Ironwood Electronics

Test socket
0.4 mm pitch

Measurement Results

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Objective

The objective of these measurements is to determine the mechanical performance of Ironwood Electronics test socket. Parameters to be determined are force, deflection, contact resistance and life cycle.

Performance Characterization

The first test examines the relationship between deflection of the spring probe, force and the contact resistance. Displacement – Force (DF) test station was used to measure the spring probe deflection and its corresponding force. Spring probe was assembled into a test fixture. The test fixture with pin was mounted on a board which is connected to a tester for contact resistance measurements. The return electrical path was connected to the force gauge plunger. Test was initialized by moving the force gauge plunger to the tip of the spring probe. Then, force gauge plunger was moved down in increments of 0.01mm and the corresponding force and contact resistance were recorded. Figure 1 shows the deflection vs force curve.

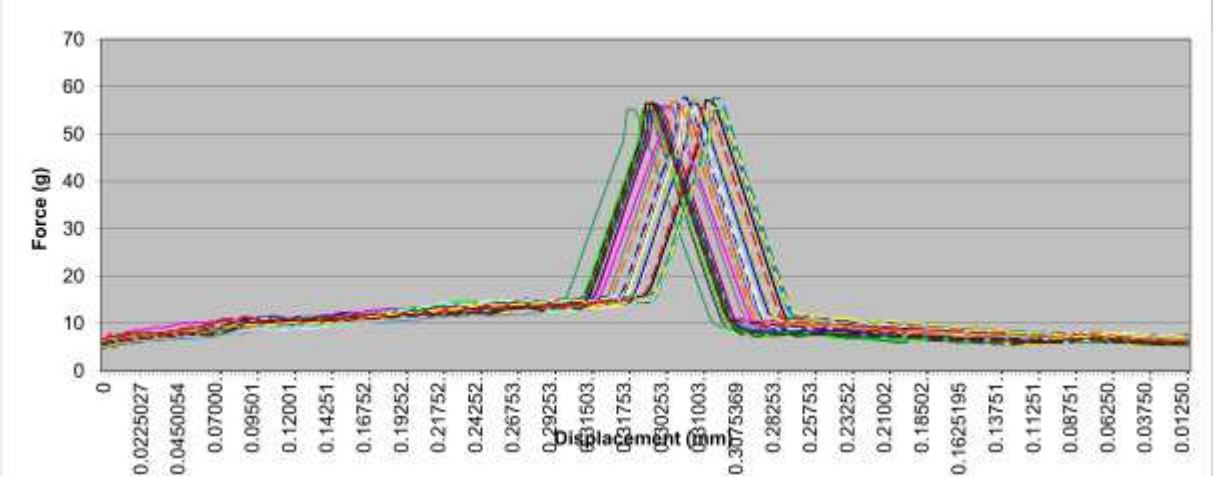

Figure 1: Force vs Displacement at 0K cycle

It can be seen from the graph that the force increases linearly as the displacement increases. Similarly the force decreases linearly as the displacement decreases. The graph shows complete displacement cycle of multiple pins at initial stage of pin life. Then, the pins were actuated for 50,000 cycles and the same displacement cycles were

repeated and shown in Figure 2. Minimal variations between the graphs indicate that the pin is mechanically stable over 50,000 device insertion/extraction cycles.

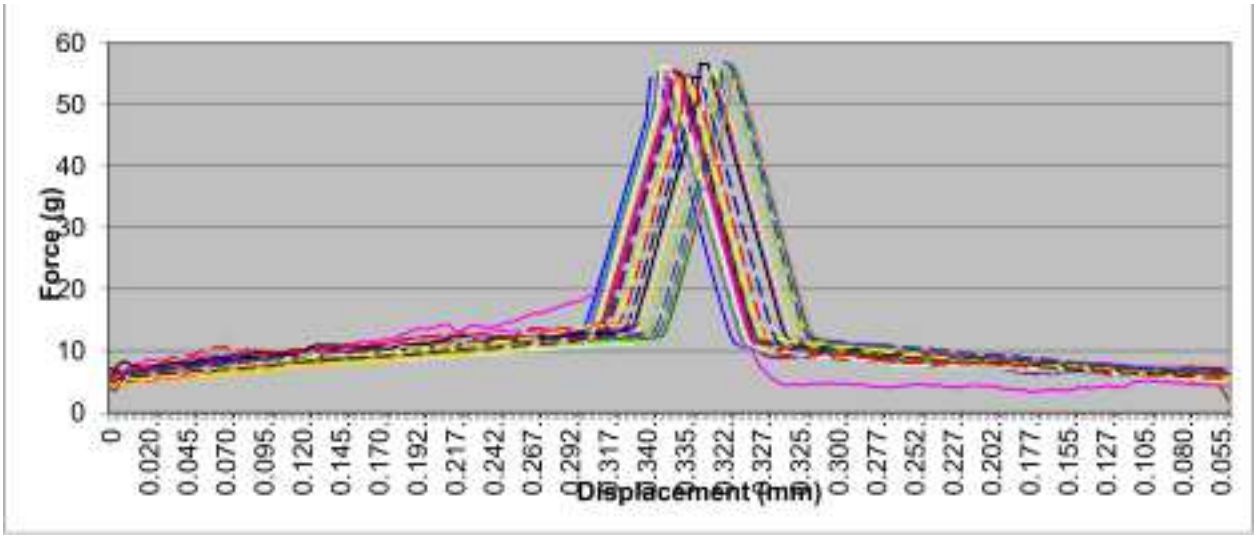

Figure 2: Force vs Displacement at 50K cycle

Figure 3 and 4 show the deflection vs contact resistance curve at 0K cycle and 50K cycle. As expected contact resistance decreases as the displacement increases.

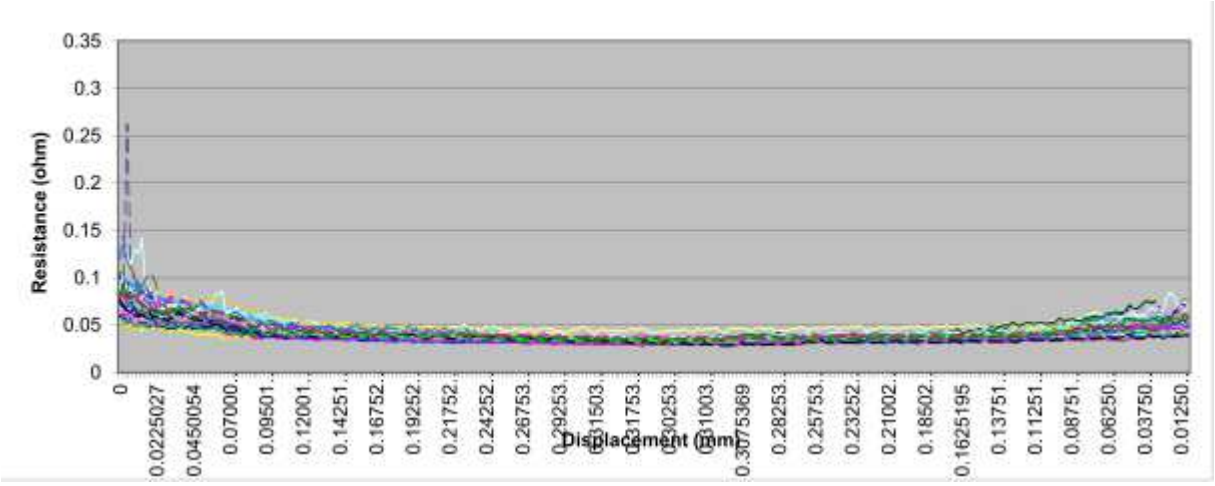

Figure 3: Resistance vs Displacement at 0K cycle

Minimal variations between the graphs indicate that the pin is mechanically stable over 50,000 device insertion/extraction cycles. A desired displacement was chosen based on the compliance requirement of each application. In this particular case, the desired displacement is 0.3mm with 0.1mm preload. Force and average contact resistance

corresponding to this displacement is 15g and 60mOhms respectively. This information is very important for test engineer to set up failure criteria when performing device test using this spring probe.

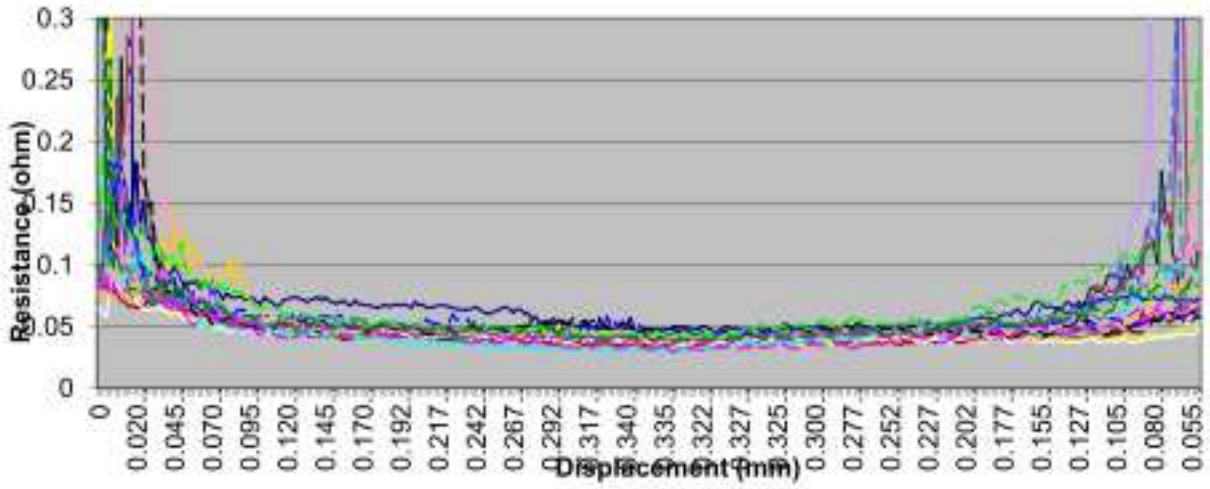

Figure 4: Resistance vs Displacement at 50K cycle

The second test examines the relationship between contact resistance over spring probes life cycle count. Since the stamped spring probe technology was proven at 0.5mm pitch and 1mm pitch, manual testing was used for this experiment. 36 pins were assembled onto a test fixture that was mounted on the daisy chained test board which was connected to a multimeter. A daisy chained test device was placed inside the socket and compressed. Initial contact resistance data was measured via multimeter and the tests were repeated by reinserting the device many times. Contact resistance data collected at different cycle intervals was shown in Figure 5. It can be seen from the graph that the average contact resistance is less than 60mOhms. Since actual device with solder balls was used for testing, the device has to be reflow after few insertions because of solder ball deformation due to spring probe impact. This can be seen in the graph that contact resistance drops immediately after solder ball reflow. Solder migration from device to spring probe tips need periodical cleaning.

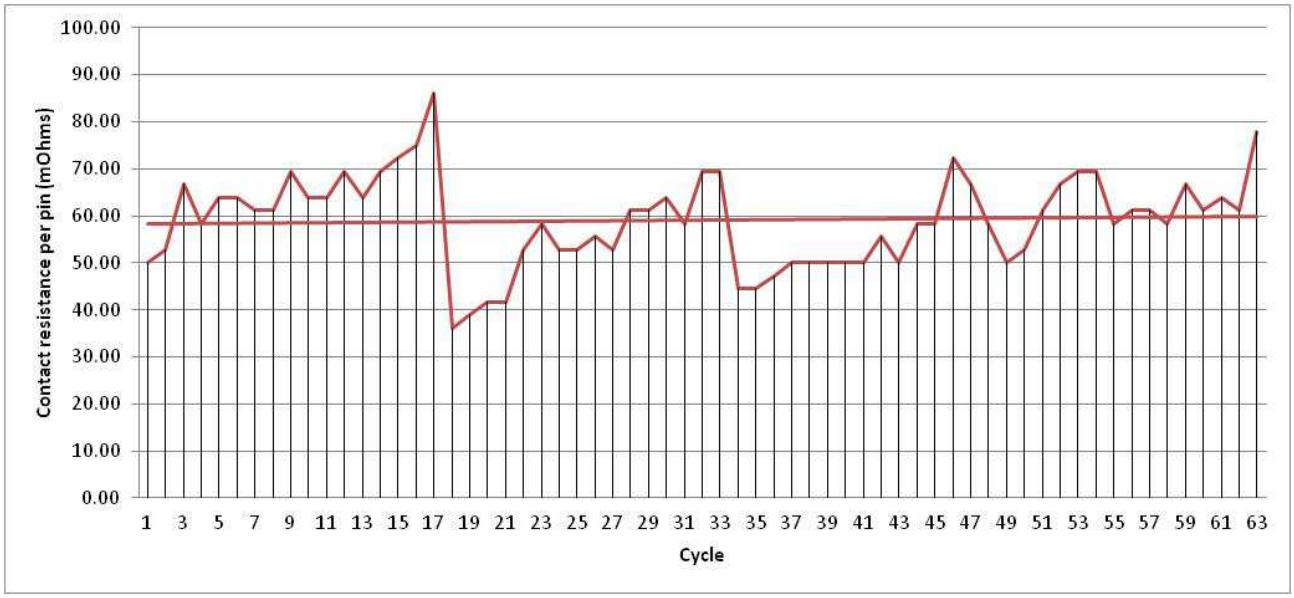

Figure 5: Resistance vs cycle

Conclusion:

Reliability of test sockets is critical to ship products without defect. Validating performance of test socket gives confidence to test engineer in testing their end product. Different tests were performed to validate spring probe that can be used in test applications. FDR (Force Deflection Resistance) test validates the specification for force and contact resistance at recommended spring probe travel. Cycle test validates spring probe performance without degradation. This means reduced ATE downtime and increased throughput for customer.