

MEMS Capacitive Accelerometers

Application Notes LCC-48 housing, mounting and soldering conditions

30N.SOLDERING.A.26.10.10

Introduction

SnPb63/37 has been used worldwide as the standard eutectic material for SMD mounting. A process, based on this material and compatible with the MS8000 accelerometer series is presented hereafter. Anyway, considering the legal and environmental aspects linked to utilization of Pb in one side and the stress induced by the mounting for advanced applications in the other side, alternative Pb solder free and low stress materials are also proposed.

LCC-48 housing description and mounting

The outline dimensions of the LCC – 48 are presented in the figure 1. Typical pitch between pins is 1 mm. To insure the right orientation of the product during mounting, the length of pin 1 is longer (see bottom view of figure 1). To improve the control of this orientation from the top, an extra point is printed on the lid of the LCC package in the side corresponding to pin 1 location.

Stress management

The stress induced by the soldering of the LCC package is a specific MEMS concern, especially when it comes to high-end capacitive sensors. In order to obtain good stress homogeneity and to have an accelerometer tightly fixed to the PCB, all the 48 pads must be welded to the accelerometer as presented in figure 2. This is especially important when the package size is big

Sn63Pb37 is the actual dominant soldering material for the standard electronic and microelectronic. This alloy is perfect concerning wettability, cost, thermal & electrical conductivity but is limited in term of stress induced to the package. Furthermore, the European community has fixed a date (July 2006) for the total Pb suppression in microelectronic. Therefore, alternative materials are proposed hereafter. Both have a CTE beneath 25 ppm/°C and are potential solutions.

Sn95.5Ag3.8Cu0.7 is a close liquidus – solidus alloy (215°C – 225°C) and is up to now identified as the recognized Tin-Lead best substitute by the microelectronic community. Mechanical properties are increased by presence of Silver. It is easily available and present a close soldering process compared to Sn63Pb37. Moreover, the stress induced by this material is ~25% lower.

Sn42Bi58 is less common but certainly better for the mounting of MEMS components. This eutectic has a lower melting point due to the presence of Bismuth, induces much less stress and presents anyway an excellent wettability. The stress induced by this material is up to ~50% lower than Sn63Pb37

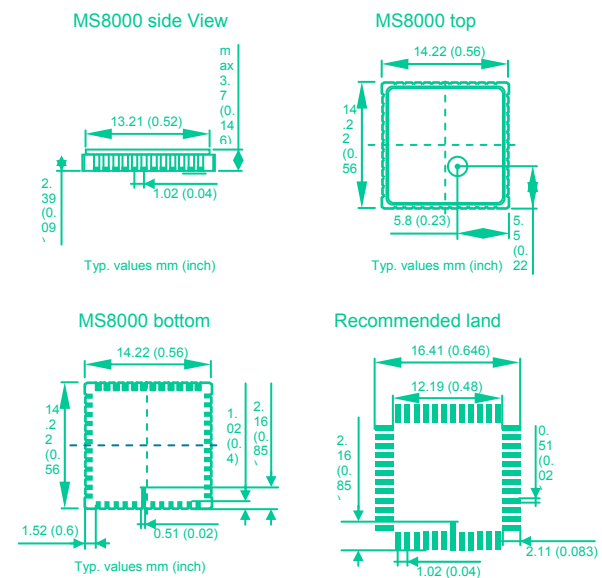


Fig. 1: LCC-48 housing dimensions

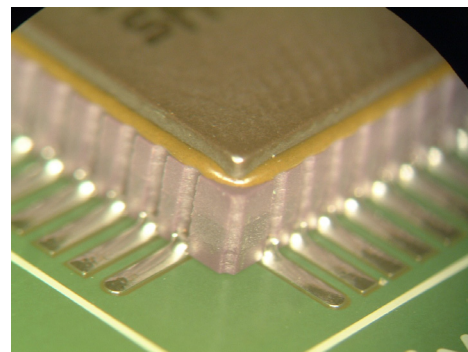


Fig. 2: close view of a soldered MS8000

The material specific characteristics are presented in the next table.

Physical behaviour	Sn63Pb37	Sn95.5Ag3.8Cu0.7	Sn42Bi58
Melting point [°C]	183	216	138
CTE [ppm/°C]	25	23	15
Tensile strength [MPa]	32	4	55

SMD processing

Soldering conditions for the various materials, as given by suppliers and have been tested by Colibrys. Typical curves are given hereafter:

Sn63Pb37

Heating rate	0.5 to 1 [°C/sec]
Liquidus stage	30 to 90 seconds at 215°C max.
Cooling rate	< 4 °C/s (stress concern, the slower, the better)

Sn95.5Ag3.8Cu0.7

Heating rate	0.5 to 1 [°C/sec]
Liquidus stage	30 to 90 seconds at 230°C max.
Cooling rate	< 4 °C/s (stress concern, the slower, the better)

Sn42Bi58

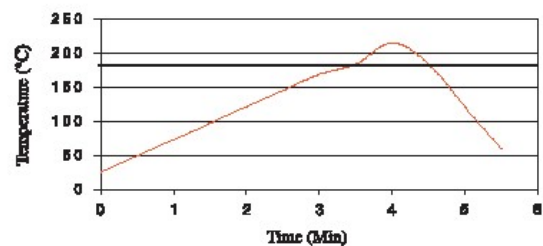
Heating rate	0.5 to 1 [°C/sec]
Liquidus stage	30 to 90 seconds at 175°C max.
Cooling rate	< 3 °C/s (stress concern, the slower, the better)

Conclusion

MS8000 are compatible with standard **Sn63Pb37** for reflow soldering process. Nevertheless, “green alloy” **Sn95.5Ag3.8Cu0.7** is well seen as a very good

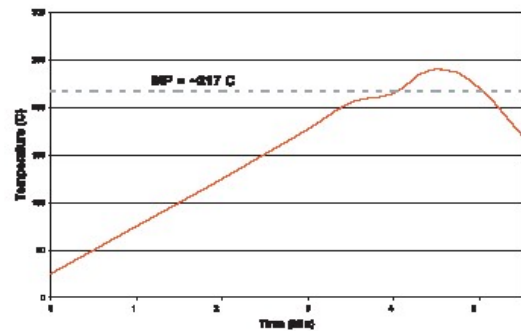
REFLOW

Recommended Profile:



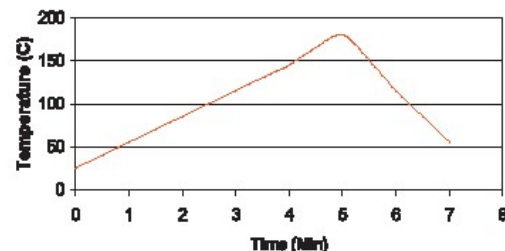
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Recommended Profile:



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Recommended Profile:



substitute due to good stress management & easy delivering material. Finally “green alloy” **Sn42Bi58** is suitable for sensitive applications where stress management is a concern.