Interplex

Solder Attach Tech Bulletin

New Solder Ball Technology Provides Enhanced Co-planarity Compensation for Module & Mezzanine Applications

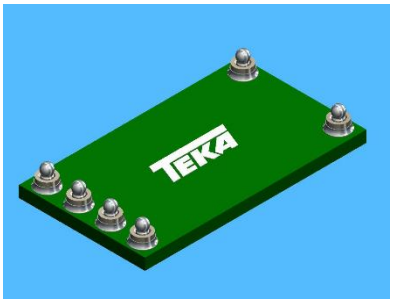
Streamlined Production, Lower Costs, Improved Solder Results

This Tech Bulletin provides an overview of how new Solder Ball technology, a specialized category in the Solder Bearing Lead (SBL) arena, provides an ideal solution for module and mezzanine board applications.

The use of advanced solder ball interconnect designs for board-to-board applications enables manufacturers to overcome co-planarity mismatch issues and also enables module suppliers to deliver products with excellent solderability across a wider process window.

Topics addressed in this Tech Bulletin include:

- Co-planarity challenges in board-to-board applications
- Solder Ball Technology overview
- Leveraging Automation Processes
- Module Manufacturing and Final Assembly
- Summary



Co-planarity Challenges

In the electronics industry, the term “co-planarity” typically refers to the maximum distance that the physical contact points of a surface-mount device (SMD) can be from its seating plane. When placed on a flat surface, an SMD device or module will rest on its three lowest points. This is the seating plane of the device. The co-planarity specification defines the maximum gap that can exist from the underside of any pin to the PCB to which it is being soldered.

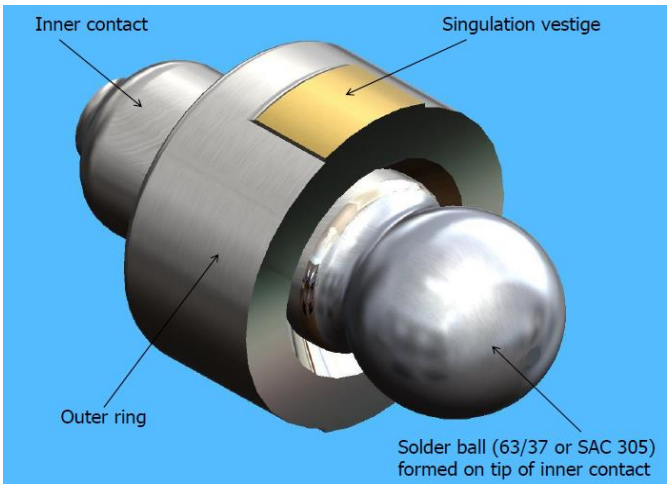
During reflow, the surface tension properties of liquid solder cause the solder to wet between the pin and pad. The solder bridges any physical gap between them to form a fillet. If the co-planarity mismatch is too great for the amount of solder deposited, some pins may not make contact to form an acceptable solder fillet, resulting in an electrical open circuit.

Some manufacturers have attempted to address this issue by using thicker solder stencils to deposit more solder. While this can accommodate parts with a higher co-planarity variance, it also can cause problems with smaller components that have fine lead pitches. Excessive solder on the pads of small parts can result in adjacent pins being bridged and shorted. The additional volume of solder also increases the risk of solder debris being formed during reflow.

The best approach, as discussed in the following section is to get the correct amount of solder exactly where it is needed at the point of interface and to design in automatic co-planarity compensation as an inherent element in the reflow process.

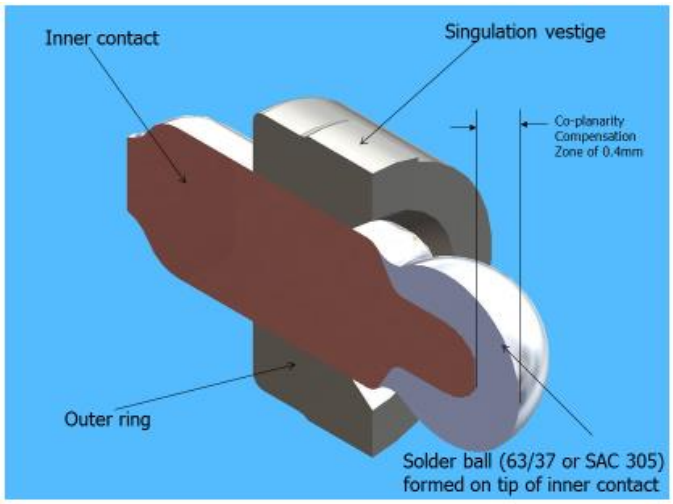
Solder ball Technology Overview

New Solder ball (SB) technology addresses these issues by incorporating a precise amount of solder directly on to the interconnects that are used on the module or mezzanine board.



The solder ball design consists of an inner contact of copper surrounded by an outer ring that assists in automated pick-and-place as well as seating and standoff distance. The module-end of the solder ball interconnect can be either through-hole or SMT.

The solder ball is formed on the tip of the inner contact to provide the subsequent interface to the mother-board. Solder is typically a standard such as 63/37 or SAC 305 and can be created in various diameters depending on the application requirements.



During reflow, the solder ball interfaces with the wet paste that is on the PCB, which puts the solder ball into a molten state and allows the module to settle on to the motherboard as the module's weight exceeds the buoyancy of the molten solder. This process automatically compensates for co-planarity variances.

Each solder ball can provide automatic adjustment flexibility that is equal to the distance by which the diameter of the solder ball extends beyond the end of the pin inside the ball.

Normally device co-planarity has a specification of .01mm max. The device sits on the highest leads (3 minimum) and then all other leads can be no more than 0.1mm off the PCB surface. The solder ball contact allows that co-planarity limit to increase a by a minimum of 4 times to over 0.4mm.

Leveraging Automation Processes

Solder ball interconnects are manufactured using a series of continuous streamlined reel-to-reel process for stamping, assembling, plating, attaching the solder balls, in-line flux cleaning and 100% automated inspection. This is followed by singulation of the individual interconnects, automated vision inspection and standards-based tape and reel packaging.

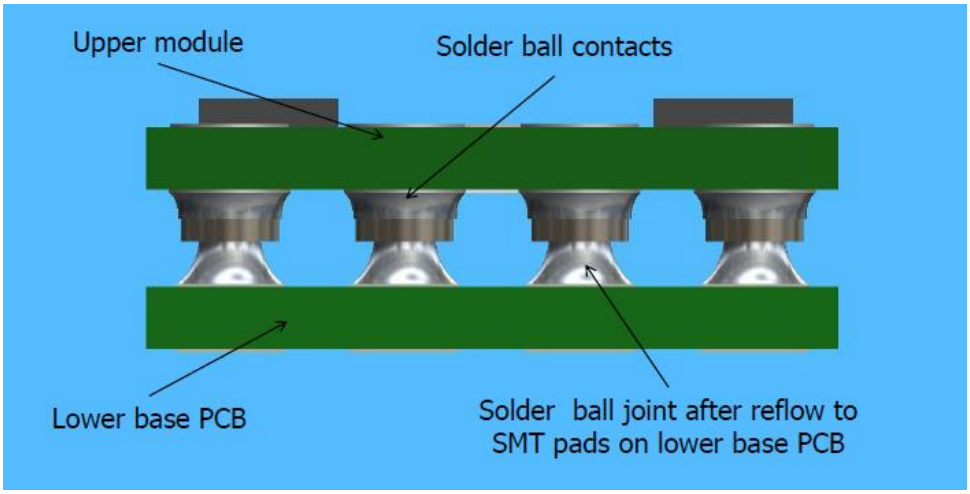
The final product is then ready for fully-automated production processes to create solder ball-based SMT modules.

Module Manufacturing & Final Assembly

The manufacturing process at the module level can be significantly streamlined through the use of solder ball technology. The SB interconnects are first placed on the underside of the board (along with any other bottom-side components) and then reflowed. Then the top-side components are all placed and, after the second reflow pass, the module is complete and ready for shipment or use in the final assembly process.

For end manufacturers, because solder ball-enabled modules automatically adjust for co-planarity variances during reflow, the manufacturer gains significant latitude in the process window. Instead of needing to be sure that all of the module contacts are perfectly seated during placement, they can rely on the automatic compensation of the solder balls to close gaps and provide 100% solderability.

For example, a typical module with 6 to 12 discrete interconnect points might have several points that could be slightly up off of the pads but which would still be brought into compliance as the module sinks towards the motherboard during reflow.



Key Application Benefits:

- An SMD interconnect system that compensates for large co-planarity differences between two parallel stacked PCBs
- Compatible with standard Pick and place systems tape & reel packaged
- High Current system with a solid copper contact with short current path
- Discrete Contact allows for pin out variability in design and manufacturing.
- Through-hole pin in paste interconnect to the main PCB for strength and compatibility with heavy copper complex multilayer PCBs.
- Self-alignment SMD interface to the associated daughter or mating SMD PCB

Summary

Solder ball technology enables product manufacturers to create advanced surface mount modules that offer a wider process-window with automatic co-planarity compensation during the final assembly process. In addition, by leveraging automation-ready solder ball interconnects, module production processes can be streamlined to reduce costs and improve yields.