A Micromachined DC-to-DC Boost Converter for Powering High-Voltage Transducers

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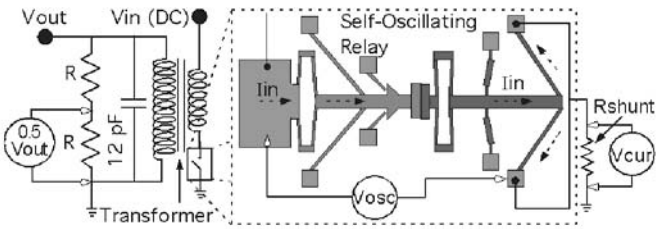
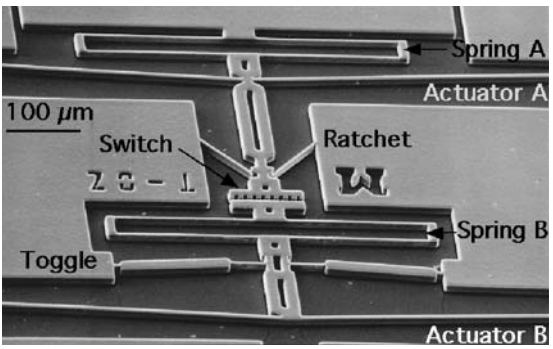


Left – Schematic of a DC-to-DC Boost Converter using a micromachined self-oscillating switch.



Right – SEM image of a micromachined self-oscillating switch.

The goal of this project is provide miniaturized voltage conversion for microsensors and microactuators with high-voltage requirements. These include, for example, micro-Geiger counter and electrostatic actuators. The device is intended to provide 300–800V AC or DC output voltage with up to 1W of power, while being powered by a 3–10V DC supply. The target area is <1cm^2. The typical implementation of a voltage converter involves storing energy on an inductor, breaking the current flow by opening a relay, and pulling the energy off the inductor. The inductor generates a high voltage because of the inductive kick. The approach used in this effort uses a self-oscillating DC-driven switch as an autonomous relay. This essential component of the boost converter results in a reduced footprint, making integration and localized customization attainable. The initial component of this effort was directed at developing the self-oscillating DC-driven switches (see above). This was used to make a prototype of the voltage converter that generates spike of magnitude up to 500V from a 4V DC supply. Present work is directed at structural and fabrication process improvements for enhancing longevity and performance of the micromachined self-oscillating switch. This project is supported primarily by the Engineering Research Centers Program of the National Science Foundation under Award Number EEC-9986866.