

MELEXIS LEAD FREE Statement

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Introduction

Faced with regulatory pressures and increasing consumer awareness of environmental issues, Melexis customers are requiring more and more lead free package alternatives for their products. Lead (Pb) content in the packages is limited to the terminal plating, and it is already very low indeed. For a JEDEC SO20 package for instance, the lead content in the package is only about 1 mg or 0.2%. Depending on the total weight of the customer's product, this may be low enough to be accepted as lead free (e.g. <1000 ppm) .

More important, because of higher lead consumption, is the soldering material used in the board assembly of the components. Lead free components will only really make sense if subsequently board-assembled using Pb-free solders. Since such solders typically melt about 30°C higher than the eutectic tin-lead (SnPb) composition, the lead free soldering process degrades or may degrade the package in JEDEC moisture sensitivity level, and potentially has an adverse impact on short term (failures after soldering) and long term (failures after temperature stress in the field) reliability.

The lead free movement is linked with the so called « green » packaging issue, of which it is an integral part. In the green packaging, the endeavour is to remove all toxic substances from the package, and this includes notably the bromine-antimony complexes now universally applied as additives to the mold compound, in order to guarantee the required fire retardancy.

A package is considered to be green if the content of the following substances is:

Pb	< 1000ppm
Cl+Br	< 900ppm
Sb ₂ O ₃	< 900ppm.

Lead free material options

For packages with terminals (the term « leaded » packages will be obviated here, to avoid confusion), the prime choice for plating is pure matte tin (low organics content). The traditional concern is whisker growth during storage. Given current day control over the plating process, major subcontractors claim, backed by long term testing, that this problem has been eliminated.

Nevertheless, some companies still prefer the addition of bismuth to the tin, to substitute for lead in its role of whisker prevention. The concern here is bringing Bi into the solder bath which creates BiPb phases with decreased melting point (96°C) which is a reliability risk for the solder joints.

A third way is offered by the NiPd (nickel-palladium) preplated leadframes. These come at a cost, and availability is scarcer. Solderability might be poorer also. We do not recommend them.

For ball grid arrays, a variety of lead free alloys is being evaluated, since here the reliability of board connections is an important additional issue. The trend is tin-silver-copper.

Flip chip solder balls, inside « flip chip in package » components, require higher reflow temperatures. The materials and processes used are of no direct relevance to the buyer of the component, as long as one is assured by the vendor that they are lead free.

Upon firm request from a customer, and for each specific package, Melexis will propose a lead free plating based on:

- availability at (one of) our approved assembly subcontractor
- reliability assessment based on available data at the assembly subcontractor
- in house qualification if deemed necessary

The last step is at considerable cost and delay. It has to be agreed between the customer and Melexis. Generic data will be available during 2005 (please contact our reliability lab and see our roadmap below).

Use conditions

In the transition period towards fully lead free, three possible lead free or quasi lead free options can be envisaged. They are shown, together with their implications, in the table below.

Component	Soldering process	Implications/issues
Lead free (MLX preference: pure tin)	Conventional (Sn63Pb37)	Solderability, whiskering
Conventional	Lead free (Melexis uses Sn95.5Ag3.8Cu0.7)	JEDEC Moisture Sensitivity Level degradation, Long term reliability – may require change of material set (mold compound, die attach glue..), depending on actual soldering temperature profile
Lead free	Lead free	Solderability, whiskering , JEDEC Moisture Sensitivity Level degradation, Long term reliability – may require change of material set (mold compound, die attach glue..), depending on actual soldering temperature profile

MELEXIS POLICY:

We do not see major quality issues to deliver lead free terminals in pure tin on our components if the subsequent soldering process is still conventional. Obviously, it does not make much sense to remove lead from the terminal plating and still use it in higher amounts in the solder, but the case may occur.

Once the customer is considering lead free soldering, we will need to be informed about the exact temperature profile.

As long as the peak is limited to 245°C, no major reliability risks are expected, but all devices must be re-classified in Moisture Sensitivity Level (MSL) according to new issue of standard JEDEC-STD 020C (issue July 2004).

In case of peak soldering temperatures in the range of 260°C, long term reliability is definitely in jeopardy if conventional material sets are used. A major package development will be required. Most likely, this will go in the direction of green package materials. Especially for automotive grade components, a lengthy qualification procedure must be anticipated prior to high volume deliveries.

MELEXIS ROADMAP:

- 1) Melexis will use pure tin as Pb free plating for all new projects in the future.
- 2) Melexis will qualify their package families for lead free soldering processes according to JEDEC-STD020 and Melexis "Qualification and Conformance Procedure 3419013".
- 3) Following lead free generic qualifications are running based on the requirements of our customers:

Package Family	Planned end qualification
SOIC NB	Q2 2005
SOIC WB	Q2 2005
SSOP 209mil	Beg Q2 2005
QSOP 300mil	Q1 2006

Based on customer inputs, we are planning to qualify additional packages like MLP, PLCC or BGA. Please contact your sales representative to have more information concerning the status of these types of packages.

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