A Zero Turn-On Voltage Rectifier for Efficient Wireless Power Supplies and Energy Harvesting

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BACKGROUND

As wireless biomedical implant devices advance to smaller sizes with higher processing power, the issue of power supply becomes a critical design hurdle. Designers for biomedical devices have turned their attention to sensors that are powered by RF energy that is implanted on or within the skin. The most popular power transfer technique is inductive coupling (near-field) because attenuation in tissue is reduced in comparison to RF (far-field) traveling waves and antenna efficiency is independent of wavelength. Unfortunately, as device (antenna) size decreases power collected by the device falls off in proportion to the mutual inductance squared or R4 where R is the radius of the antenna coil. For this reason it is important that the low RF energy levels collected by the antenna are efficiently converted to DC power to operate the implant.

TECHNOLOGY DESCRIPTION

Engineers from UC San Diego have developed a patent-pending technology that provides cross-coupled rectifiers that use near zero-threshold transistors in a switching topology that avoids reverse conduction problems. Importantly, preferred embodiment rectifiers of the invention only provide a slightly increased on-resistance in each branch, while providing both very high operating efficiency and very low tum-on voltage. An embodiment of the invention is a voltage rectifier for the conversion of RF energy into DC voltage with a tum-on threshold voltages approaching OV. Whereas traditional CMOS and Schottky diode rectifiers require several hundred millivolts to activate, the present circuit can operate upon near-zero incident energy, enabling a variety of useful applications, including:

- Wireless biomedical implants.
- Increased range of RFID devices.
- Wireless sensors with very low threshold activation.
- Reduced complexity of RFID devices while maintaining current performance.
- Energy harvesting by converting ambient RF radiation into useable DC power.

STATE OF DEVELOPMENT

This technology has been fully prototyped and measured with a functional device developed using Perigrine Semiconductor's Silicon-on-Saphire 250 nm CMOS process.

INTELLECTUAL PROPERTY INFO

This technology is protected by an issued patent. The University seeks to commercially develop this invention.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,415,837	04/09/2013	2010-135

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OTHER INFORMATION

CATEGORIZED AS

- **Communications**
  - Wireless
- **Energy**
  - Other
- **Sensors & Instrumentation**
  - Medical
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