

Massimo Alioto · Elio Consoli  
Gaetano Palumbo

# Flip-Flop Design in Nanometer CMOS

From High Speed to Low Energy



Springer

# Flip Flop Design In Nanometer Cmos From High Speed To Low Energy

**Massimo Alioto**



## **Flip Flop Design In Nanometer Cmos From High Speed To Low Energy:**

Flip-Flop Design in Nanometer CMOS Massimo Alioto, Elio Consoli, Gaetano Palumbo, 2014-10-14 This book provides a unified treatment of Flip Flop design and selection in nanometer CMOS VLSI systems The design aspects related to the energy delay tradeoff in Flip Flops are discussed including their energy optimal selection according to the targeted application and the detailed circuit design in nanometer CMOS VLSI systems Design strategies are derived in a coherent framework that includes explicitly nanometer effects including leakage layout parasitics and process voltage temperature variations as main advances over the existing body of work in the field The related design tradeoffs are explored in a wide range of applications and the related energy performance targets A wide range of existing and recently proposed Flip Flop topologies are discussed Theoretical foundations are provided to set the stage for the derivation of design guidelines and emphasis is given on practical aspects and consequences of the presented results Analytical models and derivations are introduced when needed to gain an insight into the inter dependence of design parameters under practical constraints This book serves as a valuable reference for practicing engineers working in the VLSI design area and as text book for senior undergraduate graduate and postgraduate students already familiar with digital circuits and timing

**Enabling the Internet of Things** Massimo Alioto, 2017-01-23 This book offers the first comprehensive view on integrated circuit and system design for the Internet of Things IoT and in particular for the tiny nodes at its edge The authors provide a fresh perspective on how the IoT will evolve based on recent and foreseeable trends in the semiconductor industry highlighting the key challenges as well as the opportunities for circuit and system innovation to address them This book describes what the IoT really means from the design point of view and how the constraints imposed by applications translate into integrated circuit requirements and design guidelines Chapter contributions equally come from industry and academia After providing a system perspective on IoT nodes this book focuses on state of the art design techniques for IoT applications encompassing the fundamental sub systems encountered in Systems on Chip for IoT ultra low power digital architectures and circuits low and zero leakage memories including emerging technologies circuits for hardware security and authentication System on Chip design methodologies on chip power management and energy harvesting ultra low power analog interfaces and analog digital conversion short range radios miniaturized battery technologies packaging and assembly of IoT integrated systems on silicon and non silicon substrates As a common thread all chapters conclude with a prospective view on the foreseeable evolution of the related technologies for IoT The concepts developed throughout the book are exemplified by two IoT node system demonstrations from industry The unique balance between breadth and depth of this book enables expert readers quickly to develop an understanding of the specific challenges and state of the art solutions for IoT as well as their evolution in the foreseeable future provides non experts with a comprehensive introduction to integrated circuit design for IoT and serves as an excellent starting point for further learning thanks to the broad coverage of topics and selected references

makes it very well suited for practicing engineers and scientists working in the hardware and chip design for IoT and as textbook for senior undergraduate graduate and postgraduate students familiar with analog and digital circuits

*Integrated Circuit and System Design. Power and Timing Modeling, Optimization, and Simulation* Rene van Leuken, Gilles Sicard, 2011-01-16 This book constitutes the refereed proceedings of the 20th International Conference on Integrated Circuit and System Design PATMOS 2010 held in Grenoble France in September 2010 The 24 revised full papers presented and the 9 extended abstracts were carefully reviewed and are organized in topical sections on design flows circuit techniques low power circuits self timed circuits process variation high level modeling of poweraware heterogeneous designs in SystemC AMS and minalogic      Adaptive Digital Circuits for Power-Performance Range beyond Wide Voltage Scaling Saurabh

Jain, Longyang Lin, Massimo Alioto, 2020-02-27 This book offers the first comprehensive coverage of digital design techniques to expand the power performance tradeoff well beyond that allowed by conventional wide voltage scaling Compared to conventional fixed designs the approach described in this book makes digital circuits more versatile and adaptive allowing simultaneous optimization at both ends of the power performance spectrum Drop in solutions for fully automated and low effort design based on commercial CAD tools are discussed extensively for processors accelerators and on chip memories and are applicable to prominent applications e g IoT AI wearables biomedical Through the higher power performance versatility techniques described in this book readers are enabled to reduce the design effort through reuse of the same digital design instance across a wide range of applications All concepts the authors discuss are demonstrated by dedicated testchip designs and experimental results To make the results immediately usable by the reader all the scripts necessary to create automated design flows based on commercial tools are provided and explained      **Nanometer CMOS ICs** Harry J.M.

Veendrick, 2017-04-28 This textbook provides a comprehensive fully updated introduction to the essentials of nanometer CMOS integrated circuits It includes aspects of scaling to even beyond 12nm CMOS technologies and designs It clearly describes the fundamental CMOS operating principles and presents substantial insight into the various aspects of design implementation and application Coverage includes all associated disciplines of nanometer CMOS ICs including physics lithography technology design memories VLSI power consumption variability reliability and signal integrity testing yield failure analysis packaging scaling trends and road blocks The text is based upon in house Philips NXP Semiconductors Applied Materials ASML IMEC ST Ericsson TSMC etc courseware which to date has been completed by more than 4500 engineers working in a large variety of related disciplines architecture design test fabrication process packaging failure analysis and software      **Design and Modeling of Low Power VLSI Systems** Sharma, Manoj, Gautam, Ruchi, Khan,

Mohammad Ayoub, 2016-06-06 Very Large Scale Integration VLSI Systems refer to the latest development in computer microchips which are created by integrating hundreds of thousands of transistors into one chip Emerging research in this area has the potential to uncover further applications for VLSI technologies in addition to system advancements Design and

Modeling of Low Power VLSI Systems analyzes various traditional and modern low power techniques for integrated circuit design in addition to the limiting factors of existing techniques and methods for optimization Through a research based discussion of the technicalities involved in the VLSI hardware development process cycle this book is a useful resource for researchers engineers and graduate level students in computer science and engineering **Low Power Designs in**

**Nanodevices and Circuits for Emerging Applications** Shilpi Birla, Shashi Kant Dargar, Neha Singh, P.

Sivakumar, 2023-11-14 This reference textbook discusses low power designs for emerging applications This book focuses on the research challenges associated with theory design and applications towards emerging Microelectronics and VLSI device design and developments about low power consumptions The advancements in large scale integration technologies are principally responsible for the growth of the electronics industry This book is focused on senior undergraduates graduate students and professionals in the field of electrical and electronics engineering nanotechnology This book Discusses various low power techniques and applications for designing efficient circuits Covers advance nanodevices such as FinFETs TFETs CNTFETs Covers various emerging areas like Quantum Dot Cellular Automata Circuits and FPGAs and sensors Discusses applications like memory design for low power applications using nanodevices The number of options for ICs in control applications telecommunications high performance computing and consumer electronics continues to grow with the emergence of VLSI designs Nanodevices have revolutionized the electronics market and human life it has impacted individual life to make it more convenient They are ruling every sector such as electronics energy biomedicine food environment and communication This book discusses various emerging low power applications using CMOS and other emerging nanodevices

**VLSI, Communication and Signal Processing** R. K. Nagaria, V. S. Tripathi, Carlos Ruiz Zamarreno, Yogendra Kumar Prajapati, 2023-07-01 This book covers a variety of topics in Electronics and Communication Engineering especially in the area of microelectronics and VLSI design communication systems and networks and signal and image processing The content is based on papers presented at the 5th International Conference on VLSI Communication and Signal Processing VCAS 2022 The book also discusses the emerging applications of novel tools and techniques in image video and multimedia signal processing This book is useful to students researchers and professionals working in the electronics and communication domain

*Proceedings of 2nd International Conference on Micro-Electronics, Electromagnetics and Telecommunications*

Suresh Chandra Satapathy, Vikrant Bhateja, P. Satish Rama Chowdary, V.V.S.S. Sameer Chakravarthy, Jaume

Anguera, 2017-09-06 The book is a collection of best papers presented in the Second International Conference on Microelectronics Electromagnetics and Telecommunication ICMEET 2016 an international colloquium which aims to bring together academic scientists researchers and research scholars to discuss the recent developments and future trends in the fields of microelectronics electromagnetics and telecommunication Microelectronics research investigates semiconductor materials and device physics for developing electronic devices and integrated circuits with data energy efficient performance

in terms of speed power consumption and functionality The book discusses various topics like analog digital and mixed signal circuits bio medical circuits and systems RF circuit design microwave and millimeter wave circuits green circuits and systems analog and digital signal processing nano electronics and giga scale systems VLSI circuits and systems SoC and NoC MEMS and NEMS VLSI digital signal processing wireless communications cognitive radio and data communication

**Intelligent Computing Techniques for Smart Energy Systems** Akhtar Kalam,Khaleequr Rehman Niazi,Amit Soni,Shahbaz Ahmed Siddiqui,Ankit Mundra,2019-12-16 The book compiles the research works related to smart solutions concept in context to smart energy systems maintaining electrical grid discipline and resiliency computational collective intelligence consisted of interaction between smart devices smart environments and smart interactions as well as information technology support for such areas It includes high quality papers presented in the International Conference on Intelligent Computing Techniques for Smart Energy Systems organized by Manipal University Jaipur This book will motivate scholars to work in these areas The book also prophesies their approach to be used for the business and the humanitarian technology development as research proposal to various government organizations for funding approval

**Leakage in Nanometer CMOS Technologies** Siva G. Narendra,Anantha P. Chandrakasan,2006-03-10 Covers in detail promising solutions at the device circuit and architecture levels of abstraction after first explaining the sensitivity of the various MOS leakage sources to these conditions from the first principles Also treated are the resulting effects so the reader understands the effectiveness of leakage power reduction solutions under these different conditions Case studies supply real world examples that reap the benefits of leakage power reduction solutions as the book highlights different device design choices that exist to mitigate increases in the leakage components as technology scales

**Emerging Trends in Computing and Expert Technology** D. Jude Hemanth,V. D. Ambeth Kumar,S. Malathi,Oscar Castillo,Bogdan Patrut,2019-11-07 This book presents high quality research papers that demonstrate how emerging technologies in the field of intelligent systems can be used to effectively meet global needs The respective papers highlight a wealth of innovations and experimental results while also addressing proven IT governance standards and practices and new designs and tools that facilitate rapid information flows to the user The book is divided into five major sections namely Advances in High Performance Computing Advances in Machine and Deep Learning Advances in Networking and Communication Advances in Circuits and Systems in Computing and Advances in Control and Soft Computing

**Recent Trends in Electronics and Communication** Amit Dhawan,Vijay Shanker Tripathi,Karm Veer Arya,Kshirasagar Naik,2021-12-13 This book comprises select proceedings of the International Conference on VLSI Communication and Signal processing VCAS 2020 The contents are broadly divided into three topics VLSI Communication and Signal Processing The book focuses on the latest innovations trends and challenges encountered in the different areas of electronics and communication especially in the area of microelectronics and VLSI design communication systems and networks and image and signal processing It also offers potential solutions and provides an

insight into various emerging areas such as Internet of Things IoT System on a Chip SoC Sensor Networks underwater and underground communication networks etc This book will be useful for academicians and professionals alike Sigma-Delta Converters: Practical Design Guide Jose M. de la Rosa, 2018-08-22 Thoroughly revised and expanded to help readers systematically increase their knowledge and insight about Sigma Delta Modulators Sigma Delta Modulators SDMs have become one of the best choices for the implementation of analog digital interfaces of electronic systems integrated in CMOS technologies Compared to other kinds of Analog to Digital Converters ADCs Ms cover one of the widest conversion regions of the resolution versus bandwidth plane being the most efficient solution to digitize signals in an increasingly number of applications which span from high resolution low bandwidth digital audio sensor interfaces and instrumentation to ultra low power biomedical systems and medium resolution broadband wireless communications Following the spirit of its first edition Sigma Delta Converters Practical Design Guide 2nd Edition takes a comprehensive look at SDMs their diverse types of architectures circuit techniques analysis synthesis methods and CAD tools as well as their practical design considerations It compiles and updates the current research reported on the topic and explains the multiple trade offs involved in the whole design flow of Sigma Delta Modulators from specifications to chip implementation and characterization The book follows a top down approach in order to provide readers with the necessary understanding about recent advances trends and challenges in state of the art Ms It makes more emphasis on two key points which were not treated so deeply in the first edition It includes a more detailed explanation of Ms implemented using Continuous Time CT circuits going from system level synthesis to practical circuit limitations It provides more practical case studies and applications as well as a deeper description of the synthesis methodologies and CAD tools employed in the design of converters Sigma Delta Converters Practical Design Guide 2nd Edition serves as an excellent textbook for undergraduate and graduate students in electrical engineering as well as design engineers working on SD data converters who are looking for a uniform and self contained reference in this hot topic With this goal in mind and based on the feedback received from readers the contents have been revised and structured to make this new edition a unique monograph written in a didactical pedagogical and intuitive style

Multi-voltage Nanoscale CMOS Circuit Techniques Zhiyu Liu, 2008 *Recent Trends in Communication and Electronics* Sanjay Sharma, Astik Biswas, Brajesh Kumar Kaushik, Vibhav Sachan, 2021-06-30 The Department of Electronics and Communication Engineering of KIET Group of Institutions Delhi NCR organized the 4th International Conference ICCE 2020 during November 28 29 2020 Information compiled in this book is based on the 114 research papers of excellent quality covering different domains of Electronics and Communication Engineering Computer Science Engineering Information Technology Electrical Engineering Electronics and Instrumentation Engineering The subject areas treated in the book are Satellite Radar and Microwave Techniques Secure Smart and Reliable Networks Next Generation Networks Devices Circuits Signal Image Processing New Emerging Technologies having the central focus on Recent Trends in Communication

Electronics ICCE 2020 In addition a few themes based on Special Sessions have also been conducted in ICCE 2020 The objective of the book resulting from the 4th International Conference on Recent Trends in Communication Electronics ICCE 2020 is to provide a resource for the study and research work for an interested audience comprising of researchers students audience and practitioners in the areas of Communications Computing Systems **Index to IEEE Publications** Institute of Electrical and Electronics Engineers,1998 Issues for 1973 cover the entire IEEE technical literature **Electrical & Electronics Abstracts** ,1997 **Cost-effective Methods for High-speed Nanometer CMOS VLSI Design** Charbel Akl,2009-08 The semiconductor industry has been following Moore s law over the past five decades due to the continuous CMOS process technology scaling This scaling has led to reduced integrated circuit cost higher integration density and better design performance On the other hand many new design challenges have been introduced due to scaling and these challenges become more significant when migrating from one technology node to a newer one with smaller feature size This book presents seven newly developed circuit and interconnect design methods for nanometer CMOS VLSI designs The first four methods target issues in global on chip signaling on chip busses and clock signal distribution Chapters six and seven of this book present circuit techniques for low power high speed digital circuits and high fan in logic design The last method presented in this book deals with the mode transition latency and energy overheads in the power gated low power designs

**Efficient Design of Variation-Resilient Ultra-Low Energy Digital Processors** Hans Reyserhove,Wim Dehaene,2019-03-27 This book enables readers to achieve ultra low energy digital system performance The author s main focus is the energy consumption of microcontroller architectures in digital sub systems The book covers a broad range of topics extensively from circuits through design strategy to system architectures The result is a set of techniques and a context to realize minimum energy digital systems Several prototype silicon implementations are discussed which put the proposed techniques to the test The achieved results demonstrate an extraordinary combination of variation resilience high speed performance and ultra low energy



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web replace the unit into the fuel tank and bolt it in put the electrical connectors back on and reattach the fuel line put the rear seats back in the car when you are finished you need to pressurize your toyota camry fuel system you can do this by turning on the ignition for a few seconds turn it off for 10 seconds and then repeat the

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web 2 inspect fuel pump a check the fuel pump resistance 1 measure the resistance between the terminals standard 0 2 to 3 0 w at 20 c 68 f b check fuel pump operation 1 apply battery voltage to both the terminals check that the pump operates notice these tests must be done within 10 seconds to prevent the coil from burning out

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web may 20 2020 i finally found a diagram that listed one of the wires for the fuel pump and i went from there for anyone else that needs to know on a 93 camry 4 dr 2 2l auto the fuel pump wiring goes as such from left to right as viewing from driver side rear door top row of 3 brown yellow red stripe yellow blue stripe fuel gauge

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web nov 9 2015 if your relays and fuse checked out okay in step 2 it s time to check for power and ground at the fuel pump for a complete wiring diagram you ll need to locate service information such as [alldatadly.com](#) or a local toyota dealer

remove the rear seat and locate the fuel pump electrical connector

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web 1 check operation of fuel pump a turn the ignition switch on b connect between terminal fc of the ecm connector and the body ground c check for fuel pressure in the fuel inlet hose when it is pinched off result there is pressure in fuel inlet hose hint at this time you will hear the fuel return flowing noise

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web feb 13 2022 drz 6 may 21 2020 you won t get voltage unless the engine is running or key is in the start position 4 5 depends on if you are looking at the harness connector or the fuel pump connector i can never tell remember which toyota is showing in the wiring diagram illustrations of the connectors

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