Title: A DC-DC Step-Up μ-Power Converter for Energy Harvesting Applications, Using Maximum Power Point Tracking, Based on Fractional Open Circuit Voltage

Author(s): Carvalho, Carlos¹,²; Lavareda, Guilherme; Paulino, Nuno

Source: Technological Innovation for Sustainability Book Series: IFIP Advances in Information and Communication Technology

Volume: 349 Pages: 510-517 Published: 2012

Document Type: Proceedings Paper

Language: English

Abstract: A DC-DC step-up micro power converter for solar energy harvesting applications is presented. The circuit is based on a switched-capacitor voltage tripler architecture with MOSFET capacitors, which results in an area approximately eight times smaller than using MIM capacitors for the 0.13 μm CMOS technology. In order to compensate for the loss of efficiency, due to the larger parasitic capacitances, a charge reutilization scheme is employed. The circuit is self-clocked, using a phase controller designed specifically to work with an amorphous silicon solar cell, in order to obtain the maximum available power from the cell. This will be done by tracking its maximum power point (MPPT) using the fractional open circuit voltage method. Electrical simulations of the circuit, together with an equivalent electrical model of an amorphous silicon solar cell, show that the circuit can deliver a power of 1132 μW to the load, corresponding to a maximum efficiency of 66.81%.

Author Keywords: Electronics; CMOS Circuits; Energy Harvesting; Power Management Circuits; Maximum Power Point Tracking; Amorphous Silicon Solar Cell

Reprint Address: Carvalho, C (reprint author), IPL, Inst Super Engn Lisboa ISEL ADEETC, Rua Conselheiro Emídio Navarro 1, P-1959007 Lisbon, Portugal.

Addresses:
1. Univ Beira Interior, Dept Electromech Engn, P-6201001 Covilhã, Portugal
2. Inst Super Engn Lisboa, Dept Area Elect Engn & Automat, P-1959007 Lisbon, Portugal

E-mail Address: cfc@isel.ipl.pt; gal@fct.unl.pt; nunop@uninova.pt

Publisher: Springer-Verlag Berlin
Publisher Address: Heidelberger Platz 3, D-14197 Berlin, Germany

ISSN: 1868-4238

ISBN: 978-3-642-19170-1