

Smart Power Ics Technologies And Applications Springer Series In Advanced Microelectronics

Semiconductor power electronics plays a dominant role due its increased efficiency and high reliability in various domains including the medium and high electrical drives, automotive and aircraft applications, electrical power conversion, etc. Power/HVMOS Devices Compact Modeling will cover very extensive range of topics related to the development and characterization power/high voltage (HV) semiconductor technologies as well as modeling and simulations of the power/HV devices and smart power integrated circuits (ICs). Emphasis is placed on the practical applications of the advanced semiconductor technologies and the device level compact/spice modeling. This book is intended to provide reference information by selected, leading authorities in their domain of expertise. They are representing both academia and industry. All of them have been chosen because of their intimate knowledge of their subjects as well as their ability to present them in an easily understandable manner.

This book introduces a new approach to model and predict substrate parasitic failures in integrated circuits with standard circuit design tools. The injection of majority and minority carriers in the substrate is a recurring problem in smart power ICs containing high voltage, high current switching devices besides sensitive control, protection and signal processing circuits. The

injection of parasitic charges leads to the activation of substrate bipolar transistors. This book explores how these events can be evaluated for a wide range of circuit topologies. To this purpose, new generalized devices implemented in Verilog-A are used to model the substrate with standard circuit simulators. This approach was able to predict for the first time the activation of a latch-up in real circuits through post-layout SPICE simulation analysis. Discusses substrate modeling and circuit-level simulation of parasitic bipolar device coupling effects in integrated circuits; Includes circuit back-annotation of the parasitic lateral n-p-n and vertical p-n-p bipolar transistors in the substrate; Uses Spice for simulation and characterization of parasitic bipolar transistors, latch-up of the parasitic p-n-p-n structure, and electrostatic discharge (ESD) protection devices; Offers design guidelines to reduce couplings by adding specific protections.

This book presents an in-depth treatment of various power reduction and speed enhancement techniques based on multiple supply and threshold voltages. A detailed discussion of the sources of power consumption in CMOS circuits will be provided whilst focusing primarily on identifying the mechanisms by which sub-threshold and gate oxide leakage currents are generated. The authors present a comprehensive review of state-of-the-art dynamic, static supply and threshold voltage scaling techniques and discuss the pros and cons of supply and threshold voltage scaling techniques. Many people think of the Smart Grid as a power distribution group built on advanced smart metering—but

that's just one aspect of a much larger and more complex system. The "Smart Grid" requires new technologies throughout energy generation, transmission and distribution, and even the homes and businesses being served by the grid. This also represents new information paths between these new systems and services, all of which represents risk, requiring a more thorough approach to where and how cyber security controls are implemented. This insight provides a detailed architecture of the entire Smart Grid, with recommended cyber security measures for everything from the supply chain to the consumer. Discover the potential of the Smart Grid Learn in depth about its systems See its vulnerabilities and how best to protect it The latest techniques for designing robust, high performance integrated circuits in nanoscale technologies Focusing on a new technological paradigm, this practical guide describes the interconnect-centric design methodologies that are now the major focus of nanoscale integrated circuits (ICs). High Performance Integrated Circuit Design begins by discussing the dominant role of on-chip interconnects and provides an overview of technology scaling. The book goes on to cover data signaling, power management, synchronization, and substrate-aware design. Specific design constraints and methodologies unique to each type of interconnect are addressed. This comprehensive volume also explains the design of specialized circuits such as tapered buffers and repeaters for data signaling, voltage regulators for power management, and phase-locked loops for synchronization. This is an invaluable

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resource for students, researchers, and engineers working in the area of high performance ICs. Coverage includes: Technology scaling Interconnect modeling and extraction Signal propagation and delay analysis Interconnect coupling noise Global signaling Power generation Power distribution networks CAD of power networks Techniques to reduce power supply noise Power dissipation Synchronization theory and tradeoffs Synchronous system characteristics On-chip clock generation and distribution Substrate noise in mixed-signal ICs Techniques to reduce substrate noise

Technology computer-aided design, or TCAD, is critical to today's semiconductor technology and anybody working in this industry needs to know something about TCAD. This book is about how to use computer software to manufacture and test virtually semiconductor devices in 3D. It brings to life the topic of semiconductor device physics, with a hands-on, tutorial approach that de-emphasizes abstract physics and equations and emphasizes real practice and extensive illustrations. Coverage includes a comprehensive library of devices, representing the state of the art technology, such as SuperJunction LDMOS, GaN LED devices, etc. This book is based on the 18 tutorials presented during the 28th workshop on Advances in Analog Circuit Design. Expert designers present readers with information about a variety of topics at the frontier of analog circuit design, including next-generation analog-to-digital converters , high-performance power management systems and technology considerations for advanced IC design. For anyone involved in analog

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circuit research and development, this book will be a valuable summary of the state-of-the-art in these areas. Provides a summary of the state-of-the-art in analog circuit design, written by experts from industry and academia; Presents material in a tutorial-based format; Includes coverage of next-generation analog-to-digital converters, high-performance power management systems, and technology considerations for advanced IC design.

From power electronics to power integrated circuits (PICs), smart power technologies, devices, and beyond, Integrated Power Devices and TCAD Simulation provides a complete picture of the power management and semiconductor industry. An essential reference for power device engineering students and professionals, the book not only describes the physics inside integrated power semiconductor devices such lateral double-diffused metal oxide semiconductor field-effect transistors (LDMOSFETs), lateral insulated-gate bipolar transistors (LIGBTs), and super junction LDMOSFETs but also delivers a simple introduction to power management systems. Instead of abstract theoretical treatments and daunting equations, the text uses technology computer-aided design (TCAD) simulation examples to explain the design of integrated power semiconductor devices. It also explores next generation power devices such as gallium nitride power high electron mobility transistors (GaN power HEMTs). Including a virtual process flow for smart PIC technology as well as a hard-to-find technology development organization chart, Integrated Power Devices and TCAD Simulation gives students and junior engineers a head start in the field of power semiconductor devices while helping to fill the gap between power device engineering and power management systems.

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This slide book introduces the demands of emerging high-performance power-management ICs and discusses up-to-date circuit-design techniques aimed at addressing them, especially within the context of portable microelectronics. The material starts with a top-down design perspective, much like in an industry setting, and discusses the system "from the ground up" (from basic analog IC concepts and voltage references to low-dropout regulators and switched-inductor supplies) with an educational mindset, rigorously surveying, analyzing, and evaluating basic concepts and the state of the art. The driving objective of the book is to enable the reader to model, analyze, and design power-conditioning ICs using bipolar and CMOS transistors. The material places emphasis on basic understanding and critical thinking, that is, on intuitive grasp of concepts, which is the foundation for innovative IC design.

Analog Circuit Design contains the contribution of 18 experts from the 13th International Workshop on Advances in Analog Circuit Design. It is number 13 in the successful series of Analog Circuit Design. It provides 18 excellent overviews of analog circuit design in: Sensor and Actuator Interfaces, Integrated High-Voltage Electronics and Power Management, and Low-Power and High-Resolution ADC's. Analog Circuit Design is an essential reference source for analog circuits designers and researchers wishing to keep abreast with the latest developments in the field. The tutorial coverage also makes it suitable for use in an advanced design course.

This book brings together contributions from experts in the fields to describe the current status of important topics in solid-state circuit technologies. It consists of 20 chapters which are grouped under the following categories: general information, circuits and devices, materials, and characterization techniques. These chapters have been written by renowned experts in the respective fields making this book valuable to

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the integrated circuits and materials science communities. It is intended for a diverse readership including electrical engineers and material scientists in the industry and academic institutions. Readers will be able to familiarize themselves with the latest technologies in the various fields. This book provides an in-depth overview of design and implementation of leakage reduction techniques. The focus is on applicability, technology dependencies, and scalability. The book mainly deals with circuit design but also addresses the interface between circuit and system level design on the one side and between circuit and physical design on the other side.

This book covers the fundamental knowledge of layout design from the ground up, addressing both physical design, as generally applied to digital circuits, and analog layout. Such knowledge provides the critical awareness and insights a layout designer must possess to convert a structural description produced during circuit design into the physical layout used for IC/PCB fabrication. The book introduces the technological know-how to transform silicon into functional devices, to understand the technology for which a layout is targeted (Chap. 2). Using this core technology knowledge as the foundation, subsequent chapters delve deeper into specific constraints and aspects of physical design, such as interfaces, design rules and libraries (Chap. 3), design flows and models (Chap. 4), design steps (Chap. 5), analog design specifics (Chap. 6), and finally reliability measures (Chap. 7). Besides serving as a textbook for engineering students, this book is a foundational reference for today's circuit designers. This book provides a survey of the state of the art of technology and future trends in the new family of Smart Power ICs and describes design and applications in a variety of fields ranging from automotive to telecommunications, reliability evaluation and qualification procedures. The book is

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a valuable source of information and reference for both power IC design specialists and to all those concerned with applications, the development of digital circuits and with system architecture.

Operational Amplifier Speed and Accuracy Improvement proposes a new methodology for the design of analog integrated circuits. The usefulness of this methodology is demonstrated through the design of an operational amplifier. This methodology consists of the following iterative steps: description of the circuit functionality at a high level of abstraction using signal flow graphs; equivalent transformations and modifications of the graph to the form where all important parameters are controlled by dedicated feedback loops; and implementation of the structure using a library of elementary cells. Operational Amplifier Speed and Accuracy Improvement shows how to choose structures and design circuits which improve an operational amplifier's important parameters such as speed to power ratio, open loop gain, common-mode voltage rejection ratio, and power supply rejection ratio. The same approach is used to design clamps and limiting circuits which improve the performance of the amplifier outside of its linear operating region, such as slew rate enhancement, output short circuit current limitation, and input overload recovery.

Over the years, the fundamentals of VLSI technology have evolved to include a wide range of topics and a broad range of practices. To encompass such a vast amount of knowledge, The VLSI Handbook focuses on the key concepts, models, and equations that enable the electrical engineer to analyze, design, and predict the behavior of very large-scale integrated circuits. It provides the most up-to-date information on IC technology you can find. Using frequent examples, the Handbook stresses the fundamental theory behind professional applications. Focusing not only on the

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traditional design methods, it contains all relevant sources of information and tools to assist you in performing your job. This includes software, databases, standards, seminars, conferences and more. The VLSI Handbook answers all your needs in one comprehensive volume at a level that will enlighten and refresh the knowledge of experienced engineers and educate the novice. This one-source reference keeps you current on new techniques and procedures and serves as a review for standard practice. It will be your first choice when looking for a solution.

As their name implies, VLSI systems involve the integration of various component systems. While all of these components systems are rooted in semiconductor manufacturing, they involve a broad range of technologies. This volume of the Principles and Applications of Engineering series examines the technologies associated with VLSI systems, including Analog Circuit Design contains eighteen tutorials, reflecting the contributions of six experts, as presented at the 15th workshop on Advances in Analog Circuit Design (AACD). Provides 18 overviews of analog circuit design in High-Speed A-D Converters, Automotive Electronics and Ultra-Low Power Wireless. An essential reference source for the latest developments in the field, tutorial coverage makes it suitable for advanced design courses.

Power Management Integrated Circuits and Technologies delivers a modern treatise on mixed-signal integrated circuit design for power management. Comprised of chapters authored by leading researchers from industry and academia, this definitive text: Describes circuit- and architectural-level innovations that meet advanced power and speed capabilities Explores hybrid inductive-capacitive converters for wide-range dynamic voltage scaling Presents innovative control techniques for single inductor dual output (SIDO) and single inductor multiple output (SIMO) converters Discusses cutting-

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edge design techniques including switching converters for analog/RF loads Compares the use of GaAs pHEMTs to CMOS devices for efficient high-frequency switching converters Thus, Power Management Integrated Circuits and Technologies provides comprehensive, state-of-the-art coverage of this exciting and emerging field of engineering. This first book on load-pull systems is intended for readers with a broad knowledge of high frequency transistor device characterization, nonlinear and linear microwave measurements, RF power amplifiers and transmitters. Load-Pull Techniques with Applications to Power Amplifier Design fulfills the demands of users, designers, and researchers both from industry and academia who have felt the need of a book on this topic. It presents a comprehensive reference spanning different load-pull measurement systems, waveform measurement and engineering systems, and associated calibration procedures for accurate large signal characterization. Besides, this book also provides in-depth practical considerations required in the realization and usage of load-pull and waveform engineering systems. In addition, it also provides procedure to design application specific load-pull setup and includes several case studies where the user can customize architecture of load-pull setups to meet any specific measurement requirements. Furthermore, the materials covered in this book can be part of a full semester graduate course on microwave device characterization and power amplifier design.

Exciting new developments are enabling sensors to go beyond the realm of simple sensing of movement or capture of images to deliver information such as location in a built environment, the sense of touch, and the presence of chemicals. These sensors unlock the potential for smarter systems, allowing machines to interact with the world around them in more intelligent and sophisticated ways. Featuring

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contributions from authors working at the leading edge of sensor technology, *Technologies for Smart Sensors and Sensor Fusion* showcases the latest advancements in sensors with biotechnology, medical science, chemical detection, environmental monitoring, automotive, and industrial applications. This valuable reference describes the increasingly varied number of sensors that can be integrated into arrays, and examines the growing availability and computational power of communication devices that support the algorithms needed to reduce the raw sensor data from multiple sensors and convert it into the information needed by the sensor array to enable rapid transmission of the results to the required point. Using both SI and US units, the text: Provides a fundamental and analytical understanding of the underlying technology for smart sensors Discusses groundbreaking software and sensor systems as well as key issues surrounding sensor fusion Exemplifies the richness and diversity of development work in the world of smart sensors and sensor fusion Offering fresh insight into the sensors of the future, *Technologies for Smart Sensors and Sensor Fusion* not only exposes readers to trends but also inspires innovation in smart sensor and sensor system development.

3D Integration is being touted as the next semiconductor revolution. This book provides a comprehensive coverage on the design and modeling aspects of 3D integration, in particular, focus on its electrical behavior. Looking from the perspective the Silicon Via (TSV) and Glass Via (TGV) technology, the book introduces 3DICs and Interposers as a technology, and presents its application in numerical modeling, signal integrity,

power integrity and thermal integrity. The authors underscored the potential of this technology in design exchange formats and power distribution. This authoritative first volume provides a solid understanding of modern spacecraft classification, failure, and electrical component requirements. This book focuses on the study of modern spacecraft, including their classification, packaging and protection, design versions, launch failure and accident analysis, and the main requirements of electronic components used. Readers find comprehensive coverage of the design and development of individual components as well as systems, their packaging, and how to make them last in space. This is a useful resource for military and civil applications. Specific topics include: The manufacturing of electronics for space; The main physical mechanisms of the impact of destabilizing factors of outer space, including various kinds of radiation, high-energy galactic ions, and particles of cosmic dust; The design of advanced space-grade microelectronic products such as memory microcircuits, microprocessors, interface and logic of microcircuits and power control microcircuits; Facts and features about the “space race” that have not been available until now.

Semiconductor power devices are the heart of power electronics. They determine the performance of power converters and allow topologies with high

efficiency. Semiconductor properties, pn-junctions and the physical phenomena for understanding power devices are discussed in depth. Working principles of state-of-the-art power diodes, thyristors, MOSFETs and IGBTs are explained in detail, as well as key aspects of semiconductor device production technology. In practice, not only the semiconductor, but also the thermal and mechanical properties of packaging and interconnection technologies are essential to predict device behavior in circuits. Wear and aging mechanisms are identified and reliability analyses principles are developed. Unique information on destructive mechanisms, including typical failure pictures, allows assessment of the ruggedness of power devices. Also parasitic effects, such as device induced electromagnetic interference problems, are addressed. The book concludes with modern power electronic system integration techniques and trends.

This volume collects selected papers of the 3rd CESA Automotive Electronics Congress, Paris, 2014. CESA is the most important automotive electronics conference in France. The topical focus lies on state-of-the-art automotive electronics with respect to energy consumption and autonomous driving. The target audience primarily comprises industry leaders and research experts in the automotive industry.

This symposium was the sScientific-technical event of

the centennial celebration of the Asea Brown Boveri Switzerland. The purpose was to assess the present state of the art as well as shaping the basis for future progress in the area of power devices and related power circuits. The merger of Brown Boveri (BBC) with Asea to Asea Brown Boveri (ABB) three years ago gave new stimulus and enriched the technical substance of the symposium. By 1991, 100 years after the formation of BBC in Switzerland as a single company, this organization has been decentralized, forming 35 independent ABB companies. One of them - ABB Semiconductors Ltd. - directly deals with the power semiconductor business. These significant changes reflect the changes in the market place: increased competition and higher customer expectations have to be fulfilled. In line with the core business activities of ABB and with the concept of sustainable development, it is natural for ABB to be active in the area of power devices and circuits. Increased awareness towards energy conservation is one of the main drives for these activities. User friendliness is another drive: integration of intelligent functions, e.g. protection and/or increased direct computer interfacing of the power circuits. Therefore, also the R&D activities related to the subject of this symposium will in the future be characterized by an even stronger coupling with the market needs. For the members of the R&D Laboratories this means improved customer partnership beyond operational

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excellence.

'This is an excellent reference book for graduates or undergraduates studying semiconductor technology, or for working professionals who need a reference for detailed theory and working knowledge of processes in the field of power semiconductor devices.'IEEE Electrical Insulation MagazineThis descriptive textbook provides a clear look at the theories and process technologies necessary for understanding the modern power semiconductor devices, i.e. from the fundamentals of p-n junction electrostatics, unipolar MOSFET and superjunction structures, bipolar IGBT, to the most recent wide bandgap SiC and GaN devices. It also covers their associated semiconductor process technologies. Real examples based on actual fabricated devices, with the process steps described in clear detail are especially useful. This book is suitable for university courses on power semiconductor or power electronic devices. Device designers and researchers will also find this book a good reference in their work, especially for those focusing on the advanced device development and design aspects.

Analog Circuit Design contains the contribution of 18 tutorials of the 20th workshop on Advances in Analog Circuit Design. Each part discusses a specific to-date topic on new and valuable design ideas in the area of analog circuit design. Each part is presented by six experts in that field and state of

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the art information is shared and overviewed. This book is number 20 in this successful series of Analog Circuit Design, providing valuable information and excellent overviews of: Topic 1 : Low Voltage Low Power, chairman: Andrea Baschiroto Topic 2 : Short Range Wireless Front-Ends, chairman: Arthur van Roermund Topic 3 : Power Management and DC-DC, chairman : Michiel Steyaert. Analog Circuit Design is an essential reference source for analog circuit designers and researchers wishing to keep abreast with the latest development in the field. The tutorial coverage also makes it suitable for use in an advanced design course.

Aimed at both the novice and expert in IT security and industrial control systems (ICS), this book will help readers gain a better understanding of protecting ICSs from electronic threats. Cyber security is getting much more attention and SCADA security (Supervisory Control and Data Acquisition) is a particularly important part of this field, as are Distributed Control Systems (DCS), Programmable Logic Controllers (PLCs), Remote Terminal Units (RTUs), Intelligent Electronic Devices (IEDs)-and all the other, field controllers, sensors, and drives, emission controls, and that make up the intelligence of modern industrial buildings and facilities. This book will help the reader better understand what is industrial control system cyber security, why is it different than IT security, what has really happened to date, and what needs to be done. Loads of practical advice is offered on everything from clarity on current cyber-security systems and how they can be integrated into general IT systems, to how to conduct risk assessments and how to obtain certifications, to future

trends in legislative and regulatory issues affecting industrial security.

The book summarizes and compares recent advancements in the development of novel lateral power transistors (LDMOS devices) for integrated circuits in power electronic applications. In its first part, the book motivates the necessity for lateral power transistors by a top-down approach: First, it presents typical energy conversion applications in modern industrial, automotive and consumer electronics. Next, it introduces common circuit topologies suitable for these applications, and discusses the feasibility for monolithic integration. Finally, the combination of power and logic functionality on a single chip is motivated and the requirements and limitations for the power semiconductor devices are deduced. The second part describes the evolution of lateral power transistors over the past decades from the simple pin-type concept to double-acting RESURF topologies. It describes the principle of operation for these LDMOS devices and discusses limitations of lateral power devices. Moreover, figures-of-merit are presented which can be used to evaluate the performance of the novel lateral power transistors described in this book with respect to the LDMOS devices. In the last part, [...] the fundamental physical concepts including charge compensation and trench gate topologies are discussed. Also, the status of research in LDMOS devices on silicon carbide is presented. Advantages and drawbacks for each of these integration approaches are summarized, and the feasibility with respect to power electronic applications is evaluated.

A practical and comprehensive reference that explores Electrostatic Discharge (ESD) in semiconductor components and electronic systems The ESD Handbook offers a comprehensive reference that explores topics relevant to ESD design in semiconductor components and explores ESD

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in various systems. Electrostatic discharge is a common problem in the semiconductor environment and this reference fills a gap in the literature by discussing ESD protection.

Written by a noted expert on the topic, the text offers a topic-by-topic reference that includes illustrative figures, discussions, and drawings. The handbook covers a wide-range of topics including ESD in manufacturing (garments, wrist straps, and shoes); ESD Testing; ESD device physics; ESD semiconductor process effects; ESD failure mechanisms; ESD circuits in different technologies (CMOS, Bipolar, etc.); ESD circuit types (Pin, Power, Pin-to-Pin, etc.); and much more. In addition, the text includes a glossary, index, tables, illustrations, and a variety of case studies.

Contains a well-organized reference that provides a quick review on a range of ESD topics Fills the gap in the current literature by providing information from purely scientific and physical aspects to practical applications Offers information in clear and accessible terms Written by the accomplished author of the popular ESD book series Written for technicians, operators, engineers, circuit designers, and failure analysis engineers, The ESD Handbook contains an accessible reference to ESD design and ESD systems.

This survey of the state of the art of technology and future trends in the new family of Smart Power ICs describes design and applications in a variety of fields, ranging from automotive to telecommunications, reliability evaluation and qualification procedures.

Advances in Smart Grid Power System: Network, Control and Security discusses real world problems, solutions, and best practices in related fields. The book includes executable plans for smart grid systems, their network communications, tactics on protecting information, and response plans for cyber incidents. Moreover, it enables researchers and energy professionals to understand the future of energy delivery

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systems and security. Covering fundamental theory, mathematical formulations, practical implementations, and experimental testing procedures, this book gives readers invaluable insights into the field of power systems, their quality and reliability, their impact, and their importance in cybersecurity. Includes supporting illustrations and tables along with valuable end of chapter reference sets Provides a working guideline for the design and analysis of smart grids and their applications Features experimental testing procedures in smart grid power systems, communication networks, reliability, and cybersecurity

This book documents electric power requirements for the dismounted soldier on future Army battlefields, describes advanced energy concepts, and provides an integrated assessment of technologies likely to affect limitations and needs in the future. It surveys technologies associated with both supply and demand including: energy sources and systems; low power electronics and design; communications, computers, displays, and sensors; and networks, protocols, and operations. Advanced concepts discussed are predicated on continued development by the Army of soldier systems similar to the Land Warrior system on which the committee bases its projections on energy use. Finally, the volume proposes twenty research objectives to achieve energy goals in the 2025 time frame.

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