

# Sic Power Devices And Modules Rohm Semiconductor

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**SiC based Miniaturized Devices** - Stephen Edward Sadow 2020-06-18

MEMS devices are found in many of today's electronic devices and systems, from air-bag sensors in cars to smart phones, embedded systems, etc. Increasingly, the reduction in dimensions has led to nanometer-scale devices, called NEMS. The plethora of applications on the commercial market speaks for itself, and especially for the highly precise manufacturing of silicon-based MEMS and NEMS. While this is a tremendous achievement, silicon as a material has some drawbacks, mainly in the area of mechanical fatigue and thermal properties. Silicon carbide (SiC), a well-known wide-bandgap semiconductor whose adoption in commercial products is experiencing exponential growth, especially in the power electronics arena. While SiC MEMS have been around for decades, in this Special Issue we seek to capture both an overview of the devices that have been demonstrated to date, as well as bring new technologies and progress in the MEMS processing area to the forefront. Thus, this Special Issue seeks to showcase research papers, short communications, and review articles that focus on: (1) novel designs, fabrication, control, and modeling of SiC MEMS and NEMS based on all kinds of actuation mechanisms; and (2) new developments in applying SiC MEMS and NEMS in consumer electronics, optical communications, industry, medicine, agriculture, space, and defense.

**Hybrid Electric Vehicles** - Chris Mi 2017-11-29

The latest developments in the field of hybrid electric vehicles Hybrid Electric Vehicles provides an introduction to hybrid vehicles, which include purely electric, hybrid electric, hybrid hydraulic, fuel cell vehicles, plug-in hybrid electric, and off-road hybrid vehicular systems. It focuses on the power and propulsion systems for these vehicles, including issues related to power and energy management. Other topics covered include hybrid vs. pure electric, HEV system architecture (including plug-in & charging control and hydraulic), off-road and other industrial utility vehicles, safety and EMC, storage technologies, vehicular power and energy management, diagnostics and prognostics, and electromechanical vibration issues. Hybrid Electric Vehicles, Second Edition is a comprehensively updated new edition with four new chapters covering recent advances in hybrid vehicle technology. New areas covered include battery modelling, charger design, and wireless charging. Substantial details have also been included on the architecture of hybrid excavators in the chapter related to special hybrid vehicles. Also included is a chapter providing an overview of hybrid vehicle technology, which offers a perspective on the current debate on sustainability and the environmental impact of hybrid and electric vehicle technology. Completely updated with new chapters Covers recent developments, breakthroughs, and technologies, including new drive topologies Explains HEV fundamentals and applications Offers a holistic perspective on vehicle electrification Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Second Edition is a great resource for researchers and practitioners in the automotive industry, as well as for graduate students in automotive engineering.

**Fundamentals of Modern VLSI Devices** - Yuan Taur 2013-05-02

Learn the basic properties and designs of modern VLSI devices, as well as the factors affecting performance, with this thoroughly updated second edition. The first edition has been widely adopted as a standard textbook in microelectronics in many major US universities and worldwide. The internationally renowned authors highlight the intricate interdependencies and subtle trade-offs between various practically important device parameters, and provide an in-depth discussion of device scaling and scaling

limits of CMOS and bipolar devices. Equations and parameters provided are checked continuously against the reality of silicon data, making the book equally useful in practical transistor design and in the classroom. Every chapter has been updated to include the latest developments, such as MOSFET scale length theory, high-field transport model and SiGe-base bipolar devices.

**Radiation Tolerant Electronics** - Paul Leroux 2019-08-26

Research on radiation-tolerant electronics has increased rapidly over the past few years, resulting in many interesting approaches to modeling radiation effects and designing radiation-hardened integrated circuits and embedded systems. This research is strongly driven by the growing need for radiation-hardened electronics for space applications, high-energy physics experiments such as those on the Large Hadron Collider at CERN, and many terrestrial nuclear applications including nuclear energy and nuclear safety. With the progressive scaling of integrated circuit technologies and the growing complexity of electronic systems, their susceptibility to ionizing radiation has raised many exciting challenges, which are expected to drive research in the coming decade. In this book we highlight recent breakthroughs in the study of radiation effects in advanced semiconductor devices, as well as in high-performance analog, mixed signal, RF, and digital integrated circuits. We also focus on advances in embedded radiation hardening in both FPGA and microcontroller systems and apply radiation-hardened embedded systems for cryptography and image processing, targeting space applications.

**Silicon Carbide Power Devices** - B Jayant Baliga 2006-01-05

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. Emerging Converter Topologies and Control for Grid Connected Photovoltaic Systems - Dmitri Vinnikov 2021-02-26

Continuous cost reduction of photovoltaic (PV) systems and the rise of power auctions resulted in the establishment of PV power not only as a green energy source but also as a cost-effective solution to the electricity generation market. Various commercial solutions for grid-connected PV systems are available at any power level, ranging from multi-megawatt utility-scale solar farms to sub-kilowatt residential PV installations. Compared to utility-scale systems, the feasibility of small-scale residential PV installations is still limited by existing technologies that have not yet properly address issues like operation in weak grids, opaque and partial shading, etc. New market drivers such as warranty improvement to match the PV module lifespan, operation voltage range extension for application flexibility, and embedded energy storage for load shifting have again put small-scale PV systems in the spotlight. This Special Issue collects the latest developments in the field of power electronic converter topologies, control, design, and optimization for better energy yield, power conversion efficiency, reliability, and longer lifetime of the small-scale PV systems. This Special Issue will serve as a reference and update for academics, researchers, and practicing engineers to inspire new research and developments that pave the way for next-generation PV systems for residential and small commercial applications.

Energy Efficiency in Electric Motors, Drives, Power Converters and Related Systems - Mario Marchesoni

2020-06-25

Today, there is a great deal of attention focused on sustainable growth worldwide. The increase in efficiency in the use of energy may even, in this historical moment, bring greater benefit than the use of renewable energies. Electricity appears to be the most sustainable of energies and the most promising hope for a planet capable of growing without compromising its own health and that of its inhabitants. Power electronics and electrical drives are the key technologies that will allow energy savings through the reduction of energy losses in many applications. This Special Issue has collected several scientific contributions related to energy efficiency in electrical equipment. Some articles are dedicated to the use and optimization of permanent magnet motors, which allow obtaining the highest level of efficiency. Most of the contributions describe the energy improvements that can be achieved with power electronics and the use of suitable control techniques. Last but not least, some articles describe interesting solutions for hybrid vehicles, which were created mainly to save energy in the smartest way possible.

Entrepreneurship in Power Semiconductor Devices, Power Electronics, and Electric Machines and Drive Systems - Krishnan Ramu 2020-12-07

Entrepreneurship in Power Semiconductor Devices, Power Electronics, and Electric Machines and Drive Systems introduces the basics of entrepreneurship and a methodology for the study of entrepreneurship in electrical engineering and other engineering fields. Entrepreneurship is considered here in three fields of electrical engineering, viz. power semiconductor devices, power electronics and electric machines and drive systems, and their current practice. It prepares the reader by providing a review of the subject matter in the three fields, their current status in research and development with analysis aspect as needed, thus allowing readers to gain self-sufficiency while reading the book. Each field's emerging applications, current market and future market forecasts are introduced to understand the basis and need for emerging startups. Practical learning is introduced in: (i) power semiconductor devices entrepreneurship through the prism of 20 startups in detail, (ii) power electronics entrepreneurship through 28 startup companies arranged under various application fields and (iii) electric machines and drive systems entrepreneurship through 15 startups in electromagnetic and 1 in electrostatic machines and drive systems. The book: (i) demystifies entrepreneurship in a practical way to equip engineers and students with entrepreneurship as an option for their professional growth, pursuit and success; (ii) provides engineering managers and corporate-level executives a detailed view of entrepreneurship activities in the considered three fields that may potentially impact their businesses, (iii) provides entrepreneurship education in an electrical engineering environment and with direct connection and correlation to their fields of study and (iv) endows a methodology that can be effectively employed not only in the three illustrated fields of electrical engineering but in other fields as well. This book is for electrical engineering students and professionals. For use in undergraduate and graduate courses in electrical engineering, the book contains discussion questions, exercise problems, team and class projects, all from a practical point of view, to train students and assist professionals for future entrepreneurship endeavors.

Handbook of Microwave and Radar Engineering - Anatoly Belous 2021-01-04

This comprehensive handbook provides readers with a single-source reference to the theoretical fundamentals, physical mechanisms and principles of operation of all known microwave devices and various radars. The author discusses proven methods of computation and design development, process, schematic, schematic-technical and construction peculiarities of each breed of the microwave devices, as well as the most popular and original technical solutions for radars. Coverage also includes the history of creation of the most widely used radars, as well as guidelines for their potential upgrading. Offers readers a comprehensive, systematized view of all contemporary knowledge, acquired during the last 20 years, on radars and related disciplines; Provides a single-source reference on the physical mechanisms and principles of operation of the basic components of radio location devices, including theoretical aspects of designing the necessary, high-efficiency electronic devices and systems, as well as key, practical methods of computation and design; Presents complex topics using simple language, minimizing mathematics.

Directory of Corporate Affiliations - 2003

*GaN Transistors for Efficient Power Conversion* - Alex Lidow 2019-08-23

An up-to-date, practical guide on upgrading from silicon to GaN, and how to use GaN transistors in power conversion systems design This updated, third edition of a popular book on GaN transistors for efficient power conversion has been substantially expanded to keep students and practicing power conversion engineers ahead of the learning curve in GaN technology advancements. Acknowledging that GaN transistors are not one-to-one replacements for the current MOSFET technology, this book serves as a practical guide for understanding basic GaN transistor construction, characteristics, and applications. Included are discussions on the fundamental physics of these power semiconductors, layout, and other circuit design considerations, as well as specific application examples demonstrating design techniques when employing GaN devices. GaN Transistors for Efficient Power Conversion, 3rd Edition brings key updates to the chapters of Driving GaN Transistors; Modeling, Simulation, and Measurement of GaN Transistors; DC-DC Power Conversion; Envelope Tracking; and Highly Resonant Wireless Energy Transfer. It also offers new chapters on Thermal Management, Multilevel Converters, and Lidar, and revises many others throughout. Written by leaders in the power semiconductor field and industry pioneers in GaN power transistor technology and applications Updated with 35% new material, including three new chapters on Thermal Management, Multilevel Converters, Wireless Power, and Lidar Features practical guidance on formulating specific circuit designs when constructing power conversion systems using GaN transistors A valuable resource for professional engineers, systems designers, and electrical engineering students who need to fully understand the state-of-the-art GaN Transistors for Efficient Power Conversion, 3rd Edition is an essential learning tool and reference guide that enables power conversion engineers to design energy-efficient, smaller, and more cost-effective products using GaN transistors.

**Power Electronics in Renewable Energy Systems and Smart Grid** - Bimal K. Bose 2019-06-27

The comprehensive and authoritative guide to power electronics in renewable energy systems Power electronics plays a significant role in modern industrial automation and high- efficiency energy systems. With contributions from an international group of noted experts, Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications offers a comprehensive review of the technology and applications of power electronics in renewable energy systems and smart grids. The authors cover information on a variety of energy systems including wind, solar, ocean, and geothermal energy systems as well as fuel cell systems and bulk energy storage systems. They also examine smart grid elements, modeling, simulation, control, and AI applications. The book's twelve chapters offer an application-oriented and tutorial viewpoint and also contain technology status review. In addition, the book contains illustrative examples of applications and discussions of future perspectives. This important resource: Includes descriptions of power semiconductor devices, two level and multilevel converters, HVDC systems, FACTS, and more Offers discussions on various energy systems such as wind, solar, ocean, and geothermal energy systems, and also fuel cell systems and bulk energy storage systems Explores smart grid elements, modeling, simulation, control, and AI applications Contains state-of-the-art technologies and future perspectives Provides the expertise of international authorities in the field Written for graduate students, professors in power electronics, and industry engineers, Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications offers an up-to-date guide to technology and applications of a wide-range of power electronics in energy systems and smart grids.

Fundamentals of Power Semiconductor Devices - B. Jayant Baliga 2018-09-28

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.

**Renewable Energy and the Environment** - Md. Rabiul Islam 2017-12-16

This book discusses a number of important topical technical and non-technical issues related to the global energy, environment and socio-economic developments for professionals and students directly and indirectly involved in the relevant fields. It shows how renewable energy offers solutions to mitigate energy demand and helps achieve a clean environment, and also addresses the lack of a clear vision in the

development of technology and a policy to reach the mandatory global renewable energy targets to reduce greenhouse gas emissions and stimulate socio-economic development. The book is structured in such a way that it provides a consistent compilation of fundamental theories, a compendium of current research and development activities as well as new directions to overcome critical limitations; future technologies for power grids and their control, stability and reliability are also presented.

Power GaN Devices - Matteo Meneghini 2016-09-08

This book presents the first comprehensive overview of the properties and fabrication methods of GaN-based power transistors, with contributions from the most active research groups in the field. It describes how gallium nitride has emerged as an excellent material for the fabrication of power transistors; thanks to the high energy gap, high breakdown field, and saturation velocity of GaN, these devices can reach breakdown voltages beyond the kV range, and very high switching frequencies, thus being suitable for application in power conversion systems. Based on GaN, switching-mode power converters with efficiency in excess of 99 % have been already demonstrated, thus clearing the way for massive adoption of GaN transistors in the power conversion market. This is expected to have important advantages at both the environmental and economic level, since power conversion losses account for 10 % of global electricity consumption. The first part of the book describes the properties and advantages of gallium nitride compared to conventional semiconductor materials. The second part of the book describes the techniques used for device fabrication, and the methods for GaN-on-Silicon mass production. Specific attention is paid to the three most advanced device structures: lateral transistors, vertical power devices, and nanowire-based HEMTs. Other relevant topics covered by the book are the strategies for normally-off operation, and the problems related to device reliability. The last chapter reviews the switching characteristics of GaN HEMTs based on a systems level approach. This book is a unique reference for people working in the materials, device and power electronics fields; it provides interdisciplinary information on material growth, device fabrication, reliability issues and circuit-level switching investigation.

**Semiconductor Power Devices** - Josef Lutz 2018-02-16

Halbleiter-Leistungsbaulemente sind das Kernstück der Leistungselektronik. Sie bestimmen die Leistungsfähigkeit und machen neuartige und verlustarme Schaltungen erst möglich. In dem Band wird neben den Halbleiter-Leistungsbaulementen selbst auch die Aufbau- und Verbindungstechnik behandelt: von den physikalischen Grundlagen und der Herstellungstechnologie über einzelne Bauelemente bis zu thermomechanischen Problemen, Zerstörungsmechanismen und Störungseffekten. Die 2., überarbeitete Auflage berücksichtigt technische Neuerungen und Entwicklungen.

Wide Bandgap Power Semiconductor Packaging - Katsuaki Suganuma 2018-05-28

Wide Bandgap Power Semiconductor Packaging: Materials, Components, and Reliability addresses the key challenges that WBG power semiconductors face during integration, including heat resistance, heat dissipation and thermal stress, noise reduction at high frequency and discrete components, and challenges in interfacing, metallization, plating, bonding and wiring. Experts on the topic present the latest research on materials, components and methods of reliability and evaluation for WBG power semiconductors and suggest solutions to pave the way for integration. As wide bandgap (WBG) power semiconductors, SiC and GaN, are the latest promising electric conversion devices because of their excellent features, such as high breakdown voltage, high frequency capability, and high heat-resistance beyond 200 C, this book is a timely resource on the topic. Examines the key challenges of wide bandgap power semiconductor packaging at various levels, including materials, components and device performance Provides the latest research on potential solutions, with an eye towards the end goal of system integration Discusses key problems, such as thermal management, noise reduction, challenges in interconnects and substrates

**Hybrid Power** - Yatish T. Shah 2021-02-19

Hybrid energy systems integrate multiple sources of power generation, storage, and transport mechanisms and can facilitate increased usage of cleaner, renewable, and more efficient energy sources. Hybrid Power: Generation, Storage, and Grids discusses hybrid energy systems from fundamentals through applications and discusses generation, storage, and grids. Highlights fundamentals and applications of hybrid energy storage Discusses use in hybrid and electric vehicles and home energy needs Discusses issues related to hybrid renewable energy systems connected to the utility grid Describes the usefulness of hybrid

microgrids and various forms of off-grid energy such as mini-grids, nanogrids, and stand-alone systems Covers the use of hybrid renewable energy systems for rural electrification around the world Discusses various forms and applications of hybrid energy systems, hybrid energy storage, hybrid microgrids, and hybrid off-grid energy systems Details simulation and optimization of hybrid renewable energy systems This book is aimed at advanced students and researchers in academia, government, and industry, seeking a comprehensive overview of the basics, technologies, and applications of hybrid energy systems.

*Moody's International Manual* - 2000

**Disruptive Wide Bandgap Semiconductors, Related Technologies, and Their Applications** - Yogesh Kumar Sharma 2018-09-12

SiC and GaN devices have been around for some time. The first dedicated international conference on SiC and related devices, "ICSCRM," was held in Washington, DC, in 1987. But only recently, the commercialization of SiC and GaN devices has happened. Due to its material properties, Si as a semiconductor has limitations in high-temperature, high-voltage, and high-frequency regimes. With the help of SiC and GaN devices, it is possible to realize more efficient power systems. Devices manufactured from SiC and GaN have already been impacting different areas with their ability to outperform Si devices. Some of the examples are the telecommunications, automotive/locomotive, power, and renewable energy industries. To achieve the carbon emission targets set by different countries, it is inevitable to use these new technologies. This book attempts to cover all the important facets related to wide bandgap semiconductor technology, including new challenges posed by it. This book is intended for graduate students, researchers, engineers, and technology experts who have been working in the exciting fields of SiC and GaN power devices.

**Wide Bandgap Semiconductors** - Kiyoshi Takahashi 2007-04-12

This book offers a comprehensive overview of the development, current state, and future prospects of wide bandgap semiconductor materials and related optoelectronics devices. With 901 references, 333 figures and 21 tables, this book will serve as a one-stop source of knowledge on wide bandgap semiconductors and related optoelectronics devices.

**LexisNexis Corporate Affiliations** - 2008

**Wind Energy Conversion Systems** - S.M. Muyeen 2012-01-05

Wind Energy Conversion System covers the technological progress of wind energy conversion systems, along with potential future trends. It includes recently developed wind energy conversion systems such as multi-converter operation of variable-speed wind generators, lightning protection schemes, voltage flicker mitigation and prediction schemes for advanced control of wind generators. Modeling and control strategies of variable speed wind generators are discussed, together with the frequency converter topologies suitable for grid integration. Wind Energy Conversion System also describes offshore farm technologies including multi-terminal topology and space-based wind observation schemes, as well as both AC and DC based wind farm topologies. The stability and reliability of wind farms are discussed, and grid integration issues are examined in the context of the most recent industry guidelines. Wind power smoothing, one of the big challenges for transmission system operators, is a particular focus. Fault ride through and frequency fluctuation mitigation using energy storage options are also covered. Efficiency analyses are presented for different types of commercially available wind turbine generator systems, large scale wind generators using superconducting material, and the integration of offshore wind and marine current farms. Each chapter is written by a leader in the wind energy arena, making Wind Energy Conversion System a valuable reference for researchers and students of wind energy.

Power Electronic Modules - William W. Sheng 2004-09-29

Designing and building power semiconductor modules requires a broad, interdisciplinary base of knowledge and experience, ranging from semiconductor materials and technologies, thermal management, and soldering to environmental constraints, inspection techniques, and statistical process control. This diversity poses a significant challenge to engine

**Next-Generation ADCs, High-Performance Power Management, and Technology Considerations**

**for Advanced Integrated Circuits** - Andrea Baschiroto 2019-10-24

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 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.

*High Performance Control of AC Drives with Matlab/Simulink* - Haitham Abu-Rub 2021-05-11

High Performance Control of AC Drives with Matlab®/Simulink Explore this indispensable update to a popular graduate text on electric drive techniques and the latest converters used in industry The Second Edition of High Performance Control of AC Drives with Matlab®/Simulink delivers an updated and thorough overview of topics central to the understanding of AC motor drive systems. The book includes new material on medium voltage drives, covering state-of-the-art technologies and challenges in the industrial drive system, as well as their components, and control, current source inverter-based drives, PWM techniques for multilevel inverters, and low switching frequency modulation for voltage source inverters. This book covers three-phase and multiphase (more than three-phase) motor drives including their control and practical problems faced in the field (e.g., adding LC filters in the output of a feeding converter), are considered. The new edition contains links to Matlab®/Simulink models and PowerPoint slides ideal for teaching and understanding the material contained within the book. Readers will also benefit from the inclusion of: A thorough introduction to high performance drives, including the challenges and requirements for electric drives and medium voltage industrial applications An exploration of mathematical and simulation models of AC machines, including DC motors and squirrel cage induction motors A treatment of pulse width modulation of power electronic DC-AC converter, including the classification of PWM schemes for voltage source and current source inverters Examinations of harmonic injection PWM and field-oriented control of AC machines Voltage source and current source inverter-fed drives and their control Modelling and control of multiphase motor drive system Supported with a companion website hosting online resources. Perfect for senior undergraduate, MSc and PhD students in power electronics and electric drives, High Performance Control of AC Drives with Matlab®/Simulink will also earn a place in the libraries of researchers working in the field of AC motor drives and power electronics engineers in industry.

*Advances in Innovative Materials and Applications* - Maher Soueidan 2011-08-22

Volume is indexed by Thomson Reuters CPCI-S (WoS). This volume is divided into 3 chapters. The first, focused on Materials and Elaboration Techniques, describes various types of material such as composites, polymers, semiconductors, metals, ceramics, bio-materials, inorganic alloys, textile, porous, crystalline, amorphous and hybrids elaborated by various means such as vapor-phase, liquid-phase, plasma, ion-based and laser-assisted techniques, soft chemistry, self-assembly, bonding, sintering, and including bulk, surface, interface, thin-film and nano-materials. The second chapter, on Characterization Techniques and Properties, covers both physical (optical, structural, electrical, mechanical, magnetic, damage, aging...) and chemical (surface and bulk composition, imaging, impurity, reactivity, catalysis, aging, oxidation, corrosion) aspects. The last chapter, Applications, focuses on subjects such as: (i) environment and energy (renewable energy, storage and energy conversion, transport), (ii) health, biomedical and life science, (iii) electronic devices and systems (micro-nano electronics, power electronics, photonics and optoelectronics, systems, storage and heat management) and (iv) cultural heritage (e.g. archeology).

*Emerging Capabilities and Applications of Wireless Power Transfer* - Triviño-Cabrera, Alicia 2018-09-21

Technologies that enable powering a device without the need for being connected with a cable to the grid are gaining attention in recent years due to the advantages that they provide. They are a commodity to users and provide additional functionalities that promote autonomy among the devices. Emerging Capabilities and Applications of Wireless Power Transfer is an essential reference source that analyzes the different applications of wireless power transfer technologies and how the technologies are adapted to

fulfill the electrical, magnetic, and design-based requirements of different applications. Featuring research on topics such as transfer technologies, circuit analysis, and inductive power transfer, this book is a vital resource for academicians, electrical engineers, scientists, researchers, and industry professionals seeking coverage on device power and creating autonomy through alternative power options for devices.

**Silicon Carbide, Volume 2** - Peter Friedrichs 2011-04-08

Silicon Carbide - this easy to manufacture compound of silicon and carbon is said to be THE emerging material for applications in electronics. High thermal conductivity, high electric field breakdown strength and high maximum current density make it most promising for high-powered semiconductor devices. Apart from applications in power electronics, sensors, and NEMS, SiC has recently gained new interest as a substrate material for the manufacture of controlled graphene. SiC and graphene research is oriented towards end markets and has high impact on areas of rapidly growing interest like electric vehicles. This volume is devoted to high power devices products and their challenges in industrial application. Readers will benefit from reports on development and reliability aspects of Schottky barrier diodes, advantages of SiC power MOSFETs, or SiC sensors. The authors discuss MEMS and NEMS as SiC-based electronics for automotive industry as well as SiC-based circuit elements for high temperature applications, and the application of transistors in PV-inverters. The list of contributors reads like a "Who's Who" of the SiC community, strongly benefiting from collaborations between research institutions and enterprises active in SiC crystal growth and device development. Among the former are CREE Inc. and Fraunhofer ISE, while the industry is represented by Toshiba, Nissan, Infineon, NASA, Naval Research Lab, and Rensselaer Polytechnic Institute, to name but a few.

**Elektrifizierung des Antriebsstrangs** - Helmut Tschöke 2019-11-04

Die anspruchsvollen CO2-Ziele bis 2030/2050 werden unser Mobilitätsverhalten massiv verändern. Ein wichtiger Beitrag wird von elektrifizierten Fahrzeugantrieben erwartet. Das Buch gibt einen Überblick über alle heute diskutierten elektrifizierten Antriebskonzepte für Pkw vom Mikro-Hybrid bis zum Brennstoffzellen-Auto. Neben den Definitionen werden die einzelnen Komponenten für den elektrifizierten Antrieb, wie z.B. E-Motoren, Batterien, Supercaps, Leistungselektronik, Brennstoffzellen Getriebe und Aktoren auf der Ebene eines Basiswissens beschrieben. Die einzelnen Architekturen und Topologien der Hybride werden ebenso wie die reinen Elektroantriebe vorgestellt. Zum Gesamtsystem gehören das Thermomanagement, die Typgenehmigung, die besonderen Herausforderungen an die Akustik sowie elektromagnetische Verträglichkeit (EMV). Der Umgang mit den Hochvolt-Systemen erfordert neue Sicherheitsstandards und die Ladetechnik gehört zu den Schlüsseltechnologien für die Akzeptanz der Batterie-Elektrofahrzeuge. Der Brennstoffzellen basierte Elektroantrieb zeigt weitere Möglichkeiten für die Zukunft auf. Die Auswirkungen der Teilelektrifizierung des Antriebs auf den Verbrennungsmotor im hybriden Antriebskonzept runden die Betrachtungen ab.

**Electronic Portable Instruments** - Halit Eren 2003-10-16

With the availability of advanced technologies, digital systems, and communications, portable instruments are rapidly evolving from simple, stand alone, low-accuracy measuring instruments to complex multifunctional, network integrated, high-performance digital devices with advanced interface capabilities. The relatively brief treatments these instr

*Design and Control of Power Converters 2020* - Manuel Arias 2021-06-04

In this book, nine papers focusing on different fields of power electronics are gathered, all of which are in line with the present trends in research and industry. Given the generality of the Special Issue, the covered topics range from electrothermal models and losses models in semiconductors and magnetics to converters used in high-power applications. In this last case, the papers address specific problems such as the distortion due to zero-current detection or fault investigation using the fast Fourier transform, all being focused on analyzing the topologies of high-power high-density applications, such as the dual active bridge or the H-bridge multilevel inverter. All the papers provide enough insight in the analyzed issues to be used as the starting point of any research. Experimental or simulation results are presented to validate and help with the understanding of the proposed ideas. To summarize, this book will help the reader to solve specific problems in industrial equipment or to increase their knowledge in specific fields.

**Wide Bandgap Semiconductor Power Devices** - B. Jayant Baliga 2018-10-17

Wide Bandgap Semiconductor Power Devices: Materials, Physics, Design and Applications provides readers with a single resource on why these devices are superior to existing silicon devices. The book lays the groundwork for an understanding of an array of applications and anticipated benefits in energy savings. Authored by the Founder of the Power Semiconductor Research Center at North Carolina State University (and creator of the IGBT device), Dr. B. Jayant Baliga is one of the highest regarded experts in the field. He thus leads this team who comprehensively review the materials, device physics, design considerations and relevant applications discussed. Comprehensively covers power electronic devices, including materials (both gallium nitride and silicon carbide), physics, design considerations, and the most promising applications Addresses the key challenges towards the realization of wide bandgap power electronic devices, including materials defects, performance and reliability Provides the benefits of wide bandgap semiconductors, including opportunities for cost reduction and social impact

Power MOSFET Design - B. E. Taylor 1993-05-24

Concentrates on the actual design philosophy covering the driving and behavior of these devices. Topics include the driving and protection of all MOSFET structures from conventional to current sensing devices and those with in-built conductivity modulation. Avoids the use of complex mathematics and minimizes the number of equations.

**Extreme Environment Electronics** - John D. Cressler 2017-12-19

Unfriendly to conventional electronic devices, circuits, and systems, extreme environments represent a serious challenge to designers and mission architects. The first truly comprehensive guide to this specialized field, Extreme Environment Electronics explains the essential aspects of designing and using devices, circuits, and electronic systems intended to operate in extreme environments, including across wide temperature ranges and in radiation-intense scenarios such as space. The Definitive Guide to Extreme Environment Electronics Featuring contributions by some of the world's foremost experts in extreme environment electronics, the book provides in-depth information on a wide array of topics. It begins by describing the extreme conditions and then delves into a description of suitable semiconductor technologies and the modeling of devices within those technologies. It also discusses reliability issues and failure mechanisms that readers need to be aware of, as well as best practices for the design of these electronics. Continuing beyond just the "paper design" of building blocks, the book rounds out coverage of the design realization process with verification techniques and chapters on electronic packaging for extreme environments. The final set of chapters describes actual chip-level designs for applications in energy and space exploration. Requiring only a basic background in electronics, the book combines theoretical and practical aspects in each self-contained chapter. Appendices supply additional background material. With its broad coverage and depth, and the expertise of the contributing authors, this is an invaluable reference for engineers, scientists, and technical managers, as well as researchers and graduate students. A hands-on resource, it explores what is required to successfully operate electronics in the most demanding conditions.

High Temperature Electronics - Magnus Willander 1997

High Temperature Electronics covers a very active and topical area. This text reviews in detail the trends and options for electronic materials in high temperature environments. The contributors are leading authorities from several countries to provide an international appeal. After an introduction to the subject, users of these materials (e.g. aircraft and space, automotive, military and power industries) are considered. A discussion of silicon and gallium arsenide electronics is followed by an assessment of the future for electronic materials and devices.

Short Circuit Requirements of Power Converters based upon Wide-Bandgap Semiconductors - Douglas Pappis 2021-01-01

In power electronics designs, the evaluation and prediction of potential fault conditions on semiconductors is essential for achieving safe operation and reliability, being short circuit (SC) one of the most probable and destructive failures. Recent improvements on Wide-Bandgap (WBG) semiconductors such as Silicon Carbide (SiC) and Gallium nitride (GaN) enable power electronic designs with outstanding performance, reshaping the power electronics landscape. In comparison to Silicon (Si), SiC and GaN power semiconductors physically present smaller chip areas, higher maximum internal electric fields, and higher current densities. Such characteristics yield a much faster rise of the devices' internal temperatures,

worsening their SC performance. In this way, this dissertation consists of a comprehensive investigation about SC on SiC MOSFETs, GaN HEMT, and GaN E-HEMT transistors, as well as contextualizing their particularities on SC performance by comparison with that of Si IGBTs. Moreover, an investigation towards how to prevent SC occurrences besides a review of available SC protection methods is presented.

Fundamentals of Silicon Carbide Technology - Tsunenobu Kimoto 2014-11-24

A comprehensive introduction and up-to-date reference to SiC power semiconductor devices covering topics from material properties to applications Based on a number of breakthroughs in SiC material science and fabrication technology in the 1980s and 1990s, the first SiC Schottky barrier diodes (SBDs) were released as commercial products in 2001. The SiC SBD market has grown significantly since that time, and SBDs are now used in a variety of power systems, particularly switch-mode power supplies and motor controls. SiC power MOSFETs entered commercial production in 2011, providing rugged, high-efficiency switches for high-frequency power systems. In this wide-ranging book, the authors draw on their considerable experience to present both an introduction to SiC materials, devices, and applications and an in-depth reference for scientists and engineers working in this fast-moving field. Fundamentals of Silicon Carbide Technology covers basic properties of SiC materials, processing technology, theory and analysis of practical devices, and an overview of the most important systems applications. Specifically included are: A complete discussion of SiC material properties, bulk crystal growth, epitaxial growth, device fabrication technology, and characterization techniques. Device physics and operating equations for Schottky diodes, pin diodes, JBS/MPS diodes, JFETs, MOSFETs, BJTs, IGBTs, and thyristors. A survey of power electronics applications, including switch-mode power supplies, motor drives, power converters for electric vehicles, and converters for renewable energy sources. Coverage of special applications, including microwave devices, high-temperature electronics, and rugged sensors. Fully illustrated throughout, the text is written by recognized experts with over 45 years of combined experience in SiC research and development. This book is intended for graduate students and researchers in crystal growth, material science, and semiconductor device technology. The book is also useful for design engineers, application engineers, and product managers in areas such as power supplies, converter and inverter design, electric vehicle technology, high-temperature electronics, sensors, and smart grid technology.

**Advanced Silicon Carbide Devices and Processing** - Stephen Saddow 2015-09-17

Since the production of the first commercially available blue LED in the late 1980s, silicon carbide technology has grown into a billion-dollar industry world-wide in the area of solid-state lighting and power electronics. With this in mind we organized this book to bring to the attention of those well versed in SiC technology some new developments in the field with a particular emphasis on particularly promising technologies such as SiC-based solar cells and optoelectronics. We have balanced this with the more traditional subjects such as power electronics and some new developments in the improvement of the MOS system for SiC MOSFETs. Given the importance of advanced microsystems and sensors based on SiC, we also included a review on 3C-SiC for both microsystem and electronic applications.

**Transformers and Inductors for Power Electronics** - W.G. Hurley 2013-02-21

Based on the fundamentals of electromagnetics, this clear and concise text explains basic and applied principles of transformer and inductor design for power electronic applications. It details both the theory and practice of inductors and transformers employed to filter currents, store electromagnetic energy, provide physical isolation between circuits, and perform stepping up and down of DC and AC voltages. The authors present a broad range of applications from modern power conversion systems. They provide rigorous design guidelines based on a robust methodology for inductor and transformer design. They offer real design examples, informed by proven and working field examples. Key features include: emphasis on high frequency design, including optimisation of the winding layout and treatment of non-sinusoidal waveforms a chapter on planar magnetic with analytical models and descriptions of the processing technologies analysis of the role of variable inductors, and their applications for power factor correction and solar power unique coverage on the measurements of inductance and transformer capacitance, as well as tests for core losses at high frequency worked examples in MATLAB, end-of-chapter problems, and an accompanying website containing solutions, a full set of instructors' presentations, and copies of all the figures. Covering the basics of the magnetic components of power electronic converters, this book is a

comprehensive reference for students and professional engineers dealing with specialised inductor and transformer design. It is especially useful for senior undergraduate and graduate students in electrical

engineering and electrical energy systems, and engineers working with power supplies and energy conversion systems who want to update their knowledge on a field that has progressed considerably in recent years.