SSI ELECTRONICS, INC.

FLEX-CIRCUIT ADVANTAGES. A CASE STUDY: FREEDOM INNOVATIONS

An Innovative Company Designing and Manufacturing World Class Products

There's nothing ordinary about Freedom Innovation's product line. They are the leader in innovative, high-performance prosthetics for amputees, with a primary focus on the lower leg. Freedom prides themselves on their ability to design and manufacture the most cutting edge, high-performance products, and the fact that so many champion amputee athletes choose to use Freedom's products solidifies their reputation as the leader in their industry. Strategically headquartered in Southern California, which many consider to be an outdoor activity paradise, Freedom Innovation's products are put to the test on a daily basis whether that's by being emerged in the salty waters of the Pacific on a surfboard, or downhill skiing at Bear Mountain, these products must perform.

The Kinnex Ankle is an advanced prosthetic, as it has microprocessors which control nearly endless options for the user. Many of these features and parameters are adjustable using a smart phone. Just like the ankle itself, SSI's keypad needed to be very technologically advanced, all while retaining an aesthetic appeal and water-proofing characteristics. With a laser-etched rubber front, a multi-layered circuit with metal dome tactile and numerous tri-colored LED's, there's nothing ordinary about this keypad. The face of the keypad measures just over 0.60" wide by 1.50" tall, so accomplishing all of the objectives within this limited platform took ingenuity and expertise from both parties.

Why FPC?

During the development of this product, one of the major design decisions revolved around the material choice for the circuitry layer. Mainly, a decision had to be made whether to use the traditional polyester film circuit or the more advanced polyimide (FPC) circuit. Freedom Innovations and SSI collectively identified 3 main performance requirements which made using FPC the most favorable choice. First, because of the constant motion that this product must endure, static build-up and the subsequent impact that potential electrostatic discharge (ESD) would have on the device was a major consideration. While circuits made with polyester film can provide ESD protection up to about 6k volts, the polyimide equivalent provided protection well over 10k volts. Secondly, the etching process related to FPC circuits allowed for much tighter pitch traces than their polyester film counterparts. This enabled SSI to more easily accommodate the tight concentration of keys and LEDs within the limited space allowed. Finally, the copper traces on the FPC circuit allowed for the soldering of the electrical components, providing a very strong mechanical bond to the circuit layer. All told, the FPC circuit provided the necessary platform to produce a part that must remain robust in a highly rigorous environment.

From the Designer's Perspective...

"The NRE and lead time that SSI Electronics offered allowed us to do two iterations of our keypad design, where we would have only been able to do one iteration had we gone with a competitor. This was key to the success of the project since, after the first iteration was complete, we discovered that our protection against ESD needed to be greater than anticipated."

Michael Palmer, R&D Project Manager, Freedom Innovations