Low-Power CMOS Circuits

Technology, Logic Design and CAD Tools

Christian Piguet

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Low Power Cmos Circuits Technology Logic

Antonio R. Alvarez

Low Power Cmos Circuits Technology Logic:

Low-Power CMOS Circuits Christian Piguet,2018-10-03 The power consumption of microprocessors is one of the most important challenges of high performance chips and portable devices In chapters drawn from Piguet s recently published Low Power Electronics Design Low Power CMOS Circuits Technology Logic Design and CAD Tools addresses the design of low power circuitry in deep submicron technologies It provides a focused reference for specialists involved in designing low power circuitry from transistors to logic gates The book is organized into three broad sections for convenient access The first examines the history of low power electronics along with a look at emerging and possible future technologies It also considers other technologies such as nanotechnologies and optical chips that may be useful in designing integrated circuits The second part explains the techniques used to reduce power consumption at low levels These include clock gating leakage reduction interconnecting and communication on chips and adiabatic circuits The final section discusses various CAD tools for designing low power circuits This section includes three chapters that demonstrate the tools and low power design issues at three major companies that produce logic synthesizers Providing detailed examinations contributed by leading experts Low Power CMOS Circuits Technology Logic Design and CAD Tools supplies authoritative information on how to design and model for high performance with low power consumption in modern integrated circuits It is a must read for anyone designing modern computers or embedded systems *Low Power Vlsi Design And Technology* Farid N Najm,Garey K-h Yeap,1996-08-30 Low power and low energy VLSI has become an important issue in today s consumer electronics This book is a collection of pioneering applied research papers in low power VLSI design and technology A comprehensive introductory chapter presents the current status of the industry and academic research in the area of low power VLSI design and technology Other topics cover logic synthesis floorplanning circuit design and analysis from the perspective of low power requirements The readers will have a sampling of some key problems in this area as the low power solutions span the entire spectrum of the design process The book also provides excellent references on up to date research and development issues with practical solution techniques **Integrated Circuit and System Design. Power and Timing Modeling, Optimization and Simulation** José L. Ayala,Delong Shang,Alex Yakovlev,2013-01-03 This book constitutes the refereed proceedings of the 22nd International Conference on Integrated Circuit and System Design PATMOS 2012 held in Newcastle UK Spain in September 2012 The 25 revised full papers presented were carefully reviewed and selected from numerous submissions The paper feature emerging challenges in methodologies and tools for the design of upcoming generations of integrated circuits and systems including reconfigurable hardware such as FPGAs The technical program focus on timing performance and power consumption as well as architectural aspects with particular emphasis on modeling design characterization analysis and optimization *MOS Devices for Low-Voltage and Low-Energy Applications* Yasuhisa Omura,Abhijit Mallik,Naoto Matsuo,2017-02-28 Helps readers understand the physics behind MOS devices for low voltage

and low energy applications Based on timely published and unpublished work written by expert authors Discusses various promising MOS devices applicable to low energy environmental and biomedical uses Describes the physical effects quantum tunneling of MOS devices Demonstrates the performance of devices helping readers to choose right devices applicable to an industrial or consumer environment Addresses some Ge based devices and other compound material based devices for high frequency applications and future development of high performance devices Seemingly innocuous everyday devices such as smartphones tablets and services such as on line gaming or internet keyword searches consume vast amounts of energy Even when in standby mode all these devices consume energy The upcoming Internet of Things IoT is expected to deploy 60 billion electronic devices spread out in our homes cars and cities Britain is already consuming up to 16 per cent of all its power through internet use and this rate is doubling every four years According to The UK s Daily Mail May 2015 if usage rates continue all of Britain s power supply could be consumed by internet use in just 20 years In 2013 U S data centers consumed an estimated 91 billion kilowatt hours of electricity corresponding to the power generated by seventeen 1000 megawatt nuclear power plants Data center electricity consumption is projected to increase to roughly 140 billion kilowatt hours annually by 2020 the equivalent annual output of 50 nuclear power plants Natural Resources Defense Council USA Feb 2015 All these examples stress the urgent need for developing electronic devices that consume as little energy as possible The book MOS Devices for Low Voltage and Low Energy Applications explores the different transistor options that can be utilized to achieve that goal It describes in detail the physics and performance of transistors that can be operated at low voltage and consume little power such as subthreshold operation in bulk transistors fully depleted SOI devices tunnel FETs multigate and gate all around MOSFETs Examples of low energy circuits making use of these devices are given as well The book MOS Devices for Low Voltage and Low Energy Applications is a good reference for graduate students researchers semiconductor and electrical engineers who will design the electronic systems of tomorrow Dr Jean Pierre Colinge Taiwan Semiconductor Manufacturing Company TSMC The authors present a creative way to show how different MOS devices can be used for low voltage and low power applications They start with Bulk MOSFET following with SOI MOSFET FinFET gate all around MOSFET Tunnel FET and others It is presented the physics behind the devices models simulations experimental results and applications This book is interesting for researchers graduate and undergraduate students The low energy field is an important topic for integrated circuits in the future and none can stay out of this Prof Joao A Martino University of Sao Paulo Brazil *Ulsi Front-end Technology: Covering From The First Semiconductor Paper To Cmos Finfet Technology* Wai Shing Lau,2017-08-23 The main focus of this book is ULSI front end technology It covers from the early history of semiconductor science technology from 1874 to state of the art FINFET technology in 2016 Some ULSI back end technology is also covered for example the science and technology of MIM capacitors for analog CMOS has been included in this book Electronic Design Automation for IC Implementation, Circuit Design, and Process Technology Luciano Lavagno,Igor L. Markov,Grant

Martin,Louis K. Scheffer,2017-02-03 The second of two volumes in the Electronic Design Automation for Integrated Circuits Handbook Second Edition Electronic Design Automation for IC Implementation Circuit Design and Process Technology thoroughly examines real time logic RTL to GDSII a file format used to transfer data of semiconductor physical layout design flow analog mixed signal design physical verification and technology computer aided design TCAD Chapters contributed by leading experts authoritatively discuss design for manufacturability DFM at the nanoscale power supply network design and analysis design modeling and much more New to This Edition Major updates appearing in the initial phases of the design flow where the level of abstraction keeps rising to support more functionality with lower non recurring engineering NRE costs Significant revisions reflected in the final phases of the design flow where the complexity due to smaller and smaller geometries is compounded by the slow progress of shorter wavelength lithography New coverage of cutting edge applications and approaches realized in the decade since publication of the previous edition these are illustrated by new chapters on 3D circuit integration and clock design Offering improved depth and modernity Electronic Design Automation for IC Implementation Circuit Design and Process Technology provides a valuable state of the art reference for electronic design automation EDA students researchers and professionals **Integrated Circuit and System Design. Power and Timing Modeling, Optimization and Simulation** Jose L. Ayala,Braulio Garcia-Camara,Manuel Prieto,Martino Ruggiero,Gilles Sicard,2011-09-15 This book constitutes the refereed proceedings of the 21st International Conference on Integrated Circuit and System Design PATMOS 2011 held in Madrid Spain in September 2011 The 34 revised full papers presented were carefully reviewed and selected from numerous submissions The paper feature emerging challenges in methodologies and tools for the design of upcoming generations of integrated circuits and systems and focus especially on timing performance and power consumption as well as architectural aspects with particular emphasis on modeling design characterization analysis and optimization **Low-Power Digital VLSI Design** Abdellatif Bellaouar,Mohamed Elmasry,2012-12-06 Low Power Digital VLSI Design Circuits and Systems addresses both process technologies and device modeling Power dissipation in CMOS circuits several practical circuit examples and low power techniques are discussed Low voltage issues for digital CMOS and BiCMOS circuits are emphasized The book also provides an extensive study of advanced CMOS subsystem design A low power design methodology is presented with various power minimization techniques at the circuit logic architecture and algorithm levels Features Low voltage CMOS device modeling technology files design rules Switching activity concept low power guidelines to engineering practice Pass transistor logic families Power dissipation of I O circuits Multi and low VT CMOS logic static power reduction circuit techniques State of the art design of low voltage BiCMOS and CMOS circuits Low power techniques in CMOS SRAMS and DRAMS Low power on chip voltage down converter design Numerous advanced CMOS subsystems e g adders multipliers data path memories regular structures phase locked loops with several design options trading power delay and area Low power design methodology power estimation techniques Power reduction

techniques at the logic architecture and algorithm levels More than 190 circuits explained at the transistor level **Green Mobile Devices and Networks** Hrishikesh Venkataraman,Gabriel-Miro Muntean,2016-04-19 While battery capacity is often insufficient to keep up with the power demanding features of the latest mobile devices powering the functional advancement of wireless devices requires a revolution in the concept of battery life and recharge capability Future handheld devices and wireless networks should be able to recharge themselves automaticall **Timing Performance of Nanometer Digital Circuits Under Process Variations** Victor Champac,Jose Garcia Gervacio,2018-04-18 This book discusses the digital design of integrated circuits under process variations with a focus on design time solutions The authors describe a step by step methodology going from logic gates to logic paths to the circuit level Topics are presented in comprehensively without overwhelming use of analytical formulations Emphasis is placed on providing digital designers with understanding of the sources of process variations their impact on circuit performance and tools for improving their designs to comply with product specifications Various circuit level design hints are highlighted so that readers can use then to improve their designs A special treatment is devoted to unique design issues and the impact of process variations on the performance of FinFET based circuits This book enables readers to make optimal decisions at design time toward more efficient circuits with better yield and higher reliability *The Computer Engineering Handbook* Vojin G. Oklobdzija,2001-12-26 There is arguably no field in greater need of a comprehensive handbook than computer engineering The unparalleled rate of technological advancement the explosion of computer applications and the now in progress migration to a wireless world have made it difficult for engineers to keep up with all the developments in specialties outside their own *International Conference on Multi disciplinary Technologies and challenges in Industry 4.0* Dr. Prakash s, dr. Silvia liberataullo, dr. Yogesh g s, dr. I manimozhi, prof. Shilpa patil., **Digital Design and Fabrication** Vojin G. Oklobdzija,2017-12-19 In response to tremendous growth and new technologies in the semiconductor industry this volume is organized into five information rich sections Digital Design and Fabrication surveys the latest advances in computer architecture and design as well as the technologies used to manufacture and test them Featuring contributions from leading experts the book also includes a new section on memory and storage in addition to a new chapter on nonvolatile memory technologies Developing advanced concepts this sharply focused book Describes new technologies that have become driving factors for the electronic industry Includes new information on semiconductor memory circuits whose development best illustrates the phenomenal progress encountered by the fabrication and technology sector Contains a section dedicated to issues related to system power consumption Describes reliability and testability of computer systems Pinpoints trends and state of the art advances in fabrication and CMOS technologies Describes performance evaluation measures which are the bottom line from the user s point of view Discusses design techniques used to create modern computer systems including high speed computer arithmetic and high frequency design timing and clocking and PLL and DLL design **Electronic Materials Handbook**

,1989-11-01 Volume 1 Packaging is an authoritative reference source of practical information for the design or process engineer who must make informed day to day decisions about the materials and processes of microelectronic packaging Its 117 articles offer the collective knowledge wisdom and judgement of 407 microelectronics packaging experts authors co authors and reviewers representing 192 companies universities laboratories and other organizations This is the inaugural volume of ASMAs all new ElectronicMaterials Handbook series designed to be the Metals Handbook of electronics technology In over 65 years of publishing the Metals Handbook ASM has developed a unique editorial method of compiling large technical reference books ASMAs access to leading materials technology experts enables to organize these books on an industry consensus basis Behind every article Is an author who is a top expert in its specific subject area This multi author approach ensures the best most timely information throughout Individually selected panels of 5 and 6 peers review each article for technical accuracy generic point of view and completeness Volumes in the Electronic Materials Handbook series are multidisciplinary to reflect industry practice applied in integrating multiple technology disciplines necessary to any program in advanced electronics Volume 1 Packaging focusing on the middle level of the electronics technology size spectrum offers the greatest practical value to the largest and broadest group of users Future volumes in the series will address topics on larger integrated electronic assemblies and smaller semiconductor materials and devices size levels

High Performance Embedded Computing Handbook David R. Martinez,Robert A. Bond,M. Michael Vai,2018-10-03 Over the past several decades applications permeated by advances in digital signal processing have undergone unprecedented growth in capabilities The editors and authors of High Performance Embedded Computing Handbook A Systems Perspective have been significant contributors to this field and the principles and techniques presented in the handbook are reinforced by examples drawn from their work The chapters cover system components found in today s HPEC systems by addressing design trade offs implementation options and techniques of the trade then solidifying the concepts with specific HPEC system examples This approach provides a more valuable learning tool Because readers learn about these subject areas through factual implementation cases drawn from the contributing authors own experiences Discussions include Key subsystems and components Computational characteristics of high performance embedded algorithms and applications Front end real time processor technologies such as analog to digital conversion application specific integrated circuits field programmable gate arrays and intellectual property based design Programmable HPEC systems technology including interconnection fabrics parallel and distributed processing performance metrics and software architecture and automatic code parallelization and optimization Examples of complex HPEC systems representative of actual prototype developments Application examples including radar communications electro optical and sonar applications The handbook is organized around a canonical framework that helps readers navigate through the chapters and it concludes with a discussion of future trends in HPEC systems The material is covered at a level suitable for practicing engineers and HPEC

computational practitioners and is easily adaptable to their own implementation requirements Practical Low Power Digital VLSI Design Gary K. Yeap,2012-12-06 Practical Low Power Digital VLSI Design emphasizes the optimization and trade off techniques that involve power dissipation in the hope that the readers are better prepared the next time they are presented with a low power design problem The book highlights the basic principles methodologies and techniques that are common to most CMOS digital designs The advantages and disadvantages of a particular low power technique are discussed Besides the classical area performance trade off the impact to design cycle time complexity risk testability and reusability are discussed The wide impacts to all aspects of design are what make low power problems challenging and interesting Heavy emphasis is given to top down structured design style with occasional coverage in the semicustom design methodology The examples and design techniques cited have been known to be applied to production scale designs or laboratory settings The goal of Practical Low Power Digital VLSI Design is to permit the readers to practice the low power techniques using current generation design style and process technology Practical Low Power Digital VLSI Design considers a wide range of design abstraction levels spanning circuit logic architecture and system Substantial basic knowledge is provided for qualitative and quantitative analysis at the different design abstraction levels Low power techniques are presented at the circuit logic architecture and system levels Special techniques that are specific to some key areas of digital chip design are discussed as well as some of the low power techniques that are just appearing on the horizon Practical Low Power Digital VLSI Design will be of benefit to VLSI design engineers and students who have a fundamental knowledge of CMOS digital design

Advanced Circuits for Emerging Technologies Krzysztof Iniewski,2012-04-17 The book will address the state of the art in integrated circuit design in the context of emerging systems New exciting opportunities in body area networks wireless communications data networking and optical imaging are discussed Emerging materials that can take system performance beyond standard CMOS like Silicon on Insulator SOI Silicon Germanium SiGe and Indium Phosphide InP are explored Three dimensional 3 D CMOS integration and co integration with sensor technology are described as well The book is a must for anyone serious about circuit design for future technologies The book is written by top notch international experts in industry and academia The intended audience is practicing engineers with integrated circuit background The book will be also used as a recommended reading and supplementary material in graduate course curriculum Intended audience is professionals working in the integrated circuit design field Their job titles might be design engineer product manager marketing manager design team leader etc The book will be also used by graduate students Many of the chapter authors are University Professors *BiCMOS Technology and Applications* Antonio R. Alvarez,2012-12-06 BiCMOS Technology and Applications Second Edition provides a synthesis of available knowledge about the combination of bipolar and MOS transistors in a common integrated circuit BiCMOS In this new edition all chapters have been updated and completely new chapters on emerging topics have been added In addition BiCMOS Technology and Applications Second Edition provides the reader with

a knowledge of either CMOS or Bipolar technology design a reference with which they can make educated decisions regarding the viability of BiCMOS in their own application BiCMOS Technology and Applications Second Edition is vital reading for practicing integrated circuit engineers as well as technical managers trying to evaluate business issues related to BiCMOS As a textbook this book is also appropriate at the graduate level for a special topics course in BiCMOS A general knowledge in device physics processing and circuit design is assumed Given the division of the book it lends itself well to a two part course one on technology and one on design This will provide advanced students with a good understanding of tradeoffs between bipolar and MOS devices and circuits *Nanoelectronics* Robert Puers,Livio Baldi,Marcel Van de Voorde,Sebastiaan E. van Nooten,2017-06-19 Offering first hand insights by top scientists and industry experts at the forefront of R D into nanoelectronics this book neatly links the underlying technological principles with present and future applications A brief introduction is followed by an overview of present and emerging logic devices memories and power technologies Specific chapters are dedicated to the enabling factors such as new materials characterization techniques smart manufacturing and advanced circuit design The second part of the book provides detailed coverage of the current state and showcases real future applications in a wide range of fields safety transport medicine environment manufacturing and social life including an analysis of emerging trends in the internet of things and cyber physical systems A survey of main economic factors and trends concludes the book Highlighting the importance of nanoelectronics in the core fields of communication and information technology this is essential reading for materials scientists electronics and electrical engineers as well as those working in the semiconductor and sensor industries **Basics of Electrical Engineering** Pavel Bartoš,Václav Fiala,Radek Mařík,2025-05-01 In this book we will cover the fundamental principles of electrical engineering The field that is fundamental to understanding the operation and design of electrical and electronic devices Electrical engineering is a field that is constantly evolving and has a huge impact on all aspects of modern life from basic domestic wiring to complex industrial systems and telecommunications One of the critical concepts to understand is electric charge It is a fundamental property of particles such as electrons and protons and it is electric charge that allows electric current to flow through a conductor

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