Interplex

Press Fit Tech Bulletin

Optimizing Molded Plastic Electronic Modules With Advanced Press-Fit Technologies

Press-Fit technology has already proven effective for a wide range of applications that can benefit from its ability to provide robust solderless interconnects while streamlining assembly processes. Press-Fit interconnects can be adapted to support a variety of applications such as both parallel and perpendicular PCB-to-PCB stacking interconnects, fuse holders, molded modules, smart junction boxes, controllers, mechanical anchors, lighting and other custom applications.

Performance testing has demonstrated that Press-Fit pins satisfy stringent operational requirements as defined by IEC, EIA and SAE specifications and they have been qualified to 150°C temperatures. Press-Fit interconnects provide high retention forces in excess of 30N.

Figure 1 – Press-Fit in Brake Module

Press-Fit technology offers significant advantages within molded plastic modules where the compliant Press-Fit interfaces provide robust solderless connections by simply pressing the finished electronic module assembly onto the main PCB via the Press-Fits.

This Press-Fit Tech Bulletin provides an overview of key design considerations that engineers should be aware of when using Press-Fit interconnects in molded plastic electronic modules.

The specific areas covered include:

- Shoulder design
- PCB locating posts and Z-axis stops
- Use of anchor pins for PCB hold down and leveling
- PCB edge distance and force management
- Assembly options for Press-Fit pins into module (overmold vs post insertion)
- Sealed application considerations
- Managing bend radius

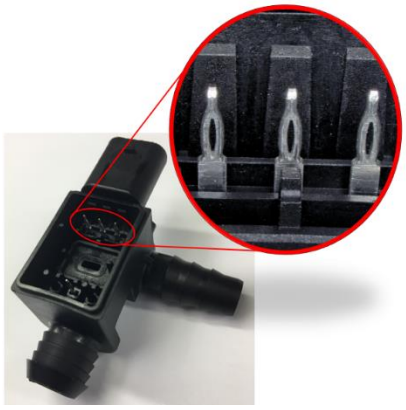

Figure 2 – Press-Fit in Sensor Module

Shoulder Design

Incorporating precision shoulder designs into each interconnect can provide a built-in mechanism for shut off of plastic formation around the specific Press-Fit zone. This maintains the required clearance for proper access and functioning of the Press-Fit interface in the final assembly (Figure 3).

Figure 3 – Design for Manufacturing and Best Performance

Some key considerations include:

- Clearance for mold tooling
- Pyramids at base of terminals
- Sufficient shut-off length
- Wide enough shoulders to avoid hitting Press-Fit eye with tooling
- Angled shoulders on terminals
- Enough air gap between terminals to avoid arcing
- Press-Fit flexibility

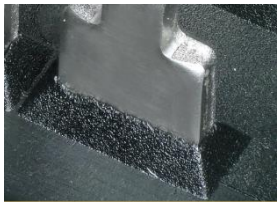

Figure 4 – Best Practice for Molding Pyramids

It is also critical that the mold tool be set up to clear the Press-Fit zone in order to avoid any damage to the compliant pin during the molding process.

To aid in tool release and tool clearance, it is also recommended to incorporate angled shut off designs into the mold. Best practices typically call for 45 degree angles, as shown in Figure 4.

If design and/or space allows it, flexibility should be incorporated into Press-Fit eye by extending the neck portion immediately below the eye to compensate for any gross PCB misalignments. This is depicted by the red dotted lines in Figure 5.

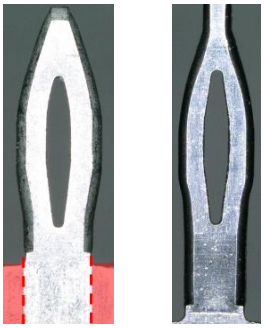

Figure 5 – Best Practices for Pin Neck Flexibility

PCB Locating Posts and Z-Axis Stops

Incorporating PCB locating posts into the plastic mold design allows for consistent positioning of the PCB sub-assembly for pressing on to the pins. The PCB should always be properly located within a two-axis space (X and Y) before being pressed on to the Press-Fit pins.

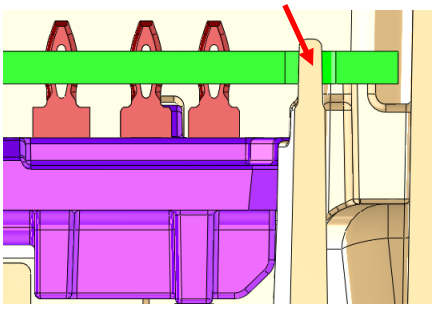

Figure 6 – Optional PCB Locating Post

Using locating posts (Figure 6) as gross locators prevents pin tip stubbing or damage during assembly. An allowance for float between the PCB and Press-Fit should also be provided as the assembly is driven home.

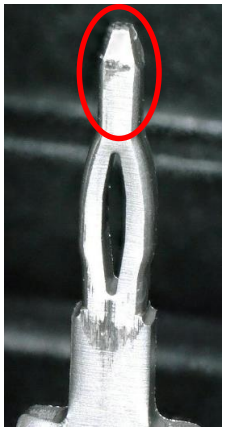

Figure 7 – Tip Extension for Assembly Assistance

Adding locator tips to the Press-Fit eye (Figure 7) can be valuable in ensuring the Press-Fit pin is aligned to the PCB hole prior to pressing operation. They provide a visual indicator for accurate alignment and assist in manual pre-assembly.

It is critically important to control the final location of the PCB after it is pressed on to the Press-Fit pins. This can be accomplished by incorporating Z-axis positional stops into the plastic molded enclosure. Depending on the specific design, the floor of the plastic part can also be used as the stop mechanism. Figure 8 illustrates the critical dimensions for a 0.64mm Press-Fit and the considerations for pressing the PCB on to the Press-Fit pins in a molded assembly.

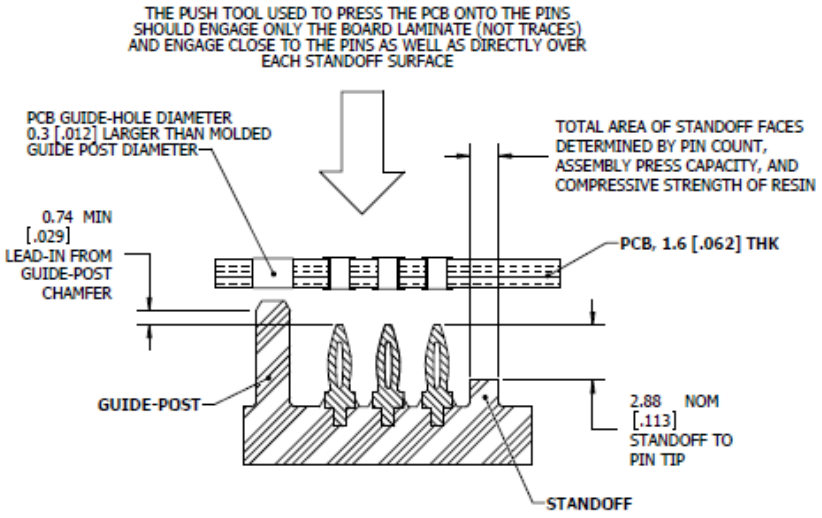

Figure 8 – PCB Pressing Guidelines

Use of Anchor Pins for PCB Hold Down and Leveling

Incorporating anchor pins into the Press-Fit design enables proper hold-down and leveling of the PCB during the pressing operation and also enhances robust operational capabilities throughout the product life cycle.

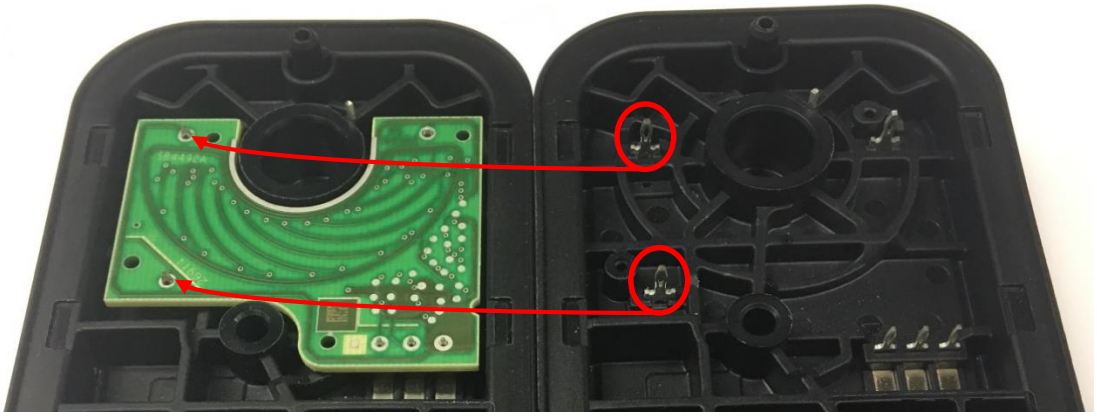

Figure 9 – Press-Fit Pins with Secondary Anchors

For example, in very demanding environments such as in automotive applications, the incorporation of secondary anchors made from the Press-Fit pins can be quite an effective mechanical solution to withstand high vibration and/or shock conditions, while also minimizing tolerance stack issues by leveling the conjoined parts during assembly (Figure 9).

PCB Edge Distance and Force Management

Another key action to success is the management of the distance between the PCB edge and the Press-Fit pin. Press-Fit pins do exert a force on to the PCB; when a Press-Fit pin is close to the edge of a PCB, it is important that there is enough material between the Press-Fit hole edge and the edge of the PCB to avoid PCB breakout. Best practices recommend that the distance from the Press-Fit hole to the PCB edge be, at the minimum, equal to the Press-Fit hole diameter. It is also recommended that the tooling for pressing the PCB includes tool steel around each row or column of pins, as well as between the last Press-Fit hole and the edge of the PCB (Figure 10).

In addition, it is important to include force monitoring and appropriate process controls to assure successful Press-Fit engagement during the PCB assembly process.

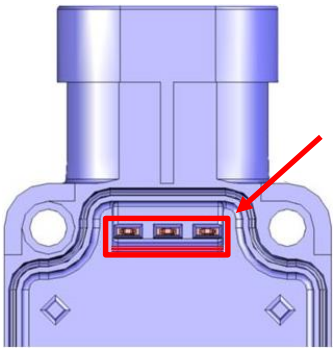

Figure 10 – Recommended Tool Steel Footprint for Pressing on to PCB

Assembly Options for Press-Fit Pins into Module (Overmold vs Post Insertion)

There are two primary methods to apply Press-Fit pins to the plastic module:

1. **Overmolding**
   This method consists of the placing the pins into the mold cavities (as individual pins or in a pre-molded header), then molding the module around these pins, securing them in place. This process is typically used when a right angled connector interface is required (connector parallel to PCB). Anchor pins perpendicular to the PCB surface can also be overmolded. Overmolding does a better job sealing pins to the outside world compared to the post insertion method.

2. **Post Inserting**
   This method allows for the plastic module to be molded without the pins being present; thereafter, in a secondary operation, the pins are stitched into the molded module. There is an interference of special pin features to the ID of the molded pocket, in addition to shoulder stops that ensure the pin does not move in the Z-direction during PCB installation. This method is reserved for connectors that are perpendicular to the PCB, and is also compatible with all anchor pins.

Sealing Application Considerations

There are various levels of sealing the Press-Fit pins to the molded module, and this depends on the amount of sealing the end application requires. In many applications, the perimeter seal around the mating wire harness connect is sufficient in the mated condition.

1. **Post Inserted Pin**
   This method offers the least amount of sealing, as air gaps will be present between the pin and the molded cavity that the pin inserts into.

2. **Overmolded Pins**
   While this method offers a degree of sealing against dust and moisture intrusion, depending on requirements, this may not suffice for the application at hand.

3. **Overmolded Pins with Sealant/potting**
   This method provides a sealed pin to plastic module to meet IP67 standards; however, secondary processes are required to apply the sealant around the pins and cure the sealant.

Managing Bend Radius

In some applications, it is advantageous to create bends in the interconnect path in order to keep moisture out of the package. Press-Fit interconnects can accommodate a variety of bend path configurations; however, it is important for designers to understand the characteristics for spring based materials used in Press-Fit pins. For Press-Fit material, the minimum bend radius is typically 2 times the material thickness; some specialized materials can go down to as far as 1.5 times (Figure 11).

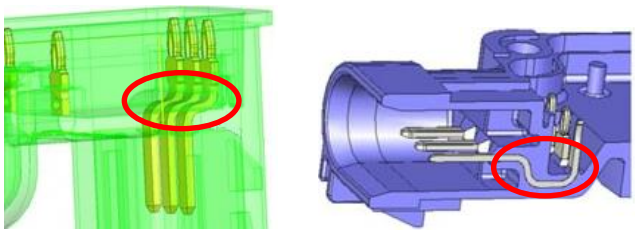

Figure 11 – Manifestations of Bend Radius for Press-Fit Pins

Summary

Compliant Press-Fit interconnects have become an important enabling technology to support the proliferation of standard and custom molded electronic modules used in an extensive range of applications. The inherent advantages of solderless assembly, simplified manufacturing processes, robust thermal characteristics and adaptability into a variety of high-volume stamping configurations make Press-Fit pins the preferred option for many module design projects.

By understanding the key issues outlined in this Tech Bulletin, module designers can plan ahead to specify the best Press-Fit configuration to meet their specific requirements and to optimize both the design and manufacturability of the final module assembly.

For more information about Press-Fit technologies and products, visit our website at https://interplex.com/press-fit or drop us an email at communications@interplex.com.