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Proof**CONTROL ID:** 1272659**CONTACT (NAME ONLY):** Josue Sanz-Robinson**Abstract Details****PRESENTATION TYPE:** Oral Presentation Preferred**CURRENT SYMPOSIUM:** A: Amorphous and Polycrystalline Thin-Film Silicon Science and Technology**KEYWORDS:** Performance/Functionality/devices, Performance/Functionality/microelectronics, Synthesis & Processing/Deposition/plasma-enhanced CVD (PECVD) (deposition).**Abstract****TITLE:** A Full-Wave Bridge Rectifier Based on Amorphous Silicon Schottky Diodes for Integration with Inductively Coupled Links on Plastic**AUTHORS (FIRST NAME, LAST NAME):** Josue Sanz-Robinson^{1, 2}, Warren S. Rieutort-Louis^{1, 2}, Naveen Verma^{1, 2}, Sigurd Wagner^{1, 2}, James C. Sturm^{1, 2}**INSTITUTIONS (ALL):** 1. Department of Electrical Engineering, Princeton University, Princeton, NJ, United States.

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ABSTRACT BODY: As large area electronic (LAE) systems incorporate increased functionality, it is desirable to transmit signals between adjacent plastic electronic sheets through near-field wireless coupling based on inductors and capacitors. Eliminating wired contacts can enable increased system scaling and reduced assembly complexity, but it can also be energy efficient due to the minimal wireless range needed. Near-field wireless coupling requires AC signals, which in turn leads to the need for a rectifier circuit, capable of efficiently converting control and data signals to DC. In this paper we describe: 1) an a-Si Schottky barrier diode, which is optimized to give a low voltage drop and operate at the relatively high frequencies (in the range of 100 kHz) required to improve the efficiency of the inductive links; 2) the integration of these diodes to form a full-wave bridge rectifier with an AC-to-DC power conversion efficiency (PCE), ranging from approximately 46 % at 200 Hz to greater than 10 % at 1 MHz; 3) a model for transient operation of these components and circuits, enabling the critical device factors as a function of frequency to be identified; 4) the demonstration of the rectifier circuit wirelessly receiving signals from an inductive link to provide DC control outputs to a TFT logic circuit.

The Schottky diode structure is based on hydrogenated amorphous silicon (a-Si:H), deposited using PECVD at under 200°C. The functional structure of the diode consists of 100 nm chrome, 50 nm n+ a-Si:H, 1000 nm a-Si:H and 100 nm chrome. Before the Schottky barrier chrome was deposited, a 24 hour anneal at 200°C was carried out to improve device yield and uniformity. The diode has a current density of approximately 10⁻³ A/cm² at 1 V, 10⁻¹ A/cm² at 8 V and 10⁻⁶ A/cm² at -8V.

One of the principal challenges we faced is the significant parallel diode capacitance (12.9 nF/cm² at 100 kHz), which prevents successful rectification at frequencies beyond 200 kHz in a half-wave rectifier configuration. To overcome this we developed a full-wave bridge rectifier by integrating four 1 mm² diodes. Employing a configuration where the inputs oscillate in counter phase, the symmetry in this structure permits cancellation of the capacitive currents, enabling rectification at over 20 MHz.

To the best of our knowledge, this is the first thin film bridge rectifier to be characterized and optimized in terms of power conversion efficiency as a function of frequency. The results obtained highlight how a full wave bridge rectifier in amorphous silicon is a viable option for a large number of potential applications over a wide range of frequencies.

(No Table Selected)

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