Interplex

Press Fit Tech Bulletin

Press-Fit Current Carrying Capacity Part 2: Current Testing & Results

This is the second in a series of three Tech Bulletins that focus on the current carrying capacity for Press-Fit applications. The specific three topics in this series are:

- Application requirements for higher current capabilities
- Current capability testing and results
- Special design considerations for power module applications

This Tech Bulletin addresses the second of these areas: Test Methods and Results

As discussed in the previous Tech Bulletin, the explosive growth of automotive electrical systems and other industries using inverter and converter based power modules is driving the need for press-fit technologies to provide reliable, solderless interconnect solutions that can support high current levels.

The previous assumptions about current carrying capacity for press-fit devices were usually considered to be in the 3 to 4 amp range for 0.64mm pins and 8 to 12 amp range for 0.80mm pins. As illustrated by the data in this Tech Bulletin, design refinement of press-fit pins and extensive testing across a range of temperatures has now demonstrated reliable high-current capacities of 20 to 30 amps and more. The following sections provide details on current testing set-up and methods, along with specific high-current capacity test results for a range of press-fit designs using a variety of alloys.

Test Methodology

The current capacity testing process should be based upon generally accepted industry specifications and test procedures, such as IEC 60512-5-2. Measurements should be performed within controlled environments using carefully managed temperature and current levels. As illustrated in Figure 1, temperature measurement thermocouple probes should be positioned as close as possible to the press-fit zone in order to accurately correlate the temperature levels to current-carrying capacity.

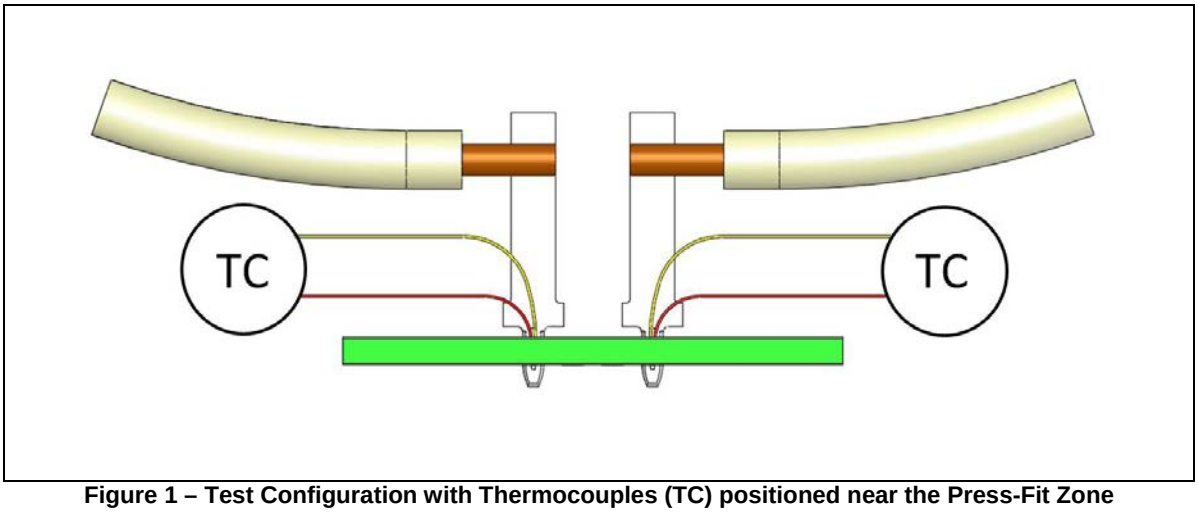

Figure 1 – Test Configuration with Thermocouples (TC) positioned near the Press-Fit Zone

After a full range of measurements have been collected for the specified temperatures, a corrected current carrying capacity curve (derated curve), should be calculated from the basic curve data. This derated curve takes into consideration any variances in manufacturing tolerances as well as uncertainties in temperature measurement and the measuring set-up.

Current capacity specifications for press-fit interconnects should always use the derated curve data to assure ample headroom for designing press-fit components into the target application's operational environment. In practice, the press-fit interconnects may be able to conduct more or less current depending on each specific application's ability to dissipate thermally during actual operation.

Current Capacity Testing Results

The following graphs show operating current test results for Interplex's two most popular sizes of press-fit zones, 0.64mm and 0.80mm. The current testing was conducted across a temperature range from 80ºC to 165ºC under controlled conditions. The graphs show multiple curves for a variety of different alloys with nominal conductivity ratings that range from 15% to 80%. All of the test data has been derated by 20 percent to provide headroom for successful deployment within demanding operational environments.

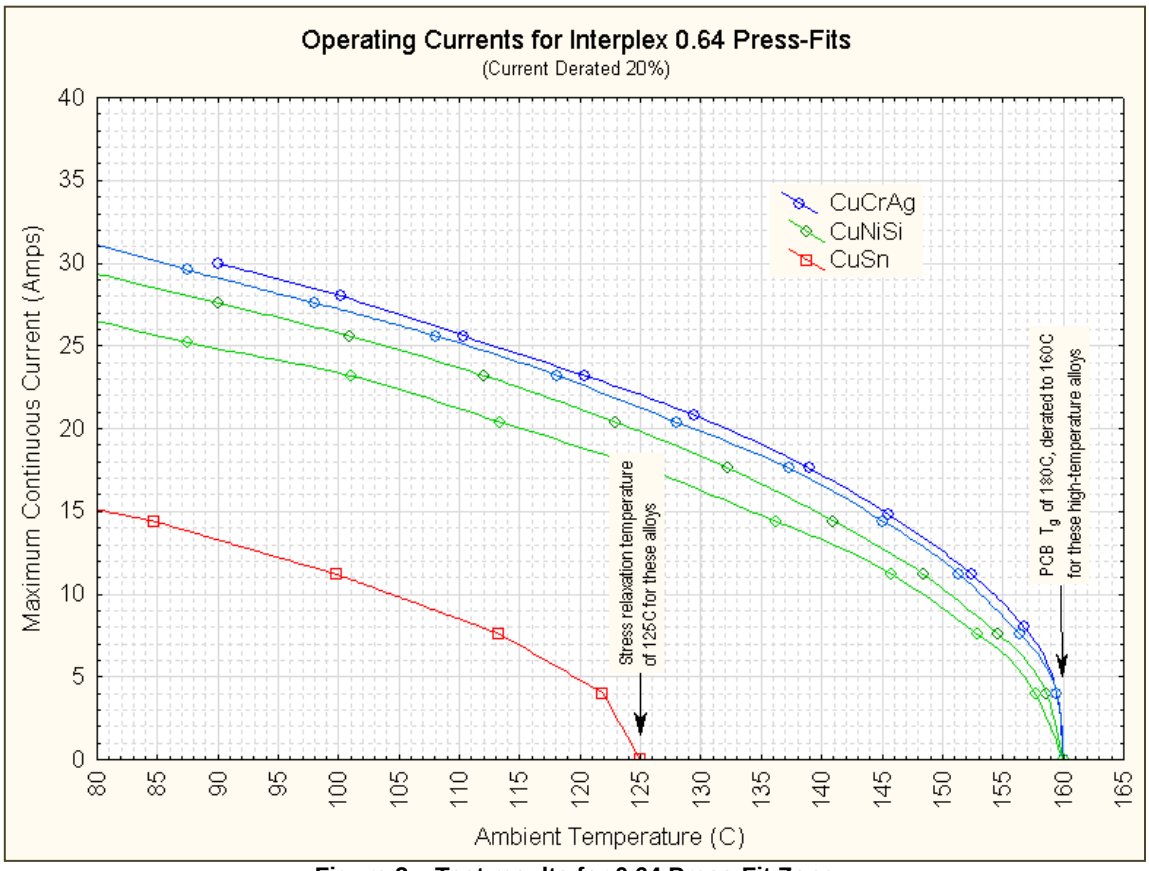

Figure 2 – Test results for 0.64 Press-Fit Zone

Alloys Tested	PCB Specifications	Test Wire Gauge
CuCrAg-80% Conductivity CuNiSi-40% Conductivity CuSn-15% Conductivity	PCB Hole- 1oz Copper PCB Trace- 3oz Copper PCB Trace Width- 3.5mm	2.0mm^2 (14 AWG)

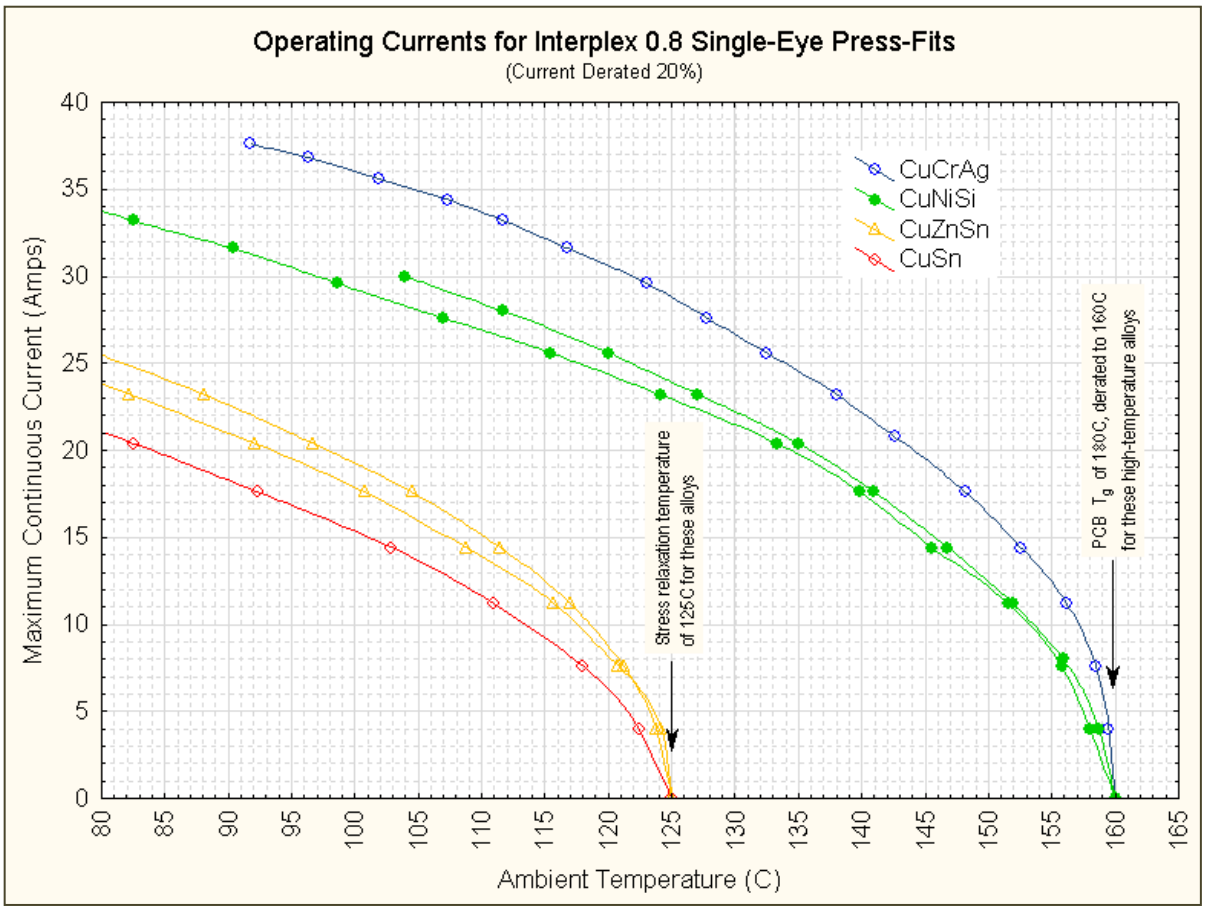

Figure 3 – Test Results for 0.80 Press-fit Zone

Alloys Tested	PCB Specifications	Test Wire Gauge
CuCrAg-80% Conductivity CuNiSi-40% Conductivity CuZnSn-30% Conductivity CuSn-15% Conductivity	PCB Hole- 1oz Copper PCB Trace- 3oz Copper PCB Trace Width- 3.5mm	2.0mm^2 (14 AWG)

Summary of Test Results

These results clearly demonstrate the capability of press-fit interconnects to provide high conductivity and current carrying capacities of 30 amps or more through a single press-fit eye, as well as the ability to maintain reliable and predicable current carrying performance curves across a broad range of operating temperatures, including 125ºC to 150ºC and above.

The availability of a full range of derated test curve data for a variety of alloys also enables product engineers to select the optimal press-fit zone interconnects to meet their specific application requirements. Depending on each application's current-carrying requirements and/or operating temperatures, the designer can choose a press-fit zone component size and alloy that meets the exact specifications while also optimizing the overall product cost and manufacturability.

For example, if the maximum operational temperature of an assembly is 125ºC the maximum current for the 0.64mm press-fit section would be 22 amps with an 80% conductivity alloy. Or, if the target application needs to conduct 10 amps, the application's maximum temperature would have to be 105ºC for a CuSn 15% alloy but it could be as high as 155ºC when using more conductive alloys, such as the CuCrAg at 80% conductivity.

In addition, the solderless nature of press-fit zone components also allows for the optimization of manufacturing processes, even if the product includes large heat sinks and/or multiple assemblies with different thermal coefficient of expansion (CTE) characteristics. This provides product engineers with more flexibility to optimize their overall product designs for efficient thermal dissipation, which in turn allows them to achieve higher current carrying capacities.

The bottom line is that press-fit zone interconnects are now capable of providing significantly higher current carrying capacities than previously assumed and can deliver reliable operating current across a wide range of temperatures. As discussed in the first Tech Bulletin in this series, these capabilities enable solderless press-fit technologies to play a key role in the ongoing electrification of automotive applications as well as the evolution of new inverter and converter power module designs. The next Tech Bulletin in this series will address some of the specific design considerations and opportunities for optimizing press-fit within new-generation power module designs.

More information regarding Press-Fit technologies and products can be found on the web by visiting www.interplex.com/pressfit or by calling (718) 961-6212.