

title	Drop Testing Reliability of Lead-free Solder Interconnections
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additional	
department	Industrial and Manufacturing Engineering
proj_desc	<p>Portable consumer electronics such as cell phones, pagers, cameras, and camcorders are prone to being dropped during their uses. The drop event could result in solder interconnection failure and malfunction of these devices. The objective of this proposal is to investigate the drop testing reliability of lead-free solder interconnections.</p> <p>The key characterization tool of solder joint failure in drop testing is a high-speed resistance measurement system. Typical pulse duration during the drop test is about 0.5 millisecond. Traditional event detectors may not be able to detect solder interconnection failures since an event detector only detects a predetermined event. JEDEC recommends a high-speed data acquisition system capable of measuring at a scan frequency of 20KHz and greater with a 16 bit signal width. Currently no such a high-speed data acquisition system is available in the market.</p> <p>This proposal consists of two parts. The first part is intended to develop a high-speed resistance measurement system that is capable of measuring the resistance of solder interconnections at a scan frequency of 50KHz and greater with a 16 bit signal width. Both hardware and software will be developed in this project. The voltage across the solder interconnection will be measured and the analog signals will be converted to digital signals through a high-speed Analog-to-Digital (A/D) converter. Software will be developed using C++ language to process the digital signals from the A/D converter. The output of the system is a format that can be used for statistical analysis since massive digital data will be collected by the system. The software will integrate with Matlab program so an operator can easily identify which solder interconnection has failed in the computer monitor. Currently we have purchased an Analog-to-Digital converter from National Instruments and an accelerometer from PCB Piezotronics.</p> <p>The second part of the proposal is to conduct drop tests. Test vehicles will be designed. Drop tests will be conducted. The solder interconnection failure will be monitored by the developed high-speed measurement system described in the above. Failure analysis will be conducted at the industry partners at San Jose. Students will also perform data analysis under the supervision of the PI.</p>
inter_desc	<p>This project will provide educational tools needed for next generation skilled and environmentally conscious engineers for the electronics industry with multidisciplinary training in areas of manufacturing engineering (electronics manufacturing processes), industrial engineering (design of experiments, statistics, and reliability), mechanical engineering (mechanics), material engineering (material characterization and failure analysis), and electrical and computer engineering (high-speed measurement system design and implementation, software development for the measurement system, design for manufacturability and reliability). Students supported by the project will not only gain valuable hands-on experience in high-speed measurement system design and implementation, electronics manufacturing processes, reliability testing, and failure analysis, but also learn analytical skills in fracture mechanics, experimental design and analysis. The multidisciplinary research experience will stimulate undergraduate students' interest for advanced graduate education and better prepare them to enter the engineering profession in industry.</p>
links	
students	2
majors	CPE, EE, MATE, ME, IME

desired_res	1 or 2 students majoring in computer engineering, electrical engineering, material engineering, mechanical engineering, industrial engineering, and/or manufacturing engineering
date_added	2008-10-10 11:53:59