Development of Standard Space Radiation Effects Test Methods - TID Effects of power MOSFETs

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There are a number of environmental hazards that spacecrafts must confront, which includes thermal plasma, high energy particle radiation, neutral gas particles, UV and X-ray photons, micrometeoroids, and orbital debris. Among theses, the high energy particle is known as the main source of malfunction of the integrated circuits in the space environments. Before the manufacturing of a satellite, it is necessary to assess the total radiation effects in the specified orbit within the mission lifetime. We are trying to setup a standard assessment and test method and procedure for the irradiation of electrical parts to Co-60 gamma ray source. As a first step, we established the test procedure for TID tests of MOSFETs encompassing p-channel and n-channel types. To get statistically significant results for the MOSFETs, a standard test board was designed, for 5 electrical parts from the same LOT to be tested at the same time. To validate the procedure, we performed the sample tests on a p-channel (IRF9Z34NL) and a n-channel (IRF730) power MOSFETs, which play a major roll in STSAT-2 electronics system. The change in electrical performance during the irradiation are introduced and the abnormal behavior of the p-channel MOSFET in the stage of annealing is briefly discussed.