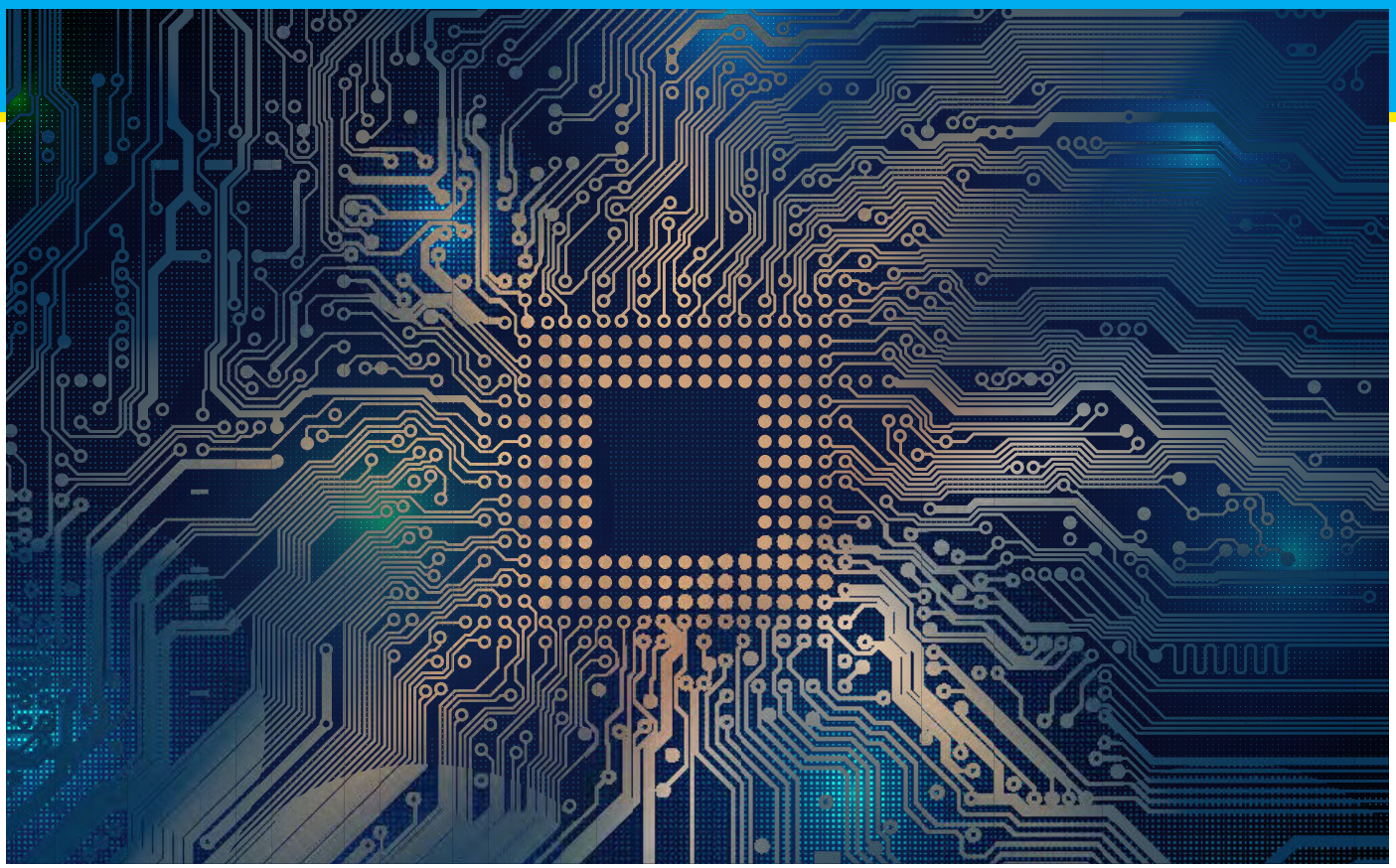
Making the Most of Conformal Coatings with Press-Fit Connectors

Press-Fit Connectors Pierce Conformal Coatings for Added Value

Technical Article

Positronic®
an **Amphenol** company



The printed circuit board or PCB has been the preferred method of designing electronic circuits since the 1970s. With the birth of semiconductors and the advent of electronic miniaturization, the established methods of joining circuits, especially using wires and wire wrap connectors, fell out of use and the PCB has come to dominate the electronics market.

The PCB offers several advantages over previous technologies. It is compact, it can be mass-produced in almost any shape to suit the application and, with the development of multi-layer boards, it has become an extremely complex and capable solution for electronic designers.

When the PCB was first introduced, all the components were mounted to the board using through-hole pins. These were inserted through holes that were drilled into the board and plated to provide continuity. Once placed into the board, the underside was then soldered to ensure secure physical and electrical contact. While through-hole mounting provides a very

stable solution, the disadvantage of this technique is that components can only be mounted to the top surface of the board. The typical soldering process uses a wave soldering machine that would damage any components mounted underneath.

This limitation has been overcome by the advent of surface-mount technology (SMT). Using SMT, components are fixed to pre-placed solder pads on the surface of the PCB. The components are then secured to the PCB using heat from a reflow operation, which melts the solder pads and forms the connection. As the board does not use a traditional wave solder bath, components can be mounted to both sides.

Through-Hole and Surface Mount

SMT boards also allow a far greater density of components to be placed on the board, and SMT has largely replaced through-hole techniques, especially for micro components. However, through-hole mounted components continue to provide a reliable way to connect several layers of a PCB. In contrast, an SMT component that is mounted onto the surface of the PCB cannot penetrate the board and provide this same connection. Additionally, SMT components are not capable of the same current carrying capacity as through-hole ones. In these circumstances, through-hole components are ideal.

There is therefore still the need for through-hole components, especially when providing the connections from the PCB to the outside world. In addition to solder tail connections, many designers like the flexibility of press-fit connectors, as they can be mounted to a PCB after it has undergone the soldering process without the need to reheat the board. Press-fit connectors are not a new concept, and have been used in the electronics industry since the earliest days of PCB design.

Conventional press-fit terminals use solid pins with a square cross-section. The sharp corners of the pin are designed to deform the plating of the through-holes to form a gas-tight seal, ensuring both a secure mechanical joint and a reliable electrical connection. The downside of this technique is that pressing the pin into the hole risks damage to the PCB, and it is rarely repairable. Despite this, press-fit connectors offer some key advantages for designers and manufacturers. As they are mounted after the solder reflow process, they do not require additional heat to be applied to the PCB. This reduces the danger of damage caused by thermal stress. As the joint is solder free, it removes the risk of failures due to defects in the soldering process or deterioration over time.

New Press-Fit Technology Facilitates Conformal Coating

Press-fit connectors therefore remain a popular choice for PCB designers. To provide a modern solution that will provide the benefits of press-fit termination without the drawbacks, Positronic has created a solution using contacts with compliant tails. Named “Omega” after the Greek letter that they resemble, their flexibility ensures the same stable mechanical and electrical joint without the damage to the through-hole plating.

The Omega press-fit contact provides further advantages for designers who need to protect their printed circuit board. The growing sophistication of miniaturized electronics has allowed PCBs to become more compact and complex. Their small size means they can be used in devices that are deployed into tough conditions. Away from the shelter of the laboratory, modern electronic systems are tasked with delivering reliable performance in all kinds of environments. Even PCBs that are sealed inside enclosures must be protected.

One of the common causes of failure in electronic systems is the damage caused by oxidation. Exposed to moisture in the air, the metallic components on the PCB can corrode. With enough time, this corrosion can cause permanent damage and create short or open circuits. The resulting failure can produce results that range from inconvenience to life-threatening.

To protect the PCB against damage caused by moisture, many manufacturers turn to conformal coatings. A conformal coating, often parylene, is a polymer that is applied to the PCB using a vapor deposition process. The parylene is introduced into a chamber as a cloud vapor that covers the entire PCB with a consistent thickness that is resistant to water and other contaminants.

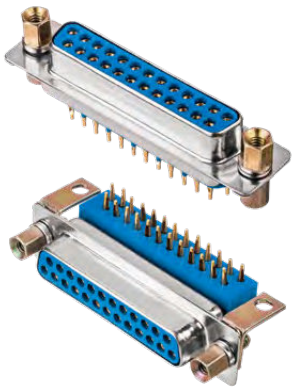
Making the Most of Parylene Coatings

The disadvantage of parylene is that it must be applied after the soldering of components to the PCB, as the heat of the reflow process would melt the polymer. For most components, this presents no problem. However, the polymer cannot be allowed to settle on the connector contacts as it is non-conductive, which would prevent the connector from working as intended.

Typically in these cases a mask is placed over the mating face of the connector before the coating is applied. In this way, the contacts are prevented from being exposed to the parylene. Once the coating has been completed, the mask can be removed and the PCB used as intended. The process of applying and removing the mask is time-consuming as it needs be conducted by hand, which adds significantly to the overall manufacturing cost of the PCB.

The Omega press-fit contact technology offers an alternative to the costly and time-consuming process of masking. Its innovative design means that a connector that is fitted with the Omega contact can be mounted to the PCB after the parylene coating has been applied. The contact simply pierces through the thin conformal layer, and its Omega-shaped design ensures a secure, gas-tight joint when fully seated.

Testing and Qualification



Positronic is committed to providing fully tested solutions to customer. To prove the performance of the Omega contact with conformal coatings, testing was conducted using Positronic standard density PCD press-fit connectors with size 20 Omega contacts, as well as products with size 22 Omega contacts from the high density PCDD series. A parylene coating was applied to PCBs prior to the insertion of the press-fit Omega compliant connectors, and continuity testing was performed to confirm the contacts pierced the coating and made electrical contact with the plated through-hole on the PCB.

The press-fit connectors were installed into PCBs conformally coated with a 0.0006” thickness of Parylene C (DPX-C) and subsequently tested using a probe test with 100 V, for 10 ohms continuity and 10 MΩ isolation.

Samples were also tested between the contact and the PCB solder pad for interface resistance using a Fluke Model 1587 FC, with values ranging from a maximum of 0.1 ohms - 0.2 ohms.

To complete the process, contact samples were cross-sectioned and inspected. The results clearly indicate a positive connection and that there are no adverse effects of using Positronic press-fit Omega contacts once parylene coating has been applied.

Conclusion

Press-fit terminations remain a popular termination method to secure connectors to PCBs. Additionally, more designers are looking to protect their devices against long-term damage. Positronic has developed a press-fit termination that combines the convenience of press-fit termination with the superior long-term reliability that is afforded by the latest conformal coatings.

For more information about how Omega press-fit contacts can help transform your reliability, visit connectpositronic.com or contact us at connectpositronic.com/en/contact/.