Create robust, durable overlap ZIF connections in four steps

By John Talbot

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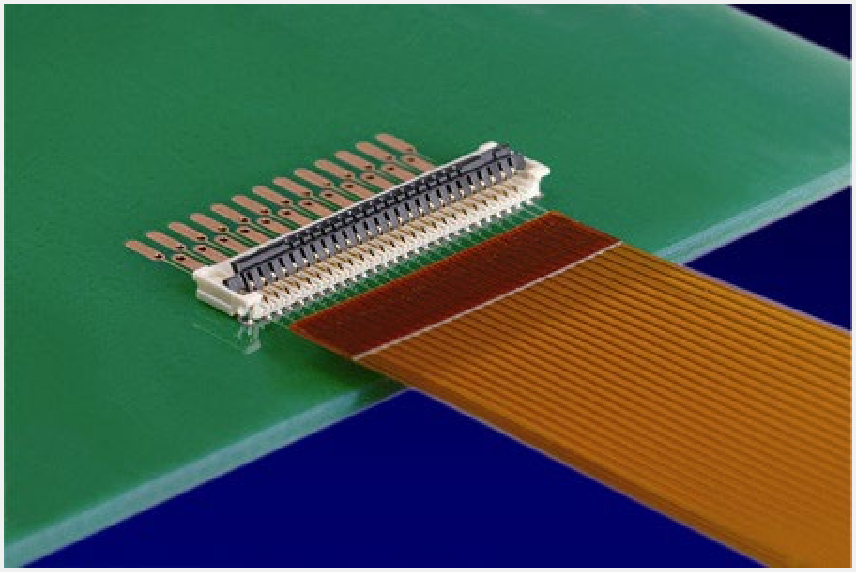
Because their design withstands the demands of flexible circuits, Zero Insertion Force (ZIF) connectors are a popular choice for attaching these circuits to other electronics.We will focus, in this article, on **flexible polyimide heaters.**



ZIF Connector on PCB Board receives FPC

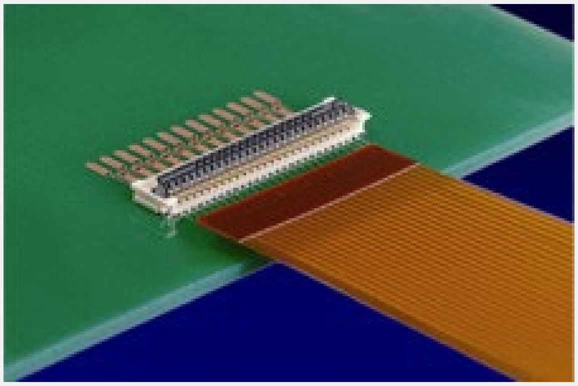
A ZIF connector is similar to a card edge connector for printed circuit boards (PCBs), but takes into account the specific connection needs of flexible circuits. The most common connector accepts a 0.3 mm thick circuit and is held in place by friction or a clamp down strain relief. The principals of overlap ZIF design apply to circuits with typical 1.0 mm and 0.5 mm pitches, as well as smaller, denser patterns.

Because the circuit is flexible it can be damaged during insertion if assemblers are not careful. By its nature, a ZIF connection requires the circuit be perfectly aligned for insertion. This is oftentimes tedious because of the small size of the connector and circuit. If the circuit is not aligned well and it is forced into the connector, it can bend or fold in a way that may fracture the copper traces or connector pads. It is prudent then to pay close attention to the design of the flexible circuit and do everything possible to make it robust.

This four-step process that can guide any overlap ZIF design to ensure robustness. It starts with knowing the application.

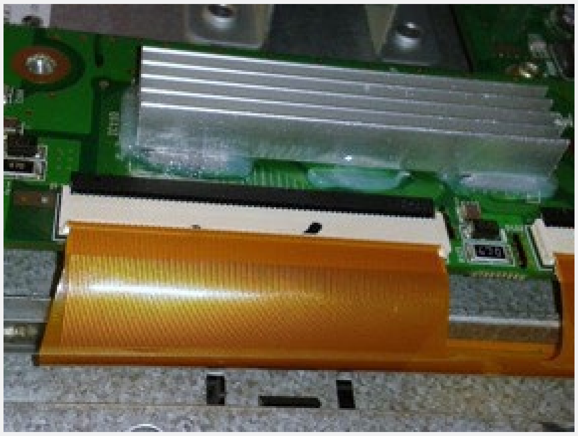
Step 1: Understand the application

Before designing a ZIF connection, it's critical to understand the application. Will the circuit route directly into the connector?



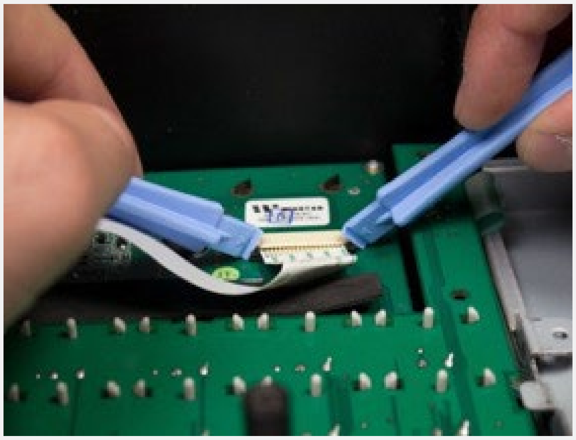
Straight insertion into ZIF connector

Will it make a slow, soft bend into the connector?



Soft bend insertion into ZIF connector

Or will it make a hard, sharp bend due to the lack of physical space?



Sharp bend insertion into ZIF connector

These questions help designers identify any unique connection challenges that might occur or affect performance.

Step 2: Follow manufacturer specifications for connector pitch and width

Following the connector manufacturer's specifications for pitch (space between pins) and width is a key part of ZIF design. Don't compromise here, because pitch and width are the first things that will cause trouble in any ZIF design. These dimensions are crucial to alignment of the connector pins to its appropriate pad on the circuit. Any compromise in tolerance will allow the circuit to slide around in the connector, causing intermittent shorts or a cable that doesn't fit into the connector at all. You must also be careful to not allow tolerances to stack up from one end of the circuit to the other when placing the pads at the correct pitch.
Because the circuit is flexible it can be damaged during insertion if assemblers are not careful. By its nature, a ZIF connection requires the circuit be perfectly aligned for insertion. This is oftentimes tedious because of the small size of the connector and circuit. If the circuit is not aligned well and it is forced into the connector, it can bend or fold in a way that may fracture the copper traces or connector pads. It is prudent then to pay close attention to the design of the flexible circuit and do everything possible to make it robust.

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Step 3: Design to thickness specifications

Once the pitch and width are designed properly, the overall thickness is the next essential specification. The most common thickness specification for ZIF connectors is 0.3 mm (0.0118"). This does not match a common thickness of flexible circuits, which is .006" - .010". To create the corresponding thickness, it's typical to add a "stiffener" under the connector pattern. The stiffener material is not important. It can be polyimide, polyester or even FR4. See image 1-1.

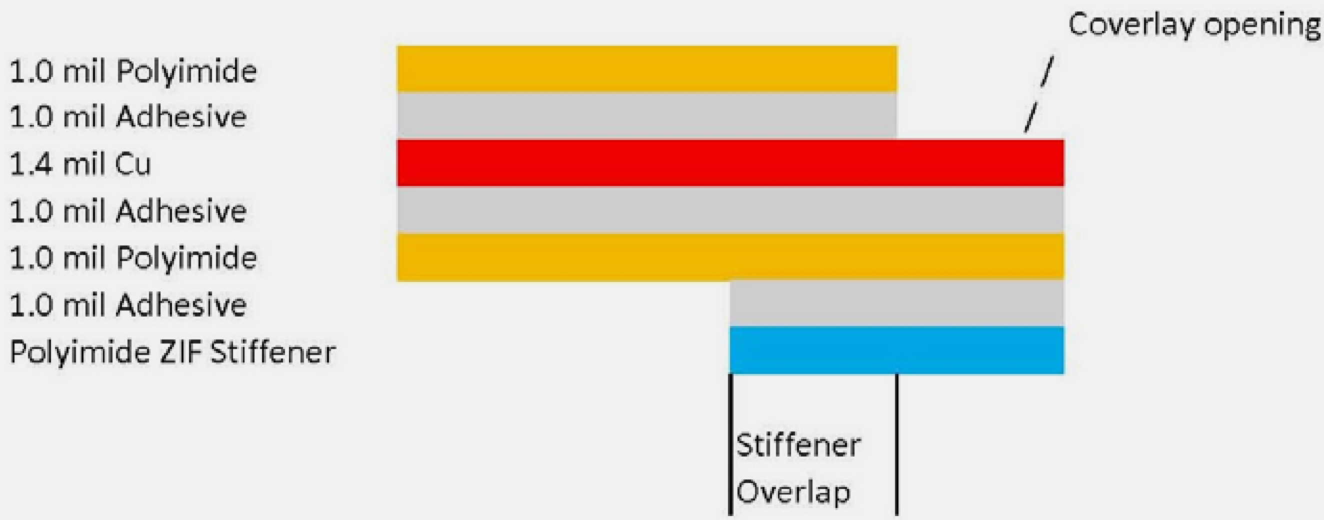

Image 1-1

In the image, the thickness of the polyimide ZIF stiffener was left off purposely. This allows the thickness to be adjusted to the construction of the circuit, whether it's a single-sided circuit as is depicted above, or a double-sided or multi-layered circuit. The thickness requirement of ZIF connectors forces us to do some calculation in order to meet the specification with the materials available. The thickness of the polyimide stiffener would need to be either 0.007" or 0.008" to meet the thickness requirement of 0.0118" +/-.001". Another option, not shown in the image, would be to adjust the adhesive thickness. No matter what method is used to meet the specifications, the thickness must match the manufacturer's specifications.

Step 4: Employ overlap for the most robust design

Once the specifications, width and thickness have been met within the required tolerance range, the final step in ZIF design is to make the connection as robust as possible. The orientation of the copper traces relative to the bend areas of the circuit are an important detail.

Robust design goes beyond simply lining up edges on top of each other. Instead, it uses a coverlay opening to expose the copper fingers for the ZIF connector, and a stiffener to create the proper thickness. If the design lines up the stiffener edge with the coverlay edge with the trace to pad junction, there will almost certainly be fractures of the trace at the pad junction. The most robust design calls for the pad to overlap the coverlay opening, and the ZIF stiffener to overlap the pad/trace junction. This allows the circuit to be inserted without fear of broken traces during insertion. It also protects the circuit in dynamic applications or those times when a sharp bend is necessary to insert the flex into the connector. See image 1-2.

Image 1-2

With these four steps, designers can build a robust, durable ZIF connection for flexible circuits every time.