WIDE BAND GAP SEMICONDUCTOR AMPLIFIERS FOR PLASMA HEATING AND CONTROL

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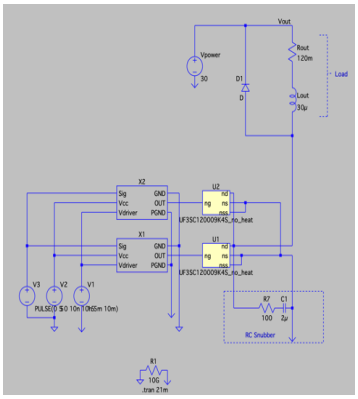
The path towards fusion power net gain requires high wall-plug efficiencies. Fusion power plants will need efficient, high-power electrical drivers for plasma heating, compression, and control.

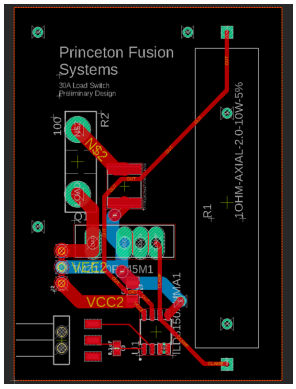
The growing R&D on wide-bandgap (WBG) semiconductor devices and innovative amplifiers shows promise for speeding up the development of high-power fusion systems and reducing their eventual levelized cost of electricity.

Princeton Fusion Systems (PFS), in collaboration with Princeton University, The National renewable Energy Laboratory (NREL) and Qorvo (UnitedSiC) is developing integrated, power dense, reliable and scalable switching power amplifier boards for plasma heating and control applications using WBG switching amplifiers which are known to have an ideal efficiency of 100%. This ideal efficiency upper limit enables circuit boards with high wall-plug efficiencies.

We are designing, testing and qualifying individual circuit boards for **short high power pulses (~ 5 μs), control pulses (~ 1ms), and RF amplifiers (10's of MHz)** for fusion-energy systems.

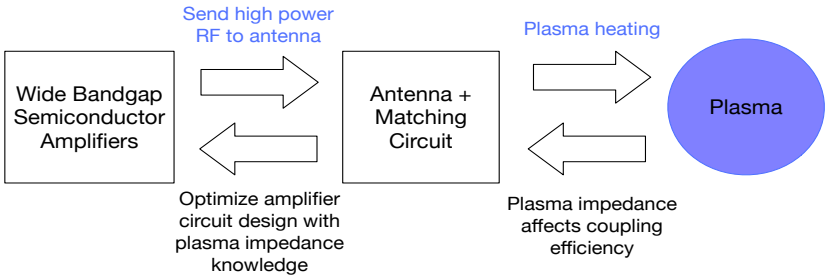


Load switch SPICE model



Load switch board layout

Model in progress which inputs parameters such as plasma density and temperature to make equivalent circuit for optimizing amplifier design.



PFS is additionally working on a model which will take input parameters such as plasma density and temperature to make equivalent circuit models. These equivalent circuit models can be incorporated in circuit simulator software to optimize amplifier design for plasma applications.