

## **Extreme Temperature Thermal Cycling Tests and Results to Assess Reliability of Hardware for Flight Qualification**

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Qualification of the advanced packaging and interconnects technologies and other hardware for a space application is a very important step to enhance the mission assurance. The qualification and reliability requirements for testing of electronic parts, packages and assemblies under extreme cold temperatures depend on the specific needs of the projects. Thermal cycling tests for qualification of real flight parts and packages are more specified to adapt for a specific mission. In general, the flight parts, packages, modules, subassemblies, systems etc., are designed to survive three times the total number of expected temperature cycles resulting from all environmental and operational exposures occurring over the life of the flight hardware including all relevant manufacturing, ground operations and mission phases such as launching, cruising, landing, etc. Specifically, it shall be demonstrated that subjecting flight-like hardware to the environmental temperature extremes will not result in structural failures or electrical performance degradations due to either overstress or low thermal cycle fatigue. Our activity is to characterize package robustness of newly available and advanced electronic parts/packaging technologies and assemblies under extreme cold temperatures (down to liquid nitrogen,  $-196.6^{\circ}\text{C}$ ) representing current and future needs of NASA. The results on some of the tests performed using several types of technologies under extreme temperatures will be presented.

**Key words:** Extreme temperatures, qualification, package reliability, thermal cycling, etc.

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