Interplex

Solder Attach Tech Bulletin

Key Issues and Considerations for Implementing Solder Bearing Lead Applications

This is the first in a series of Tech Bulletins focusing on Solder Bearing Lead (SBL) Technology, which will provide information on a wide range of usage cases, configurations and practical applications. To establish a common foundation of understanding, this initial Tech Bulletin will first provide some background on Solder Bearing Lead Technology along with an overview of the key considerations to keep in mind when implementing SBL applications.

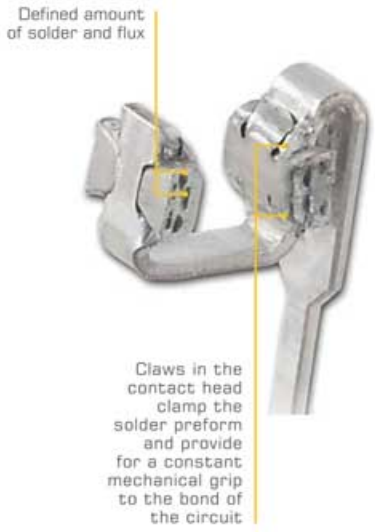
Background and Evolution of Solder Bearing Lead Technology

Over many generations of product designs, soldering continues to be the most widely used method of attachment for individual components on printed circuit boards (PCBs) as well as a myriad of interconnects for joining mother-boards and daughter-boards, sub-assemblies, specialized odd form components, lead frames, etc.

With conventional soldering processes, the two metal components to be joined are first brought into position and mechanically held in place. Then flux and solder are applied to the conjoined parts, typically by a dipping process. When the circuit is dipped into a flux pot, care must be taken to not over flux, or cover too much area. The circuit is next dipped into a molten solder pot and care must be taken to avoid solder bridges or solder wicking into unwanted areas. The biggest issue is the inability of the solder dipping process to consistently assure precise and complete coverage of the desired areas on the pad and pin, which can result in variances of solder joint quality and reliability.

For instance, with today's tightly constrained board-level real estate and close tolerance dimensions, a pin or clip may cover as much as 80 percent of the pad, leaving relatively little room around it for forming the solder joint. Therefore, when flux and solder are applied through secondary dipping operations, the solder will only adhere between the pin and the 10 percent of the pad surface that is exposed on each side of the pin.

Originated by Interplex NAS, SBL technology creates leads with a precise amount of solder already on them, such as the iconic "claw design" shown at right.



As a result of a nonstop focus on innovation, SBL has evolved into a multi-faceted technology foundation with many configurations for a wide range of standard and custom application requirements.

Some of the basic approaches include:

- Holding the solder on the outside of the metal lead
- Holding the solder on the inside of the metal lead
- Forming the solder around the metal (minimize profile)
- Stamping the solder directly into the lead frame
- Molded solder-card modules for PCB-to-PCB assembly
- Solder-ball pins for discretely placeable SMT interconnects

Key Considerations for Applications Using SBL Technology

When applied properly, SBL technology provides manufacturers with soldering consistency of 100% and enables precise control over the predetermined amount of solder and flux. For each set of application requirements, the amount of solder must be adequate for good electrical and mechanical bonding, but not so much as to create shorting or bridging situations.

A number of key issues must be considered when converting existing applications or implementing new SBL applications, including:

1. The selection of solder alloy best suited to your application.
2. Choice of flux best suited to your application.
3. Choice of base metal and plating system.
4. Size and form factor needed to achieve optimal solder joint integrity especially in situations where part geometry is delicate, difficult to reach or solder joint integrity is critical.

Selection of Solder Alloy
One should consider temperature, vibration, and mechanical stress when selecting a solder type. Some of the key selection criteria include:

- Temperature – depending on the temperature environment for the end product the correct solder alloy can have important influence on the integrity of solder joints
- Vibration – solder joints should never be considered as structural elements but in high vibration applications certain alloys offer superior strength to resist the mechanical stress induced by vibration.
- Mechanical Stress – similar to stress induced by vibration, solder joints should be isolated from mechanical stress that can be a result of subsystem mechanical design.

Designers should consult with their interconnect providers regarding the selection of the best solders for high stress applications and the design of stamped components that can isolate the solder joint form mechanical stress.

Choice of Flux
One should consider cleaning of the subassembly when selecting flux type. SBL interconnect designers can provide technical support to ensure the best flux selection for each application.

- Rosin Base – very aggressive cleaning of oxides to improve wetting however they require post cleaning and may be inappropriate for some applications.
- No Clean – flux does not require post cleaning but may result in less setting of the solder surfaces and still leaves some residue.
- Water Soluble – easy to post clean with aqueous cleaning system but is hydroscopic and has limited shelf life.

Choice of base metal and plating system
Material fundamentals are always important considerations when designing new products and the choice of base metal in combination with plating system have effects on solder ability. Experienced interconnect designers can provide input as to the best combinations for your application.

- Heat Transfer – differing thermal conductivities of base metal alloys can have an influence on the formation of reliable solder joints.
- Plating Systems – plating technology such as electro plating and hot dip will influence solder joint formation and mechanical performance.

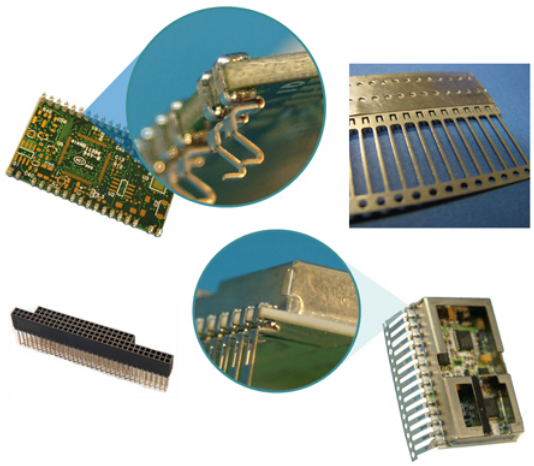
Size and Form Factor
These are important aspects that need careful consideration if reliable solder joint are to be achieved.

- Solder area – it is critical to design the SBL interconnect to include sufficient solder and flux in the precise location needed to form the joint but to avoid excess solder
- Avoiding Bridging - components can be designed to restrict solder joint formation in one area in favor of another, thereby decreasing the potential of bridging between conduction paths
- Maintaining Mechanical Interface – the interconnect should also be designed so as to assure that the parts to be joined maintain sufficient proximity during solder reflow

Working closely with interconnect designers is a key factor for product engineers to achieve optimal solder joint integrity, especially in situations where part geometry is delicate, difficult to reach or solder joint integrity is critical.

Summary
Solder and flux bearing lead technologies are being deployed across a wide spectrum of product designs and industry segments. Virtually any arena that requires the joining of metal parts via solder is a candidate application for integrating the solder within one of the components. As circuit densities increase and dimensions become smaller, hybrid circuits are more prevalent and integration is critical. Therefore the advantage of solder bearing lead technology has moved to the forefront as the best way and in many cases the only way to accomplish overall design goals.

Building on this brief overview, subsequent SBL Tech Bulletins in this series will drill down and provide detailed information on a variety of these configurations and the applications they serve.



Product designers, production managers and process engineers are constantly in need of interconnect solutions that can simplify product designs, maximize production efficiency and reduce costs while assuring quality.

For an ever-growing number of existing and new designs, solder and flux bearing leads deliver exactly the needed solutions by providing the following key benefits:

- Eliminate the need for solder paste, solder dipping or the addition of secondary flux - processes which increase the chances for bridging and wicking.
- Offer high degree of production flexibility to mesh with existing methodologies
- Adaptable for local heating to avoid re-raising the temperature of pre-populated boards to the reflow point.
- Can include a wide range of solder types, melting points and flux choices.
- Many different standard and custom configurations to choose from and adapt
- The bottom line benefits: Simplicity, Reliability, Efficiency & Flexibility

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More information regarding Solder Bearing Lead Technologies and products can also be found on the web by visiting http://www.interplex.com/nas or by calling (201) 367-1300.