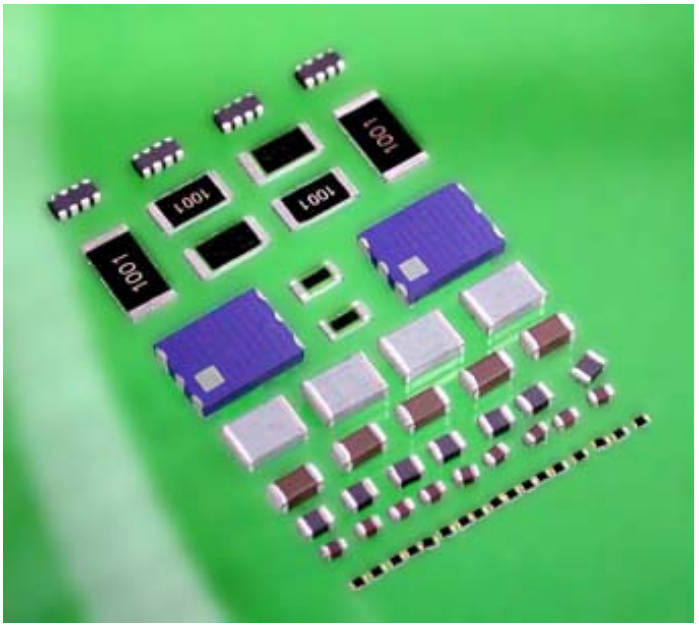
New Product Information

Lead Free MLCC, Chip-R, MLCI



SMA Application Guideline

Background

Pb free solder material was started in 1995. A composition of (Sn-4Bi-2Ag-0.5Cu-0.1Ge) was announced in July 1998, though, since later it was found that for 42 alloy (most popular material fore lead frame), wetting and joint strength was insufficient and further "Life-off" problem was newly found, the composition was reviewed and resulted in the present composition. According to the test data shown in that meeting, major components (QFP, Chip-R, MLCC) were tested and significant difference in mechanical strength was not found compared with Sn/Pb solder. Some of Japanese electronic equipment providers may think technical problems were to some extent cleared. However, since the data was just experimental and looked at only one aspect, different reliability problems might come up from each device manufacturer. The company also mentioned the solution as "latest" and "maybe not final".

Concretely technical standards for some test items were given by Sony. The standards are to test wetting and robustness of electrical components quantitatively. For some tests, use of special test equipment is required, however some of them can be replaced by other methods that require none of special equipment. Particularly for wetting test, "self-alignment method" can be used, because self-alignment effect seen in reflow soldering process depends large part on wetting.

Sn/Pb Phase Diagram *(Engineering version)*

An alloy cannot necessarily be soldered at its melting point. At or slightly above its melting temperature the alloy is still sluggish, does not flow very easily, and seems to have restraint in its wetting characteristics.

A good rule of thumb to use a range of approximately by 33~90℃ above the melting point for soldering operation, this range is suitable for most alloys.

For 63/37 solder alloy, recommended alloy temperature during wetting around 245~275 °C.

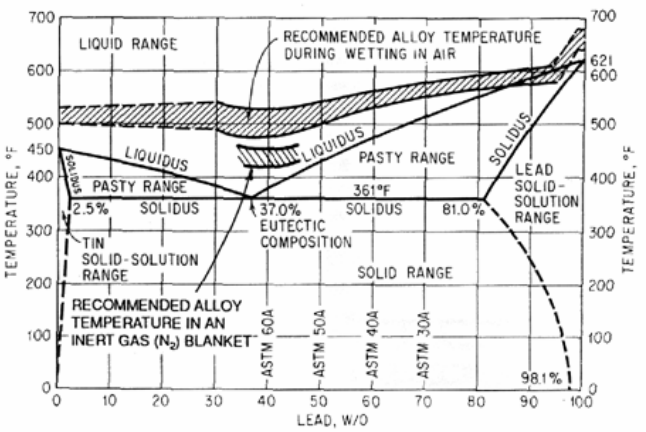


Figure 1. Sn/Pb Phase Diagram (Ref. "Solders and Soldering 3rd edition", Howard H. Manko)

The proposal of Infineon, Philips and STMicroelectronics contains an upper limit for "lead-free" components of 0.1% related to the individual material, not to the whole package or component. The "lead-free" products give at least their European clients a certainty to be "green" in time. Although legislation has not yet been consolidated, a max. level of 1000ppm is mentioned in the law of some countries.

Note: Shipping materials such as blister tape and paper based boxes are not part of this consideration, since they are usually part of existing recycling processes.

Evaluation of Pb Free solder paste

Score=1 means very good, score=6 means very poor. Score=10 means extremely bad (Ref. and rated by Soldertec Ltd.)

	Sn-3.5Ag	Sn-Ag-Cu *8	Sn-Ag-Cu-Sb *9	Sn-0.7Cu	Sn-Bi-Ag	Sn-Zn-Bi
Melting/Process temperature	5	3.5	3.5	6	2	1
Peeling off after soldering *1	2.5	2.5	2.5	2.5	5.5	5.5
Solderability *2	4	2	3	5	1	10
Profile *3	3	1.5	1.5	5	4	10
Reliability *4	3	1.5	1.5	4	5	6
Recycling *5	2.5	2.5	2.5	2.5	5	6
Cost *6	4.5	4.5	4.5	1.5	4.5	1.5
Alloy authorization *7	1.5	3	4	1.5	5	6
Total score	**26**	**21**	**23**	**28**	**32**	**46**
Average score	**3.3**	**2.6**	**2.9**	**3.5**	**4.0**	**5.6**

*1 Bi alloy easy to peel-off or lift-off after soldering, as well as not so environmental friendly. But Bi is helpful in wettability and solderability and to reduce soldering temperature.

*2 Zn alloy easy to be oxides, powerful flux is required.

*3 The advantage of Sn-Ag-Cu (-Sb) and Sn-Bi-Ag is able to apply lower solder joint temperature. However, need to considerate the soldered peel-off issue by applying Sn-Bi-Ag.

*4 It is average performance; the ranking might be changed under different application conditions.

*5 Zn and Bi will also created issues/costs, same situation as other alloys.

*6 The approximately of related costs is depended on Ag content. Tin strip is efficient than Solder paste.

*7 Sn-Ag-Cu is secured by some patents; some authorizations and patents secure Sn-Ag-Cu-Sb; Sn-Bi-Ag and Sn-Zn-Bi are secured in various ways of patents.

*8 The recommended composition : Sn- (3.4~4.1)Ag- (0.5~0.9)Cu

*9 Standard composition : Sn-2.5Ag-0.8Cu-0.55Sb

Pb Free Components from Walsin Technology

New coating technology, then offers advantages beyond the simpler elimination of lead :

- Pure tin termination coating.
- Improved shelf life because of low intermetallic growth.
- Improved solderability because of neglible degradation of the solder surface.
- No whiskers and no lead.

Recommended IR Reflow Soldering Conditions

- The following Lead free solderpastes are suitable to be applied with WTC components :

  1. **Sn-3Ag-0.5Cu series** of Lead free solder paste. Recommended by JEITIA on Jun.-2000. Typical ally melting point at +225~230℃.
  2. **Sn-(3.7~4.1)Ag-(0.4~0.8)Cu series** (e.g. Multicore Sn-3.8Ag-0.7Cu) of Lead free solder paste. Recommended by NEMI.
  3. **Sn-2.5Ag-0.5Cu-1Bi series** (e.g. Senju #OZ-7085-340F-32-12) of Lead free solderpaste. Typical alloy melting point at +222℃.
  4. **Sn-2.2Ag-20In series** (e.g. Indium Indalloy #227) Lead free solderpaste.

- Soldering profile :

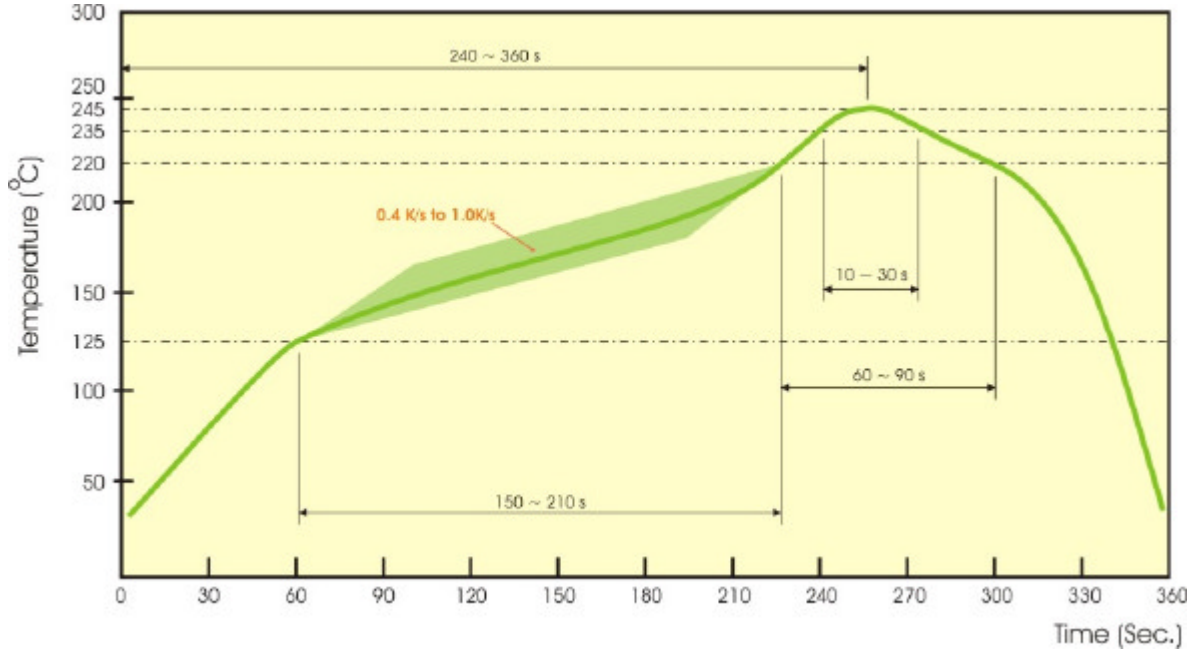


Fig 2. Infrared soldering profile for Lead-Free SMD

Others

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