RAD Hard Application Practices

General

The correct application of microcircuits is essential to overall performance, hardening and survivability for nuclear and space environments, reliability and cost/availability of systems. This section provides a discussion of the issues that must be addressed to ensure correct part selection for systems with a radiation hardening requirement.

Radiation Hardness Assurance

The proper operation of microelectronics in a radiation environment requires knowledge and understanding of the radiation environment (e.g., nuclear weapons engendered, earth's magnetosphere, space, man-made commercial, etc.), the performance required of the microelectronics in the environment (e.g., operate-through, etc.), the equipment configuration (e.g., shielding, shadowing, circumvention, etc.), the response of the actual device and the device response in the intended circuit application. The last point is especially important in a nuclear weapons environment (NWE) due to dose-rate and internal electromagnetic pulse (IEMP) effects.

Qualification Requirements

For the case of the QML supplier the RHACL shall be used to determine the margin between the actual radiation levels and the device capability. For those suppliers who are not QML certified but maintain stringent SPC of the critical design and process parameters, report all design and process changes and have characterization data concerning device, the application of devices use shall be based on radiation test results.

A proposed method to derive the required data base would consist of radiation testing using MIL-PRF-38535, Appendix A, Class Q or Class V requirements (as appropriate to the application), performing steady state life tests on a sample of each lot of die to establish parameter deltas and finally establishing post-radiation temperature and end-of-life deltas.

In addition, this process should be reperformed following any major change of the vendor’s fabrication methodology.

For those vendors who provide commercial parts without any guarantee of change control, a lot sample plan or equivalent would have to be developed by the equipment manufacturer to assure fabrication lot uniformity (i.e., same wafer

lot, homogeneous lot process, etc.). The plan must identify a lot sample plan and qualification testing procedures. A more detailed description of these requirements is provided in the Selection Guidance section.