

The Majorana low background low noise front-end electronics

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The Majorana Demonstrator will search for the neutrinoless double beta decay ($\beta\beta_{0\nu}$) of the isotope ^{76}Ge with a mixed array of enriched and natural germanium detectors. In view of the next generation of tonne-scale germanium-based $\beta\beta_{0\nu}$ -decay searches that will probe the neutrino mass scale in the inverted-hierarchy region, a major goal of the Majorana Demonstrator is to demonstrate a path forward to achieving a background rate at or below 1 cnt/(ROI-t-y) in the 4 keV region of interest (ROI) around the 2039-keV Q-value of the ^{76}Ge $\beta\beta_{0\nu}$ -decay. Such a requirement on the background level in conjunction with the best possible energy resolution to increase the signal-to-noise ratio in the ROI significantly constrain the readout electronics. We present here the low background low noise front-end electronics developed for the low-capacitance P-type point-contact (PPC) germanium detectors of the Majorana Demonstrator. This resistive-feedback front-end, specifically designed to have low mass, is fabricated on a radioactivity-assayed fused silica substrate where the feedback resistor consists of a sputtered thin film of high purity amorphous germanium and the feedback capacitor is based on the stray capacitance between circuit Au traces.

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