

American Semiconductor and Molex have demonstrated solder assembly capability for complex Flexible Hybrid Electronics (FHE) systems by successfully attaching ultra-thin flexible integrated circuits (Flex-ICs), resistors and LEDs to printed Silver Flexible Circuits (SFCs) using low-temp solder. While others have demonstrated assembly of rigid test die and traditional packaged components to SFCs, American Semiconductor and Molex continue to lead innovation in manufacturing and assembly of truly thin and flexible systems without the traditional bulky components. The total thickness of the silver flexible circuit plus flexible IC as shown in Figure 1 and 2 is approximately 100µm. The team’s early work shown here successfully employed low-temp solder to make the interconnects between the Flex-IC bond pads and the printed traces on the silver flexible circuits and demonstrated feasibility for solder connections on printed PET.



Figure 1. FleX-SoC FHE System Assembled Using Low-Temp Solder in Operation

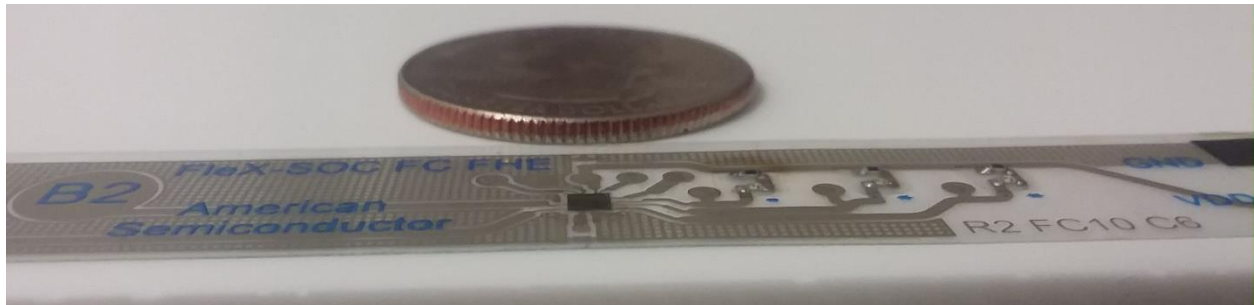


Figure 2. FleX-SoC FHE System Side View

The completed system operates at 2.5-5.0V and supports two capacitive touch input sensors for mode control, three output LEDs, and in-circuit system programming (Figure 3). The LEDs were also attached using the low-temp solder process.

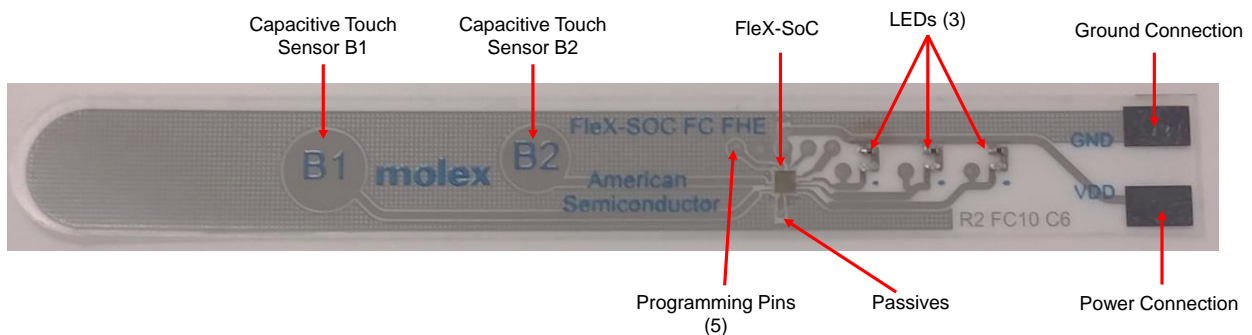


Figure 3. Identification of FleX-SOC FHE System Components

To create these advanced system demonstrators, Molex screen-printed the silver flexible circuits with silver conductive inks on a 3mil (75µm) polyethylene terephthalate (PET) substrate. The primary system component on the substrate is the American Semiconductor AS_CY8C20 Flex-SOC, the industry’s first physically flexible microcontroller system-on-chip with high-density

flash nonvolatile memory. This FleX-SOC™ is an ultra-thin, flexible version of a Cypress Semiconductor Programmable System-on-Chip (PSOC® CY8C20XX6A/S). The FleX-SOC uses polyimides from HD Microsystems to provide encapsulation and mechanical integrity to the ultra-thin die. This effort was the first time the team has demonstrated assembly and interconnect of the FleX-SoC die pads to the printed silver using low temperature solder.

Figure 4 is a magnified image of the FleX-SoC die as seen looking up through the PET substrate. The FleX-SOC die is only 2.16mm X 2.28mm. The 53 Ni/Au bumped bond pads are only 70um x 80um with electrically isolated pads only 33um apart. This makes the placement accuracy of the FleX-SoC die extremely important. For this initial demonstration, we are only using 13 of the bond pads to support device programming, capacitive touch sensor inputs and LED outputs. The electrical connections were completed using a commercially available low-temp solder paste.

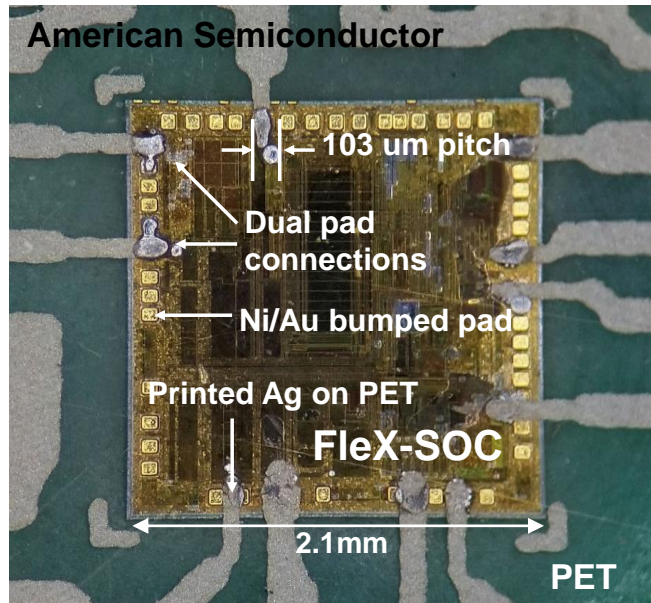


Figure 4. FleX-SoC Low-Temp Solder Connections to Silver on PET