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High-Speed Devices and Circuits with THz Applications

Edited by **Jung Han Choi**

High Speed Devices And Circuits With Thz Applications

Marta Bagatin, Simone Gerardin



High Speed Devices And Circuits With Thz Applications:

High-Speed Devices and Circuits with THz Applications Jung Han Choi, 2017-09-19 Presenting the cutting edge results of new device developments and circuit implementations High Speed Devices and Circuits with THz Applications covers the recent advancements of nano devices for terahertz THz applications and the latest high speed data rate connectivity technologies from system design to integrated circuit IC design providing relevant standard activities and technical specifications Featuring the contributions of leading experts from industry and academia this pivotal work Discusses THz sensing and imaging devices based on nano devices and materials Describes silicon on insulator SOI multigate nanowire field effect transistors FETs Explains the theory underpinning nanoscale nanowire metal oxide semiconductor field effect transistors MOSFETs simulation methods and their results Explores the physics of the silicon germanium SiGe heterojunction bipolar transistor HBT as well as commercially available SiGe HBT devices and their applications Details aspects of THz IC design using standard silicon Si complementary metal oxide semiconductor CMOS devices including experimental setups for measurements detection methods and more An essential text for the future of high frequency engineering High Speed Devices and Circuits with THz Applications offers valuable insight into emerging technologies and product possibilities that are attractive in terms of mass production and compatibility with current manufacturing facilities

Emerging Trends in Terahertz Solid-State Physics and Devices Arindam Biswas, Amit Banerjee, Aritra Acharyya, Hiroshi Inokawa, Jintendra Nath Roy, 2020-03-20 This book highlights recent advances and applications in terahertz THz technology addressing advanced topics such as THz biomedical imaging pattern recognition and tomographic reconstruction for THz biomedical imaging by machine learning and artificial intelligence THz imaging radars for autonomous vehicle applications and THz imaging systems for security and surveillance It also discusses theoretical experimental established and validated empirical work on these topics

Labs on Chip Eugenio Iannone, 2018-09-03 Labs on Chip Principles Design and Technology provides a complete reference for the complex field of labs on chip in biotechnology Merging three main areas fluid dynamics monolithic micro and nanotechnology and out of equilibrium biochemistry this text integrates coverage of technology issues with strong theoretical explanations of design techniques Analyzing each subject from basic principles to relevant applications this book Describes the biochemical elements required to work on labs on chip Discusses fabrication microfluidic and electronic and optical detection techniques Addresses planar technologies polymer microfabrication and process scalability to huge volumes Presents a global view of current lab on chip research and development Devotes an entire chapter to labs on chip for genetics Summarizing in one source the different technical competencies required Labs on Chip Principles Design and Technology offers valuable guidance for the lab on chip design decision making process while exploring essential elements of labs on chip useful both to the professional who wants to approach a new field and to the specialist who wants to gain a broader perspective

Laser-Based Optical Detection of Explosives Paul M.

Pellegrino, Ellen L. Holthoff, Mikella E. Farrell, 2018-09-03 **Laser Based Optical Detection of Explosives** offers a comprehensive review of past present and emerging laser based methods for the detection of a variety of explosives This book Considers laser propagation safety and explains standard test material preparation for standoff optical based detection system evaluation Explores explosives detection using deep ultraviolet native fluorescence Raman spectroscopy laser induced breakdown spectroscopy reflectometry and hyperspectral imaging Examines photodissociation followed by laser induced fluorescence photothermal methods cavity enhanced absorption spectrometry and short pulse laser based techniques Describes the detection and recognition of explosives using terahertz frequency spectroscopic techniques Each chapter is authored by a leading expert on the respective technology and is structured to supply historical perspective address current advantages and challenges and discuss novel research and applications Readers are left with an in depth understanding and appreciation of each technology s capabilities and potential for standoff hazard detection

Structural Health

Monitoring of Composite Structures Using Fiber Optic Methods Ginu Rajan, B. Gangadhara Prusty, 2016-10-03 This highly comprehensive introductory book explains the basics of structural health monitoring aspects of composite structures This book serve as an all in one reference book in which the reader can receive a basic understanding of composite materials manufacturing methods the latest types of optical fiber sensors used for structural health monitoring of composite structures and demonstrated applications of the use of fiber sensors in a variety of composite material structures The content draws upon the authors and distinguished contributors extensive research teaching and industrial experience to fully cover the structural health monitoring of composite materials using fiber optic sensing methods

Gallium Nitride (GaN)

Farid Medjdoub, 2017-12-19 **Addresses a Growing Need for High Power and High Frequency Transistors Gallium Nitride GaN Physics Devices and Technology** offers a balanced perspective on the state of the art in gallium nitride technology A semiconductor commonly used in bright light emitting diodes GaN can serve as a great alternative to existing devices used in microelectronics It has a wide band gap and high electron mobility that gives it special properties for applications in optoelectronic high power and high frequency devices and because of its high off state breakdown strength combined with excellent on state channel conductivity GaN is an ideal candidate for switching power transistors Explores Recent Progress in High Frequency GaN Technology Written by a panel of academic and industry experts from around the globe this book reviews the advantages of GaN based material systems suitable for high frequency high power applications It provides an overview of the semiconductor environment outlines the fundamental device physics of GaN and describes GaN materials and device structures that are needed for the next stage of microelectronics and optoelectronics The book details the development of radio frequency RF semiconductor devices and circuits considers the current challenges that the industry now faces and examines future trends In addition the authors Propose a design in which multiple LED stacks can be connected in a series using interband tunnel junction TJ interconnects Examine GaN technology while in its early stages of

high volume deployment in commercial and military products Consider the potential use of both sunlight and hydrogen as promising and prominent energy sources for this technology Introduce two unique methods PEC oxidation and vapor cooling condensation methods for the deposition of high quality oxide layers A single source reference for students and professionals Gallium Nitride GaN Physics Devices and Technology provides an overall assessment of the semiconductor environment discusses the potential use of GaN based technology for RF semiconductor devices and highlights the current and emerging applications of GaN **Nanoelectronic Device Applications Handbook** James E. Morris, Krzysztof Iniewski, 2017-11-22 Nanoelectronic Device Applications Handbook gives a comprehensive snapshot of the state of the art in nanodevices for nanoelectronics applications Combining breadth and depth the book includes 68 chapters on topics that range from nano scaled complementary metal oxide semiconductor CMOS devices through recent developments in nano capacitors and AlGaAs GaAs devices The contributors are world renowned experts from academia and industry from around the globe The handbook explores current research into potentially disruptive technologies for a post CMOS world These include Nanoscale advances in current MOSFET CMOS technology Nano capacitors for applications such as electronics packaging and humidity sensors Single electron transistors and other electron tunneling devices Quantum cellular automata and nanomagnetic logic Memristors as switching devices and for memory Graphene preparation properties and devices Carbon nanotubes CNTs both single CNT and random network Other CNT applications such as terahertz sensors interconnects and capacitors Nano system architectures for reliability Nanowire device fabrication and applications Nanowire transistors Nanodevices for spintronics The book closes with a call for a new generation of simulation tools to handle nanoscale mechanisms in realistic nanodevice geometries This timely handbook offers a wealth of insights into the application of nanoelectronics It is an invaluable reference and source of ideas for anyone working in the rapidly expanding field of nanoelectronics

Systems-Level Packaging for Millimeter-Wave Transceivers Mladen Božanić, Saurabh Sinha, 2019-03-26 This book provides a system level approach to making packaging decisions for millimeter wave transceivers In electronics the packaging forms a bridge between the integrated circuit or individual device and the rest of the electronic system encompassing all technologies between the two To be able to make well founded packaging decisions researchers need to understand a broad range of aspects including concepts of transmission bands antennas and propagation integrated and discrete package substrates materials and technologies interconnects passive and active components as well as the advantages and disadvantages of various packages and packaging approaches and package level modeling and simulation Packaging also needs to be considered in terms of system level testing as well as associated testing and production costs and reducing costs This peer reviewed work contributes to the extant scholarly literature by addressing the aforementioned concepts and applying them to the context of the millimeter wave regime and the unique opportunities that this transmission approach offers *Soft Errors* Jean-Luc Autran, Daniela Munteanu, 2017-12-19 Soft errors are a multifaceted issue at the

crossroads of applied physics and engineering sciences Soft errors are by nature multiscale and multiphysics problems that combine not only nuclear and semiconductor physics material sciences circuit design and chip architecture and operation but also cosmic ray physics natural radioactivity issues particle detection and related instrumentation *Soft Errors From Particles to Circuits* addresses the problem of soft errors in digital integrated circuits subjected to the terrestrial natural radiation environment one of the most important primary limits for modern digital electronic reliability Covering the fundamentals of soft errors as well as engineering considerations and technological aspects this robust text Discusses the basics of the natural radiation environment particle interactions with matter and soft error mechanisms Details instrumentation developments in the fields of environment characterization particle detection and real time and accelerated tests Describes the latest computational developments modeling and simulation strategies for the soft error rate estimation in digital circuits Explores trends for future technological nodes and emerging devices *Soft Errors From Particles to Circuits* presents the state of the art of this complex subject providing comprehensive knowledge of the complete chain of the physics of soft errors The book makes an ideal text for introductory graduate level courses offers academic researchers a specialized overview and serves as a practical guide for semiconductor industry engineers or application engineers

Technologies for Smart Sensors and Sensor Fusion Kevin Yallup, Krzysztof Iniewski, 2017-12-19 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 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

MIMO Power Line Communications Lars Torsten Berger, Andreas Schwager, Pascal Pagani, Daniel Schneider, 2017-12-19 One of the first publications of its kind in the exciting field of multiple input multiple output MIMO power line communications PLC *MIMO Power Line Communications Narrow and Broadband*

Standards EMC and Advanced Processing contains contributions from experts in industry and academia making it practical enough to provide a solid understanding of how PLC technologies work yet scientific enough to form a base for ongoing R D activities This book is subdivided into five thematic parts Part I looks at narrow and broadband channel characterization based on measurements from around the globe Taking into account current regulations and electromagnetic compatibility EMC part II describes MIMO signal processing strategies and related capacity and throughput estimates Current narrow and broadband PLC standards and specifications are described in the various chapters of part III Advanced PLC processing options are treated in part IV drawing from a wide variety of research areas such as beamforming precoding time reversal multi user processing and relaying Lastly part V contains case studies and field trials where the advanced technologies of tomorrow are put into practice today Suitable as a reference or a handbook MIMO Power Line Communications Narrow and Broadband Standards EMC and Advanced Processing features self contained chapters with extensive cross referencing to allow for a flexible reading path

Microfluidics and Nanotechnology Eric Lagally, 2017-12-19 An increasing number of technologies are being used to detect minute quantities of biomolecules and cells However it can be difficult to determine which technologies show the most promise for high sensitivity and low limit detection in different applications Microfluidics and Nanotechnology Biosensing to the Single Molecule Limit details proven approaches for the detection of single cells and even single molecules approaches employed by the world s foremost microfluidics and nanotechnology laboratories While similar books concentrate only on microfluidics or nanotechnology this book focuses on the combination of soft materials elastomers and other polymers with hard materials semiconductors metals and glass to form integrated detection systems for biological and chemical targets It explores physical and chemical as well as contact and noncontact detection methods using case studies to demonstrate system capabilities Presenting a snapshot of the current state of the art the text Explains the theory behind different detection techniques from mechanical resonators for detecting cell density to fiber optic methods for detecting DNA hybridization and beyond Examines microfluidic advances including droplet microfluidics digital microfluidics for manipulating droplets on the microscale and more Highlights an array of technologies to allow for a comparison of the fundamental advantages and challenges of each as well as an appreciation of the power of leveraging scalability and integration to achieve sensitivity at low cost Microfluidics and Nanotechnology Biosensing to the Single Molecule Limit not only serves as a quick reference for the latest achievements in biochemical detection at the single cell and single molecule levels but also provides researchers with inspiration for further innovation and expansion of the field

Ionizing Radiation Effects in Electronics Marta Bagatin, Simone Gerardin, 2018-09-03 Ionizing Radiation Effects in Electronics From Memories to Imagers delivers comprehensive coverage of the effects of ionizing radiation on state of the art semiconductor devices The book also offers valuable insight into modern radiation hardening techniques The text begins by providing important background information on radiation effects their underlying mechanisms and the use of Monte Carlo techniques to simulate

radiation transport and the effects of radiation on electronics The book then Explains the effects of radiation on digital commercial devices including microprocessors and volatile and nonvolatile memories static random access memories SRAMs dynamic random access memories DRAMs and Flash memories Examines issues like soft errors total dose and displacement damage together with hardening by design solutions for digital circuits field programmable gate arrays FPGAs and mixed analog circuits Explores the effects of radiation on fiber optics and imager devices such as complementary metal oxide semiconductor CMOS sensors and charge coupled devices CCDs Featuring real world examples case studies extensive references and contributions from leading experts in industry and academia Ionizing Radiation Effects in Electronics From Memories to Imagers is suitable both for newcomers who want to become familiar with radiation effects and for radiation experts who are looking for more advanced material or to make effective use of beam time Analog Electronics for Radiation Detection Renato Turchetta, 2017-12-19 Analog Electronics for Radiation Detection showcases the latest advances in readout electronics for particle or radiation detectors Featuring chapters written by international experts in their respective fields this authoritative text Defines the main design parameters of front end circuitry developed in microelectronics technologies Explains the basis for the use of complementary metal oxide semiconductor CMOS image sensors for the detection of charged particles and other non consumer applications Delivers an in depth review of analog to digital converters ADCs evaluating the pros and cons of ADCs integrated at the pixel column and per chip levels Describes incremental sigma delta ADCs time to digital converter TDC architectures and digital pulse processing techniques complementary to analog processing Examines the fundamental parameters and front end types associated with silicon photomultipliers used for single visible light photon detection Discusses pixel sensors with per pixel TDCs channel density challenges and emerging 3D technologies interconnecting detectors and electronics Thus Analog Electronics for Radiation Detection provides a single source for state of the art information on analog electronics for the readout of radiation detectors

Cell and Material Interface Nihal Engin Vrana, 2018-09-03 A significant portion of biomedical applications necessitates the establishment of an interface between the cells of the patient and the components of the device In many cases such as in implants and engineered tissues the interaction of the cells with the biomaterial is one of the main determinants of the success of the system Cell and Material Interface Advances in Tissue Engineering Biosensor Implant and Imaging Technologies explores this interaction and its control at length scales ranging from the nano to the macro Featuring contributions from leading molecular biologists chemists and material scientists this authoritative reference Presents practical examples of cell and material interface based applications Reflects the interdisciplinary nature of bioengineering covering topics such as biosensing immunology and controlled delivery Explains the role of the cell and material interface in the context of cardiac and skin tissue engineering nanoparticles natural polymers and more Cell and Material Interface Advances in Tissue Engineering Biosensor Implant and Imaging Technologies addresses concepts essential to biomaterial

production methods and cell and material interactions The book provides a solid starting point for elucidating and exploiting the different aspects of cellular interactions with materials for biomedical engineering **MRI** Angshul Majumdar, Rabab Ward, 2018-09-03 The field of magnetic resonance imaging MRI has developed rapidly over the past decade benefiting greatly from the newly developed framework of compressed sensing and its ability to drastically reduce MRI scan times MRI Physics Image Reconstruction and Analysis presents the latest research in MRI technology emphasizing compressed sensing based image reconstruction techniques The book begins with a succinct introduction to the principles of MRI and then Discusses the technology and applications of T1rho MRI Details the recovery of highly sampled functional MRIs Explains sparsity based techniques for quantitative MRIs Describes multi coil parallel MRI reconstruction techniques Examines off line techniques in dynamic MRI reconstruction Explores advances in brain connectivity analysis using diffusion and functional MRIs Featuring chapters authored by field experts MRI Physics Image Reconstruction and Analysis delivers an authoritative and cutting edge treatment of MRI reconstruction techniques The book provides engineers physicists and graduate students with a comprehensive look at the state of the art of MRI **Smart Grids** David Bakken, 2017-12-19 The utilization of sensors

communications and computer technologies to create greater efficiency in the generation transmission distribution and consumption of electricity will enable better management of the electric power system As the use of smart grid technologies grows utilities will be able to automate meter reading and billing and consumers will be more aware of their energy usage and the associated costs The results will require utilities and their suppliers to develop new business models strategies and processes With an emphasis on reducing costs and improving return on investment ROI for utilities Smart Grids Clouds Communications Open Source and Automation explores the design and implementation of smart grid technologies considering the benefits to consumers as well as businesses Focusing on industrial applications the text Provides a state of the art account of the smart grid Explains how smart grid technologies are currently being used Includes detailed examples and test cases for real life implementation Discusses trade offs associated with the utilization of smart grid technologies Describes smart grid simulation software and offers insight into the future of the smart grid The electric power grid is in the early stages of a sea of change Nobody knows which business models will survive but companies heeding the lessons found in Smart Grids Clouds Communications Open Source and Automation might just increase their chances for success

Radiation Detectors for Medical Imaging Jan S. Iwanczyk, 2015-10-16 Radiation Detectors for Medical Imaging discusses the current state of the art and future prospects of photon counting detectors for medical imaging applications Featuring contributions from leading experts and pioneers in their respective fields this book Describes x ray spectral imaging detectors based on cadmium zinc telluride CdZnTe and cad Introduction to Smart eHealth and eCare Technologies Sari Merilampi, Andrew Sirkka, 2016-11-18 Both the demographics and lack of resources in the health and well being industry are increasingly forcing us to find alternative solutions for individualized health and social care In an effort to address this issue

smart technologies present enormous potential in solving this challenge This book strives to enhance communication and collaboration between technology and health and social care sectors The reader will receive an extensive overview of the possibilities of various technologies in care sectors including ICT electronics automation and sensor technology written by experts from various countries It will prove extremely useful for engineers developing well being related systems software or other devices that can be used by professionals working with people with specialist needs well being and health service providers educators teaching related courses and upper level undergraduate students and graduate student studying related topics The technology focus of the book is widespread and addresses elderly care and hospitals in addition to solutions for various user groups devices and technologies Beyond serving as a resource for nurses and people working in care sector the book is also meant to give guidelines for engineers developing person centered systems by exploring the integration of these technologies into service systems

Noise Coupling in System-on-Chip Thomas Noulis, 2018-01-09 Noise Coupling is the root cause of the majority of Systems on Chip SoC product fails The book discusses a breakthrough substrate coupling analysis flow and modelling toolset addressing the needs of the design community The flow provides capability to analyze noise components propagating through the substrate the parasitic interconnects and the package Using this book the reader can analyze and avoid complex noise coupling that degrades RF and mixed signal design performance while reducing the need for conservative design practices With chapters written by leading international experts in the field novel methodologies are provided to identify noise coupling in silicon It additionally features case studies that can be found in any modern CMOS SoC product for mobile communications automotive applications and readout front ends

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