**Abstract**

One of the challenges of solder joint reliability tests is estimating the time of failure of the solder joint. Failure criteria should be able to detect solder joint failure as early as possible, while minimizing the probability of false detection. The failure mechanism under study is cracks due to thermal fatigue. The most common method to estimate failure due to cracks is to monitor the resistance during testing, because solder imaging and cross-sectioning methods are destructive. Current industry failure criteria do not adequately demonstrate the relationship between the size of the crack and the resulting change in resistance. This project analyzes data from a thermal fatigue reliability study of low-silver ball grid array spheres. Traditional quality control charts are used to estimate the time-to-failure of the solder joints, as well as observe common failure trends. These time-to-failure estimates are compared to the IPC standard of 20% increase from initial resistance. Three common failure trends are discussed, and the reliability parameters are estimated. The results show that there is no statistically significant difference between the time-to failure estimates of the IPC standard and traditional control chart method.