



Contribution ID: 313

Type: **Poster**

M2Po3A-02: Optically-Powered and Optically-Controlled Cryogenic Gate Driver

Tuesday 20 May 2025 14:00 (2 hours)

The implementation of cryogenic distribution systems with solid-state switches, such as those required in hydrogen-electric aircraft, faces challenges in achieving both electrical and thermal isolation for gate drivers. Traditional methods, including magnetic and capacitive isolation, are unsuitable for systems requiring thermal isolation. This article introduces a novel, partially cryogenic gate driver for gallium nitride high-electron-mobility transistors (GaN HEMT). It utilizes optical isolation through power over fiber (POF) as well as signal over fiber. POF addresses both the thermal and electrical isolation challenges by leveraging the low thermal conductivity of glass and its demonstrated efficiency in transmitting power under cryogenic conditions. The control of the gate driver can be at ambient temperatures while the GaN HEMT driving side can be at cryogenic temperatures. Following the introduction of the gate driver, the performance will be measured at a range of temperatures using a double-pulse tester and compared to a traditional implementation of a gate-driver.

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Session Classification: M2Po3A - Cryogenic Electronics, Detectors, and Topological Materials