Wide band gap devices enable high-efficiency electronics critical for net-gain fusion reactors

The path towards fusion power net gain requires high wall-plug efficiencies. Fusion power plants will need efficient, high power electrical drivers for **plasma heating, compression, and control.** The growing research and development on wide band gap (WBG) semiconductor devices and innovative amplifiers shows promise for speeding up the development of high-power fusion systems and reducing their eventual levelized cost of electricity. WBG devices are less temperature-sensitive, allow faster switching, and have lower resistance leading to higher efficiency and reliability. We are developing integrated, power dense, reliable, and scalable switching power amplifier boards for plasma heating and control applications:

1. Short high power pulses (~5 µs)
2. Control pulses (~1 ms)
3. RF amplifiers (~10s of MHz)

We are designing our boards to be **fault-tolerant** with **plug-and-play** capability for both cooling and power, so boards can be easily replaced. **Fault detection and prediction** are achieved with a tailored combination of detectors and machine learning applied to both simulations and experiments.

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Send us your power electronics requirements

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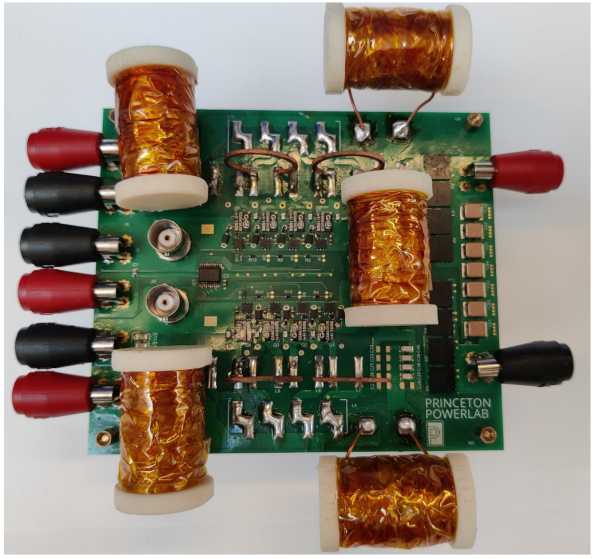

Wide Band Gap Semiconductor Amplifiers for Plasma Heating and Control

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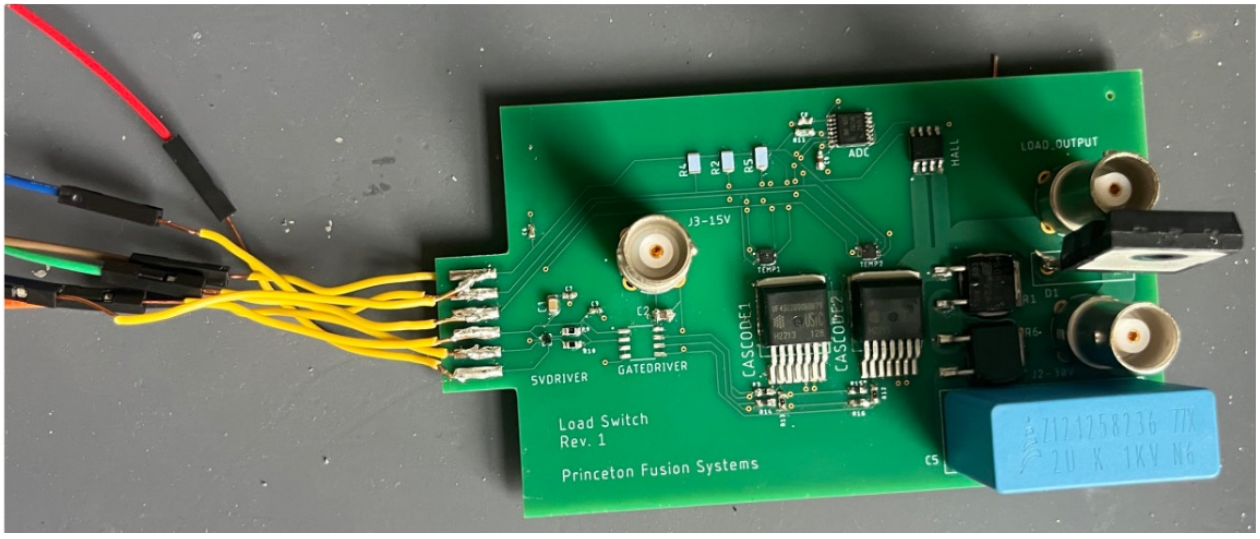
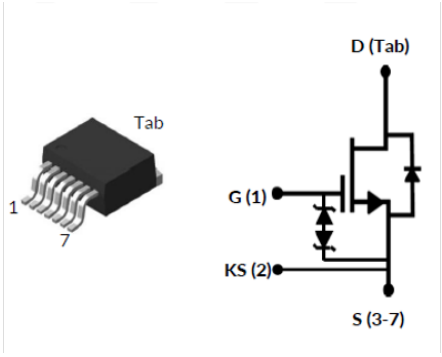
Wide Band Gap Semiconductor Amplifiers for Plasma Heating and Control

Load Switch and Class-E Boards for Pulse and RF Applications



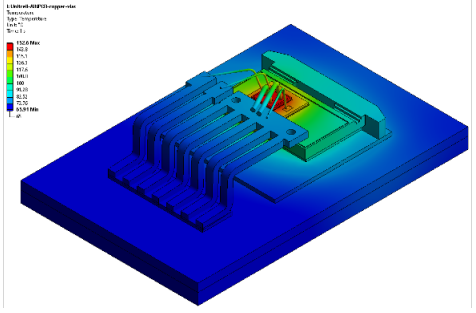
Load Switch Prototype Board



High-voltage (2kV), Low resistance (60 mOhm) Cascodes developed by collaborator Qorvo

The Load Switch uses **high-voltage 2kV cascodes**, allowing lower current and power dissipation for the same load-required power.

Collaborator Princeton University has built a prototype Class-E board at 10 MHz, 200 W, with **reactance steering**, which allows handling of output load variations.



Thermal analyses for cooling optimization performed by collaborator NREL

Collaborating with Qorvo, the Princeton Power Electronics Research Lab at Princeton University, and the National Renewable Energy Laboratory (NREL)

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