

High Voltage High Frequency Devices For Solid State Power

Electronic Devices and Circuits Switching Power Converters Journal of Radiology Official Gazette of the United States Patent and Trademark Office Advanced High Voltage Power Device Concepts High-Frequency Integrated Circuits ANSI Z49. 1-2005, Safety in Welding, Cutting, and Allied Processes Silicon Carbide Power Devices SOTAPOCS XXXII Handbook of Modern Ferromagnetic Materials Solid State Devices and Electronics Emerging Nanoelectronic Devices Mobile Point-of-Care Monitors and Diagnostic Device Design Silicon Carbide High-Frequency Oscillator Design for Integrated Transceivers RF Power Amplifiers Design of High Voltage xDSL Line Drivers in Standard CMOS Practical RF Circuit Design for Modern Wireless Systems Microelectronics Technology and Devices Reference Data for Engineers Protection Electrical Power Systems and Computers Proceedings of the Symposium on High Voltage and Smart Power ICs E M F Electrical Year Book Gallium Nitride Electronics High Voltage Devices and Circuits in Standard CMOS Technologies Power Electronics Handbook Advanced High Speed Devices Protection Devices and Systems for High-Voltage Applications Southern California Practitioner Power Electronic Control in Electrical Systems Transients of Modern Power Electronics Radio Frequency Transistors Electric Relays The Physics of Diagnostic Imaging Second Edition High Efficiency Power Supply Using New SiC Devices Health Devices The Southern California Practitioner Failure Analysis of Integrated Circuits Fundamentals of Power Semiconductor Devices

Electronic Devices and Circuits

Switching Power Converters

Reference Data for Engineers is the most respected, reliable, and indispensable reference tool for technical professionals around the globe. Written by professionals for professionals, this book is a complete reference for engineers, covering a broad range of topics. It is the combined effort of 96 engineers, scientists, educators, and other recognized specialists in the fields of electronics, radio, computer, and communications technology. By providing an abundance of information on essential, need-to-know topics without heavy emphasis on complicated mathematics, Reference Data for Engineers is an absolute "must-have" for every engineer who requires comprehensive electrical, electronics, and communications data at his or her fingertips. Featured in the Ninth Edition is updated coverage on intellectual property and patents, probability and design, antennas, power electronics, rectifiers, power supplies, and properties of materials. Useful information on units, constants and conversion factors, active filter design, antennas, integrated circuits, surface acoustic wave design, and digital signal processing is also included. The Ninth Edition also offers new knowledge in the fields of satellite technology, space communication, microwave science, telecommunication, global positioning systems, frequency data, and radar. * Widely acclaimed as the most practical reference ever published for a wide range of electronics and computer professionals, from technicians through post-graduate

engineers. * Provides a great way to learn or review the basics of various technologies, with a minimum of tables, equations, and other heavy math.

Journal of Radiology

Official Gazette of the United States Patent and Trademark Office

This new text derived from class tested lecturer notes by the author fulfills the needs for a core course in Electrical, Electronics, Instrumentation and Control Engineering. Written in a lucid manner covering the fundamentals of electronic devices and circuits will help the students build a firm foundation on the subject. Key Features: Worked examples Short questions & answers

Advanced High Voltage Power Device Concepts

High-Frequency Integrated Circuits

Over recent years there has been a vast expansion in the variety of imaging techniques available, and developments in machine specifications continue apace. If radiologists and radiographers are to obtain optimal image quality while minimising exposure times, a good understanding of the fundamentals of the radiological science underpinning diagnostic imaging is essential. The second edition of this well-received textbook continues to cover all technical aspects of diagnostic radiology, and remains an ideal companion during examination preparation and beyond. The content includes a review of basic science aspects of imaging, followed by a detailed explanation of radiological sciences, conventional x-ray image formation and other imaging techniques. The enormous technical advances in computed tomography, including multislice acquisition and 3D image reconstruction, digital imaging in the form of image plate and direct radiography, magnetic resonance imaging, colour flow imaging in ultrasound and positron radiopharmaceuticals in nuclear medicine, are all considered here. A chapter devoted to computers in radiology considers advances in radiology information systems and computer applications in image storage and communication systems. The text concludes with a series of general topics relating to diagnostic imaging. The content has been revised and updated throughout to ensure it remains in line with the Fellowship of the Royal College of Radiologists (FRCR) examination, while European and American perspectives on technology, guidelines and regulations ensure international relevance.

ANSI Z49. 1-2005, Safety in Welding, Cutting, and Allied Processes

Silicon Carbide Power Devices

This book will provide useful information to material growers and evaluators,

device design and processing engineers as well as potential users of SiC technologies. This book will help identify remaining challenging issues to stimulate further investigation to realize the full potential of wide band gap SiC for optoelectronic and microelectronic applications.

SOTAPOCS XXXII

The Handbook of Modern Ferromagnetic Materials is an up-to-the-minute compendium of all ferromagnetic materials, metallic and ceramic, intended for electrical and electronic applications. Coverage of the newest and most economically important materials (soft ferrites, the rare-earth magnet alloys, amorphous and nanocrystalline alloys) is extensive. The distinctive feature of this book is its correlation of basic material properties (metallurgical and ceramic) with their magnetic characteristics and eventually to the choice in an application. Unique to this work is information on the many magnetic components into which these materials can be formed and the pertinent design data. Another useful feature is the criteria (quality, stability and economic) for selection of a particular material. Included are the mechanical, thermal and physical properties of these materials. The author not only presents the latest information from suppliers and magnetism conferences but includes a section on new materials (e.g. colossal magnetostriction materials) being developed but not yet available. The format is arranged according to frequency of operation, which turns out to be almost concurrent with the application. Thus, direct current applications are considered first, then low frequency line power, followed by applications at increasing frequencies up to microwave uses. This anthology of ferromagnetic materials is an essential reference work for electrical and electronic designers and materials scientists. It may also serve as a text for a magnetic materials course and as a materials guide for purchasing agents and technical executives.

Handbook of Modern Ferromagnetic Materials

This book fits in the quest for highly efficient fully integrated xDSL modems for central office applications. It presents a summary of research at one of Europe's most famous analog design research groups over a five year period. The book focuses on the line driver, the most demanding building block of the xDSL modem for lowering power. The book covers the total design flow of monolithic CMOS high voltage circuits. It is essential reading for analog design engineers.

Solid State Devices and Electronics

Cellular telephones, satellite communications and radar systems are adding to the increasing demand for radio frequency circuit design principles. At the same time, several generations of digitally-oriented graduates are missing the essential RF skills. This book contains a wealth of valuable design information difficult to find elsewhere. It's a complete 'tool kit' for successful RF circuit design. Written by experienced RF design engineers from Motorola's semiconductors product section. Book covers design examples of circuits (e.g. amplifiers; oscillators; switches; pulsed power; modular systems; wiring state-of-the-art devices; design techniques).

Emerging Nanoelectronic Devices

Mobile Point-of-Care Monitors and Diagnostic Device Design

Electric relays pervade the electronics that dominate our world. They exist in many forms, fulfill many roles, and each have their own behavioral nuances and peculiarities. To date, there exists no comprehensive reference surveying the broad spectrum of electric relays, save one-Electric Relays: Principles and Applications. This ambitious work is not only unique in its scope, but also in its practical approach that focuses on the operational and functional aspects rather than on theory and mathematics. Accomplished engineer Dr. Vladimir Gurevich builds the presentation from first principles, unfolding the concepts and constructions via discussion of their historical development from the earliest ideas to modern technologies. He uses a show-not-tell approach that employs nearly 1300 illustrations and reveals valuable insight based on his extensive experience in the field. The book begins with the basic principles of relay construction and the major functional parts, such as contact and magnetic systems. Then, it devotes individual chapters to the various types of relays. The author describes the principles of function and construction for each type as well as features of several relays belonging to a type that operate on different principles. Remarkably thorough and uniquely practical, Electric Relays: Principles and Applications serves as the perfect introduction to the plethora of electric relays and offers a quick-reference guide for the experienced engineer.

Silicon Carbide

This volume includes extended and revised versions of a set of selected papers from the International Conference on Electric and Electronics (EEIC 2011) , held on June 20-22 , 2011, which is jointly organized by Nanchang University, Springer, and IEEE IAS Nanchang Chapter. The objective of EEIC 2011 Volume 3 is to provide a major interdisciplinary forum for the presentation of new approaches from Electrical Power Systems and Computers, to foster integration of the latest developments in scientific research. 133 related topic papers were selected into this volume. All the papers were reviewed by 2 program committee members and selected by the volume editor Prof. Xiaofeng Wan. We hope every participant can have a good opportunity to exchange their research ideas and results and to discuss the state of the art in the areas of the Electrical Power Systems and Computers.

High-Frequency Oscillator Design for Integrated Transceivers

High-Frequency Oscillator Design for Integrated Transceivers covers the analysis and design of all high-frequency oscillators required to realize integrated transceivers for wireless and wired applications. This includes the design of oscillator types as single-phase LC oscillators, I/Q LC oscillators, multi-phase LC oscillators, and ring oscillators in various IC technologies such as bipolar, BiCMOS, CMOS, and SOI (silicon on insulator). Starting from an in depth review of basic oscillator theory, the authors discuss key oscillator specifications, numerous

oscillator circuit topologies, and introduce the concepts of design figures of merit (FOMs) and benchmark FOMs, which assist the oscillator designer during the overall design cycle. Taking advantage of behavioral modeling, the elementary properties of LC oscillators and ring oscillators are analyzed first. A detailed analysis of oscillator properties at circuit level follows taking parasitic elements and other practical aspects of integrated oscillator design into account. Special attention is given to advantages and limitations of linear time invariant (LTI) phase noise modeling, leading to the concept of optimum coupling in I/Q LC oscillators and a simulation method for fast and efficient phase noise optimization in oscillators. In addition, all modern linear time variant (LTV) phase noise theories are covered. As not only phase noise is of high importance to the designer, but optimization of other oscillator properties as well, additional subjects such as various tuning methods of LC oscillators are analyzed, too. Design examples of integrated LC and ring oscillators in the frequency range of 100 MHz up to 11 GHz are thoroughly discussed throughout the book. The clear and structured discussion of basic oscillator properties make High-Frequency Oscillator Design for Integrated Transceivers an excellent starting point for the inexperienced oscillator designer. The detailed analysis of many oscillator types and circuit topologies, the discussion of numerous practical design issues together with fast optimization methods, and more than 200 carefully selected literature references on oscillator literature, LC oscillator and ring oscillator designs make this book a very valuable resource for the experienced IC designer as well.

RF Power Amplifiers

Within this book the fundamental concepts associated with the topic of power electronic control are covered alongside the latest equipment and devices, new application areas and associated computer-assisted methods. *A practical guide to the control of reactive power systems *Ideal for postgraduate and professional courses *Covers the latest equipment and computer-aided analysis

Design of High Voltage xDSL Line Drivers in Standard CMOS

Practical RF Circuit Design for Modern Wireless Systems

The devices described in “Advanced MOS-Gated Thyristor Concepts” are utilized in microelectronics production equipment, in power transmission equipment, and for very high power motor control in electric trains, steel-mills, etc. Advanced concepts that enable improving the performance of power thyristors are discussed here, along with devices with blocking voltage capabilities of 5,000-V, 10,000-V and 15,000-V. Throughout the book, analytical models are generated to allow a simple analysis of the structures and to obtain insight into the underlying physics. The results of two-dimensional simulations are provided to corroborate the analytical models and give greater insight into the device operation.

Microelectronics Technology and Devices

Efficient mobile systems that allow for vital sign monitoring and disease diagnosis

at the point of care can help combat issues such as rising healthcare costs, treatment delays in remote and resource-poor areas, and the global shortage of skilled medical personnel. Covering everything from sensors, systems, and software to integration, usability, and regulatory challenges, *Mobile Point-of-Care Monitors and Diagnostic Device Design* offers valuable insight into state-of-the-art technologies, research, and methods for designing personal diagnostic and ambulatory healthcare devices. Presenting the combined expertise of contributors from various fields, this multidisciplinary text: Gives an overview of the latest mobile health and point-of-care technologies Discusses portable diagnostics devices and sensors, including mobile-phone-based health systems Explores lab-on-chip systems as well as energy-efficient solutions for mobile point-of-care monitors Addresses computer vision and signal processing for real-time diagnostics Considers interface design for lay healthcare providers and home users *Mobile Point-of-Care Monitors and Diagnostic Device Design* provides important background information about the design process of mobile health and point-of-care devices, using practical examples to illustrate key aspects related to instrumentation, information processing, and implementation.

Reference Data for Engineers

This book is based on nearly a decade of materials and electronics research at the leading research institution on the nitride topic in Europe. It is a comprehensive monograph and tutorial that will be of interest to graduate students of electrical engineering, communication engineering, and physics; to materials, device, and circuit engineers in research and industry; to all scientists with a general interest in advanced electronics.

Protection

Power electronics, which is a rapidly growing area in terms of research and applications, uses modern electronics technology to convert electric power from one form to another, such as ac-dc, dc-dc, dc-ac, and ac-ac with a variable output magnitude and frequency. Power electronics has many applications in our every day life such as air-conditioners, electric cars, sub-way trains, motor drives, renewable energy sources and power supplies for computers. This book covers all aspects of switching devices, converter circuit topologies, control techniques, analytical methods and some examples of their applications. * 25% new content * Reorganized and revised into 8 sections comprising 43 chapters * Coverage of numerous applications, including uninterruptable power supplies and automotive electrical systems * New content in power generation and distribution, including solar power, fuel cells, wind turbines, and flexible transmission

Electrical Power Systems and Computers

The second of two authoritative, highly practical volumes, this hands-on resource covers active and nonlinear circuits, and introduces advanced topics in RF circuit and system design. The book opens with an overview of active RF devices and their modeling. It explores nonlinear circuit simulation techniques such as harmonic balance, and extensively illustrates the use of CAD tools in active circuit

design throughout. This is a tested and insightful book that contains answers to most of the questions practical engineers are asking. In this thoroughly practical second volume, you learn the theory behind linear and low-noise RF amplifiers, high power RF transistor amplifiers, oscillators, mixers, and frequency multipliers, so you gain an intuitive understanding of their operation.

Proceedings of the Symposium on High Voltage and Smart Power ICs

Simulation and experimental results on GaN based ultra-short planar negative differential conductivity diodes for THz power generation / B. Aslan, L. F. Eastman and Q. Diduck -- 5-terminal THz GaN based transistor with field- and space-charge control electrodes / G. Simin, M. S. Shur and R. Gaska -- Performance comparison of scaled III-V and Si ballistic nanowire MOSFETs / L. Wang [et al.] -- A room temperature ballistic deflection transistor for high performance applications / Q. Diduck, H. Irie and M. Margala -- Emission and intensity modulation of terahertz electromagnetic radiation utilizing 2-dimensional plasmons in dual-grating-gate HEMT's / T. Otsuji [et al.] -- Millimeter wave to terahertz in CMOS / K. K. O, S. Sankaran [et al.] -- The effects of increasing AlN mole fraction on the performance of AlGaIn active regions containing nanometer scale compositionally inhomogeneities / A. V. Sampath [et al.] -- Surface acoustic wave propagation in GaN-On-sapphire under pulsed sub-band ultraviolet illumination / V. S. Chivukula [et al.] -- Solar-blind single-photon 4H-SiC avalanche photodiodes / A. Vert [et al.] -- Monte Carlo simulations of InGaAs MOSFETs at 0.5 V supply voltage for high-performance CMOS / J. S. Ayubi-Moak, K. Kalna and A. Asenov -- The first 70nm 6-inch GaAs PHEMT MMIC process / H. Karimy [et al.] -- High-performance 50-nm metamorphic high electron-mobility transistors with high breakdown voltages / D. Xu [et al.] -- MBE growth and characterization of Mg-doped III-nitrides on sapphire / X. Chen [et al.] -- Performance of MOSFETs on reactive-ion-etched GaN surfaces / K. Tang, W. Huang, T. P. Chow -- High current density/high voltage AlGaIn/GaN HFETs on sapphire / J. Shi, M. Pophristic and L. F. Eastman -- InAlN/GaN MOS-HEMT with thermally grown oxide / M. Alomari [et al.] -- GaN transistors for power switching and millimeter-wave applications / T. Ueda [et al.] -- 4-nm AlN barrier all binary HFET with SiNx gate dielectric / T. Zimmermann [et al.] -- Effect of gate oxide processes on 4H-SiC MOSFETs on (000-1) oriented substrate / H. Naik, K. Tang and T. P. Chow -- Characterization and modeling of integrated diode in 1.2kV 4H-SiC vertical power MOSFET / H. Naik, Y. Wang and T. P. Chow -- Packaging and wide-pulse switching of 4 mm x 4 mm silicon carbide GTOs / H. O'Brien and M. G. Koebke -- Bi-directional scalable solid-state circuit breakers for hybrid-electric vehicles / D. P. Urciuoli and V. Veliadis

E M F Electrical Year Book

Gallium Nitride Electronics

High Voltage Devices and Circuits in Standard CMOS Technologies

Power Electronics Handbook

Fundamentals of Power Semiconductor Devices provides an in-depth treatment of the physics of operation of power semiconductor devices that are commonly used by the power electronics industry. Analytical models for explaining the operation of all power semiconductor devices are shown. The treatment here focuses on silicon devices but includes the unique attributes and design requirements for emerging silicon carbide devices. The book will appeal to practicing engineers in the power semiconductor device community.

Advanced High Speed Devices

Protection Devices and Systems for High-Voltage Applications

Emerging Nanoelectronic Devices focuses on the future direction of semiconductor and emerging nanoscale device technology. As the dimensional scaling of CMOS approaches its limits, alternate information processing devices and microarchitectures are being explored to sustain increasing functionality at decreasing cost into the indefinite future. This is driving new paradigms of information processing enabled by innovative new devices, circuits, and architectures, necessary to support an increasingly interconnected world through a rapidly evolving internet. This original title provides a fresh perspective on emerging research devices in 26 up to date chapters written by the leading researchers in their respective areas. It supplements and extends the work performed by the Emerging Research Devices working group of the International Technology Roadmap for Semiconductors (ITRS). Key features:

- Serves as an authoritative tutorial on innovative devices and architectures that populate the dynamic world of "Beyond CMOS" technologies.
- Provides a realistic assessment of the strengths, weaknesses and key unknowns associated with each technology.
- Suggests guidelines for the directions of future development of each technology.
- Emphasizes physical concepts over mathematical development.
- Provides an essential resource for students, researchers and practicing engineers.

Southern California Practitioner

An examination of all of the multidisciplinary aspects of medium- and high-power converter systems, including basic power electronics, digital control and hardware, sensors, analog preprocessing of signals, protection devices and fault management, and pulse-width-modulation (PWM) algorithms, Switching Power Converters: Medium and High Power, Second Edition discusses the actual use of industrial technology and its related subassemblies and components, covering facets of implementation otherwise overlooked by theoretical textbooks. The updated Second Edition contains many new figures, as well as new and/or improved chapters on: Thermal management and reliability Intelligent power modules AC/DC and DC/AC current source converters Multilevel converters Use of IPM within a "network of switches" concept Power semiconductors Matrix converters Practical aspects in building power converters Providing the latest

research and development information, along with numerous examples of successful home appliance, aviation, naval, automotive electronics, industrial motor drive, and grid interface for renewable energy products, this edition highlights advancements in packaging technologies, tackles the advent of hybrid circuits able to incorporate control and power stages within the same package, and examines design for reliability from the system level perspective.

Power Electronic Control in Electrical Systems

Transients of Modern Power Electronics

This second edition of the highly acclaimed RF Power Amplifiers has been thoroughly revised and expanded to reflect the latest challenges associated with power transmitters used in communications systems. With more rigorous treatment of many concepts, the new edition includes a unique combination of class-tested analysis and industry-proven design techniques. Radio frequency (RF) power amplifiers are the fundamental building blocks used in a vast variety of wireless communication circuits, radio and TV broadcasting transmitters, radars, wireless energy transfer, and industrial processes. Through a combination of theory and practice, RF Power Amplifiers, Second Edition provides a solid understanding of the key concepts, the principle of operation, synthesis, analysis, and design of RF power amplifiers. This extensive update boasts: up to date end of chapter summaries; review questions and problems; an expansion on key concepts; new examples related to real-world applications illustrating key concepts and brand new chapters covering 'hot topics' such as RF LC oscillators and dynamic power supplies. Carefully edited for superior readability, this work remains an essential reference for research & development staff and design engineers. Senior level undergraduate and graduate electrical engineering students will also find it an invaluable resource with its practical examples & summaries, review questions and end of chapter problems. Key features: • A fully revised solutions manual is now hosted on a companion website alongside new simulations. • Extended treatment of a broad range of topologies of RF power amplifiers. • In-depth treatment of state-of-the art of modern transmitters and a new chapter on oscillators. • Includes problem-solving methodology, step-by-step derivations and closed-form design equations with illustrations.

Radio Frequency Transistors

Standard voltages used in today's ICs may vary from about 1.3V to more than 100V, depending on the technology and the application. High voltage is therefore a relative notion. High Voltage Devices and Circuits in Standard CMOS Technologies is mainly focused on standard CMOS technologies, where high voltage (HV) is defined as any voltage higher than the nominal (low) voltage, i.e. 5V, 3.3V, or even lower. In this standard CMOS environment, IC designers are more and more frequently confronted with HV problems, particularly at the I/O level of the circuit. In the first group of applications, a large range of industrial or consumer circuits either require HV driving capabilities, or are supposed to work in a high-voltage environment. This includes ultrasonic drivers, flat panel displays, robotics,

automotive, etc. On the other hand, in the emerging field of integrated microsystems, MEMS actuators mainly make use of electrostatic forces involving voltages in the typical range of 30 to 60V. Last but not least, with the advent of deep sub-micron and/or low-power technologies, the operating voltage tends towards levels ranging from 1V to 2.5V, while the interface needs to be compatible with higher voltages, such as 5V. For all these categories of applications, it is usually preferable to perform most of the signal processing at low voltage, while the resulting output rises to a higher voltage level. Solving this problem requires some special actions at three levels: technology, circuit design and layout. High Voltage Devices and Circuits in Standard CMOS Technologies addresses these topics in a clear and organized way. The theoretical background is supported by practical information and design examples. It is an invaluable reference for researchers and professionals in both the design and device communities.

Electric Relays

The Physics of Diagnostic Imaging Second Edition

This publication discusses general problems related to the structure of current overload protection systems in high voltage (HV) electrical installations and introduces a family of new devices based on reed switch contacts, solid-state units, hybrid technology and automatic systems based on these components. It highlights their application in high

High Efficiency Power Supply Using New SiC Devices

This "must have" reference work for semiconductor professionals and researchers provides a basic understanding of how the most commonly used tools and techniques in silicon-based semiconductors are applied to understanding the root cause of electrical failures in integrated circuits.

Health Devices

The Southern California Practitioner

A transistor-level, design-intensive overview of high speed and high frequency monolithic integrated circuits for wireless and broadband systems from 2 GHz to 200 GHz, this comprehensive text covers high-speed, RF, mm-wave and optical fiber circuits using nanoscale CMOS, SiGe BiCMOS and III-V technologies. Step-by-step design methodologies, end-of-chapter problems and practical simulation and design projects are provided, making this an ideal resource for senior undergraduate and graduate courses in circuit design. With an emphasis on device-circuit topology interaction and optimization, it gives circuit designers and students alike an in-depth understanding of device structures and process limitations affecting circuit performance.

Failure Analysis of Integrated Circuits

In high power, high voltage electronics systems, a strategy to manage short timescale energy imbalances is fundamental to the system reliability. Without a theoretical framework, harmful local convergence of energy can affect the dynamic process of transformation, transmission, and storage which create an unreliable system. With an original approach that encourages understanding of both macroscopic and microscopic factors, the authors offer a solution. They demonstrate the essential theory and methodology for the design, modeling and prototyping of modern power electronics converters to create highly effective systems. Current applications such as renewable energy systems and hybrid electric vehicles are discussed in detail by the authors. Key features: offers a logical guide that is widely applicable to power electronics across power supplies, renewable energy systems, and many other areas analyses the short-scale (nano-micro second) transient phenomena and the transient processes in nearly all major timescales, from device switching processes at the nanoscale level, to thermal and mechanical processes at second level explores transient causes and shows how to correct them by changing the control algorithm or peripheral circuit includes two case studies on power electronics in hybrid electric vehicles and renewable energy systems Practitioners in major power electronic companies will benefit from this reference, especially design engineers aiming for optimal system performance. It will also be of value to faculty staff and graduate students specializing in power electronics within academia.

Fundamentals of Power Semiconductor Devices

Power semiconductor devices are widely used for the control and management of electrical energy. The improving performance of power devices has enabled cost reductions and efficiency increases resulting in lower fossil fuel usage and less environmental pollution. This book provides the first cohesive treatment of the physics and design of silicon carbide power devices with an emphasis on unipolar structures. It uses the results of extensive numerical simulations to elucidate the operating principles of these important devices.

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