Semiconductor Devices

Vítezslav Benda,Duncan A. Grant,John Gowar

Semiconductor Devices:

<u>Physics of Semiconductor Devices</u> Simon M. Sze,Kwok K. Ng,2006-12-13 The Third Edition of the standard textbook and reference in the field of semiconductor devices This classic book has set the standard for advanced study and reference in the semiconductor device field Now completely updated and reorganized to reflect the tremendous advances in device concepts and performance this Third Edition remains the most detailed and exhaustive single source of information on the most important semiconductor devices It gives readers immediate access to detailed descriptions of the underlying physics and performance characteristics of all major bipolar field effect microwave photonic and sensor devices Designed for graduate textbook adoptions and reference needs this new edition includes A complete update of the latest developments New devices such as three dimensional MOSFETs MODFETs resonant tunneling diodes semiconductor sensors quantum cascade lasers single electron transistors real space transfer devices and more Materials completely reorganized Problem sets at the end of each chapter All figures reproduced at the highest quality Physics of Semiconductor Devices Third Edition offers engineers research scientists faculty and students a practical basis for understanding the most important devices in use today and for evaluating future device performance and limitations A Solutions Manual is available from the editorial department *Semiconductor Devices* Jasprit Singh,2000-08-03 This introductory text designed for the first course in semiconductor physics presents a well balanced coverage of semiconductor physics and device operation and shows how devices are optimized for applications The text begins with an exploration of the basic physical processes upon which all semiconductor devices diodes transistor light emitters and detectors are based Topics such as bandstructure effective masses holes doping carrier transport and lifetimes are discussed Next the author focuses on the operation of the important semiconductor devices along with issues relating to the optimization of device performance Issues such as how doping device dimensions and parasitic effects influence device operation are also included The book is appropriate for the following courses Device Physics Semiconductor Devices Device Electronics Physics of Semiconductor Devices Integrated Circuit Devices Device Electronics Solid State Devices **Introduction to Semiconductor Devices** Kevin F. Brennan,2005-02-03 From semiconductor fundamentals to semiconductor devices used in the telecommunications and computing industries this 2005 book provides a solid grounding in the most important devices used in the hottest areas of electronic engineering The book includes coverage of future approaches to computing hardware and RF power amplifiers and explains how emerging trends and system demands of computing and telecommunications systems influence the choice design and operation of semiconductors Next the field effect devices are described including MODFETs and MOSFETs Short channel effects and the challenges faced by continuing miniaturisation are then addressed The rest of the book discusses the structure behaviour and operating requirements of semiconductor devices used in lightwave and wireless telecommunications systems This is both an excellent senior graduate text and a valuable reference for engineers and researchers in the field <u>Physics of</u>

Semiconductor Devices J.-P. Colinge,C.A. Colinge,2005-10-03 Physics of Semiconductor Devices covers both basic classic topics such as energy band theory and the gradual channel model of the MOSFET as well as advanced concepts and devices such as MOSFET short channel effects low dimensional devices and single electron transistors Concepts are introduced to the reader in a simple way often using comparisons to everyday life experiences such as simple fluid mechanics They are then explained in depth and mathematical developments are fully described Physics of Semiconductor Devices contains a list of problems that can be used as homework assignments or can be solved in class to exemplify the theory Many of these problems make use of Matlab and are aimed at illustrating theoretical concepts in a graphical manner **Discrete and Integrated Power Semiconductor Devices** Vítezslav Benda,Duncan A. Grant,John Gowar,1999-01-26 Power Semiconductor Devices Theory and Applications V t zslav Benda Czech Technical University Prague Czech Republic John Gowar Duncan A Grant University of Bristol UK Recent advances in robotics automatic control and power conditioning systems have prompted research into increasingly sophisticated power semiconductor devices This cutting edge text explores the design physical processes and applications performance of current power semiconductor devices The extensive scope covers the complete range of discrete and integrated devices now available Features include Use of physical models to explain the device structures and functions without complicated mathematical techniques Explanation of the structure function characteristics and features of the most important discrete and integrated power devices Demonstration of the influence of construction and technological parameters on important device characteristics Sections on power modules and conditions for reliable operation plus a look at future materials and devices This valuable reference encompassing the structure operation and application of power semiconductor devices will benefit both practising electronics engineers and students of power electronics **Semiconductor Devices, 2nd Edition** John Sparkes,1994-07-28 Since its inception the Tutorial Guides in Electronic Engineering series has met with great success among both instructors and students Designed for first and second year undergraduate courses each text provides a concise list of objectives at the beginning of every chapter key definitions and formulas highlighted in margin notes and references to other texts in the series Semiconductor Devices begins with a review of the necessary basic background in semiconductor materials and what semiconductor devices are expected to do that is their typical applications Then the author explains in order of increasing complexity the main semiconductor devices in use today beginning with p n junctions in their various forms and ending with integrated circuits In doing so he presents both the band model and the bond model of semiconductors since neither one on its own can account for all device behavior The final chapter introduces more recently developed technologies particularly the use of compound instead of silicon semiconductors and the improvement in device performance these materials make possible True to the Tutorial Guides in Electronic Engineering series standards Semiconductor Devices offers a clear presentation a multitude of illustrations and fully worked examples supported by end of chapter exercises and suggestions for further reading This book

provides an ideal introduction to the fundamental theoretical principles underlying the operation of semiconductor devices and to their simple and effective mathematical modelling **Semiconductor Devices** Yaduvir Singh,2013-12-30 Semiconductor devices is an interdisciplinary subject of great industrial importance This subject has led to the emergence of various state of art areas of engineering and technology like IC fabrication and packaging Microelectronics VLSI analog digital electronics semiconductor electronics etc This book provides an integrated treatment of all aspects of semiconductor devices like semiconductor physics semiconductor electronics device designing circuit development analog circuit design development and analysis etc This book has been written as per the syllabus of Semiconductor Devices of various technical universities like UPTU PTU Thapar University BITS VIT BIT PEC NITs IITs SLIET DEI NSIT DEC VJTI RGPV MIT NERIST MAHE GBPUAT JU BEC BVP Pune Pune University Mumbai University It discusses p n junction diodes bipolar junction transistors high frequency transistors field effect transistors and power supplies in detail Salient features Minutely worked out examples give a complete understanding and hold on this subject Variety of solved unsolved and multiple choice questions completely cover the diversity of this subject which is extremely useful for semester examinations GATE PSUs examinations Pedagogy includes relevant and to the point text solved questions unsolved questions and multiple choice questions **Springer Handbook of Semiconductor Devices** Massimo Rudan,Rossella Brunetti,Susanna Reggiani,2022-11-10 This Springer Handbook comprehensively covers the topic of semiconductor devices embracing all aspects from theoretical background to fabrication modeling and applications Nearly 100 leading scientists from industry and academia were selected to write the handbook s chapters which were conceived for professionals and practitioners material scientists physicists and electrical engineers working at universities industrial R D and manufacturers Starting from the description of the relevant technological aspects and fabrication steps the handbook proceeds with a section fully devoted to the main conventional semiconductor devices like e g bipolar transistors and MOS capacitors and transistors used in the production of the standard integrated circuits and the corresponding physical models In the subsequent chapters the scaling issues of the semiconductor device technology are addressed followed by the description of novel concept based semiconductor devices The last section illustrates the numerical simulation methods ranging from the fabrication processes to the device performances Each chapter is self contained and refers to related topics treated in other chapters when necessary so that the reader interested in a specific subject can easily identify a personal reading path through the vast contents of the handbook **Optical Semiconductor Devices** Mitsuo Fukuda,1998-12-24 This book is devoted to optical semiconductor devices and their numerous applications in telecommunications optoelectronics and consumer electronics areas where signal processing or the transmission of signals across fiber optic cables is paramount It introduces a new generation of devices that includes optical modulators quantum well QW lasers and photodiodes and explores new applications of more established devices such as semiconductor lasers light emitting diodes and photodiodes Mitsuo Fukuda

examines the material properties operation principles fabrication packaging reliability and applications of each device and offers a unique industrial perspective discussing everything engineers and scientists need to know at different phases of research development and production This guide to the state of the art of optical semiconductor devices Helps you choose the right device for a given application Covers important performance data such as temperature and optical feedback noise in lasers Highlights epitaxial growth techniques and fabrication for each device Features one hundred figures and an extensive bibliography Provides a clear and concise treatment unencumbered by excessive theory Optical Semiconductor Devices is an essential resource for engineers and researchers in telecommunications and optoelectronics equipment designers and manufacturers and graduate students and scholars interested in this rapidly evolving field

Semiconductor Devices Jasprit Singh,1994 The basic semiconductor devices are explored at two levels 1 a mathematically rigorous but simple model for each device is developed and then 2 the motivations of modern devices which are more complex are provided By discussing silicon gallium arsenide and other semiconductor based devices the text provides a state of the art discussion of modern electronic devices Most subsections end with a solved example so that the reader develops a feel of real numbers and the importance of device design *Fundamentals of Power Semiconductor Devices* B. Jayant Baliga,2008-09-05 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 <u>Electronics (fundamentals And Applications)</u> D. Chattopadhyay,2006 The Book Is Meant For The Students Pursuing A Beginners Course In Electronics Current Syllabi Of Basic Electronics Included In Physics Honours Curriculum Of Different Universities And Those Offered In Various Engineering And Technical Institutions Have Been Consulted In Preparing The Material Contained Herein In 22 Chapters The Book Deals With Formation Of Energy Bands In Solids Electron Emission From Solid Surfaces Vacuum Tubes Properties Of Semiconductors Pn Junction Diodes Rectifiers Voltage Multipliers Clipping And Clamping Circuits Bipolar Junction Transistors Basic Voltage And Poweramplifiers Feedback In Amplifiers Regulated Power Supply Sinusoidal Oscillators Multivibrators Modulation And Demodulation Jfet And Mosfet Ics Op Amps Special Semiconductor Devices Such As Phototransistor Scr Triac Diac Ujt Impatt Diode Gunn Diode Pin Diode Igbt Digital Circuits Cathode Ray Oscilloscope Radio Communication Television Radar And Laser Fundamental Principles And Applications Are Discussed Herein With Explanatory Diagrams In A Clear Concise Way Physical Aspects Are Emphasized Mathematical Details Are Given When Necessary Many Of The Problems And Review Questions Included In The Book Are Taken From Recent Examination Papers Some Objective Type Questions Typically Set In Different Competitive Examinations Are Also Given At The End Of Each Chapter Salient

Features Small Geometry Effects And Effects Of Interconnects Included In Chapter 18 A Quick Discussion On Fibre Optic Communication System In Chapter 22 Revised And Updated To Cope With The Current Syllabii Of Some More Universities And Technical Institutions Chapters 6 8 16 18 And 22 Have Been Changed With The Addition Of New Material Some More University Questions And Problems Have Been Included   *Computational Aspects of VLSI Design with an Emphasis on Semiconductor Device Simulation* Randolph E. Bank,1990-02-15 Numerical simulation is rapidly becoming an important part of the VLSI design process allowing the engineer to test evaluate and optimize various aspects of chip design without resorting to the costly and time consuming process of fabricating prototypes This procedure not only accelerates the design process but also improves the end product since it is economically feasible to numerically simulate many more options than might otherwise be considered With the enhanced computing power of today s computers more sophisticated models are now being developed This volume contains the proceedings of the AMS SIAM Summer Seminar on Computational Aspects of VLSI Design held at the Institute for Mathematics and Its Applications at the University of Minnesota in the spring of 1987 The seminar featured presentations by some of the top experts working in this area Their contributions to this volume form an excellent overview of the mathematical and computational problems arising in this area   The Stationary Semiconductor Device Equations P.A. Markowich,1985-12-12 In the last two decades semiconductor device simulation has become a research area which thrives on a cooperation of physicists electrical engineers and mathe maticians In this book the static semiconductor device problem is presented and analysed from an applied mathematician s point of view I shall derive the device equations as obtained for the first time by Van Roosbroeck in 1950 from physical principles present a mathematical analysis discuss their numerical solu tion by discretisation techniques and report on selected device simulation runs To me personally the most fascinating aspect of mathematical device analysis is that an interplay of abstract mathematics perturbation theory numerical analysis and device physics is prompting the design and development of new technology I very much hope to convey to the reader the importance of applied mathematics for technological progress Each chapter of this book is designed to be as selfcontained as possible however the mathematical analysis of the device problem requires tools which cannot be presented completely here Those readers who are not interested in the mathemati cal methodology and rigor can extract the desired information by simply ignoring details and proofs of theorems Also at the beginning of each chapter I refer to textbooks which introduce the interested reader to the required mathematical concepts   Sub-Micron Semiconductor Devices Ashish Raman,Deep Shekhar,Naveen Kumar,2022-05-10 This comprehensive reference text discusses novel semiconductor devices including nanostructure field effect transistors photodiodes high electron mobility transistors and oxide based devices The text covers submicron semiconductor devices device modeling novel materials for devices novel semiconductor devices optimization techniques and their application in detail It covers such important topics as negative capacitance devices surface plasmon resonance devices Fermi level pinning external stimuli based optimization techniques

optoelectronic devices and architecture based optimization techniques The book Covers novel semiconductor devices with submicron dimensions Discusses comprehensive device optimization techniques Examines conceptualization and modeling of semiconductor devices Covers circuit and sensor based application of the novel devices Discusses novel materials for next generation devices This text will be useful for graduate students and professionals in fields including electrical engineering electronics and communication engineering materials science and nanoscience   **Principles of Semiconductor Devices** Sima Dimitrijev,2006 Designed for senior and first year graduates students in electrical and computer engineering departments taking a semiconductor device course This text focuses on the fundamentals of semiconductor devices and the physical operating principles within them It provides the underlying theories with applications of semiconductor device physics   **Elementary Semiconductor Device Physics** Kazuya Masu,Shuhei Amakawa,2024-10-31 This book by two leading experts on integrated circuit design adopts an untraditional approach to introducing semiconductor devices to beginners The authors use circuit theory to provide a digestible explanation of energy band theory and understanding of energy band diagrams After briefly summarizing the basics of semiconductors the authors describe semiconductor devices from a circuit theoretic point of view making the book especially suitable for circuit design students and engineers Further to the emphasis on the circuit perspective the book then uses circuit theory to introduce readers to the famously indigestible energy bands of crystalline solids Additionally the book explains how to read physics from energy band diagrams of semiconductor devices in great detail The key to appreciating the real power of energy band diagrams is shown to lie in the understanding of the concept of the quasi Fermi levels introduced in 1949 by William Shockley but remaining elusive to date and therefore often omitted from energy band diagrams To rectify this some of the energy band diagrams presented in this book complete with quasi Fermi levels were drawn using a device simulator a k a technology computer aided design TCAD offering quantitative information about device physics The book could therefore also serve as a hands on course text in TCAD drawn band diagram reading Because no prior exposure to quantum mechanics is required and the book does not attempt to teach it this book is ideal for students in various disciplines who may or may not be specializing in semiconductor devices The numerous practical examples of reading TCAD based energy band diagrams are also invaluable to practicing semiconductor device engineers   *Semiconductor Device Failure Analysis: From Fundamentals to Advanced Techniques* AMRUTHA SAMPATH, DR. JAGDEV SINGH RANA, PREFACE The field of semiconductor device failure analysis is of paramount importance in ensuring the reliability and performance of modern electronic systems As semiconductor technology continues to evolve with devices becoming smaller faster and more complex the need to understand and diagnose failures in these devices become even more critical From the early days of integrated circuits to the cutting edge microelectronics that power everything from smartphones and computers to medical devices and autonomous vehicles semiconductor devices are at the heart of our increasingly interconnected world The goal of this book Semiconductor Device Failure Analysis From

Fundamentals to Advanced Techniques is to provide a comprehensive guide to the principles methodologies and tools used to diagnose and understand failures in semiconductor devices Whether you are a student engineer or researcher this book offers valuable insights into both the foundational concepts and advanced techniques that are essential for identifying analyzing and mitigating failures in semiconductor components At its core this book is structured to address the needs of both beginners and experienced professionals in the field of semiconductor failure analysis We begin with fundamental topics such as the physics of semiconductor devices the various types of device failures and the importance of failure analysis in the development of robust semiconductor technologies From there we delve deeper into advanced techniques that allow for more precise diagnostics including electron microscopy X ray imaging and infrared thermal imaging which are essential for uncovering subtle defects that may not be immediately visible Throughout this book we emphasize a practical approach to failure analysis providing not only theoretical explanations but also real world case studies and examples that illustrate how these techniques are applied in industry With advancements in nanotechnology 3D integrated circuits and quantum devices new challenges in failure analysis arise and this book discusses the latest research and innovations that are shaping the future of semiconductor reliability Failure analysis is an interdisciplinary field and this book acknowledges the importance of collaboration between materials scientists electrical engineers physicists and other professionals Thus we explore both the scientific principles behind failure mechanisms and the technical skills needed to implement effective failure analysis practices in industry settings The importance of semiconductor device failure analysis cannot be overstated As technology becomes more complex and sophisticated ensuring the reliability and durability of semiconductor devices is crucial for minimizing the safety risks associated with device malfunctions By providing a comprehensive overview of failure analysis techniques this book aims to equip its readers with the tools and knowledge needed to address these challenges advancing both the understanding and practice of semiconductor device failure analysis In conclusion this book serves as a bridge between the fundamental concepts of semiconductor devices and the cutting edge techniques used to diagnose and resolve device failures As semiconductor devices continue to power the technological innovations of the future understanding how to prevent identify and correct failures will remain a cornerstone of ensuring the continued progress and success of the semiconductor industry Authors Amrutha Sampath Dr Jagdev Singh Rana   *Essentials of Semiconductor Device Physics* Emiliano R. Martins,2022-07-05 ESSENTIALS OF SEMICONDUCTOR DEVICE PHYSICS An introductory semiconductor device physics textbook that is accessible to readers without a background in statistical physics I wish this book had been available when I needed to make a Semiconductor class myself a few years ago A very nice aspect is that some concepts e g density of states are explained in a way that I have not seen elsewhere These types of unconventional approaches are very valuable for a teacher Bjorn Maes University of Mons Belgium the author offers an accessible description of statistical analysis and adopts it to explain the core properties of semiconductors He uses interesting metaphors and analogies to

exemplify some of the most difficult notions in an innovative and engaging way Andrea di Falco University of St Andrews UK The subject of this book is the physics of semiconductor devices which is an important topic in engineering and physics because it forms the background for electronic and optoelectronic devices including solar cells The author aims to provide students and teachers with a concise text that focuses on semiconductor devices and covers the necessary background in statistical physics This text introduces the key prerequisite knowledge in a simple clear and friendly manner It distills the key concepts of semiconductor devices down to their essentials enabling students to master this key subject in engineering physics and materials The subject matter treated in this book is directly connected to the physics of p n junctions and solar cells which has become a topic of intense interest in the last decade Sample topics covered within the text include Chemical potential Fermi level Fermi Dirac distribution drift current and diffusion current The physics of semiconductors band theory and intuitive derivations of the concentration of charge carriers The p n junction with qualitative analysis preceding the mathematical descriptions A derivation of the current vs voltage relation in p n junctions Shockley equation Important applications of p n junctions including solar cells The two main types of transistors Bipolar Junction Transistors BJT and Metal Oxide Semiconductor Field Effect Transistors MOSFET For students and instructors it may be used as a primary textbook for an introductory semiconductor device physics course and is suitable for a course of approximately 30 50 hours Scientists studying and researching semiconductor devices in general and solar cells in particular will also benefit from the clear and intuitive explanations found in this book *MICROWAVE SEMICONDUCTOR DEVICES* SITESH KUMAR ROY,MONOJIT MITRA,2003-01-01 The main objective of this comprehensive text is to introduce the students the physics and the operational principles as well as the characteristics and applications of the microwave semiconductor devices These devices are making a revolutionary change in the field of communication and radars As a result of the accelerating rate of growth of microwave technology in research and industry students engineers and scientists need to understand the theoretical and experimental design and analysis of these devices The book also deals with higher frequency microwaves called millimeter waves which are finding wide applications in ground and satellite communication radars and missile guidance Millimeter wave system development is one of the most advanced technologies in radio science especially in view of the ever increasing demand of communication and saturation of microwave frequency range with increasing number of channels The book discusses in greater detail about the semiconductor devices such as IMPATT diodes Gunn diodes HEMT diodes and FET diodes It emphasizes on various two and three terminal devices in the microwave and millimeter wave field based on silicon and Groups III V compound semiconductors The book is intended to serve as a textbook for undergraduate electronics and electrical engineering students and postgraduate students of physics It would also be a valuable reference book for professional engineers and physicists

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