

SPRINGER BRIEFS IN
ELECTRICAL AND COMPUTER ENGINEERING

Ana Paula Pinto Correia
Pedro Miguel Cândido Barquinha
João Carlos da Palma Goes

A Second-Order $\Sigma\Delta$ ADC Using Sputtered IGZO TFTs

SpringerBriefs in Electrical and Computer Engineering

More information about this series at <http://www.springer.com/series/10059>

Ana Paula Pinto Correia
Pedro Miguel Cândido Barquinha
João Carlos da Palma Goes

A Second-Order $\Sigma\Delta$ ADC Using Sputtered IGZO TFTs

Ana Paula Pinto Correia
CTS/UNINOVA and Department
of Electrical Engineering
Universidade NOVA de Lisboa
Lisbon, Portugal

Pedro Miguel Cândido Barquinha
I3N/CENIMAT and Department of Materials
Science
Universidade NOVA de Lisboa
Lisbon, Portugal

João Carlos da Palma Goes
CTS/UNINOVA and Department
of Electrical Engineering
Universidade NOVA de Lisboa
Lisbon, Portugal

ISSN 2191-8112 ISSN 2191-8120 (electronic)
SpringerBriefs in Electrical and Computer Engineering
ISBN 978-3-319-27190-3 ISBN 978-3-319-27192-7 (eBook)
DOI 10.1007/978-3-319-27192-7

Library of Congress Control Number: 2015958077

Springer Cham Heidelberg New York Dordrecht London
© The Author(s) 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Foreword

The materials science of thin films and associated fabrication process technologies continue to stimulate new technologically significant application areas related to human-machine interaction. A good case in point is the active matrix display, which relies on a layer of thin-film transistor (TFT) electronics (referred to as the display backplane) to drive the display. The backplane is crucial from the standpoint of speed, resolution, and stability, including instability compensation. An interesting material that has emerged for the backplane is the metal oxide semiconductor. The material is transparent and low-temperature processible making it amenable for layering on plastic or even paper substrates. Fully transparent displays have been demonstrated by leading companies such as LG or Samsung, which are starting to create new application areas such as smart windows for automobiles and buildings and immersive environments. These applications place new demands on the TFT, which now will have to go beyond its standard role as a simple switch to new circuit functions.

This book is an abridged version of the materials science and characterization of oxide TFTs tailored to circuit applications. Following a short introduction, the operating principles of TFTs addressing materials selection are covered in Chap. 2. Processing techniques for TFTs along with materials characterization are addressed in Chap. 3 followed by the theory, operation, and current state of the art of thin-film analog-to-digital converters (ADCs). Implementation considerations are reported in Chap. 5 with emphasis on the comparator and sigma-delta modulator ($\Sigma\Delta M$). The book concludes with future perspectives of materials and ADC architectures.

While the design concepts and circuits demonstrated here are based on metal oxide TFT technology, the design considerations can be adapted to a broader range of materials families that support p-channel transistors.

The book is well written and will benefit the engineering design community, materials scientists, physicists, and chemists who are looking for applications of new materials. The book can also serve as a useful reference for graduate or short courses in universities or industry. The authors are renown in the area of oxide TFTs.

Cambridge, UK
August 2015

Arokia Nathan

Acknowledgments

This work has been funded by FEDER funds through the COMPETE 2020 Programme and National Funds through FCT, Portuguese Foundation for Science and Technology, under the projects “Multifunctional nanoscale oxide materials” (EXCL/CTM-NAN/0201/2012), DISRUPTIVE (EXCL/EEI-ELC/0261/2012), INCENTIVO (EEI/UI0066/2014), and strategic projects (UID/CTM/50025/2013) and (UID/EEA/00066/2013). The work has also received funding from the European Communities 7th Framework Programme under grant agreement i-FLEXIS project (ICT-2013-10-611070) and H2020 Programme under grant agreement ROLLOUT project (ICT-03-2014-644631).

