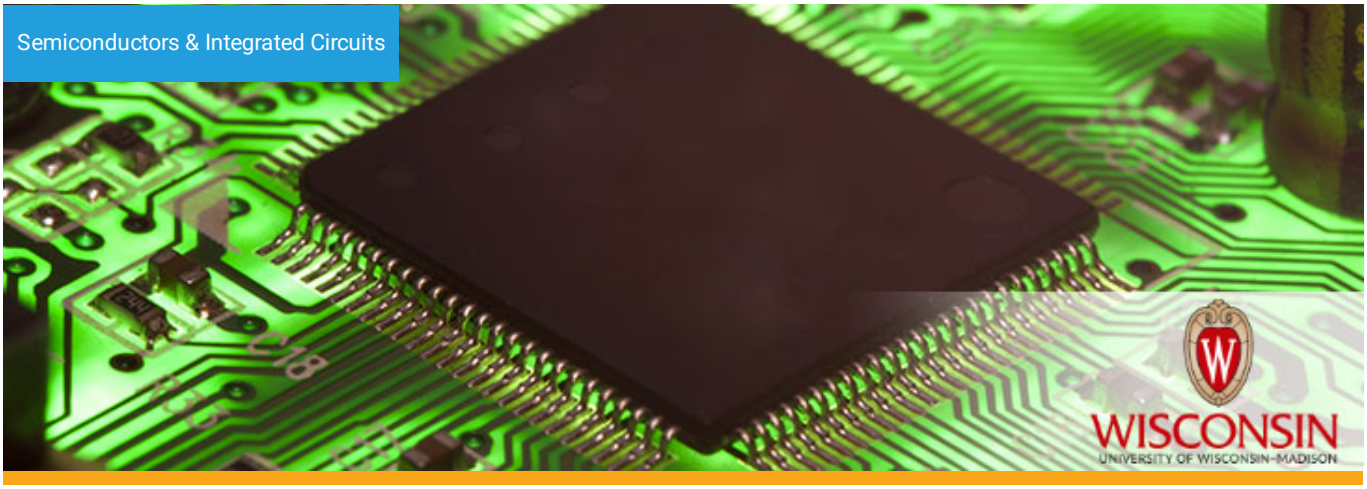
Semiconductors & Integrated Circuits



High-Frequency Bridge Suspended Diode for Power Generation from High Frequency Microwave Sources

View U.S. Patent No. 8,217,495 in PDF format.

WARF: P100160US01

Inventors: Robert Blick, Chulki Kim, Jonghoo Park

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing freely suspended full metal nano-diodes with high cutoff frequencies and reduced parasitic capacitances, and a method to manufacture such diodes.

Overview

Diodes are two-terminal electrical devices that only allow electrical current to flow in one direction. Diodes are used often in electrical circuits to extract a direct current from an alternating current source for either power generation or demodulation.

Common diodes use a junction between specially doped, or charged, semiconductors and provide a forward voltage drop across the diode terminals in the conduction direction of 0.7 to 1.7 volts. Schottky diodes, also known as hot carrier diodes, are a special type of diode that use a junction between a metal and a doped semiconductor. Schottky diodes provide higher system efficiency due to a lower voltage drop of 0.15 to 0.45 volts.

In contrast, metal-insulator-metal (MIM) tunnel diodes provide two metal terminals separated by an insulating layer. MIM diodes have the potential for high operating frequencies, making them possible candidates for “rectennas,” which are arrays of diodes placed in wideband antennas to absorb electromagnetic radiation for power generation.

The Invention

UW-Madison researchers have developed full metal electrical nano-diodes and a method to fabricate such diodes with desirable properties for high-frequency applications. The diodes produced by this method have an ultra-high cutoff frequency, since most of the surrounding dielectric material is removed. The method involves a metal-coated semiconductor structure, which is further coated with a Teflon-like layer. The semiconductor substrate material is then etched, leaving islands of metal suspended by the Teflon-like material. The suspended islands operate as coupled MIM junctions. This structure functions as a freely suspended diode with reduced parasitic junction capacitance.

Applications

- Ultra-sensitive nano-diodes
- Terahertz sensing at room temperature
- “Rectennas” for power generation from high-frequency microwave sources

Key Benefits

- Provides a tenfold increase in bandwidth without the surrounding dielectric material
- Operates at room temperature

- Functions without any moving parts

Tech Fields

- Engineering : Micro & nanotechnologies
- Semiconductors & Integrated Circuits : Design & fabrication

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854