of any of the RoHS banned substances to confirm the make up of the alloy of the BGA solder spheres. The lowest level of testing involves the use of lead testing kits. These test kits use a simple swab on chemical in order to detect the presence of elemental lead. A chemical reagent, which changes color in the presence of lead, is swabbed onto the BGA balls to determine the presence of lead (Figure D). Shortcomings of this method includes false readings as test swabs can become contaminated and the shelf life of the reagent. XRF testing (IEC 62321) is a solid, non-destructive analytical approach to screening components for the presence of lead, cadmium and mercury. It also detects elemental bromine and chromium but will not be able to identify these compounds if they are in the molecular form such as PBB or PBDE or the valent state of chromium. The XRF handheld units (Figure E) can measure solder ball area but not sub-millimeter solder bumps. These units will measure all elements in their field of view. A solder joint on a PCB will have take an average reading of these elements of the solder joint AND the PCB material. So there is an "averaging effect" which is dependant on the field of view. There are also some benchtop designs of XRF tools which provide smaller analysis areas. Many of these systems have X-Y stage automation and mapping software which the XRF user can then use to map the location of restricted metals on a device. These more sophisticated systems do however come with a higher price tag.

Figure D- Swab on style reagent uses color to tell the user about the presence of lead

Figure E- Handheld XRF tester provides good level of "first defense" in RoHS compliance and due diligence

Marking of Boards and Parts

There are several industry guidelines which have been adopted by a portion of the part vendors with respect to the marking of lead free components, boards and assemblies. In May of 2004 JEDEC and the EIA adopted the JESD97 standard (http://www.jedec.org/download/search/jesd97.pdf) which defines the marking and labeling of lead-free components and assemblies. Similarly the IPC has released the IPC-1066 defining the marking of same (http://www.ipc.org/TOC/IPC-1066.pdf). Both of these standards provide specific labeling formats for PCB assemblies, components and devices. In general these guidelines define the marking on a PCB assembly (Figure F) to:

1. Be on the topside of the board, lower right hand segment

2. Contain information on the type of lead free alloy

3. Contain the maximum safe processing temperature

Figure F- Typical lead free component labeling scheme

Some vendors, though not all, have adopted a unique part numbering scheme for their lead free parts