Challenges in Solder Attaching an Air Cavity Device Using Tin Bismuth Solder

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The most common solders to attach components are either Sn63Pb37 or a lead free solder such as Sn96Ag3Cu5. There are some cases that come up where a lower temp solder is needed whether it is due to the order of assembly process steps or temperature sensitivity to components inside a device. This particular application which will be shown involved the attachment of a laminate air cavity device required the use of a solder that had a max temp of 170 C due to the construction of a piece part inside the device and overall temperature sensitivity and reduction of movement due to CTE differences causing electrical performance issues. For this development two devices were selected, one with an embedded heat sink and one without a heat sink. In this particular case, tin bismuth solder was selected for its low melting temperature. Tin Bismuth solder has some known mechanical issues that include a low drop shock resistance, solder tends to be brittle, the solder tends to expand as it cools which can cause component lifting and a lower surface tension compared to standard solders which can affect the registration of the device. It will be shown how careful selection of the land pads utilized in the final design, stencil modifications due to flatness issues, dye penetrant testing to validate X-ray images, EDX analysis to confirm proper intermetallic can lead to a robust connection that allowed for the devices to pass qualification.